RURAL HEALTHY PEOPLE 2020

VOLUME TWO

Southwest Rural Health Research Center
Texas A&M Health Science Center School of Public Health
1266 TAMU
College Station, Texas 77843-1266
www.sph.tamhsc.edu/srhrc

ISBN 978-1-4951-5243-6
90000>
9 781495 152436

32452 0615

TEXAS A&M HEALTH SCIENCE CENTER

RURAL HEALTHY PEOPLE 2020

SCHOOL OF PUBLIC HEALTH

VOLUME TWO








PUBLIC HEALTH
TEXAS A&M HEALTH SCIENCE CENTER

*transforming*HEALTH™

RURAL HEALTHY PEOPLE 2020

A Companion Document to Healthy People 2020

VOLUME TWO

> “...[D]efining rural America is a complex and a challenging task for policy makers and health care experts alike...[R]ural America can be characterized as being an expansive and sparsely populated geographic location where the population at large experiences avoidable ‘differences in the incidence, prevalence, mortality, and burden of diseases and other adverse health conditions’ (Minority Health and Health Disparities Research and Education Act, 2000, p. 2498). To best understand rural health disparities, one must first understand that being rural is not merely a smaller version of being urban. Rural America has a specific history and defining characteristics that represent a unique health care delivery environment.*”

*Elizondo AL, Morgan A. *History of Rural Public Health in America*. (2012) In: Crosby RA, Wendel ML, Vanderpool RC, Casey BR (eds). *Rural Populations and Health: Determinants, Disparities, and Solutions*, Jossey-Bass, San Francisco, CA.

SENIOR EDITORS

Jane N. Bolin, PhD, JD, BSN
Professor, Department of Health Policy & Management,
Texas A&M Health Science Center School of Public Health
Director, Southwest Rural Health Research Center

Gail Bellamy, PhD
Professor, Department of Family Medicine & Rural Health,
Florida State University College of Medicine
Director, Center for Rural Health Research and Policy

EDITORS

Alva O. Ferdinand*, DrPH, JD

Bita A. Kash*, PhD, MBA, FACHE

Janet W. Helduser*, MA

Copyright© 2015 by the Southwest Rural Health Research Center
All rights reserved.
Printed in the United States of America
Newman Printing Company, Inc., Bryan, Texas

PUBLIC HEALTH
TEXAS A&M HEALTH SCIENCE CENTER
*transforming*HEALTH™

THE FLORIDA STATE UNIVERSITY
COLLEGE OF MEDICINE

This publication was supported through a grant from the Public Health Policy Program at the Texas A&M Health Science Center School of Public Health.

Suggested Citation: Bolin JN, Bellamy G, Ferdinand AO, Kash BA, Helduser JW, eds. (2015). *Rural Healthy People 2020.* Vol. 2. College Station, Texas: Texas A&M Health Science Center School of Public Health, Southwest Rural Health Research Center.

Southwest Rural Health Research Center
Texas A&M Health Science Center School of Public Health
*Department of Health Policy and Management
1266 TAMU, College Station, Texas 77843-1266

ISBN 978-1-4951-5243-6

Library of Congress Control Number: 2015938498

FOREWORD

Over a decade ago, the Health Resources and Services Administration's Office of Rural Health funded the two-volume *Rural Healthy People 2010: A Companion Document to Healthy People 2010*. The results of a nationwide survey of rural stakeholders, based on the Healthy People 2010 priorities and objectives, the publication served as a foundational starting point for identifying rural health priorities and objectives for that decade, along with life and community models known to work in rural settings.

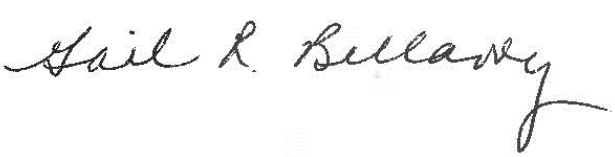
Rural Healthy People 2020 builds upon that earlier work, expanding the national Healthy People 2020 initiative by giving a rural focus to the Healthy People 2020 priorities. *Rural Healthy People 2020* is specifically intended to support rural stakeholder-focused priority setting and the comprehensive reporting of national rural health priorities for rural stakeholders and policy planners.

The Healthy People 2020 objectives that received "top ten" votes from 1,214 rural stakeholders in a nationwide survey have been described fully in a recently published study in the *Journal of Rural Health* (Bolin et al., 2015). The topic "access to quality health care" was selected as the most important health priority for rural Americans.

Rural Healthy People 2020 is organized into two separate volumes. Volume One, produced earlier in 2015, addressed each of the ten top-ranked rural health priorities and included reviews of the relevant literature, updated for those topics previously identified as priorities in *Rural Healthy People 2010*. Models for practice that rural practitioners can utilize to support community and regional programs are also included. Volume Two is formatted similarly, addressing rural health priorities that ranked as numbers 11 through 20.

Rural health challenges are complex, reflecting both significant disparities across rural populations residing in the United States and unique regional, political, and social differences that influence how we craft solutions to problems. Rural populations face even greater challenges today than they did in 2001 when *Rural Healthy People 2010* was conceptualized. To better understand challenges that rural residents face in accessing health care, researchers, practitioners, and policy makers must rethink the lens through which they view rural populations. Beyond location, rural challenges also include race, ethnicity, customs, the economy, and geography.

We sincerely hope that you find *Rural Healthy People 2020* to be both helpful and informative as you address the unique needs of rural Americans who continue to experience significant and severe challenges in both living in rural areas and staying healthy.



Jane N. Bolin, BSN, JD, PhD

Professor, Dept. of Health Policy & Management, School of Public Health, Texas A&M Health Science Center & Director, Southwest Rural Health Research Center

Gail R. Bellamy, PhD

Professor, Dept. of Family Medicine & Rural Health, College of Medicine, Florida State University & Director, Center for Rural Health Research and Policy

ABOUT RURAL HEALTHY PEOPLE 2020 VOLUME ONE

Rural Healthy People 2020, Volume One, is a collection of literature reviews on rural health priorities numbers one through ten, resulting from the national survey of rural stakeholders. Please see http://sph.tamhsc.edu/srhrc/ to download your free copy of *Rural Healthy People 2020, Volume One.*

1. Access to Quality Health Services in Rural Areas
   a. Rural Access to Quality Health Insurance
   b. Access to Quality Health Services in Rural Areas – Primary Care: A Literature Review
   c. Rural Access to Quality Emergency Services
2. Nutrition and Weight Status in Rural Areas
3. The Burden of Diabetes in Rural America
4. Mental Health and Mental Disorders: A Rural Challenge
5. Substance Abuse Trends in Rural America
6. Heart Disease and Stroke in Rural America
7. Physical Activity in Rural America
8. Older Adults
9. Maternal and Child Health in Rural United States: Updates and Challenges
10. Tobacco Use in Rural America

TABLE OF CONTENTS
VOLUME TWO

RURAL HEALTHY PEOPLE 2020 ADVISORY COMMITTEE

Maggie Blackburn, MD
President (retired), Florida School-Based Health Alliance

Earle Fox, MD, MPH
Administrator (retired), Health Resources and Services Administration, and former Director, Florida Public Health Institute

Larry Gamm, PhD
Regents Professor (retired), School of Public Health, Texas A&M University Health Science Center

Hilda Heady, MSW, ACSW
Senior Vice President and Chair, Rural Health Research and Policy Group, Atlas Research

W. Brad Jones, PhD
Chief Executive Officer, Life Well Promotions, LLC

Alan Morgan, MPA
Chief Executive Officer, National Rural Health Association

Wayne Myers, MD
Director (retired), Health Resources and Services Administration Office of Rural Health Policy

Debra C. Nichols, MD, MPH
Office of Disease Prevention and Health Promotion, Office of the Assistant Secretary for Health, U.S. Department of Health and Human Services

Nisha Patel, MA, CHES
Director, Community Based Division, Health Resources and Services Administration Office of Rural Health Policy

Mary Selecky
Secretary of Health (retired), Washington State Department of Health

Tim Size
Chief Executive Officer, Rural Wisconsin Health Cooperative, and Past-President, National Rural Health Association

VOLUME TWO CONTRIBUTORS

EDITORS:

Jane Bolin, PhD, JD, BSN
Professor in the Department of Health Policy and Management at the Texas A&M Health Science Center School of Public Health and Director of the Southwest Rural Health Research Center.

Gail Bellamy, PhD
Professor in the Department of Family Medicine and Rural Health at the Florida State University College of Medicine and Director of the Center for Rural Health Research and Policy

Alva O. Ferdinand, DrPH, JD
Assistant Professor in the Department of Health Policy and Management at the Texas A&M Health Science Center School of Public Health

Bita A. Kash, PhD, MBA, FACHE
Associate Professor in the Department of Health Policy and Management at the Texas A&M Health Science Center School of Public Health and Director of the Center for Health Organization Transformation

Janet W. Helduser, MA
Senior Program Coordinator in the Department of Health Policy and Management at the Texas A&M Health Science Center School of Public Health

AUTHORS AND OTHER CONTRIBUTORS:

Nida Ali, MPH
Former Graduate Assistant in the Office of Special Programs at the Texas A&M Health Science Center School of Public Health; Doctoral Student at the University of Louisville

Patience Appiah, BA
Research Assistant in the Center for Health Organization Transformation in the Department of Health Policy and Management at the Texas A&M Health Science Center School of Public Health

Kimberly Babicz, MHA
Former Graduate Assistant in the Office of Special Programs at the Texas A&M Health Science Center School of Public Health

Suman Challa, DDS
Assistant Professor, Comprehensive Dentistry, and Assistant Program Director in the Dental Public Health Residency Program at the UT Health Science Center in San Antonio, Texas

Heather R. Clark, DrPH, MSPH
Clinical Assistant Professor in the Department of Health and Kinesiology at the Texas A&M University College of Education

Rachel Coughlin, MPH
Former Graduate Research Assistant and Graduate of the Texas A&M Health Science Center School of Public Health

Susan H. Fenton, PhD, RHIA, FAHIMA
Associate Dean for Academic Affairs at the UTHealth School of Biomedical Informatics in Houston, Texas

Laura Hugill-Warren, MPH
Research Assistant at the Texas A&M Public Policy Research Institute

Linnae Hutchison, MBA, MT
Director of Research at the Texas A&M Health Science Center School of Public Health

Shruti Kaul, BDS, MHA
Former Graduate Student in the Health Policy and Management Department at the Texas A&M Health Science Center School of Public Health

Chanam Lee, PhD, MLA
Joint Associate Professor in the Department of Landscape Architecture and Urban Planning Center for Health Systems and Design at the Texas A&M University College of Architecture

Szu-Hsuan Lin, PhD, MPH
Assistant Director of the Program on Disability Research and Community-based Care in the Department of Health Policy and Management at the Texas A&M Health Science Center School of Public Health

David McClellan, MD
Assistant Professor in the Department of Family and Community Medicine at the College of Medicine and Faculty Physician at the Texas A&M Physicians Family Medicine Center

Darcy McMaughan, PhD
Assistant Professor in the Department of Health Policy and Management at the Texas A&M Health Science Center School of Public Health and Director of the Program on Disability Research and Community-based Care

Philip Nash, BSc
Former Program Coordinator at the Texas A&M Physicians Family Medicine Center, Texas A&M Health Science Center College of Medicine

Chinedum O. Ojinnaka, MBBS, MPH
Doctoral Student in the Department of Health Policy and Management at the Texas A&M Health Science Center School of Public Health

Marcia G. Ory, PhD, MPH
Regents and Distinguished Professor in the Department of Health Promotion and Community Health Sciences at the Texas A&M Health Science Center School of Public Health and Director of the Program on Healthy Aging

Carlos A. O. Pavão, MPA
Doctoral Student in the Department of Health Promotion and Community Health Sciences at the Texas A&M Health Science Center School of Public Health

Cara L. Pennel, DrPH, MPH
Director, Public Health Practice, in the Department of Preventive Medicine and Community Health at the University of Texas Medical Branch

Billy U. Philips, Jr., PhD, MPH
Executive Vice President for Rural and Community Health at the Texas Tech University Health Sciences Center

Jairus Pulczinski
Graduate Research Assistant in the Department of Environmental and Occupational Health at the Texas A&M Health Science Center School of Public Health

Barbara J. Quiram, PhD
Professor in the Department of Health Policy and Management at the Texas A&M Health Science Center School of Public Health; Director of Special Programs & Global Health; Director of the USA Center for Rural Public Health Preparedness

Rhonda N. Rahn, PhD, CHES
Instructional Assistant Professor in the Department of Health and Kinesiology at the Texas A&M University College of Education

Alexandra Roach, MPH
Former Graduate Research Assistant and Graduate of the Texas A&M Health Science Center School of Public Health

Matthew L. Smith, PhD, MPH, CHES
Assistant Professor in the Department of Health Promotion and Behavior at the University of Georgia College of Public Health

Suzanne M. Swierc, MPH
Former Graduate Research Assistant and Graduate of the Texas A&M Health Science Center School of Public Health

Samuel D. Towne Jr., PhD, MPH, CPH
Assistant Professor in the Department of Health Promotion and Community Health Sciences at the Texas A&M Health Science Center School of Public Health

ADDITIONAL ACKNOWLEDGEMENTS:

The authors wish to gratefully acknowledge the superb editorial skills of Deborah Kellstedt, MPH, and Vanessa O'Neal, BS, and Madeleine Quick, BS. Assistance in the development of this volume was also provided by Lauren Jones and Dylan Dacy. Many thanks go to Mr. Carroll Hedrick for the page design and layout, and to Mr. John Colvin of Newman Printing Company, Inc.

CANCER IN RURAL AMERICA

By Chinedum O. Ojinnaka, MBBS, MPH; Jane Bolin, PhD, JD, BSN; Philip Nash, BSc; Marcia Ory, PhD, MPH; and David McClellan, MD

SCOPE OF THE PROBLEM

- Healthy People 2010 had inadequate data available to determine urban versus rural disparities in overall cancer mortality for any cancer.[1]
- Overall colorectal cancer screening rates in rural areas lag behind non-rural by ten percent.[1]
- Rural women are ten to 49 percent less likely to have had a mammogram in the past two years, or a Pap test within the past three years.[1]
- Rural versus non-rural cancer survival rates were not analyzed in Healthy People 2010.[1]
- State cancer registries, and data from the Surveillance, Epidemiology, and End Results (SEER) program provide rural researchers and community planners with current data to evaluate cancer prevalence and mortality.[2]
- Tobacco was expected to account for about 30 percent of all cancer deaths in 2014.[3]
- An estimated 1,658,370 new cases of cancer will occur in 2015.[4]
- Breast and prostate cancer remain the most commonly occurring types of cancer in women and men, respectively.[3]
- Rural/urban disparities exist across the cancer continuum because access to health care continues to be a challenge for rural dwellers.[5]
- Rates of cancer are highest across the Southeast and Midwest with pockets of high rates in the extreme Northeast, Montana, and Wyoming.[1]
- It is projected that costs associated with cancer care in 2020 will be $157.77 billion, assuming current incidence, survival, and cost of health care treatment.[6]

Healthy People 2020 continued the Healthy People 2010 cancer goal to reduce the overall number of new cancer cases, as well as the illness, disability, and death caused by cancer.[7] Although there was a 20 percent reduction in reported cancer deaths between 1991 and 2009,[8] cancer remains the second leading cause of death in the United States[4,9,10] accounting for one in every four deaths.[8] It is the leading cause of death for both males and females between age 40 and 79.[10] In 2015, it is projected that 1,658,370 new cases of cancer and 589,430 cancer-related deaths will occur.[4] It is also projected that cancers of the prostate, lung and bronchus, and colorectal areas will account for about 50 percent of new cancer cases among men in 2015; prostate cancer will account for 26 percent of these new cases.[4]

Among women, it is projected that cancers of the breast, lung and bronchus, and colorectal area will account for 50 percent of new cases; breast cancer will account for 29 percent of the new cases.[4] In the past five years for which data is available (2007-2011), there was a steady decline in cancer incidence among males while incidence rates among females did not change.[4] The decline seen among males has been attributed to rapid declines in colorectal, lung, and prostate cancer.[4] Although a decline in lung and colorectal cancer incidence has been observed among females, breast cancer incidence rates have remained stable.[10]

The costs of treating cancer continue to rise. National expenditure for cancer care in 2010 was $124.57 billion; it is projected that assuming steady trends, the cost would rise to $157.77 billion by year 2020.[6]

HEALTHY PEOPLE 2020 GOALS AND OBJECTIVES

This chapter discusses rural-urban variations and/or factors that may influence the following Healthy People 2020 goals[7]:

- **C-1** Reduce the overall cancer death rate
- **C-9** Reduce invasive colorectal cancer
- **C-10** Reduce invasive uterine cervical cancer
- **C-11** Reduce late-stage breast cancer
- **C-13** Increase the proportion of cancer survivors who are living five years or longer after diagnosis
- **C-15** Increase the proportion of women who receive a cervical cancer screening based on the most recent guidelines
- **C-16** Increase the proportion of adults who receive a colorectal cancer screening based on the most recent guidelines
- **C-17** Increase the proportion of women who receive a breast cancer screening based on the most recent guidelines

CANCER DISPARITIES IN RURAL AREAS

Rural disparities in cancer incidence and mortality exist throughout the United States with some regions experiencing significantly higher rates of cancers and higher mortality due to later stage of detection and poorer access to screening, care and clinical trials.

Mortality rates for all cancers combined is seven percent higher in Appalachian states compared to the rest of the nation, and five percent higher for all cancers combined for Appalachian counties compared to non-Appalachian counties.[11]

Colorectal cancer mortality has also been reported to be 15 percent higher for rural Georgia residents compared to urban Georgia residents.[12] Although cervical cancer related deaths declined over the past four decades, women residing in non-metropolitan areas have had persistently higher mortality rates compared to those residing in metropolitan areas; in 2007, cervical cancer mortality rate was 22 percent higher among non-metropolitan residents compared to metropolitan residents.[13] Cervical cancer mortality rates have also been reported to be two times higher for Black women compared to white women and three times higher for Black women residing in rural areas compared to white women resident in metropolitan areas.[13] Compared to urban residents, cervical cancer incidence rates are six to 15 percent higher among women residing in small urban and rural areas respectively, compared to residents of metropolitan areas.[13]

Routine screening reduces the occurrence of certain forms of cancer such as colorectal, breast and cervical cancers therefore; expert organizations such as the United States Preventive Services Task Force[14] and the American Cancer Society[15] recommend age-based screening guidelines for these cancers. However, sub-optimal adherence rates are still reported.[16] These sub-optimal rates are more pronounced for rural residents. A study that utilized the Behavioral Risk Factor Surveillance Survey data, a nationally representative data, reported that although an increase in colorectal cancer screening for rural residents occurred between 1998 and 2005, rural residents were still less likely to be screened for colorectal cancer compared to their urban counterparts; this disparity increased with increasing rurality.[17]

A Utah study also reported that rural residents were less likely to be adherent to colorectal cancer screening guidelines compared to urban residents.[18] Bennett et al. found that rural white residents had decreased odds of screening for colorectal cancer compared to urban white residents.[19]

A study conducted in rural Oregon found that patients with a positive family history of breast or colorectal cancer were more likely to be up-to-date with screening tests compared to those with no known family history.[20] Rural Kansas residents participating in an employee wellness program were less likely than urban or suburban residents to be adherent to breast and colorectal cancer screening.[21] Nuño and colleagues, found that compared to their urban counterparts, Hispanic and American Indian females resident in rural Southwestern states were five percent less likely to report having a mammogram within the past year, seven percent less likely to report having a mammogram within the past three years, and four percent more likely to report that their last mammogram was within the previous five years.[22] However, breast cancer screening among Medicaid enrollees has been reported to be highest among women resident in non-metropolitan rural areas compared to residents of non-metropolitan urban areas or metropolitan urban areas.[23] Cervical cancer screening using cytology has

also been reported to be lower among residents of the Appalachian Ohio region compared to their non-Appalachian Ohio counterparts.[24]

Disparities in cancer diagnosis and treatment have also been documented. Compared to urban residents, women residing in rural areas have been reported to have lower biopsy rates following abnormal diagnostic mammography; rural women who had biopsies were more likely to have longer average time to biopsies compared to urban women.[25] Rural breast cancer patients have been reported to be less likely to receive conservative treatment compared to urban residents.[26] Breast cancer patients who had mastectomy in a rural hospital were found to be less likely to have immediate reconstruction surgery compared to their urban counterparts.[27]

A study that utilized the National Cancer Institute's SEER data, a nationally representative dataset, found that rural breast cancer patients were less likely to receive radiation therapy compared to urban breast cancer patients.[28] Baldwin and colleagues also found that older and widowed rural cancer patients had the lowest rates of receipt of radiation therapy.[28] Although sentinel lymph node biopsy (SLNB) is currently preferred over axillary lymph node dissection for lymph node staging in patients with a breast cancer diagnosis, rural patients are less likely to undergo SLNB compared to urban patients; a lag in adoption of SLNB among rural physicians has also been reported.[29]

Rural residents diagnosed with melanoma have been found to be less likely than their urban counterparts to receive a sentinel lymph node biopsy.[30] Prostate cancer patients resident in rural areas have also been reported to be less likely than their urban counterparts to receive definitive treatment.[31] Compared to their urban counterparts, rural colorectal cancer patients have been reported to be less likely to undergo laparoscopic procedure.[32] In their study which utilized the Georgia Cancer Registry, Johnson et al. report that rural and sub-urban residents with a diagnosis of non-small cell lung cancer had 63 percent and 23 percent increased odds of having un-staged disease respectively compared to their urban counterparts.[33] Johnson et al. also found that rural residents had 13 percent decreased odds of receiving any treatment following diagnosis for non-small cell lung cancer.[33] This study also found that rural residents had eight percent lower odds of receiving chemotherapy, and 11 percent decreased odds of receiving radiation therapy compared to urban residents.[33] However, Johnson et al. found that rural residents diagnosed at stage I or II had nine percent and ten percent decreased odds of death compared to urban residents.[33] Markossian and colleagues, found that women residing in small and isolated rural areas were more likely to have un-staged breast cancer compared to urban residents.[34] They also found that compared to urban residents, rural residents were more likely (30 percent increased odds) to receive surgery after a breast cancer diagnosis but less likely (17 percent decreased odds) to receive radiotherapy.[34] Using SEER data, Martinez, et al. found that following lumpectomy for breast cancer, rural residents (OR=0.39) and residents of near metropolitan counties (OR=0.66) had decreased odds of receiving radiation therapy compared to urban residents. [35]

Cancer outcomes and survival are also influenced by rural residence. Increased psychological and psychosocial problems have also been reported among rural breast cancer patients.[26] Rural cancer survivors are less likely to report availability of a psychologist or cancer support group within 30 miles distance than their non-rural counterparts.[36] Five-year cervical cancer survival rates have been reported to be 3.5 percent lower for non-metropolitan women compared to metropolitan women.[13]

A Kentucky study found that rural cancer survivors had poorer mental health outcomes.[37] Rural lung cancer patients have also been found to have poor mental health outcomes compared to urban patients.[38] Cancer survivors age 65 and above who reside in rural areas have been reported to be more likely to forgo medical and dental care due to cost.[39] Another cancer that has been found to have a poor outcome for rural residence is carcinoid tumor.[40]

RURAL DISPARITIES ACCESSING CANCER CLINICAL TRIALS

Prior research has shown that clinical trials are an important resource for advancing new forms of cancer treatment, and for evaluating methods to improve pain management and palliative care as well as quality of life.[41] The problem of differential access to cancer care for rural versus urban populations has been widely recognized.[41-43] It has also been shown that rural communities and the uninsured participate less than other groups in cancer clinical trials.

Rates of survival for cancer are lower in rural areas where there are fewer sub-specialists.[44] The reasons for lack of participation in clinical trials are numerous but include lack of availability of

oncologists and radiation oncologists in rural areas, as well as scarcity of information about available clinical trial opportunities. Another major barrier to rural physician participation in clinical trials is costs associated with compliance with clinical trials reporting criteria. Another common problem in cancer clinical trial participation are patients' inability to afford travel and hotel bills, as payment for these expenses is considered an inducement to participation by review boards, and cannot be covered by the investigator. Patient-related barriers also include lack of health insurance, transportation costs, feelings of uncertainty, mistrust, personal and cultural barriers, and lack of understanding.[42,43] Provider barriers to recruitment include perceptions of lack of trust of participants, time constraints, lack of resources, inadequate knowledge of the community, selection bias, and trial design criteria.[42]

VARIATION BY RURAL REGION

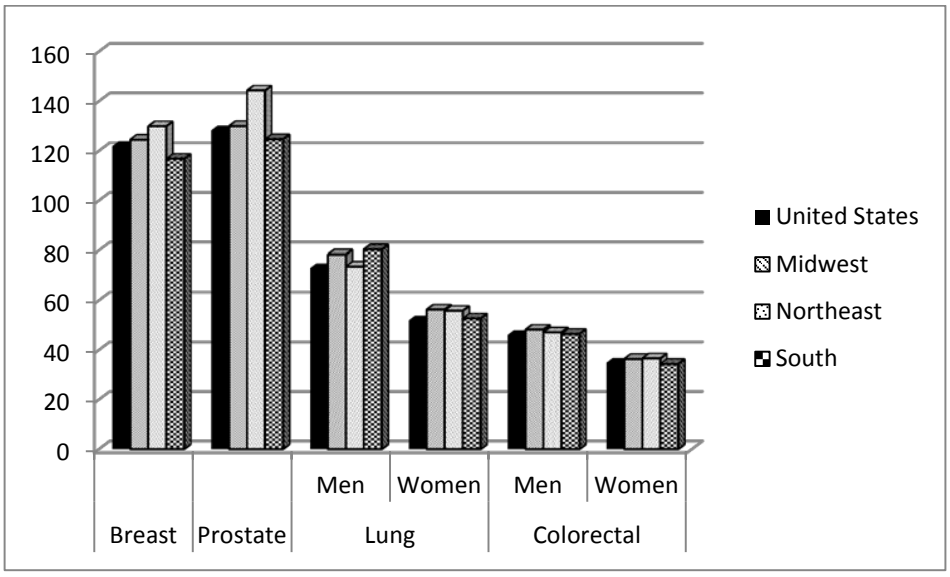
Regional variations have been demonstrated in both cancer incidence and mortality rates. **Figure 1** and **Figure 2** show the regional variations for the three most common types of cancer. It also shows the United States rates. Regional variations in receipt of care also exist. Cancer survivors in the South have been reported to be more likely to forgo medical care while cancer survivors who reside in the West are more likely to forgo medical and dental care.[39]

VARIATION BY RACE AND ETHNICITY

Cancer rates vary among the racial and ethnic groups. Asian Americans have the lowest cancer incidence and mortality rates while Blacks have the highest cancer incidence and mortality rates.[10] Rate of cancer occurrence among Blacks is double that among Asian Americans.[10] Whites have higher cancer incidence and mortality rates for all cancer sites combined compared to Asian Americans/Pacific Islanders, American Indians/Alaska Natives and Hispanics.[10] Whites also have higher incidence rates for the four most common cancer sites which include cancer of the prostate, lung and bronchus, colon and rectum, and urinary bladder for males, and cancer of the breast, lung and bronchus, colon and rectum, and uterine corpus for females. However, whites have lower incidence and mortality rates for cancers caused by infectious agents such as cervical, liver, and stomach cancers.[10] Breast cancer incidence is highest among white women; however, mortality rates are highest among Black women.[10] Between 1999 and 2009, Hispanics had the highest incidence of cervical cancer; in 2010, Black women had the highest incidence of cervical cancer.[46] Cervical cancer death rates were highest among Black women between 1999 and 2010; Hispanic women had the second highest mortality rates from cervical cancer between 1999 and 2010 except for year 2008 when American Indians/Alaska Natives had the highest cervical cancer mortality rates.[46] Cervical cancer mortality and incidence have been reported to be higher with increasing rurality for all racial/ethnic groups except for Hispanics, with women residing in small urban non-metropolitan and rural areas having increased mortality risk compared to urban residents.[13] Rural non-Hispanic and Black women have higher cervical cancer incidence rates, compared to their urban counterparts.[13]

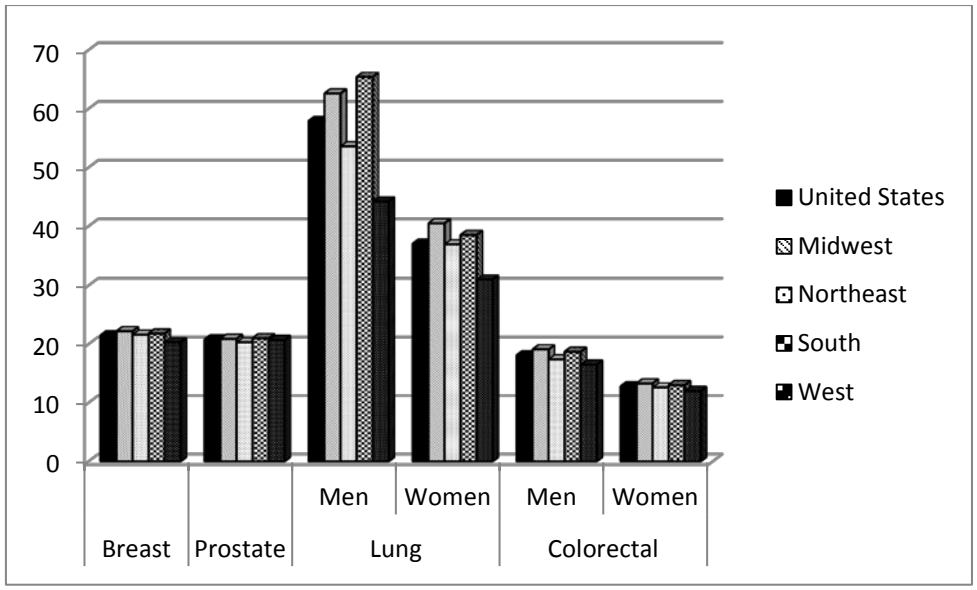
Compared to their urban counterparts, colorectal cancer screening rates have been found to be lower among, rural

Figure 1: Regional Incidence Rates of the Four Most Common Cancer Sites



Adapted from http://www.cdc.gov/cancer/dcpc/data/geographic.htm[45]

Figure 2: Regional Mortality Rates of the Four Most Common Cancer Sites



Adapted from http://www.cdc.gov/cancer/dcpc/data/geographic.htm[45]

whites, African Americans/Blacks and Hispanics, however, screening rates are lower among Asians and American Indian/Alaska natives resident in urban areas compared to those resident in rural areas.[47] African American females have been found to be more likely to report having had cervical cancer screening compared to whites.[19]

Race/ethnicity has also been reported to influence cancer diagnosis, treatment and survival. Blacks are less likely than whites to be diagnosed with cancers that are still at localized stage, thus, decreasing the likelihood of successful treatment.[10] Black rural residents have been reported to have an increased likelihood of being diagnosed with cervical cancer at an advanced stage compared to non-Hispanic non-metropolitan residents and metropolitan residents.[13] A Georgia study found that Hispanics were more likely to have a late stage diagnosis of breast cancer compared to non-Hispanics.[34] Markossian et al. also report that African Americans were more likely to have un-staged cancer and late stage cancer diagnoses compared to whites.[34] With regard to breast cancer treatment, Markossian et al. report that rural cancer patients are less likely to receive surgery and radiotherapy respectively compared to urban residents; African Americans were less likely to receive radiotherapy following diagnosis compared to whites.[34] Baldwin et al. found that African Americans and Hispanic/Latino women diagnosed with breast cancer were less likely to receive radiation therapy compared to other racial/ethnic groups.[31] Markossian and colleagues also report that African Americans are more likely to die following their diagnosis compared to whites.[34] Press and colleagues report that African Americans and Hispanics are more likely to have delayed treatment following an abnormal mammogram.[48] Blacks have lower five-year survival rates than whites for most cancers.[10] Singh found that cervical cancer survival rate was lower for non-metropolitan Blacks compared to metropolitan Blacks.[13] A South Carolina study found that African American women residing in rural South Carolina had decreased survival rate compared to their white counterparts.[49]

IMPACT ON MORTALITY, MORBIDITY, AND OTHER HEALTH PROBLEMS

Barriers to Prevention, Screening, and Treatment

Barriers that have been found to contribute to cancer disparities can be classified as patient-level or system-level barriers.[50] Some patient-level barriers include fatalistic beliefs,[51] lack of knowledge,[52,53] embarrassment,[54] fear of a negative outcome following routine screening,[53] cost of care/lack of insurance coverage[53,55] and fear of the screening procedure.[53,55,56] System-level barriers include lack of physician recommendation, increased travel time and travel distance to nearest care facility,[57] inadequate physician/healthcare provider supply,[58] complexities of navigation.[59] Perceived barriers have also been reported to be influenced by rural-urban residence.[51,55,57,58,60] These barriers have been found to impact cancer screening,[53] diagnosis,[59] and participation in clinical trials.[52]

Befort and colleagues found that rural residents were more likely to have fatalistic beliefs such as believing that cancer recommendations are confusing, cancer is not preventable, and everything causes cancer.[51] Lack of insurance, lack of transportation,

embarrassment, travel distance, and fear of having a cancer diagnosed have been reported as barriers to obtaining mammogram among rural residents.[57] A study conducted in a rural area in Washington found that perceived low risk, cost of screening, needing to take time off work, and fear of pain and finding cancer were barriers to screening mammography.[61] An Appalachian study reported that embarrassment, lack of health insurance, and no physician recommendation for mammogram in the past 12 months were barriers to breast cancer screening.[54] Cost and lack of insurance has been associated with decreased likelihood of compliance with preventative mammography and Pap test screening recommendation.[22] In their study, Nuño et al. found that visiting a health care provider within the past year was associated with increased Pap test and mammography screening among rural Hispanic women resident in southwestern region, however, cost was a statistically significant hindrance to visiting a health care provider.[22]

Fatalism, lack of provider recommendation, having insurance coverage that did not pay for colonoscopy, and fear of a negative outcome are some of the factors that have been found to negatively influence colorectal cancer screening.[62] A study which comprised of rural, low-income, and minority residents of North Carolina, identified cost of screening, fear of a cancer diagnosis, embarrassment and fear of the procedure as barriers to colorectal cancer screening.[55] A Georgia study in which all participants were rural residents reported that not having enough time with their physicians, cost, fear of complications, lack of transportation, anxiety about bowel preparation and procedure, and embarrassment were barriers to colorectal cancer screening.[56]

A rural Appalachian study reported that lack of knowledge, confusing screening guidelines, lack of physician recommendation, and embarrassment were barriers to colorectal cancer screening.[63] Colorectal cancer screening has also been reported to be more likely among older patients, college graduates, and married individuals.[64] Greiner et al. also reported that patients who had adequate time for discussion during physician visit and those with a cancer diagnosis were more likely to be up-to-date with colorectal cancer screening.[64] Rural residents have also identified fear of a negative outcome and pain as hindrances to Prostate Specific Antigen test or digital rectal exam.[65] Lack of knowledge, travel distance, cost, discouragement from oncologist and family physicians has been reported as barriers to participation in clinical trials by rural residents.[66] A rural Oregon study found that those who had at least one health maintenance visit within the previous two years were more likely to be up-to-date with colorectal cancer screening, Pap test, clinical breast exam, a mammogram or both clinical breast examination and mammogram compared to those who did not have a health maintenance visit.[67] Carney et al. also found that uninsured individuals were less likely to be up-to-date with colorectal cancer screening or Pap test compared to women with private insurance.[67] A study utilizing the Behavioral Risk Factor Surveillance Survey, a nationally representative dataset, found that rural Hispanic women who had health insurance were more likely to report being up-to-date with mammogram and Pap tests compared to rural Hispanic southwestern women who did not have health insurance; women who had visited a health care provider in the past year were more likely to report having a mammogram within the past one year compared to those who had not had a health care provider visit within the past year.[22] Having a health care provider visit within the past year, current employment and higher household income were also associated with increased likelihood of Pap test use among rural American Indians resident in the Southwestern region.[22]

With regards to health-system related barriers, an Iowa study found that travel time to nearest radiotherapy facility for rural residents was three times that of urban residents.[60] In an Appalachian study, Physicians reported that concerns about patients' inability to afford colorectal cancer screening tests, cultural barriers, inadequate reimbursement, and few physicians trained in colonoscopy were barriers to recommending colorectal cancer screening to patients.[63] An Alaskan study identified inadequate exchange of information between primary care physicians and gastroenterologists resulting in patients being uninformed about requirements was a barrier to colorectal cancer screening compliance.[68] A long wait time before appointments has also been identified as a barrier to colorectal cancer screening compliance.[68] A Pennsylvania study reported that primary physicians in rural Pennsylvania perceived insufficient physician supply as a contributing factor to decreased colorectal cancer screening.[58] The physicians reported that decreased physician supply resulted in increased patient load leading to time constraints when attending to patients.[58] The resultant

time constrains resulted in decreased likelihood of discussing preventive measures including colorectal cancer screening with patients.[58] A North Carolina study conducted in four rural counties with high rates of invasive cervical cancer found that inadequate reimbursement, cost, the burden of determining if patients' insurance company covered human papillomavirus (HPV) vaccine, cost of purchasing the vaccine, low demand for vaccine, and fear of expiration of vaccine were cited by providers as barriers to providing to patients an HPV vaccine.[69] Another study found that acculturated Hispanic women were significantly more likely than non-Hispanic whites to be compliant with Pap test while non-acculturated Hispanic women were less likely than non-Hispanic white women to be compliant with Pap test.[70] They also found that non-acculturated Hispanic women were more likely than acculturated Hispanic women and non-Hispanic whites to report barriers to cervical cancer screening.[70]

Women residing in rural intermountain regions of California diagnosed with breast cancer and who have mental health illness have been found to have limited access to mental health services.[71] Celaya et al. found that increased travel distance and increasing age was associated with decreased likelihood of receiving breast conserving surgery and radiation therapy among breast cancer patients.[72] Celaya and colleagues also found that receiving a diagnosis in winter and being unmarried decreased the likelihood of receiving radiation therapy.[72] Privately insured patients have also been reported to be more likely to receive laparoscopic surgery compared to individuals covered through government programs and uninsured individuals across all races/ethnicity.[32] This study also found that patients receiving care in rural hospitals were less likely to have laparoscopic surgery compared to those receiving care in urban hospitals.[32] Alnasser et al. also found that individuals receiving care in teaching hospitals were more likely to receive laparoscopic surgery compared to those receiving care in non-teaching hospitals.[32]

Access to health care also contributes to the cancer disparities. Markossian et al. report that a unit-increase in per-capita rate of breast cancer care physicians was associated with a 13 percent decrease in the risk of death following a breast cancer diagnosis.[34] In their 2007 literature review, Bettencourt et al. reported that challenges experienced by rural breast cancer patients such as increased travel time required to access health care, disruption of family life, and employment impact their psychosocial and psychological problems.[26]

KNOWN CAUSES OF THE PROBLEM

Although genetic predisposition plays a role in cancer incidence, factors such as poor lifestyle choices[73,74] and inadequate access to health care services[34] have also been found to influence cancer disparities. Lung cancer is a type of cancer that is greatly influenced by life style choices such as smoking. Prevalence of smoking in Kentucky is more than twice that in Utah for both males (29.1 percent vs 10.4 percent) and females (28.0 vs. 9.3 percent).[73] Lung cancer incidence and mortality rates exhibit similar trends to smoking prevalence with highest rates in Kentucky and lowest rates in Utah.[73] Factors that have been associated with increased prevalence of smoking include not having a high school diploma[74] and lower tobacco tax.[73] The leveling off seen in lung cancer rates among females compared to the decline in males has been attributed to lower smoking cessation rates among women.[73] Jemal et al. 2008 found that states with higher smoking prevalence and lower tobacco excise tax had increased lung cancer deaths between 1999 and 2005 among females.[73] Other factors that have been found to influence state smoking prevalence include public awareness of the deleterious effects of smoking, acceptable tobacco practices, tobacco control activities, and educational levels of residents.[73,75]

PROPOSED SOLUTIONS OR INTERVENTIONS

An Alabama study found that tailored counseling calls improved breast cancer screening guidelines adherence among rural African American women.[76] Thompson and colleagues found that following provision of culturally appropriate education and patient navigation using community health workers, 76.5 percent of women residing in New Mexico border counties who were previously not up-to-date with cervical cancer screening obtained Pap tests.[77] The use of patient navigators have also been shown to improve colorectal cancer screening rates,[68] and recruitment and retention of minority and low-income women in clinical trials.[78] An Iowa study found that mailed education letters and reminder phone calls improved colorectal cancer screening using fecal immunochemical tests (a.k.a. FIT) and colonoscopy among rural family medicine patients.[79] An Alaskan study found that training a physician assistant and a nurse practitioner increased colorectal cancer screening rates from ten percent to 47 percent.[68] A Wisconsin study found that awarding grants to health systems who worked with community partners improved access to colorectal cancer screening among underserved populations.[80]

While few studies have examined interventions to improve enrollment into cancer clinical trials among patients within rural communities, there are a set of best practices for engaging communities in research that can be applied toward this effort.[81] Additionally, emergent evidence that the use of patient navigators might help facilitate accrual of disadvantaged populations into clinical trials,[82] supports prior research on the general value of community health workers in helping underserved populations get access to needed health care.[83]

A randomized control trial in FQHCs in rural Louisiana with three arms: 1) women who received a recommendation for mammography and were scheduled at facilities in close proximity to their residence; or 2) who received health literacy intervention of videos featuring a) women discussing barriers and facilitators to screening, b) women recommending screening to other women, c) physicians recommending screening and a woman getting screened, and d) a fifth-grade level pamphlet highlighting breast cancer risk factors, benefits of routine screening and explanation of the test; or 3) women who received educational intervention, brief counselling and screening recommendation as well as scheduled and follow up reminder by a nurse including ensuring that they can locate the clinic, found that although screening rates increased among the three arms of intervention, screening rates were highest among the nurse support arm (study arm 3). However, this study pointed out that the cost of implementation might be a challenge in rural areas with limited resources.[84]

Organizing screening events during which fecal occult blood test kits (a.k.a. FOBT) were distributed has also been shown to increase colorectal cancer screening rate with 80 percent of those who received test kits returning them; these screening rates were further improved by follow-up calls and use of incentives.[80]

COMMUNITY MODELS KNOWN TO WORK

Texas Cancer Screening, Training, Education and Prevention

The Texas A&M Cancer Screening, Training, Education and Prevention program (**Texas C-STEP)**[85] was originally funded by the Texas Cancer Prevention and Research Institute (CPRIT) in 2011 to address barriers to colorectal cancer, and later breast and cervical cancer screening, in the largely rural Brazos Valley of Texas. Concurrently, the project trains family medicine residents in colonoscopy and women's health procedures. The project enhanced the ability of the Texas A&M Physicians Family Medicine Center, clinical home to a family medicine residency program, to provide accessible, affordable, culturally relevant cancer screening and diagnostic services to uninsured and underinsured area residents.[85]

The Texas C-STEP program has achieved significant success in meeting its original objectives and goals, conducting almost 1300 colonoscopies in its first 42 months, as a result of its education and outreach efforts by state-certified community health workers (a.k.a. promotoras). Individuals who self-reported as African American and Hispanic accounted for 20 percent and 44 percent of CPRIT-funded colonoscopies, respectively. Eighty-three percent of the CPRIT-funded colonoscopy recipients had never been screened before receiving colonoscopy. Perceived barriers to colorectal cancer using colonoscopy were identified by recipients; these barriers were found to exhibit demographic variations.[86]

"Mountain Tops & Bottoms" in Grundy County, Tennessee[87]

Nurse practitioner Darryl Adams initiated "Mountain Tops and Bottoms: A Women's Health Event" [87] in 2009 following the death of a patient with breast cancer. The 53-year-old woman came to see Adams because she thought she had a breast infection. Adams' examination revealed a large cancerous mass that had metastasized throughout the woman's body. The woman had never done a breast self-examination or had a mammogram. Mountain Tops and Bottoms now attracts 50 to 60 women each year, many of them driving from their sparsely populated mountain homes over rough, narrow roads from as far away as 50 miles. As the enthusiasm spread, other small communities have held their own outreaches, using Adams as their keynote speaker. Core to all events is what Adams calls "my simple and girly Power Point presentation," which outlines how to access free screenings and why self-care and screenings are so important. The all-female atmosphere also gives Adams an opportunity to explain what women can expect. Some women are uncomfortable thinking a man might be looking at their breasts, others worry that screenings are painful. Once she is able to convince them to have that first screening, Adams said those worries dissipate.

Friend to Friend: Translating an Evidence-Based Program to Rural Texas

Women living in many parts of rural Texas are not meeting recommendations for mammogram or Pap tests. Treatment costs and mortality are often higher for rural and underserved women due, in part, to lack of access to preventive screening which is associated with later diagnosis and poorer survivorship. Friend to Friend[88] is a research tested, best practice program supported by Texas AgriLife Extension which aims at increasing screening rates for underserved, diverse women living in rural and frontier communities in 40 counties in Texas. Friend to Friend attracted a diverse population of women from rural and frontier areas whose current screening rates are lower than those seen in other Texas communities. It improved knowledge about best practices for mammogram screening although there is still some room for improvement. The majority of women who attended signed commitment cards for future screening. Community events such as Friend to Friend can be utilized to plan, market, and implement evidence-based intervention programs to diverse groups of Texas women living in rural and frontier areas. AgriLife Extension's extensive statewide outreach education system could further aid in partnering with healthcare professionals and obtaining resources for such initiatives. More than 1,000 participants were recruited in the first phase of this project.

Stanford University's Cancer Thriving and Surviving

Cancer survivors often experience late or long-term effects of the disease or its treatment. Examples of these long-term complications include depression, fatigue, pain, impaired physical function, and fear of recurrence.[89] The Cancer Thriving and Surviving (CTS) program[90] was developed to enable cancer survivors develop self-management skills that would help them combat these late or long-term effects. The CTS program is a modified version of the Chronic Disease Self-Management Program,[91] an evidence based intervention (Stanford School of Medicine). The program consists of small group workshops. Each workshop lasts for six weeks and each once-a-week session lasts for two and half hours. After going through the program, participants were more likely to report better communication with their physicians and improved energy levels, and less likely to report sleep or stress problems. They were also less likely to report being depressed.

Programs for Cancer Survivors

The care and well-being of the estimated 13 million cancer survivors in the U.S. presents an enormous challenge to public health.[92] Cancer survivors are at risk for recurrence and second cancers, and are more likely than the general population to experience co-morbid conditions such as cardiovascular disease, diabetes, and osteoporosis than the general population not only due to the late and long-term side effects of cancer and its treatment, but a common set of risk factors. Despite studies identifying physical inactivity and other lifestyle factors as having a negative impact on a wide variety of survivorship outcomes, relatively few cancer survivors meet established recommendations for physical activity, fruit and vegetable consumption, or weight management.[93-96] Cancer survivors, as well as health care professionals, are often unaware of what types of health promotion programs are available for cancer survivors, or how to access them. Working with the Cancer Alliance of Texas, The Texas A&M School of Public Health surveyed organizations in Texas about the availability of psychosocial, physical activity, nutrition, and weight management program services. Results were compiled and displayed in google maps so that persons across the state could identify the location of different services. This type of locator service,[97] which will be especially helpful to those living in rural areas, is being further developed in a web-based application expanded to consider a variety of programs and services for those with chronic conditions.

SUMMARY AND CONCLUSIONS

Rural and minority populations are at risk for sub-optimal adherence to recommended screening guidelines, and receipt of evidence-based treatment. They are also more likely to receive a late stage cancer diagnosis. These disparities as well as, inadequate access to specialized cancer services, put rural residents at an increased risk for poorer outcomes. Community based models show that targeted and culturally relevant education and interventions could increase cancer awareness and screening rates. These models also show that expanding access to screening for those who cannot afford it also improves screening rates. These findings provide a template for stakeholders and organizations working to reduce cancer disparities. Efforts to identify other strategies that could improve awareness, access, screening rates, and use of evidence-based treatment among rural residents are recommended.

REFERENCES

1. National Center for Health Statistics. *Healthy People 2010 Final Review.* Hyattsville, MD. 2012. http://www.cdc.gov/nchs/data/hpdata2010/hp2010_final_review.pdf. Accessed December 16, 2014.

2. National Cancer Institute. http://seer.cancer.gov/. National Institutes of Health. Accessed June 26, 2015.

3. American Cancer Society. *Cancer Facts & Figures 2014*. Atlanta, GA: American Cancer Society; 2014. http://www.cancer.org/acs/groups/content/@research/documents/webcontent/acspc-042151.pdf. Accessed December 15, 2014.

4. Siegel RL, Miller KD, Jemal A. Cancer statistics, 2015. *CA Cancer J Clin.* 2015;65(1):5-29.

5. Bolin JN, Bellamy G, Ferdinand AO, Ojinnaka C. Rural access to quality health insurance. In: Bolin JN, Bellamy G, Ferdinand AO, et al., eds. *Rural Healthy People 2020*. Vol. 1. College Station, TX: Texas A&M University Health Science Center, School of Public Health, Southwest Rural Health Research Center; 2015:1-11.

6. Mariotto AB, Yabroff KR, Shao Y, Feuer EJ, Brown ML. Projections of the cost of cancer care in the United States: 2010-2020. *J Natl Cancer Inst*. 2011;103(2):117-128.

7. U.S. Department of Health and Human Services. Healthy People 2020: Cancer Objectives. http://www.healthypeople.gov/2020/topicsobjectives2020/objectiveslist.aspx?topicId=5. Updated December 15, 2014. Accessed December 16, 2014.

8. Siegel R, Naishadham D, Jemal A. Cancer statistics, 2013. *CA Cancer J Clin*. 2013;63(1):11-30.

9. Hoyert DL, Xu J. Deaths: preliminary data for 2011. *Natl Vital Stat Rep*. 2012;61(6):1-51.

10. Siegel R, Ma J, Zou Z, Jemal A. Cancer statistics, 2014. *CA Cancer J Clin*. 2014;64(1):9-29.

11. Blackley D, Behringer B, Zheng S. Cancer mortality rates in Appalachia: descriptive epidemiology and an approach to explaining differences in outcomes. *J Community Health*. 2012;37(4):804-813.

12. Hines RB, Markossian TW. Differences in late-stage diagnosis, treatment, and colorectal cancer-related death between rural and urban African Americans and whites in Georgia. *J Rural Health*. 2012;28(3):296-305.

13. Singh GK. Rural-urban trends and patterns in cervical cancer mortality, incidence, stage, and survival in the United States, 1950-2008. *J Community Health*. 2012;37(1):217-223

14. U.S. Preventive Services Task Force. Recommendations for Primary Care Practice. http://www.uspreventiveservicestaskforce.org/Page/Name/recommendations. Published December, 2013. Accessed February 3, 2015.

15. American Cancer Society. American Cancer Society Guidelines for the Early Detection of Cancer. http://www.cancer.org/healthy/findcancerearly/cancerscreeningguidelines/american-cancer-society-guidelines-for-the-early-detection-of-cancer. Updated October 29, 2014. Accessed February 12, 2015.

16. Centers for Disease Control and Prevention (CDC). Cancer screening - United States, 2010. *MMWR Morb Mortal Wkly Rep.* 2012;61(3):41-45.

17. Cole AM, Jackson JE, Doescher M. Urban-rural disparities in colorectal cancer screening: cross-sectional analysis of 1998-2005 data from the Centers for Disease Control's Behavioral Risk Factor Surveillance Study. *Cancer Med*. 2012;1(3):350-356.

18. Anderson AE, Henry KA, Samadder NJ, Merrill RM, Kinney AY. Rural vs urban residence affects risk-appropriate colorectal cancer screening. *Clin Gastroenterol Hepatol*. 2013;11(5):526-533.

19. Bennett KJ, Probst JC, Bellinger JD. Receipt of cancer screening services: surprising results for some rural minorities. *J Rural Health*. 2012;28(1):63-72.

20. Carney PA, O'Malley JP, Gough A, et al. Association between documented family history of cancer and screening for breast and colorectal cancer. *Prev Med*. 2013;57(5):679-684.

21. Hui SK, Engelman KK, Shireman TI, Ellerbeck EF. Adherence to cancer screening guidelines and predictors of improvement among participants in the Kansas State Employee Wellness Program. *Prev Chronic Dis*. July 11 2013;10:E115.

22. Nuño T, Gerald JK, Harris R, Martinez ME, Estrada A, García F. Comparison of breast and cervical cancer screening utilization among rural and urban Hispanic and American Indian women in the Southwestern United States. *Cancer Causes Control*. 2012;23(8):1333-1341.

23. Bhanegaonkar A, Madhavan SS, Khanna R, Remick SC. Declining mammography screening in a state Medicaid Fee-for-Service program: 1999-2008. *J Womens Health (Larchmt)*. 2012;21(8):821-829.

24. Pierce Campbell CM, Menezes LJ, Paskett ED, Giuliano AR. Prevention of invasive cervical cancer in the United States: past, present, and future. *Cancer Epidemiol Biomarkers Prev*. 2012;21(9):1402-1408.

25. Goldman LE, Walker R, Hubbard R, Kerlikowske K; Breast Cancer Surveillance Consortium. Timeliness of abnormal screening and diagnostic mammography follow-up at facilities serving vulnerable women. *Med Care*. 2013;51(4):307-314.

26. Bettencourt BA, Schlegel RJ, Talley AE, Molix LA. The breast cancer experience of rural women: a literature review. *Psychooncology*. 2007;16(10):875-887.

27. Hershman DL, Richards CA, Kalinsky K, et al. Influence of health insurance, hospital factors and physician volume on receipt of immediate post-mastectomy reconstruction in women with invasive and non-invasive breast cancer. *Breast Cancer Res Treat*. 2012;136(2):535-545.

28. Baldwin LM, Patel S, Andrilla CH, Rosenblatt RA, Doescher MP. Receipt of recommended radiation therapy among rural and urban cancer patients. *Cancer*. 2012;118(20):5100-5109.

29. Arrington AK, Kruper L, Vito C, Yim J, Kim J, Chen SL. Rural and urban disparities in the evolution of sentinel lymph node utilization in breast cancer. *Am J Surg*. 2013;206(5):674-681.

30. Shah DR, Yang AD, Maverakis E, Martinez SR. Assessing rural-urban disparities in the use of sentinel lymph node biopsy for melanoma. *J Surg Res*. 2013;184(2):1157-1160.

31. Baldwin LM, Andrilla CH, Porter MP, Rosenblatt RA, Patel S, Doescher MP. Treatment of early-stage prostate cancer among rural and urban patients. *Cancer*. 2013;119(16):3067-3075.

32. Alnasser M, Schneider EB, Gearhart SL, et al. National disparities in laparoscopic colorectal procedures for colon cancer. *Surg Endosc*. 2014;28(1):49-57.

33. Johnson AM, Hines RB, Johnson JA 3rd, Bayakly AR. Treatment and survival disparities in lung cancer: the effect of social environment and place of residence. *Lung Cancer*. 2014;83(3):401-407.

34. Markossian TW, Hines RB, Bayakly R. Geographic and racial disparities in breast cancer-related outcomes in Georgia. *Health Serv Res*. 2014;49(2):481-501.

35. Martinez SR, Shah DR, Tseng WH, Canter RJ, Bold RJ. Rural-urban disparities in use of post-lumpectomy radiation. *Med Oncol.* 201229(5):3250-3257.

36. Andrykowski MA, Burris JL. Use of formal and informal mental health resources by cancer survivors: differences between rural and nonrural survivors and a preliminary test of the theory of planned behavior. *Psychooncology*. 2010;19(11):1148-1155.

37. Burris JL, Andrykowski M. Disparities in mental health between rural and nonrural cancer survivors: a preliminary study. *Psychooncology*. 2010;19(6):637-645.

38. Andrykowski MA, Steffens RF, Bush HM, Tucker TC. Disparities in mental health outcomes among lung cancer survivors associated with ruralness of residence. *Psychooncology*. 2014;23(4):428-436.

39. Palmer NR, Geiger AM, Lu L, Case LD, Weaver KE. Impact of rural residence on forgoing healthcare after cancer because of cost. *Cancer Epidemiol Biomarkers Prev*. 2013;22(10):1668-1676.

40. Cheung R. Racial and socioeconomic disparities in malignant carcinoid cancer cause specific survival: analysis of the surveillance, epidemiology and end results national cancer registry. *Asian Pac J Cancer Prev*. 2013;14(12):7117-1720.

41. Baquet CR, Henderson K, Commiskey P, Morrow JN. Clinical trials: the art of enrollment. *Semin Oncol Nurs*. 2008;24(4):262-269.

42. Paskett ED, Cooper MR, Stark N, et al. Clinical trial enrollment of rural patients with cancer. *Cancer Pract.* 2002;10(1):28-35.

43. Mills EJ, Seely D, Rachlis B, et al. Barriers to participation in clinical trials of cancer: a meta-analysis and systematic review of patient-reported factors. *Lancet Oncol.* 2006;7(2):141-148.

44. Shugarman LR, Sorbero ME, Tian H, Jain AK, Ashwood JS. An exploration of urban and rural differences in lung cancer survival among medicare beneficiaries. *Am J Public Health*. 2008;98(7):1280-1287.

45. Centers for Disease Control and Prevention (CDC). http://www.cdc.gov/cancer/dcpc/data/geographic.htm. Accessed June 26, 2015.

46. Centers for Disease Control and Prevention (CDC). Cervical Cancer Rates by Race and Ethnicity. http://www.cdc.gov/cancer/cervical/statistics/race.htm. Updated August 27, 2014. Accessed December 15, 2014.

47. Cole AM, Jackson JE, Doescher M. Colorectal cancer screening disparities for rural minorities in the United States. *J Prim Care Community Health*. 2013;4(2):106-111.

48. Press R, Carrasquillo O, Sciacca RR, Giardina EG. Racial/ethnic disparities in time to follow-up after an abnormal mammogram. *J Womens Health (Larchmt)*. 2008;17(6):923-930.

49. Adams SA, Butler WM, Fulton J, et al. Racial disparities in breast cancer mortality in a multiethnic cohort in the Southeast. *Cancer*. 2012;118(10):2693-2699.

50. Klabunde CN, Vernon SW, Nadel MR, Breen N, Seeff LC, Brown ML. Barriers to colorectal cancer screening: a comparison of reports from primary care physicians and average-risk adults. *Med Care*. 2005;43(9):939-944.

51. Befort CA, Nazir N, Engelman K, Choi W. Fatalistic cancer beliefs and information sources among rural and urban adults in the USA. *J Cancer Educ*. 2013;28(3):521-526.

52. Aumiller BB, Parrott R, Lengerich EJ, et al. Responses to a theoretically adapted clinical trial education session: faith-based sites versus rural work site dissemination. *J Cancer Educ*. 2013;28(4):698-708.

53. Howell JL, Shepperd JA, Logan H. Barriers to oral cancer screening: a focus group study of rural Black American adults. *Psychooncology*. 2013;22(6):1306-11.

54. Schoenberg NE, Studts CR, Hatcher-Keller J, Buelt E, Adams E. Patterns and determinants of breast and cervical cancer non-screening among Appalachian women. *Women Health*. 2013;53(6):552-571.

55. Jilcott Pitts SB, Lea CS, May CL, et al. "Fault-line of an earthquake": a qualitative examination of barriers and facilitators to colorectal cancer screening in rural, Eastern North Carolina. *J Rural Health*. 2013;29(1):78-87.

56. Wilkins T, Gillies RA, Harbuck S, Garren J, Looney SW, Schade RR. Racial disparities and barriers to colorectal cancer screening in rural areas. *J Am Board Fam Med*. 2012;25(3):308-317.

57. Ndikum-Moffor FM, Braiuca S, Daley CM, Gajewski BJ, Engelman KK. Assessment of mammography experiences and satisfaction among American Indian/Alaska Native women. *Womens Health Issues*. 2013;23(6):e395-e402.

58. Rosenwasser LA, McCall-Hosenfeld JS, Weisman CS, Hillemeier MM, Perry AN, Chuang CH. Barriers to colorectal cancer screening among women in rural central Pennsylvania: primary care physicians' perspective. *Rural Remote Health*. 2013;13(4):2504.

59. Tejeda S, Darnell JS, Cho YI, Stolley MR, Markossian TW, Calhoun EA. Patient barriers to follow-up care for breast and cervical cancer abnormalities. *J Womens Health (Larchmt)*. 2013;22(6):507-517.

60. Ward MM, Ullrich F, Matthews K, et al. Where do patients with cancer in Iowa receive radiation therapy? *J Oncol Pract*. 2014;10(1):20-25.

61. Tejeda S, Thompson B, Coronado GD, Martin DP. Barriers and facilitators related to mammography use among lower educated Mexican women in the USA. *Soc Sci Med*. 2009;68(5):832-839.

62. Holt CL, Shipp M, Eloubeidi M, et al. Use of focus group data to develop recommendations for demographically segmented colorectal cancer educational strategies. *Health Educ Res*. 2009;24(5):876-889.

63. Hatcher J, Dignan MB, Schoenberg N. How do rural health care providers and patients view barriers to colorectal cancer screening? Insights from appalachian kentucky. *Nurs Clin North Am*. 2011;46(2):181-192.

64. Greiner KA, Engelman KK, Hall MA, Ellerbeck EF. Barriers to colorectal cancer screening in rural primary care. *Prev Med*. 2004;38(3):269-275.

65. Oliver JS, Grindel CG, DeCoster J, Ford CD, Martin MY. Benefits, barriers, sources of influence, and prostate cancer screening among rural men. *Public Health Nurs*. 2011;28(6):515-522.

66. Virani S, Burke L, Remick SC, Abraham J. Barriers to recruitment of rural patients in cancer clinical trials. *J Oncol Pract*. 2011;7(3):172-177.

67. Carney PA, O'Malley J, Buckley DI, et al. Influence of health insurance coverage on breast, cervical, and colorectal cancer screening in rural primary care settings. *Cancer*. 2012;118(24):6217-6225.

68. Redwood D, Provost E, Perdue D, Haverkamp D, Espey D. The last frontier: innovative efforts to reduce colorectal cancer disparities among the remote Alaska Native population. *Gastrointest Endosc*. 2012;75(3):474-480.

69. Keating KM, Brewer NT, Gottlieb SL, Liddon N, Ludema C, Smith JS. Potential barriers to HPV vaccine provision among medical practices in an area with high rates of cervical cancer. *J Adolesc Health*. 2008;43(4 Suppl):S61-S67.

70. Coronado GD, Thompson B, Koepsell TD, Schwartz SM, McLerran D. Use of Pap test among Hispanics and non-Hispanic whites in a rural setting. *Prev Med*. 2004;38(6):713-722.

71. Aylward A, Kreshka MA, Parsons R, et al. Access to mental health care in rural communities among women diagnosed with breast cancer. *Breast J*. 2012;18(6):630-631.

72. Celaya MO, Rees JR, Gibson JJ, Riddle BL, Greenberg ER. Travel distance and season of diagnosis affect treatment choices for women with early-stage breast cancer in a predominantly rural population (United States). *Cancer Causes Control*. 2006;17(6):851-856.

73. Jemal A, Thun MJ, Ries LA, et al. Annual report to the nation on the status of cancer, 1975-2005, featuring trends in lung cancer, tobacco use, and tobacco control. *J Natl Cancer Inst*. 2008;100(23):1672-1694.

74. Garrett BE, Dube SR, Winder C, Caraballo RS; Centers for Disease Control and Prevention (CDC). Cigarette smoking - United States, 2006-2008 and 2009-2010. *MMWR Surveill Summ*. 2013;62 Suppl 3:81-84.

75. Ibrahim JK, Glantz SA. The rise and fall of tobacco control media campaigns, 1967 2006. *Am J Public Health*. 2007;97(8):1383-1396.

76. West DS, Greene P, Pulley L, et al. Stepped-care, community clinic interventions to promote mammography use among low-income rural African American women. *Health Educ Behav*. 2004;31(4 Suppl):29S-44S.

77. Thompson B, Vilchis H, Moran C, Copeland W, Holte S, Duggan C. Increasing cervical cancer screening in the United States-Mexico border region. *J Rural Health*. 2014;30(2):196-205.

78. Fouad MN, Johnson RE, Nagy MC, Person SD, Partridge EE. Adherence and retention in clinical trials: a community-based approach. *Cancer*. 2014;120 Suppl 7:1106-1112.

79. Levy BT, Xu Y, Daly JM, Ely JW. A randomized controlled trial to improve colon cancer screening in rural family medicine: an Iowa Research Network (IRENE) study. *J Am Board Fam Med*. 2013;26(5):486-497.

80. LoConte NK, Weeth-Feinstein L, Conlon A, Scott S. Engaging health systems to increase colorectal cancer screening: community-clinical outreach in underserved areas of Wisconsin. *Prev Chronic Dis*. November 21 2013;10:E192.

81. Bolin JN, Ory M. Community Based Participatory Research (CBPR): How communities in Texas can improve health through CBPR. *Texas Public Health Association Journal*. 2007;59(1):6-9.

82. Guadagnolo BA, Petereit DG, Helbig P, et al. Involving American Indians and medically underserved rural populations in cancer clinical trials. *Clin Trials*. 2009;6(6):610-617.

84. Davis TC, Rademaker A, Bennett CL, et al. Improving mammography screening among the medically underserved. *J Gen Intern Med*. 2014;29(4):628-635.

83. U.S. Department of Health and Human Services, Health Resources and Services Administration, Bureau Of Health Professions. Community Health Worker National Workforce Study. http://bhpr.hrsa.gov/healthworkforce/reports/chwstudy2007.pdf. Published March, 2007. Accessed February 12, 2015.

85. Texas Cancer Screening, Training, Education and Prevention program. http://www.texascstep.org/ Published 2014. Updated February 2015. Accessed February 4, 2015.

86. Ojinnaka C, Vuong A, Helduser J, et al. Determinants of Variations in Self-reported Barriers to Colonoscopy Among Uninsured Patients in a Primary Care Setting [published online ahead of print August 6 2014]. *J Community Health*. 2015;40(2):260-270.

87. Helseth, C. Screening Tennessee women from top to bottom. *The Rural Monitor.* August 13, 2013. https://www.raconline.org/rural-monitor/screening-tennessee-women-top-to-bottom/. Accessed June 26, 2015.

88. Texas A&M AgriLife Extension. Friend to Friend – Staying Healthy Together. Texas A&M AgriLife Extension – District 12. http://southtexas.tamu.edu/special-projects/friend-to-friend-staying-healthy-together/. Accessed June 26, 2015.

89. Hewitt ME, Greenfield S, Stovall E. National Cancer Policy Board (US), Committee on Cancer Survivorship: Improving Care and Quality Of Life. From Cancer Patient to Cancer Survivor: Lost in Transition. Washington, DC: National Academies Press; 2006.

90. Stanford Medicine. Cancer: Thriving and Surviving Internet Program. Stanford School of Medicine. http://patienteducation.stanford.edu/internet/cancerol.html. Accessed June 26, 2015.

91. Stanford Medicine. Chronic Disease Self-Management Program (Better Choices, Better Health® Workshop). Stanford School of Medicine. http://patienteducation.stanford.edu/programs/cdsmp.html. Accessed December 17, 2014.

92. Valdivieso M, Kujawa AM, Jones T, Baker LH. Cancer survivors in the United States: a review of the literature and a call to action. *Int J Med Sci*. 2012;9(2):163-173.

93. Coups EJ, Ostroff JS. A population-based estimate of the prevalence of behavioral risk factors among adult cancer survivors and noncancer controls. *Prev Med*. 2005;40(6):702-711.

94. Demark-Wahnefried W, Rock CL, Patrick K, Byers T. Lifestyle interventions to reduce cancer risk and improve outcomes. *Am Fam Physician*. 2008;77(11):1573-1578.

95. Arroyave WD, Clipp EC, Miller PE, et al. Childhood cancer survivors' perceived barriers to improving exercise and dietary behaviors. *Oncol Nurs Forum*. 2008;35(1):121-130.

96. Carmack CL, Basen-Engquist K, Gritz ER. Survivors at higher risk for adverse late outcomes due to psychosocial and behavioral risk factors. *Cancer Epidemiol Biomarkers Prev*. 2011;20(10):2068-2077.

97. MyHealthFinder. http://myhealthfinder.org/. Accessed June 26, 2015.

Suggested Chapter Citation:

Ojinnaka C, Bolin JN, Nash P, Ory M, McClellan D. Cancer in Rural America. In: Bolin JN, Bellamy G, Ferdinand AO, et al. eds. *Rural Healthy People 2020*. Vol. 2. College Station, TX: Texas A&M University Health Science Center, School of Public Health, Southwest Rural Health Research Center; 2015:1-14.

RURAL HEALTH EDUCATION AND COMMUNITY-BASED PROGRAMS

By Cara L. Pennel, DrPH, MPH; Heather R. Clark, DrPH, MSPH; Rhonda N. Rahn PhD, CHES

SCOPE OF THE PROBLEM

- Educational and community-based programs were ranked as the 12th most important rural health priority by respondents to the national Rural Healthy People 2020 survey.[1]
- The vast majority of the nation's poorest rural school districts are in the southern U.S.; however, other largely rural states, such as Montana, South Dakota, and parts of Kentucky, have also identified rural regions with high student poverty rate.[2]
- In the poorest districts, Title I eligibility is more than double that of all other districts, where the children are also more likely to be English Language Learners.[2]
- High school competency test rates vary, but data suggests that rural schools face many of the same graduation challenges as inner-city urban schools, including poor, old infrastructure, high poverty, and scarce financial resources.[2,3]
- Due to smaller populations, rural communities are faced with 'economies of scale' issues for service delivery, including education and community-based programs.[4,p.11]
- Rural education and community-based programs are more likely to be staffed by individuals with less higher education, fewer credentials, less specialization, and fewer opportunities for continuing education to meet the licensure requirements imposed by many states.[5]
- Transportation and long travel distances in rural and remote areas are problems for both educators, staff, and the rural populations they serve.[4,6]
- Federally funded programs in rural communities, such as Head Start, struggle to meet national performance standards.[4,6]
- Rural settings are more likely to lack the organizational capacity, technical and financial support, and expertise to develop, implement, and sustain evidence-based education and community-based programs.[7]

Over the past decade, some national progress has been made toward reaching the objectives of the education and community-based program priority area set forth in Healthy People 2010.[8] For the 17 objectives with measurable data, one objective met the Healthy People 2010 goal: to increase school nurse-to-students ratios to at least 1:750 in middle and junior high schools. Twelve Healthy People 2010 objectives made progress toward their targets. Six Healthy People 2010 objectives improved significantly from baseline to follow up, including high school graduation rates; school health education for all priority areas, unintentional injury, and violence; and school nurse-to-student ratios in all middle/junior and senior high schools. Two Healthy People 2010 objectives showed no change: school health education for unhealthy dietary patterns and environmental health. Two other Healthy People 2010 objectives moved away from their target: participation in employer-sponsored health promotion activities, which showed a statistically significant shift, and school health education on alcohol and other drug use in middle/junior and senior high schools. Thirty-nine of the objectives did not have measurable data. Of these, 22 objectives only had baseline data, two remained developmental, and 15 objectives from Healthy People 2010 were deleted.[8] Due to the wide range of health education and community-based program types, topics and the settings in which they occur, tracking progress is

difficult. Healthy People 2010 objectives are tracked nationally, but these data are not stratified by rurality/urbanity.

HEALTHY PEOPLE 2020 GOALS AND OBJECTIVES

The Healthy People 2020 goal for the education and community-based programs topic area is to "increase the quality, availability, and effectiveness of educational and community-based programs designed to prevent disease and injury, improve health, and enhance quality of life." [9] Under this goal, objectives, by setting, include:

1. **School-based objectives**
    - Early Head Start and Head Start health education programs to prevent health problems
    - Elementary, middle, and senior high schools health education programs to prevent health problems
    - Elementary, middle, and senior high schools with health education goals or objectives
    - Elementary, middle, and senior high schools with registered school nurse to student ratio of 1:750
    - High school graduation completion
    - College and university students who receive health risk behavior information
2. **Worksite-based objectives**
    - Worksites with employee health promotion programs
    - Employees who participate in employer-sponsored health promotion activities
3. **Community-based organization objectives**
    - Community-based organizations providing population-based primary prevention services
    - Local health departments with culturally appropriate and linguistically competent programs
4. **Health professions-based objectives**
    - Core clinical prevention and population health curriculum in MD, DO, undergraduate nursing, nurse practitioner, physician assistant, pharmacy, dental schools, programs, and/or training
    - Academic institutions with health professions education programs that include and target interprofessional, (trans-disciplinary), educational experiences

RURAL HEALTHY PEOPLE 2020 SURVEY OUTCOMES

Rural stakeholders who responded to a nationwide web-based survey, in advance of *Rural Healthy People 2020*, [1] ranked educational and community-based programs as the 12th most frequently cited rural health priority. Consistent with Healthy People 2020 priorities, improved school-based health education and promotion was identified as a significant sub-priority by 43 percent of respondents volunteering sub-priority issues, while ten percent of respondents identified access and availability, as well as community engagement as the next most important (SRHRC, unpublished data, 2015).[10] Suggestions for important programming ranged from basic community program services such as diet and exercise, breast feeding, cardiopulmonary resuscitation (i.e., CPR), nutrition and healthy eating, to poison control.

PREVALENCE AND DISPARITIES IN RURAL AREAS

As indicated in earlier chapters, rural populations face the same health and safety problems found in urban and suburban areas, but also encounter barriers unique to living in rural and remote regions. These challenges include longer distances to access education or community services, as well as shortages of healthcare providers.[4,6] Morbidity and mortality rates for most chronic diseases, childbirth, and work-place injuries are often higher in rural populations. Across all age groups, children in rural areas have higher mortality rates compared to urban children; children in rural areas also have higher rates of tobacco, alcohol, and drug use compared to their urban counterparts.[11] Methamphetamines, in particular, disproportionately affect rural populations, directly and indirectly.[11]

Other rural health concerns include combined injury-related mortality, which increases as counties become more rural,[12] and fatal car crashes are twice as high in rural areas. Guns pose significant risk to rural populations, due to the higher rates of hunting and target shooting, as well as guns in homes.

Additionally, air quality in rural areas may be worse due to industry exposures contributing to both the prevalence of respiratory symptoms and chronic obstructive pulmonary disease, e.g., mountain-top removal mining for coal in Appalachia.[13] However, spending early childhood years in a rural area with agricultural industry seems to offer protection against respiratory-related symptoms and illnesses.[11] Water sources in rural areas are more likely to be wells, which are more susceptible to contamination and less likely to contain fluoride.[11] Obesity rates in adults, children, and racial and ethnic minorities are higher in rural populations than in urban populations.[14] Exclusively rural concerns include injuries from working with large animals and farm work, as well as illness from agricultural pesticides.[11]

Objectives by Setting

The focus of this chapter is on promoting and improving health and preventing disease through educational and community-based programs. While there is no clear evidence that health education and community-based programs are less ubiquitous in rural than urban areas, rural communities are likely to have fewer resources and place greater reliance on the limited resources they do have. Based on these health issues and disparities, education and community-based programs are important in rural communities to promote individual, organizational, and environmental changes to improve health. This chapter primarily uses the Guide to Community Preventive Services (Community Guide) and Community Preventive Task Force (Task Force) recommendations as a framework to discuss education and community-based programs in school, worksite, and other community-based settings.[15,16] The Task Force, through the Community Guide, conducts systematic reviews, evaluates evidence, and makes recommendations on effective health program and policy interventions. This includes programs and policies in various community-based settings. Where possible, the Community Guide addresses use of health education and community-based programs in rural settings.

1. School-based objectives

There are observed differences in the quality of rural elementary and secondary schools compared to non-rural schools, with significant disparities noted particularly across the rural Southeast and rural Southwest. The vast majority of the nation's *poorest* rural school districts are in the southern U.S.; however, other largely rural states, such as Montana, South Dakota, and parts of Kentucky, have also identified rural regions with high student poverty rate.[2] In the poorest districts, where the children are also more likely to be English Language Learners, Title I (school lunch) eligibility is more than double than all other districts.[2] High school graduation rates vary, but data suggests that rural schools face many of the same graduation challenges as inner-city urban schools, including high poverty and scarce financial resources.[2,3] The following summarizes rural disparities by type of program, as well as age classification.

Head Start and Early Head Start programs**.** In 2013, Head Start programs served over one million children, pregnant women, and families in urban, suburban, and rural communities throughout the U.S.[17] While the purpose of Head Start and Early Head Start programs is to "promote the school readiness of young children from low-income families," Head Start programs have also been used as settings for health promotion programs.[18] According to the Fiscal Year 2013 Head Start Program Fact Sheet, Head Start programs do more than prepare children for school: they "work with families to ensure they have the means to obtain health insurance, services for children with disabilities, adequate housing, job training, and more." [17] Nationally, oral health and obesity prevention interventions are particularly prevalent in the Head Start setting.[19-30] Rural Head Start programs, however, struggle to provide health-related programs due to the lack of rural-based medical, dental, and mental health providers with whom they must work to provide enrolled children with services.[4,6]

School-based programs**.** More than half of all school districts and one-third of all public schools are located in rural areas, while 20 percent of all students in the U.S. attend a rural school.[31]Schools are natural settings for education and community-based programs to reach school-aged children, particularly in rural communities that may lack other organizational infrastructure for health promotion and disease prevention programs. The Task Force recommends several types of school- or classroom-based health promotion and disease prevention programs covering a wide array of program subjects that can be implemented in a rural school.

Related to safety and injury prevention, the Community Preventive Task Force recommends school-based instructional programs to reduce students riding with alcohol-impaired drivers. They also recommend various types of intervention

strategies to reduce youth violence. Effective violence reduction interventions include informational, cognitive/affective, and social skills building strategies with all ages, pre-kindergarten through high school, in all types of school environments. These programs are intended to reduce aggressive or violent behavior, bullying, and dating violence through the development of social and behavioral skills.[15]

Recommended health promotion interventions include behavioral interventions, many of which are classroom-based, to reduce television, computer, video game, and other screen time. School-based interventions are also recommended to increase physical activity through "enhanced school-based physical education" to "increase the amount of time that K-12 students engage in moderate- or vigorous-intensity physical activity during physical education classes." [15]

Disease prevention interventions recommended by the Task Force include group-based comprehensive risk reduction interventions for adolescents to prevent HIV/AIDS, other sexually transmitted infections, and pregnancy. Programs are often school-based, but can be delivered in other community-based settings. Also recommended to reduce sexual risk behaviors in adolescents are youth development behavioral interventions, coordinated with scheduled community service activities. Finally, the Task Force recommends closure of educational facilities for a required duration to reduce transmission of influenza.[15]

In addition to traditional school- and classroom-based settings, school-based health centers (SBHC) are another site for health promotion programs and services. School-based health centers are largely staffed by primary care providers, nurses or other clinical support staff, mental health providers and, to a lesser extent, health educators, nutritionists, and dental providers.[32] There are approximately 2,000 SBHC in the United States (of which over 25 percent are located in rural communities) that provide primary care, mental health care, substance abuse counseling, case management, dental health, nutrition education, health education, and health promotion.[32,33] Given SBHC staffing expertise and accessibility, SBHC are well positioned to implement education and community-based programs in rural communities.

Schools with health goals/objectives**.** The *Healthy, Hunger-Free Kids Act* of 2010 is designed to fund child nutrition and free lunch programs in schools. It also mandates that local education agencies or school districts develop a local wellness policy, a written document that "guides efforts to establish a school environment that promotes students' health, well-being, and ability to learn." [34] Even with a federal mandate, however, there is little evidence schools have taken steps to develop, formalize, and/or enforce such policies. A study of rural, low-income Colorado schools suggests many schools lack the organizational capacity and technical and financial support to establish and enforce health and wellness policies at the local level.[7]

School nurse-to-student ratios**.** Lower school nurse-to-student ratios on school campuses result in significantly more services for children with wide-ranging health issues and social conditions, including diabetes, allergies, asthma, unintended pregnancy, depression, autism, and school-related injuries.[35] Twenty-five percent of public schools in the U.S., however, do not have a school nurse and fewer than half have a school nurse all day, every day.

Another 30 percent of U.S. public schools have a school nurse who works part-time in one or more schools. This is particularly true in rural communities.[36] School nurses in rural communities are more likely to provide services to multiple school campuses, are less educated, and less likely to receive up-to-date child health continuing education.[5] In the absence of school nurses, their duties are delegated to unlicensed assistive personnel, who, studies suggest, are significantly more likely to send students home from school sick, which impacts student academic success, as well as school budgets and the ability to provide necessary school-related resources.[37]

Further, due to medical professional shortages in rural areas, school nurses are often the most consistently involved health professionals in school-aged children's health.[35,38] School nurses may become the primary source of health information, education, screenings, and monitoring of health issues in children. They may also have the benefit of interacting with and observing students over many years, unlike teachers who change every year.

High school graduation completion**.** Despite previous findings indicating that urban dropout rates are higher than suburban and rural dropout rates, once gender, race, family, and peer characteristics are controlled for, more recent studies are showing no difference between urban and rural dropout

rates.[39] While high school dropouts tend to be more concentrated in cities, almost one-third are in rural areas, primarily in the South.[40] Rural schools are also less likely to prepare students for college. Approximately 70 percent of high schools offer dual-credit or advanced placement classes nationally; however, only half of small and rural high schools offer dual-credit classes.[41]

2. Worksite-based objectives

Rural industry has traditionally included agriculture, forestry, mining, manufacturing, and natural amenity-based recreation.[42] The Task Force recommends interventions at the worksite to "help employees reduce health risks and improve their quality of life." Viewing health through the social ecological model, worksite health professionals are better able to understand the connection between the worksite, the individual, and other levels of influence. By understanding this connection, they can develop strategies to intervene at multiple levels of influence, which increases the likelihood of effective, sustainable programs.[43]

A recommendation for worksite-based programs includes interventions to protect workers in outdoor occupational settings and promote sun protective behaviors to prevent skin cancer. This is of particular importance in rural areas, where long-term occupational exposures in agricultural, forestry, mining, and natural amenity-based recreational industries are more common. The Task Force recommends educational and environmental approaches, such as media posters and brochures, as well as providing sunscreen to workers or shaded areas for employees to take breaks in. Further, the Task Force recommends policy change (such as requiring sunscreen and sun-protective clothing) and behavioral interventions (such as employers modeling or demonstrating behaviors to employees) designed to increase knowledge, change attitudes, and alter behavior of workers.

In order to aid in the prevention and control of obesity, worksites can implement nutrition and physical activity programs "designed to improve health-related behaviors and health outcomes." These programs "can include one or more approaches to support behavioral change including informational and educational, behavioral and social, and policy and environmental strategies." To promote physical activity in the workplace, the Task Force recommends using point-of-decision prompts to encourage stair use. The creation of, or enhanced access to, places for physical activities by worksites, when combined with informational outreach activities, is also recommended. Such interventions include creating walking trails, building exercise facilities, or providing access to existing nearby facilities. Worksites could also provide discounts to local fitness facilities to not only decrease costs for employees but also encourage worksite-community business collaboration. By implementing educational programs on physical activity and nutrition, offering counseling and positive reinforcement, and investigating policy changes (such as improving access to healthy foods and providing more opportunities for physical activity), worksites can aid their employees in making healthier decisions regarding their health. Nutrition strategies may include programs such as a garden market within the worksite to encourage employees to increase their fruit and vegetable intake, education on how to make healthier food choices when away from home, and other nutritious eating toolkits. In addition, worksite programs have potential to improve health behaviors and health of employees' families through a "trickle-down effect." [16]

Seasonal influenza has a long history of causing substantial morbidity and mortality in a variety of settings and the worksite is no exception. In fact, the close contact between employees and the infections brought to work after contact with sick family members can increase the spread of influenza at the worksite.[44] In order to reduce the spread of influenza, and aid in prevention of the possible millions of dollars in lost earnings and lost workdays, worksites can implement programs to ensure employees are vaccinated against seasonal influenza. One of the recommendations made by the Task Force includes worksites offering on-site vaccinations for employees either at cost, reduced cost, or at no cost. In addition, marketing the vaccinations through channels such as newsletters, e-mails, or paycheck inserts to ensure employees are aware of the vaccination programs can aid in compliance. Education on preventing the spread of the flu and recognizing early signs and symptoms can also aid in the prevention of influenza at the worksite. The Centers for Disease Control and Prevention (CDC) recommend worksites either host a flu vaccination clinic at the worksite or actively promote flu vaccination in the community.[45]

The Task Force recommends instituting smoke-free indoor air policies for all, or for designated, indoor workplaces. Although there is insufficient evidence to recommend the use of incentives and competitions

alone to increase smoking cessation among workers, the use of these with additional interventions are recommended. Other worksite-sponsored or supported interventions include education, smoking cessation groups, self-help cessation materials, telephone cessation support, workplace smoke-free policies, and social support networks. The Task Force recommends the use of health risk assessment with feedback and health education programs to improve health behaviors or conditions in workers.[16]

Finally, the Task Force recommends that worksites encourage preventive health screenings, specifically mental health screenings for all employees. Poor mental health and drug and alcohol addictions affect millions of working Americans annually with 21 percent of the adult U.S. population suffering from a mental health problem. The National Work Life Program recommends a "more responsive health/mental health services and human resources responses" as a strategy to lower health costs for employers and employees.[47] Resources for these types of screenings include health fairs, screenings as part of an overall employee wellness program, and coordination with the Substance Abuse and Mental Health Services Administration for web-based mental health screenings for employees.[46,47] Health improvements achieved through the use of assessments and programs include increased use of healthcare services and seat belts, decreased tobacco use, excessive alcohol use, dietary fat intake, blood pressure and cholesterol, and number of workdays lost due to illness or disability.

3. Community-based organization objectives

Another Healthy People 2020 goal is for community-based organizations to provide population-based primary prevention services. In rural areas, cross-jurisdictional and interorganizational sharing of resources could help fill resource gaps and improve service provision. However, only 13 percent of local health departments shared population-based primary prevention program resources across jurisdictions.[48] Local health departments serving smaller populations provided progressively fewer population-based primary prevention services than local health departments serving larger populations.[48]

Another goal was to increase the number of local health departments with culturally appropriate and linguistically competent community health promotion and disease prevention programs. However, only 47 percent of local health departments offer staff training in cultural/linguistic competency to address health disparities among all local health departments.[48] Increasingly, community health workers are becoming a crucial piece of the puzzle to serving rural, poor, and underserved communities.[49,50] Community health workers, commonly known as outreach workers or *promotoras,* are indigenous to their community and trusted community members. As such, they provide an important link to culturally and linguistically competent community health promotion and disease prevention programs and messages.[51] The role of community health workers in health care has grown considerably in the past decade, evidenced by (1) the addition of community health workers to the U.S. Department of Labor's Standard Occupational Classification system, and (2) their inclusion in health care reform and recognition in the Patient Protection and Affordable Care Act.[49,52]

4. Health professions-based objectives

In the United States, health sciences educational programs have seen significant growth through the expansion of existing programs and creation of new programs. Allopathic and osteopathic medicine, dental, pharmacy, optometry, public health, and nursing programs have grown in number, as well as in the number of enrolled students.[53] Health professions curriculum, specifically with an emphasis on student placement in rural communities and community/population health, have shown some success.[54] Studies of these programs, such as the Community Partnerships Program at East Tennessee State University and the Rural Medical Education (RMED) Program in Illinois, indicate that rural and community/population health curriculum and rural experiences positively influence graduates' decisions to go into primary care specialties, locate and practice in rural areas, care for the underserved, and participate in interdisciplinary group collaboration.[54-57] Intern and volunteer programs, and requirements in undergraduate health coursework, can also aid in increasing the number of graduates going into specialties focusing on the health of rural communities. Further, using competency-based education to achieve desired performance characteristics of health care professionals is essential when identifying successful programs.[58,p.1] These types of programs can establish observable and measurable learning outcomes that students are expected to accomplish in order to be successful in their respective programs. Communities and educational institutions can work together in order to improve the health outcomes in rural areas.

University programs can also implement a curriculum-planning guide to improve the competency of graduates interested in working in rural communities. A guide such as this can aid in demonstrating effective strategies to facilitate achievement of Healthy People 2020 objectives; equip future health professionals with competencies in both health promotion and disease prevention; facilitate health disparities awareness and offer solutions on addressing them; facilitate awareness of community-campus partnerships to aid in lack of resource issues; and contribute to the national effort to improve education and the overall health of communities.[59]

BARRIERS

The primary barrier to education and community-based programs in rural areas is the general lack of resources. Carmen and Scutchfield (2012) state "the ability of rural local health departments to provide public health services is affected by federal- and state-level infrastructure and financing mechanisms available." [60,p.83] They continue discussing the impact of smaller rural programs, which "often lack the infrastructure for grant writing or program management, [and] may fall behind urban counterparts in their ability to access these funds." [60,p.83] With limited resources (both human and financial) and smaller populations, there is limited availability and access to healthcare, health promotion, disease prevention, and other community-based resources. Program staff, such as health educators, school nurses, or head start personnel, are more likely to cover multiple sites or wear multiple hats and less likely to receive continuing education. For example, due to staffing, transportation, and enrollment problems, rural Head Start grantees are more likely to rely on home visits versus classroom-based programs, increasing workloads for personnel. Additionally, schools and worksites are more likely to lack the organizational capacity, technical and financial support, and expertise to develop, implement, and sustain evidence-based education and community-based programs. Finally, federally funded rural programs often struggle to meet performance standards that may be more applicable to and attainable by non-rural communities.[4,6,61]

PROPOSED SOLUTIONS OR INTERVENTIONS

While there are barriers to providing education and community-based programs in rural areas, a strength is the relationships among local stakeholders, which can provide an important opportunity for integrating and leveraging resources.[62,63] "Geographical, personnel, infrastructure and funding challenges… lack of public transportation, fewer health care providers, and lower levels of community services" [63,p.191-192] all serve as barriers to public health, health education, and health promotion programs in rural communities. Therefore, coalition building becomes a critical solution for rural communities where the partnership is mutually beneficial for all parties involved as they work towards a common goal. Rural communities possess many characteristics that promote collaborative problem solving: "ability to reach a large portion of residents with modest efforts; interconnected social networks; relatively accessible media, organizational leaders, and policy makers; a strong attachment to place; and a well-developed sense of community." [63,p.192]

Policies can be designed for places rather than programs to: allow tailoring for rural programs and outcomes; "streamline otherwise redundant and disconnected programs;" integrate complementary, non-duplicative programs; and meet more realistic, rural-specific performance standards.[62,64,65] "Place-based policies can integrate federal and other programs for community good" to "strengthen communities while promoting individual and population health." [62,p.4] Single-shot, unilateral approaches to health and social issues are not generally successful. However, program integration and place-based policies can increase the likelihood of improved health outcomes. Distance learning can provide training, certification, and continuing education opportunities to school nurses, Head Start program staff, and other health professionals in rural communities. Train-the-trainer programs can be provided to community health workers and other lay health advisors to provide education and community-based programs to hard-to-reach, rural populations.

Educational and community-based programs are occasionally criticized for their lack of effectiveness. However, the different typologies of community-based programs are not often considered. Community-based programs most often refer to the *setting* for interventions. As in this chapter, programs are often setting-based (school-, worksite-, faith-based). Setting-based programs are primarily defined geographically and are the location in which programs are implemented. The focus of these programs "is primarily on changing individuals' behaviors as a method for reducing the population's risk of disease." [66,p.530]

Three other typologies of community-based programs are used less frequently. Target-, resource-, and agent-based programs, aim to create healthier physical environments, use existing resources and institutions to address community issues, and respect and develop the naturally occurring capacities, respectively. These typologies go beyond simply treating community as an aggregate of individuals and recognize and consider the physical environment, community-based assets, community participation and ownership, and "the natural adaptive, supportive, and developmental capacities of communities." [66,p.530] Setting-based programs that focus on education and behavior change are important, but should be used in conjunction with intervention strategies that target family support and other social network influences, neighborhood characteristics, organizational policies and practices, community context, public policy, the physical environment, and culture. [66]

COMMUNITY MODELS KNOWN TO WORK

A **Head Start** program in Coffeyville, Kansas, has benefited from collaboration with a local federally qualified health center (FQHC).[4] "The FQHC's ambulatory unit reduces some problems that arise in transporting enrolled children to medical appointments and its portable dental equipment has been critical in meeting HSPPS [Head Start Program Performance Standards] requirements for dental health…The Head Start director explicitly stated that the FQHC was the difference between compliance and noncompliance with HSPPS for her program." [4,p.3] One grant initiative, the Head Start Dental Home program, funds "programs to improve the oral health of children enrolled in Head Start through creation of dental home networks, including those that address the needs in rural communities." [61,p.S52] These grants have funded initiatives throughout the U.S. to establish a dental home for every Head Start child.

Worksite health promotion programs can benefit both employees and employers by decreasing absenteeism and costs and increasing productivity. Programs such as the **City of Great Falls Wellness Program** in Great Falls, Montana, offer a variety of worksite wellness programs in different settings within the community.[67] The Great Falls Police Department, Public Works, and Civic Center participate in the program and have accomplished such goals as establishing a cohesive wellness team at each worksite, providing cancer prevention awareness days, stocking vending machines with healthy options, distributing walking maps developed by wellness team members to each worksite, and offering biometric screenings with insurance incentives. The City of Great Falls Wellness Program was highlighted in the CDC Action Guide for Breast Cancer and Cervical Cancer Screening. This work was highlighted due to their outstanding promotion of cancer screenings in the work place. [67] Another program in Somerset County, Maine has implemented a worksite program and developed a guide for small businesses to implement worksite programs. This community-based approach demonstrated that collaboration between small businesses within a community to offer employee wellness programs can be financially beneficial to all businesses involved. Because Maine self-identifies as a rural state, much of the employment is through small businesses. Objectives of this program are "to (1) lower costs and improve health status through improved wellness and prevention; (2) improve financial and social sustainability of community wellness activities; and (3) create a clear pathway for medical care providers to shift sustainably towards increased wellness and prevention support and services." Further, the approach was to include environmental interventions; policies and financial incentives; frequent and simple health messages; health education classes and workshops; and health screenings.[68]

Comprehensive school-based programs, such as **Coordinated Approach to Child Health (CATCH)**, provide health education instruction, opportunities for increased physical activity, healthier cafeteria food options, and opportunities for family involvement in program activities.[69] One rural community in Alaska, accessible only by ferry or small charter plane, developed a local health coalition of citizens and agencies known as the Hoonah Fun and Fit Partnership. Partnership members collaborated to enhance access to recreational activities and events, promote better nutrition in schools, and alert people to the real impact of obesity in the community.[70] The Start Health, Start Now program implemented in one urban and five rural Washington counties "brings free health promotion and child development training, technical assistance, and educational resources to childcare providers." [71] While long-term outcomes of Start Health, Start Now have not yet been evaluated, the program has successfully provided tools and training to 246 providers from 45 centers to increase physical activity in rural childcare facilities, 76 cooks and directors from 53 centers to prepare and purchase healthy food on a budget, and 426 providers from 98

childcare centers to better understand how trauma impacts emotion and behavior. Further, the YMCA, as a partner of Start Health, Start Now, achieved "a cost savings of $2,100 over a five-month period." [71]

Models for health professions-based programs include **Community Partnerships Program at East Tennessee State University** and **RMED Program in Illinois**. Nursing, public health and medical school graduates of the Community Partnerships Program indicated a significantly greater interest in rural primary care, care for the underserved, and interdisciplinary group collaboration, and were more likely to practice in rural locations than did their traditionally educated peers.[55] The RMED Program graduates go into primary care specialties at a higher rate and are highly likely to locate and practice in rural areas.[56]

SUMMARY AND CONCLUSIONS

Rural populations face significant barriers and challenges to receiving or providing health promotion, disease prevention education, and community-based programs. In addition to addressing educational challenges and resource barriers, federal and state policies and standards should be tailored for rural communities. Additionally, most program and intervention recommendations from the Community Preventive Task Force are based on evidence from urban programs, where there are large enough populations (sample sizes) to make claims of effectiveness, an occurrence that may or may not hold true for rural communities implementing the same programs. Sufficient levels of funding are needed in rural communities in order to adequately implement and evaluate health education and community-based programs to increase the evidence of effectiveness for rural-based programs. Collaborations should be encouraged in order to address lack of resource problems in rural communities. Colleges and universities should also promote rural community public health programs through internships and volunteer opportunities as well as competency-based education with observable, achievable, and measurable learning outcomes in order to encourage more health professionals to work in the rural communities.

REFERENCES

1. Bolin JN, Bellamy GR, Ferdinand AO, et al. Rural Healthy People 2020: new decade, same challenges. *J Rural Health*. 2015;31(3):326-333.

2. Johnson J, Strange M, Madden K. The Rural Dropout Problem: An Invisible Achievement Gap. Rural School and Community Trust. Washington, D.C. http://www.ruraledu.org/user_uploads/file/Rural_Dropout_Problem_2010.pdf. Accessed July 15, 2015.

3. Kena G, Aud S, Johnson F, et al. The Condition of Education 2014 (NCES 2014-083). U.S. Department of Education, National Center for Education Statistics. Washington, DC. http://nces.ed.gov/pubs2014/2014083.pdf. Published May 2014. Accessed June 30, 2015.

4. The National Advisory Committee on Rural Health and Human Services (NACRHHS). Challenges to Head Start and Early Childhood Development Programs in Rural Communities. http://www.hrsa.gov/advisorycommittees/rural/publications/headstartearlychildhood2012.pdf. Published December 2012. Accessed June 30, 2014.

5. Ramos MM, Fullerton L, Sapien R, Greenberg C, Bauer-Creegan J. Rural-urban disparities in school nursing: implications for continuing education and rural school health. *J Rural Health*. 2014;30(3):265-274.

6. The National Advisory Committee on Rural Health and Human Services (NACRHHS). The 2007 Report to the Secretary: Rural Health and Human Service Issues. http://www.hrsa.gov/advisorycommittees/rural/2007secreport.pdf. Published January 2007. Accessed June 30, 2014.

7. Belansky ES, Cutforth N, Gilbert L, et al. Local Wellness Policy 5 years later: is it making a difference for students in low-income, rural Colorado elementary schools? *Prev Chronic Dis*. 2013;10:E184.

8. National Center for Health Statistics. Healthy People 2010 Final Review. Hyattsville, MD. 2012. http://www.cdc.gov/nchs/data/hpdata2010/hp2010_final_review.pdf. Accessed June 14, 2014.

9. U.S. Department of Health and Human Services. Office of Disease Prevention and Health Promotion. Healthy People 2020: Educational and Community-Based Programs. http://www.healthypeople.gov/2020/topicsobjectives2020/overview.aspx?topicid=11. Updated July 7, 2014. Accessed June 14, 2015.

10. Southwest Rural Health Research Center. Texas A&M Health Science Center. Rural Healthy People 2020 national survey. Unpublished data. Accessed February 1, 2015.

11. Cherry DC, Huggins B, Gilmore K. Children's health in the rural environment. *Pediatr Clin North Am*. 2007;54(1):121-133.

12. Myers SR, Branas CC, French BC, et al. Safety in numbers: are major cities the safest places in the United States? *Ann Emerg Med*. 2013;62(4):408-418.

13. Hendryx M, Luo J. An examination of the effects of mountaintop removal coal mining on respiratory symptoms and COPD using propensity scores. *Int J Environ Health Res*. July 24 2014:1-12. [Epub ahead of print].

14. Trust for America's Health. The Prevention and Public Health Fund: Helping to Reduce Rural Health Disparities. http://healthyamericans.org/health-issues/wp-content/uploads/2013/05/Rural-disparities.pdf. Published November 2012. Accessed August 31, 2014.

15. Guide to Community Preventive Services. Improving Adolescent Health. Centers for Disease Control and Prevention. http://www.thecommunityguide.org/adolescenthealth/index.html. Updated October 25, 2013. Accessed May 27, 2014.

16. Guide to Community Preventive Services. Worksite Health Promotion. Centers for Disease Control and Prevention. http://www.thecommunityguide.org/worksite/index.html. Updated June 2, 2014. Accessed May 27, 2015.

17. Administration for Children and Families (ACF). Head Start Program Facts Fiscal Year 2013. U.S. Department of Health and Human Services. https://eclkc.ohs.acf.hhs.gov/hslc/data/factsheets/docs/hs-program-fact-sheet-2013.pdf. Published April, 2014. Accessed June 14, 2014.

18. Administration for Children and Families (ACF). About Head Start. U.S. Department of Health and Human Services. http://eclkc.ohs.acf.hhs.gov/hslc/hs/about. Updated May 2014. Accessed June 14, 2014.

19. Adams SH, Rowe CR, Gansky SA, Cheng NF, Barker JC, Hyde S. Caregiver acceptability and preferences for preventive dental treatments for young African-American children. *J Public Health Dent*. 2012;72(3):252-260.

20. Anderson L, Martin NR, Burdick A, Flynn RT, Blaney DD. Oral health status of New Hampshire Head Start children, 2007-2008. *J Public Health Dent*. 2010;70(3):245-248.

21. Berry DC, Neal M, Hall EG, et al. Recruitment and retention strategies for a community-based weight management study for multi-ethnic elementary school children and their parents. *Public Health Nurs*. 2013;30(1):80-86.

22. Chi DL, Rossitch KC, Beeles EM. Developmental delays and dental caries in low-income preschoolers in the USA: a pilot cross-sectional study and preliminary explanatory model. *BMC Oral Health*. October 12 2013;13:53.

23. Davis SM, Sanders SG, FitzGerald CA, Keane PC, Canaca GF, Volker-Rector R. CHILE: an evidence-based preschool intervention for obesity prevention. *J Sch Health*. 2013;83(3):223-229.

24. Hesketh KD, Campbell KJ. Interventions to prevent obesity in 0-5 year olds: an updated systematic review of the literature. *Obesity (Silver Spring)*. 2010;18(S1):S27-S35.

25. Hu WT, Foley TA, Wilcox RA, Kozera RM, Morgenstern BZ, Juhn YJ. Childhood obesity among Head Start enrollees in southeastern Minnesota: prevalence and risk factors. *Ethn Dis*. 2007;17(1):23-28.

26. Hughes CC, Gooze RA, Finkelstein DM, Whitaker RC. Barriers to obesity prevention in Head Start. *Health Aff (Millwood)*. 2010;29(3):454-462.

27. Kranz AM, Rozier RG, Zeldin LP, Preisser JS. Oral health activities of early Head Start teachers directed toward children and parents. *J Public Health Dent*. 2011;71(2):161-169.

28. Maher EJ, Li G, Carter L, Johnson DB. Preschool child care participation and obesity at the start of kindergarten. *Pediatrics*. 2008;122(2):322-330.

29. Milgrom P, Weinstein P, Huebner C, Graves J, Tut O. Empowering Head Start to improve access to good oral health for children from low income families. *Matern Child Health J*. 2011;15(7):876-882.

30. Whitaker RC, Gooze RA, Hughes CC, Finkelstein DM. A national survey of obesity prevention practices in Head Start. *Arch Pediatr Adolesc Med*. 2009;163(12):1144-1150.

31. National Center for Education Statistics (NCES). The Status of Rural Education. http://nces.ed.gov/programs/coe/pdf/coe_tla.pdf. Published May 2013. Accessed June 18, 2014.

32. Strozer J, Juszczak L, Ammerman A. 2007-2008 National School-Based Health Care Census. Washington, DC: National Assembly on School-Based Health Care; 2010. http://www.

nasbhc.org/atf/cf/%7Bcd9949f2-2761-42fb-bc7a-cee165c701d9%7D/NASBHC%202007-08%20CENSUS%20REPORT%20FINAL.PDF. Accessed October 11, 2014.

33. Health Resources and Services Administration. School-Based Health Centers. http://www.bphc.hrsa.gov/about/schoolbased/index.html. Accessed October 11, 2014.

34. United States Department of Agriculture (USDA). Local School Wellness Policy Implementation Under the Healthy, Hunger-Free Kids Act of 2010: Summary of the Proposed Rule. http://www.fns.usda.gov/sites/default/files/LWPproprulesummary.pdf. Published March 2014. Accessed July 1, 2014.

35. Guttu M, Engelke MK, Swanson M. Does the school nurse-to-student ratio make a difference? *J Sch Health*. 2004;74(1):6-9.

36. Robert Wood Johnson Foundation. School Nurse Shortage May Imperil Some Children, RWJF Scholars Warn. http://www.rwjf.org/en/about-rwjf/newsroom/newsroom-content/2013/12/School-Nurse-Shortage-May-Imperil-Some-Children.html. Published December 12, 2013. Accessed July 10, 2014.

37. Pennington N, Delaney E. The number of students sent home by school nurses compared to unlicensed personnel. *J Sch Nurs*. 2008;24(5):290-297.

38. Hillemeier MM, Davis LA, Smith CA. School nurses on the front line: challenges in meeting the diverse health needs of rural Pennsylvania school children. http://www.rural.palegislature.us/school_nurses07.pdf. Published September 2007. Accessed June 30, 2014.

39. Jordan JL, Kostandini G, Mykerezi E. Rural and urban high school dropout rates: are they different? *Journal of Research in Rural Education*. 2012;27(12):1-21.

40. Murnane RJ. U.S. high school graduation rates: patterns and explanations. *Journal of Economic Literature*. 2013;51(2):370-422.

41. Balfanz R. Can the american high school become an avenue of advancement for all? *Future Child*. 2009;19(1):17-36.

42. United States Department of Agriculture (USDA). Economic Research Service: Business and Industry. http://www.ers.usda.gov/topics/rural-economy-population/business-industry.aspx#.VDmbsyldUlY. Published 2014. Accessed October 11, 2014.

43. Eddy JM, Donahue RE, Webster RD, Bjornstad ED. Application of an ecological perspective in worksite health promotion: a review. *Am J Health Stud.* 2002;17(4):197-202.

44. Occupational Safety and Health Administration (OSHA). Guidance on Preparing Workplaces for an Influenza Pandemic. U.S. Department of Labor. https://www.osha.gov/Publications/influenza_pandemic.html. Updated 2009. Accessed October 11, 2014.

45. Centers for Disease Control and Prevention (CDC). Make it Your Business to Fight the Flu. http://www.cdc.gov/flu/pdf/business/recommended_strategies.pdf. Published 2013. Accessed October 3, 2014.

46. Centers for Disease Control and Prevention (CDC). Healthier Worksite Initiative: Other Preventive Health Screenings Toolkits. http://www.cdc.gov/nccdphp/dnpao/hwi/toolkits/screenings.htm. Updated January 6, 2010. Accessed October 3, 2014.

47. Centers for Disease Control and Prevention (CDC). Healthier Worksite Initiative: Mental Health Screenings. http://www.cdc.gov/nccdphp/dnpao/hwi/toolkits/mental_health_screenings.htm. Updated January 6, 2010. Accessed October 3, 2014.

48. National Association of County & City Health Officials (NACCHO). 2013 National Profile of Local Health Departments. http://www.naccho.org/topics/infrastructure/profile/upload/2013-National-Profile-of-Local-Health-Departments-report.pdf. Published January 2014. Accessed June 20, 2014.

49. Rosenthal EL, Brownstein JN, Rush CH, et al. Community health workers: part of the solution. *Health Aff (Millwood)*. 2010;29(7):1338-1342.

50. Health Resources and Services Administration . Community Health Workers Evidence-Based Models Toolbox. U.S. Department of Health and Human Services. http://www.hrsa.gov/ruralhealth/pdf/chwtoolkit.pdf. Published August 2011. Accessed June 22, 2015.

51. Clark HR, St. John JA, Stephenson MT, Johns M, Berkowitz J. Implementing a second-hand smoke intervention in two Texas colonias: The case of *Sabemos: Por Respeto, No Se Fuma Aqui*. In: M. Brann, ed. *Contemporary Case Studies in Health Communication: Theoretical & Applied Approaches*. Dubuque, IA: Kendall Hunt Publishing; 2011:166-184.

52. Bureau of Labor Statistics. The 2010 Standard Occupational Classification System: 21-1094 Community Health Workers. United States Department of Labor. http://www.bls.gov/soc/2010/soc211094.htm. Updated March 11, 2010. Accessed October 2, 2014.

53. University of California. A new era of growth: a closer look at recent trends in health professions education. http://www.ucop.edu/health-sciences-services/_files/a-new-era-of-growth_may2013.pdf. Published May 2013. Accessed July 3, 2014.

54. Barrett FA, Lipsky MS, Lutfiyya MN. The impact of rural training experiences on medical students: a critical review. *Acad Med*. 2011;86(2):259-263.

55. Florence JA, Goodrow B, Wachs J, Grover S, Olive KE. Rural health professions education at East Tennessee State University: survey of graduates from the first decade of the community partnership program. *J Rural Health*. 2007;23(1):77-83.

56. Glasser M, Hunsaker M, Sweet K, MacDowell M, Meurer M. A comprehensive medical education program response to rural primary care needs. *Acad Med*. 2008;83(10):952-961.

57. Rabinowitz HK, Diamond JJ, Markham FW, Wortman JR. Medical school programs to increase the rural physician supply: a systematic review and projected impact of widespread replication. *Acad Med*. 2008;83(3):235-243.

58. Gruppen LD, Mangrulkar RS, Kolars JC. The promise of competency-based education in the health professions for improving global health. *Hum Resour Health.* November 16 2012;10:43.

59. Connors KM, author; Cashman S, Seifer SD, Unverszagt M, eds. Advancing the Healthy People 2010 Objectives through Community-Based Education: A Curriculum Planning Guide. San Francisco, CA: Community Campus Partnerships for Health; 2003.

60. Carman AL, Scutchfield FD. Public health systems, health policy, and population-level prevention in rural America. In: Crosby RA, Wendel ML, Vanderpool RC, Casey BR, eds. *Rural Populations and Health: Determinants, Disparities, and Solutions.* San Francisco, CA: Jossey-Bass; 2012:75-93.

61. Skillman SM, Doescher MP, Mouradian WE, Brunson DK. The challenge to delivering oral health services in rural America. *J Public Health Dent*. 2010;70(S1):S49-S57.

62. Mueller KJ, MacKinney AC, Gutierrez M, Richgels J. Place-Based Policies and Public Health: The Road to Healthy Rural People and Places. Rural Policy Research Institute (RUPRI). http://www.rupri.org/Forms/HHSPanels_Integration_March2011.pdf. Published March 2011. Accessed July 1, 2014.

63. Kegler MC, Butterfoss FD. Strategies for building coalitions in rural communities. In: Crosby RA, Wendel ML, Vanderpool RC, Casey BR, eds. *Rural Populations and Health: Determinants, Disparities, and Solutions*. San Francisco, CA: Jossey-Bass; 2012:191-214.

64. Rural Policy Research Institute (RUPRI). Rethinking Rural Human Service Delivery in Challenging Times: The Case for Service Integration. http://www.rupri.org/Forms/ServiceIntegration_Feb2010.pdf. Published February 2010. Accessed July 1, 2014.

65. Orszag PR, Barnes M, Carrion A, Summers L. The White House. Memorandum for the Heads of Executive Departments and Agencies: Developing Effective Place-Based Policies for the FY 2011 Budget. http://www.whitehouse.gov/sites/default/files/omb/assets/memoranda_fy2009/m09-28.pdf. Published August 11, 2009. Accessed July 2, 2014.

66. McLeroy KR, Norton BL, Kegler MC, Burdine JN, Sumaya CV. Community-based interventions. *Am J Public Health*. 2003;93(4):529-533.

67. Montana Rural Health Initiative. City of Great Falls Wellness Program. http://montanaruralhealthinitiative.info/?p=3297. Published March 10, 2014. Accessed June 22, 2015.

68. Somerset Public Health. Small Business Worksite Wellness Toolkit: A Community Approach to Improving Small Business Health and Productivity. Maine Health Access Foundation (MeHAF). http://www.somersetpublichealth.org/wp-content/uploads/Small-Business-Worksite-Wellness-Toolkit.pdf. Posted April 21, 2014. Accessed June 22, 2015.

69. University of Texas School of Public Health. The CATCH Program. https://sph.uth.edu/research/centers/dell/resources/CATCH_Overview.pdf. Accessed October 7, 2014.

70. Guide to Community Preventive Services. The Community Guide in Action: Rural Community Works Together to Stay "Fun and Fit." http://www.

thecommunityguide.org/CG-in-Action/FunandFit-AK.pdf. Updated March 2012. Accessed July 3, 2014.

71. Rural Assistance Center. Rural Health Models and Innovations: Start Healthy, Start Now. http://www.raconline.org/success/project-examples/751. Published April 21, 2014. Accessed July 11, 2014.

Suggested Chapter Citation:

Pennel CL, Clark HR, Rahn RN. Rural Health Education and Community-based Programs. In: Bolin JN, Bellamy G, Ferdinand AO, et al. eds. *Rural Healthy People 2020.* Vol. 2. College Station, TX: The Texas A&M University Health Science Center, School of Public Health, Southwest Rural Health Research Center; 2015:15-27.

RURAL ORAL HEALTH

By Bita A. Kash PhD, MBA; Linnae Hutchison, MBA, MT; Shruti Kaul, BDS, MHA; Patience Appiah, BA; and Suman Challa, DDS

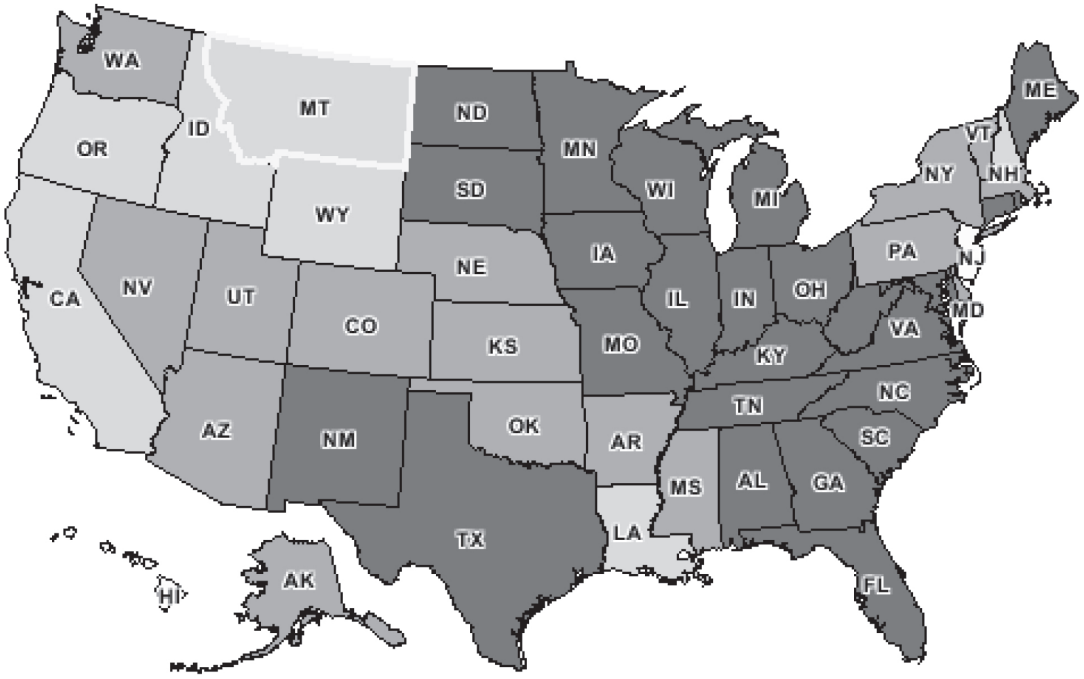
SCOPE OF THE PROBLEM

- The number of people who visited the dentist in the past year (age adjusted, percent, 2+ years) is a key health indicator and has dropped from 45 percent in 2007 to about 42 percent in 2011.[1]
- There is a significantly higher prevalence of rural residents who are unable to access dental care, compared to turban residents.[2]
- About 11 percent of the 25 million Americans living in underserved areas never receive dental treatment.[3]

The U.S. Surgeon General's message in the 2000 report, titled *Oral Health in America: A Report of the Surgeon General*, was that oral health is essential for overall general health and well-being of "all Americans and can be achieved by all Americans."[4] However, today not all Americans are able to achieve the same desired level of oral health. Disparities in oral health status are still associated with poverty (especially poor children), ethnicity, and geographic isolation.

One of the most important Healthy People 2010 objectives in the area of oral public health has been to increase community water fluoridation to 75 percent of the proportion of the U.S. population served by such community water systems that receive optimal fluoridated water.[5] A recent Centers for Disease Control and Prevention (CDC) fluoridation data analysis revealed that optimally fluoridated water has increased from 62 percent in 1992 to 69 percent in 2006.[6] Although progress has been made with this highly effective public health initiative, there are still

Figure 1. Percentage of State Public Water System Population Receiving Fluoridated Water (2006) Water Fluoridation: National Fluoridation Report



Source:[7]

*States with darker shading have a relatively higher percentage compared to states with lighter shading.

variations by state and region. Community water fluoridation ranges from 100 percent in the District of Columbia to just eight percent for Hawaii.

HEALTHY PEOPLE 2020 GOALS AND OBJECTIVES

This chapter addresses the following Healthy People 2020 objectives[8] and describes some evidence-based approaches to address these objectives:

- **OH-1.1** Reduce the proportion of children aged 3 to 5 years with dental caries experience in their primary teeth
- **OH-1.2** Reduce the proportion of children aged 6 to 9 years with dental caries experience in their primary teeth
- **OH-3.3** Reduce the proportion of adults aged 75 years and older with untreated root surface caries
- **OH-4.1** Reduce the proportion of adults aged 45 to 64 years who have ever had a permanent tooth extracted because of dental caries or periodontal disease
- **OH-4.2** Reduce the proportion of adults aged 65 to 74 years who have lost all of their natural teeth
- **OH-6** Increase the proportion of oral and pharyngeal cancers detected at the earliest stage
- **OH-7** Increase the proportion of children, adolescents, and adults who used the oral health care system in the past year
- **OH-8** Increase the proportion of low-income children and adolescents who received any preventive dental service during the past year
- **OH-9.1 thru OH-9.3** Increase the proportion of school-based health centers with an oral health component that includes dental sealants (OH-9.1), dental care (OH-9.2), and topical fluoride (OH-9.3)
- **OH-10.1** Increase the proportion of Federally Qualified Health Centers (FQHCs) that have an oral health care program
- **OH-10.2** Increase the proportion of local health departments that have oral health prevention or care programs
- **OH-11** Increase the proportion of patients who receive oral health services at FQHCs each year
- **OH-13** Increase the proportion of the U.S. population served by community water systems with optimally fluoridated water
- **OH-14.2** (Developmental) Increase the proportion of adults who received an oral and pharyngeal cancer screening from a dentist or dental hygienist in the past year
- **OH-14.3** (Developmental) Increase the proportion of adults who were tested or referred for glycemic control from a dentist or dental hygienist in the past year
- **OH-17.1** Increase the proportion of States (including the District of Columbia) and local health agencies that serve jurisdictions of 250,000 or more persons with a dental public health program directed by a dental professional with public health training

Several medical terminology definitions are pertinent to the discussion of oral health issues and solutions in the rural United States:

- Dental caries is defined as tooth decay.
- Periodontal disease is defined as an inflammation of the gums involving the bones, which is usually an adult issue.
- Edentulism is defined as loss of natural teeth, a major contributor of health disparities among the poor and geographically isolated populations.

RURAL HEALTHY PEOPLE 2020 SURVEY OUTCOMES

According to the Rural Healthy People 2020 survey of key informants, oral health ranked 13th among the Healthy People 2020 focus areas of importance to rural Americans, receiving priority rankings from 31.4 percent of the respondents.[9] Respondents comments about the need for better access to basic oral health services for children and adults are of value as oral health education and hygiene programs are considered for implementation in rural communities. The following are examples of comments[10] from survey respondents that best represent the emerging themes of access, education, financing, and shortage of dentists:

Theme - Shortage of Dentists:

"Lack of providers in rural areas who will see uninsured patients"

"Recruit more dentists, train more providers."

"Few dentists [are] available. Rural culture does not make this a priority."

"Open access to dentists, [i.e.] push to increase dentists' numbers graduating or train allied health professionals to perform some functions."

Theme - Access:

"Adult dental care for the underinsured and uninsured"

"Strengthen workforce development for dental health workers."

"Better availability of low cost routine dental care"

"No provider accepts Medicaid Assistance here."

"Adults with no insurance suffer tremendously."

Theme - Financing:

"Access to affordable dental care and dental voucher programs"

"What will insurance coverage look like, or will there be any?"

"Increasing the number of dentists who accept Medicaid"

"Affordable dental exams"

"Screening for underinsured"

"The oral health in this area for the poor, and the working poor is almost nonexistent. Oral health affects the whole body and causes heart diseases, infections that led to death."

Theme - Education:

"Increase preventive activities through schools and local public health."

"Teaching more children and families that this can affect your whole body"

"Another core issue – poor oral health in young people affects their health outcomes throughout life."

"Receives dental evaluation by age two"

"Emphasis on prevention; payment and financing reform"

PREVALENCE AND DISPARITIES IN RURAL AREAS

Children's Oral Health in Rural America

Various studies of oral health status among children of various ages, conducted within a number of U.S. states and regions, reinforce the pattern of oral health disparities that are linked to geographic isolation (rurality), lack of access to oral health services, and low-income status resulting in not being able to afford fee-for-service dental care. Lack of access to oral health for children living in rural communities is further aggravated by the fact that the few rural dentists are mostly busy seeing adult patients.[11] Overall, rural American children are found to have higher rates of dental diseases than children who live in urban American geographies.[12] Older children living in rural areas without insurance were more likely to have untreated dental caries based on an analysis of a sample of about 2,500 children in South Central Kentucky.[13]

In West Virginia a study (population sample of 1150) recorded 92 percent prevalence of unmet preventive care needs among children.[14] With children from four special education schools of ages between three and 22 years in two rural Southern Illinois school districts, dental decay was detected in 36 percent of the sample population.[15]

A study of almost 1000 rural children participating in Head Start confirmed that this vulnerable population, that is less likely to have dental insurance, also is at a higher risk of not having dental care needs met when compared to children participating in Medicaid but not Head Start.[16] Another study of rural Head Start children reported a 33 percent prevalence of untreated caries.[17] Low socio-economic factors, rural residency, and Hispanic ethnicity seemed to increase many barriers to good oral health in children. A study of 212 infants participating in a nutrition program for Women, Infants, and Children (WIC) in rural Iowa concluded that causes of bad oral health status among low socio-economic, rural minority populations included high sugar contents of snacks and beverages, nighttime bottle feeding practices, poor oral hygiene, higher levels of mutans streptococci, and overall poor diet.[18]

In an Iowan rural community, the prevalence of caries, plaque, and mutans streptococci was described in children between six- and 24-months old. These results originate from a study of 212 infants on a WIC program.[18]

Based on a study of Black adolescents and their level of oral health knowledge, about 55 percent had accurate dental health knowledge. Of those age ten to 12 years old, two-thirds were below a satisfactory level of dental health knowledge.[19]

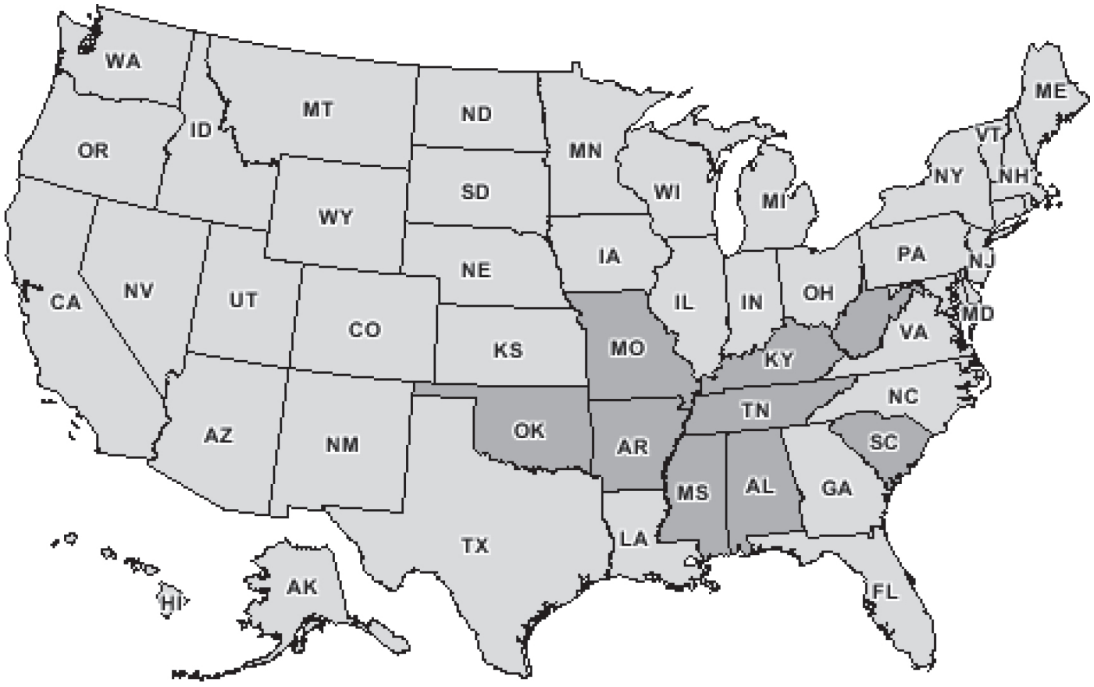
Adults in Rural America

In a study comprised of African-American, American Indian, and white older adults living in two rural North Carolina counties, more than 89 percent of participants indicated the presence of oral pain.[20] Furthermore, 12 percent of these rural older adults would be classified as having high dental anxiety. Adults most susceptible to edentulism are non-white older populations in poor health and adults who are 18 years or older and live in certain high-poverty rural counties.[21] A study of dental care utilization among rural older adults in North Carolina showed that 11 percent of older adults suffered from oral pain, 22 percent had sore or bleeding gums, and 45 percent admitted to having fair to poor oral health.[22]

Compared to urban dwellers, rural adults in rural North Carolina are more likely to experience severe tooth loss.[24] In two North Carolina rural counties, older residents were found to either modify the food intake or avoid them all together due to teeth, mouth, or denture problems. These life style modifications also resulted in a lower dietary quality.[25] Avoidance and modification of certain foods such as specific fruits, vegetables, and meats because of oral and dental discomfort have been reported in the geriatric and long-term care literature for years.[26]

A survey of over 2,500 residents in both rural and urban areas of Texas confirms these disparities based on self-reported oral health problems that were linked to bad oral health habits, including smoking, high cost of dental care, and access to affordable dental care.[27] In Wisconsin, a study of Medicaid enrollees demonstrated the consequences of lack of access to affordable dental care: 16 percent of total Medicaid enrollees who lived in rural areas sought treatment for non-traumatic dental conditions in emergency departments and physician offices.[28] A survey of a rural community in California (specifically, the central San Joaquin Valley) reported that among adults 18 to 55 years of age, only 34 percent had seen a dentist in the past year, despite the fact that 44 percent had a regular source of dental care.[29]

Figure 2. Percentage of Adults aged 65+ Who Have Lost Six or More Teeth Due to Tooth Decay or Gum Disease – 2008



Source:[23]

*States with darker shading have a relatively higher percentage compared to states with lighter shading.

This observed low utilization rate, compared to availability of oral health services, was explained by survey participants by barriers such as lack of knowledge about basic oral health, lack of time, financial resources, and transportation.[29] Further, barriers to seeking dental services in rural areas are often associated with fear. In a survey of rural community members in five West Virginia rural counties, 27 percent of participants reported fear of seeking dental care, while 58 percent of the sample reported the importance of dental care.[30]

A 2010 comprehensive review of literature, evaluating challenges in providing dental care and oral health services in rural America, identified several key issues including insurance rates, less water fluoridation, fewer dentists per 1,000 rural residents, and challenges associated with longer travel distances to seek dental care compared with urban residents.[31] Overall, rural residents lacked financial resources to access dental care services on a timely basis.[31]

Shortage of Dentist in Rural Areas: Expected to Continue

Disparities may exist between urban and rural areas, in part, because dentists continue to be attracted to areas that will assure them higher income levels, population density, and physician-to-population ratios. A 2010 study projected that this trend will continue in the near future.[32] It is also expected that a high number of rural dentists will retire within the next five to ten years.[33]

The number of dental graduates practicing in Pennsylvania's rural communities, for example, has been dropping over the last ten years.[34] Regardless of where the dentists were trained (foreign trained or U.S. trained), they were unlikely to practice in underserved and rural areas. A recent study in Washington State showed that foreign-trained dentists were also unlikely to practice in underserved areas, just like their U.S.-trained counterparts.[35]

As a result of ongoing provider shortages, dental patients often end up visiting emergency departments when suffering from severe tooth pain and gum bleeding. The combined effects of limited insurance programs and the shortage of dental health professionals have led to a greater number of rural residents using emergency departments for oral health problems intended for dental offices.[36]

VARIATION BY RURAL REGION

Compared with the rest of the nation, Kentucky, an Appalachian state, is faced with some of the nation's worst oral health outcomes. It ranks seventh for complete edentulous older adults, eighth in prevalence of individuals who have not been to the dentist within a year, and ninth in adults with any permanent tooth extraction.[37] Parents were more likely to suffer from complete or partial edentulism based data on the study on rural communities in Appalachia. These populations also have less demand for orthodontic care although they have a high unmet need, and infrequent history of treatment. The adolescents in this region tend to demonstrate lower demand; but, a high treatment history need.[38]

VARIATIONS BY RACE AND ETHNICITY

The results of a research study in a small, rural Central California community revealed that Latino children had poorer oral health when compared to other race/ethnicity groups, while Mexican Americans overall had the poorest oral health status.[39] The effect of race and ethnicity, as well as socio-economic factors associated with overall oral health status complicates direct association of oral health status with rurality and geographic isolation of populations.

A study of older adults in a multi-ethnic rural North Carolina region established that prevalence of oral health deficiencies was not associated with rurality, but rather with ethnicity.[40] Within rural regions studied, Caucasians had a lower rate of self-reported periodontal diseases and bleeding gums when compared to minority rural residents.[40] A large scale study of students in Northern and Southern Nevada concluded that non-Hispanic Blacks and Hispanics were more likely to have cases of decayed, missing, or filled teeth when compared to whites.[41] Finally, the prevalence of periodontal diseases is higher among migrant and seasonal farmworkers when compared to the general population. This conclusion was deduced from a national study of migrant seasonal farmworkers and dental services.[42] It might be important to note though that ethnicity is not necessarily a predictor of high dental anxiety.[20]

IMPACT ON MORTALITY, MORBIDITY, AND OTHER HEALTH PROBLEMS

Oral health has an impact on the overall health of a person.[30,37] According to the most recent report on Oral Health by the Surgeon General, general health is

dependent on oral health.[2] Generally, poor oral health negatively affects activities regardless of the type of activity. Also, poor oral health diminishes quality of life.[3,12,43] Untreated dental caries to oral cancer cause pain and disability for many U.S. rural residents. Furthermore, oral health affects mortality rates. In a year, nearly 30,000 new cases of oral and pharyngeal cancers are diagnosed, of which about 7,500 deaths occur. Also, stroke, coronary heart disease, atherosclerosis, preterm and low-birth-weight babies, cardiovascular disease, diabetes, and respiratory disease are all associated with poor oral health.[2]

Many chronic diseases including cardiovascular disease and diseases associated with low-birth weight, are often connected to poor oral health.[13] As we age, the likelihood of additional acute and chronic diseases, such as acute myocardial infarction, strokes, and coronary heart disease, are increased with untreated periodontal disease.[17] Poor oral health can also lead to periodontitis and carotid atherosclerosis.[44] Further, poor oral health may interfere with HIV medication treatment and serve as a catalyst for HIV/AIDS disease progression.[45] Finally, untreated dental caries and diseases have the potential of increasing co-morbidities and mortality; diminishing the overall health quality; as well as impairing function.[46] Therefore, addressing dental care could improve the health and quality of life of older adults in rural communities.[22] An established relationship exists between tooth-loss health problems, such as low functional status, sub-clinical cardiovascular diseases, cognitive decline, ischemic stroke, coronary heart disease, diabetes, pneumonia, nutritional deficiencies, social isolation, and mortality.[40,47-49]

A study of the association between oral health and birth weight outcomes in rural Kentucky depicted that poor oral health and increased incidence of negative birthing outcomes were prevalent among rural prenatal women.[50] Expectant mothers living in rural areas are also at a higher risk for having preterm babies with low birth weights when compared to expectant mothers living in urban areas.[51]

BARRIERS

Access to dental health services seems to be the key barrier to improving oral health status in the U.S. Based on American Hospital Association data, there is a higher prevalence rate of rural residents' inability to access dental care than urban residents as indicated in this paper focusing on the continual importance of rural dental services in the U.S. [2]

Shortage of workforce

The shortage of overall healthcare workforce in rural areas is another concerning factor. According to a study examining trends in dental workforce in rural areas, it was concluded that a large number of dental health professionals will retire in the next decade, which will further worsen the problem of dental care accessibility in rural areas.[52]

Lack of Insurance

In addition, because of the lack of insurance for dental services, rural residents are more likely to use emergency departments for their oral health needs. According to a study based on the State Emergency Department Databases (a.k.a. SEDD) in Health Provider Shortage Areas, limited acceptance of the Medicaid and State Children's Health Insurance Program, and the shortage of dental personnel, have forced a greater number of rural residents to use the EDs for oral health problems meant for dental offices. Also, Medicaid, often used by rural and urban residents, does not cover dental services.[53] Therefore, there is unwillingness on the part of dentists to treat Medicaid enrolled children. Other observed barriers to appropriate dental services are: inability to get time off work for dental visits, difficulty in finding child care, transportation problems for rural residents, long waiting time for appointments, perceived discrimination in treatment, cost, and lack of demand for dental care.[54]

Education

Lack of education on the importance of oral health and hygiene is also one of the contributing factors in timely prevention and follow-up. For example, a study focused on pregnant women and young children highlighted the fact that lack of education affected oral health outcome.[19] Also, parents of children from low-income families may not consider oral healthcare as a priority.[45]

On the other end of the spectrum, is a lack of education about dental issues amongst the caregivers which often results in delayed treatment and poor prognosis.[41] Nurses in the nursing homes lack training for preventive oral health, further predisposing our rural elderly to adverse health outcomes.[36]

KNOWN CAUSES OF THE PROBLEM

Shortage of Workforce

One of the solutions identified to address the problem of lack of oral health preventive care and

screening in rural areas is to target physicians, so that oral health screening is a part of overall health checkup. Also, new dental workforce strategies, such as dental office assistants trained to include dental auxiliaries can increase the number of dental health professionals. For example, training registered nurses to perform certain dental services under supervision, and expansion of community health center dental services, should be considered as alternatives to seeing traditional dentists for regular screenings.[26, 55]

Insurance

Lack of dental insurance is another major factor that impacts rural oral healthcare. A recent study proposed two policy interventions: 1) to increase the acceptance of Medicaid by rural dentists and 2) amendment of laws to incorporate allied dental providers so that they are reimbursed directly by Medicaid.[53] The dental services provided through Medicare to rural residents could be expanded to include regular dental care.[20]

Public policies need to permanently address payment to dentists who decide to practice in rural areas, as compared with their counterparts in urban areas. For example, rural dentists could be given tax breaks or differential payment rates.[56]

Education

Integrating dental education into school health education curriculum is an innovative approach to increasing awareness among young children.[54] A recent study points out that the school-based dental programs targeting rural children who do not have access to dental care is an effective way to reduce dental health disparities.[21]

Oral health education programs for mothers should be rendered in rural communities as mothers are the primary influence on family health.[19]

Education of both providers and the public increases awareness and early detection of diseases, such as cancers.[35] Other potential policy implications include: recruitment of individuals with rural backgrounds or interests to study and practice dentistry in rural areas; reducing the educational cost of dental school through rural access scholarships; and more attractive loan repayment programs linked to rural practice.[2] Recruitment of rural applicants, rural health education rotations, and student loan programs for students resident in rural communities seem to be effective in improving access to care and oral health status.[16]

Dietary Education

Increased caries incidence is associated with dietary intake of foods that contribute to caries, as well as lack of access to appropriate oral hygiene education and tools. One national study proposes nutritional counselling to reduce sugar-sweetened beverage consumption and attention on the behavioral change with respect to dietary practices in young children.[57] There is a need for designing dental health promotion programs to emphasize avoidance of the consumption of cariogenic snacks and non-diet soft drinks in the target population group.[24]

PROPOSED SOLUTIONS OR INTERVENTIONS

Andersen and colleagues' Behavioral Model of Health Services Utilization.[30] Barriers to seeking dental services in rural areas are often associated with fear. In a survey of rural community members in five West Virginia rural counties, 27 percent of participants reported fear of seeking dental care, while 58 percent of the sample reported the importance of dental care. This model of care can help address dental care anxiety specific to rural populations.

The effect of race and ethnicity on overall oral health status complicates direct association of oral health status with rurality and geographic isolation of populations. Race and ethnicity barriers in rural areas can be addressed through the deployment of trained lay health workers, who can educate and screen targeted rural populations. A Californian study was the first to use a lay dental nosological model - i.e., interpreting symptoms and seeking care – and showed promising results for specific rural populations.[39]

An East Carolina University model allows dental faculty to supervise small groups of residents who reach out to isolated low-income communities.[58] The American Association for Community Dental Programs in collaboration with the National Maternal and Child Oral Health Resource Center have developed a practical tool kit designed to assist health professions and schools in the development and implementation of school-based dental sealant programs. School-based sealant programs are effective in reaching children from low-income families. These programs usually target schools based on the percentage of children eligible for federal free or reduced-cost lunch programs. An easy-to-use manual is designed for any of the following individuals who might be interested to start a school-based sealant program: state and local oral

health program directors, school nurses, community health center staff, other safety net providers, dentistry and dental-hygiene-school faculty, and other dentists and dental hygienists.[59] This highly effective manual is a project of the American Association of Community Dental Programs in cooperation with the Association of State and Territorial Dental Directors, the Health Resources and Services Administration's Maternal and Child Health Bureau (MCHB), the CDC's Division of Oral Health, and the National Maternal and Child Oral Health Resource Center.

COMMUNITY MODELS KNOWN TO WORK

Created under Section 301 of the ***Public Health Service Act,*** §***330,*** this program is designed to improve the health of rural communities by providing seed funds for a variety of pressing public health issues including oral health programs.[60] Included in these programs are initiatives designed to improve oral health in rural areas. In a recent literature review focusing on effective rural oral health models and seven 330A Outreach Authority grantees that developed oral health programs, investigators identified the following models types which were successful in addressing oral health issues in rural areas: Workforce models which are aimed at expanding the dental workforce in rural areas by offering incentives for rural student to pursue careers in dentistry; mobile dental services, school-based models, dental home models, oral health primary care integration models, allied health worker models, and community outreach and engagement models. It should be noted the programs are not mutually exclusive and there is overlap among these models with communities choosing to integrate multiple models.[61] The models included program evaluation to gain community support and buy-in as well as creative approaches to sustainability.[61]

Dental provider shortages remain a key barrier to accessing oral health. In an innovative approach to increase the number of dental providers in order to address the needs of underserved populations, Minnesota is one of two states that have adopted the use of licensed Dental Therapists and Advanced Dental Therapists specifically to reach underserved populations. In 2009, Minnesota became the first state to authorize the licensure of Dental Therapists.[62] These mid-level providers are able to perform basic dental procedures such as crowns and fillings under the supervision of dentists. One challenge to expanding oral health care is the lack of providers willing to accept Medicaid payment rates. Therapists are also able to accept Medicaid and because their hourly rate is lower than a dentist's hourly rate, and safety net providers are able to stretch their resources further by employing dental therapists.[63] In a 2014 review of the fledgling Minnesota Dental Therapists program, there were 32 licensed Dental Therapists and Advanced Therapists in Minnesota and the majority (84 percent) of patients served by these providers were enrolled in public assistance programs.[62] The report concluded that the dental therapists are meeting "statutory intent" of the program by providing care to underserved, low-income, and uninsured patients[61]. Other findings include reduced wait times for dental visits, decreased travel times for patients to obtain access to dental care, and decreases in dental related emergency department visits.[62] The clinics employing dental therapist reported personnel cost savings, improved patient satisfaction, and increased productivity.[62] Alaska adopted the therapist model and other states are pursuing legislation to license dental therapists in their states including Maine, Vermont, New Mexico, and Kansas.[64]

Apple Tree Dental of Minnesota is a non-profit targeting the needs of individuals with special access needs such as rural populations, low income children and families, those with disabilities, and nursing home residents. One method to reach underserved populations is through the use of mobile services which visit nursing homes, Head Start Centers, and schools. Another approach is through the use of teledentistry in which dental hygienists establish telehealth links with dentists. Apple Tree collaborates with many colleges and universities in the state to offer innovative training and educational opportunities for dental practitioners and health providers to gain first-hand experience in working with the elderly, underserved, and those with special needs across a variety of settings including mobile health units, nursing homes, and schools.[65]

The state of Washington's **Access to Baby and Child Dentistry** (ABCD) Program was initiated in 1994-95 to improve dental care for children under the age of six who were insured through Medicaid.[66,67] The program strives to enroll Medicaid-eligible children by age one, and provides education, outreach, and case management in order to improve dental hygiene, as well as ensure that children are seen by a dentist. There is also a training component, as participating dentists learn best practices for working with children under six. Supported in its early stages by the

Washington Dental Service, the ABCD Program had reached three-fourths of the counties in Washington by 2009.[66] By 2014, the percentage of Medicaid-enrolled children under age six who receive dental care in Washington state had more than doubled.[67]

SUMMARY AND CONCLUSIONS

Adequate oral and dental care continues to be a problem and a significant priority of Rural Healthy People 2020. While, in the past, the progress of optimal fluoridation of the public water system has aided in caries and oral disease prevention, there continues to be significant barriers to access adequate oral healthcare, especially in the rural communities. The various contributing factors are lack of trained dental professionals, insurance, and oral health education within rural areas as compared to urban areas. Rural-urban disparities have resulted in poor oral health status among both children and adults, especially in low-income rural families.

The solutions to the problem cannot be looked at in isolation. There is a need to educate the rural population beginning early in schooling, as well address the fundamental issues of access to care in these areas. An increasing shortage of dental workforce can potentially have a greater impact in the future. Expanding the scope of dental auxiliaries, school-based health programs and trained nurses and lay health workers, can help in addressing the oral health concerns in the underserved communities promptly. Finally, the ongoing challenges around oral health status in rural areas calls for a revision of both Medicare and Medicaid reimbursement rates to cover the preventive services by providers other than dentists, and also include oral health exams as a part of regular health screening. Looking into the future, advancements in delivery of dental care through mobile clinics and telehealth provide hope for broader outreach and such methods should be integrated with current practices for better care coordination in rural areas.

REFERENCES

1. U.S. Department of Health and Human Services. Healthy People 2020: Leading Health Indicators: Progress Update. HealthyPeople.gov. http://www.healthypeople.gov/sites/default/files/LHI-ProgressReport-ExecSum_0.pdf. Published March 2014. Accessed July 23, 2015.

2. Harrison JP, Daniel RC, Nemecek V. The growing importance of dental services in rural America. *Health Care Manag (Frederick)*. 2007;26(1):34-42.

3. Bailey JR, Winfree WJ, Hailu K. Addressing the shortage of dentists in underserved areas. *Dent Today.* 2006;25(6):24.

4. U.S. Department of Health and Human services. *Oral Health in America: A Report of the Surgeon General*. Rockville, MD: U.S. Department of Health and Human Services, National Institute of Dental and Craniofacial Research, National Institutes of Health; 2000.

5. U.S. Department of Health and Human Services. Healthy People 2010: Understanding and Improving Health: Oral Health. HealthyPeople.gov. http://www.healthypeople.gov/2010/document/pdf/volume2/21oral.pdf. Published November 2000. Accessed July 23, 2015.

6. Centers for Disease Control and Prevention (CDC). Populations receiving optimally fluoridated public drinking water---United States, 1992-2006. *MMWR Morb Mortal Wkly Rep.* 2008;57(27):737-741.

7. U.S. Department of Health and Human Services. 2006 Water Flouridation Statistics. Centers for Disease Control and Prevention. http://www.cdc.gov/fluoridation/statistics/2006stats.htm. Published December 2006. Updated July 10, 2013. Accessed July 23, 2015.

8. U.S. Department of Health and Human Services. Healthy People 2020: Cancer Objectives. http://www.healthypeople.gov/2020/topics-objectives/topic/oral-health/objectives. Updated July 29, 2015. Accessed July 31, 2015.

9. Bolin JN, Bellamy GR, Ferdinand AO, et al. Rural Healthy People 2020: new decade, same challenges. *J Rural Health*. 2015;31(3):326-333.

10. Southwest Rural Health Research Center, Rural Healthy People 2020 National Survey. 2015, Texas A&M Health Science Center. Unpublished data. Accessed June 11,2015.

11. McFarland KK, Salama F, Yaseen M. Access to dental care for rural children: a survey of Nebraska general dentists. *J Rural Health.* 2011;27(2):205-210.

12. Weinstein P, Coolidge T, Raff CA, Riedy CA. Recruiting rural dentally-avoidant adolescents into an intervention study. *Eur Arch Paediatr Dent.* 2009;10(4):233-236.

13. Dawkins E, Michimi A, Ellis-Griffith G, Peterson T, Carter D, English G. Dental caries among children visiting a mobile dental clinic in South Central

Kentucky: a pooled cross-sectional study. *BMC Oral Health*. May 2 2013;13:19.

14. Wiener RC, Wiener MA. Unmet dental and orthodontic need of children with special healthcare needs in West Virginia. *Rural Remote Health*. 2012;12:2069.

15. DeMattei RR, Allen J, Goss B. A service-learning project to eliminate barriers to oral care for children with special health care needs. *J Sch Nurs*. 2012;28(3):168-174.

16. Martin AB, Hardin JW, Veschusio C, Kirby HA. Differences in dental service utilization by rural children with and without participation in Head Start. *Pediatr Dent*. 2012;34(5):107-111.

17. Anderson L, Martin NR, Burdick A, Flynn RT, Blaney DD. Oral health status of New Hampshire Head Start children, 2007-2008. *J Public Health Dent*. 2010;70(3):245-248.

18. Warren JJ, Weber-Gasparoni K, Marshall TA, et al. A longitudinal study of dental caries risk among very young low SES children. *Community Dent Oral Epidemiol*. 2009;37(2):116-122.

19. Yuen HK, Wiegand RE, Slate EH, Magruder KM, Salinas CF, London SD. Dental health knowledge in a group of Black adolescents living in rural South Carolina. *J Allied Health*. 2008;37(1):15-21.

20. Bell RA, Arcury TA, Anderson AM, et al. Dental anxiety and oral health outcomes among rural older adults. *J Public Health Dent*. 2012;72(1):53-59.

21. Mitchell J, Bennett K, Brock-Martin A. Edentulism in high poverty rural counties. *J Rural Health*. 2013;29(1):30-38.

22. Arcury TA, Savoca MR, Anderson AM, et al. Dental care utilization among North Carolina rural older adults. *J Public Health Dent*. 2012;72(3):190-197.

23. Department of Health and Human Services, Centers for Disease Control and Prevention, http://apps.nccd.cdc.gov/gisdoh/adult.aspx. Accessed: February 3, 2015.

24. Savoca MR, Arcury TA, Leng X, et al. Impact of denture usage patterns on dietary quality and food avoidance among older adults. *J Nutr Gerontol Geriatr*. 2011;30(1):86-102.

25. Savoca MR, Arcury TA, Leng X, et al. Association between dietary quality of rural older adults and self-reported food avoidance and food modification due to oral health problems. *J Am Geriatr Soc*. 2010;58(7):1225-1232.

26. Quandt SA, Chen H, Bell RA, et al. Food avoidance and food modification practices of older rural adults: association with oral health status and implications for service provision. *Gerontologist.* 2010;50(1):100-111.

27. Ahn S, Burdine JN, Smith ML, Ory MG, Phillips CD. Residential rurality and oral health disparities: influences of contextual and individual factors. *J Prim Prev*. 2011;32(1):29-41.

28. Okunseri C, Pajewski NM, Jackson S, Szabo A. Wisconsin Medicaid enrollees' recurrent use of emergency departments and physicians' offices for treatment of nontraumatic dental conditions. *J Am Dent Assoc*. 2011;142(5):540-550.

29. Finlayson TL, Gansky SA, Shain SG, Weintraub JA. Dental utilization among Hispanic adults in agricultural worker families in California's Central Valley. *J Public Health Dent*. 2010;70(4):292-299.

30. Frisbee SJ, Chambers CB, Frisbee JC, Goodwill AG, Crout RJ. Association between dental hygiene, cardiovascular disease risk factors and systemic inflammation in rural adults. *J Dent Hyg*. 2010;84(4):177-184.

31. Skillman SM, Doescher MP, Mouradian WE, Brunson DK. The challenge to delivering oral health services in rural America. *J Public Health Dent*. 2010;70 Suppl 1:S49-S57.

32. Saman DM, Arevalo O, Johnson AO. The dental workforce in Kentucky: current status and future needs. *J Public Health Dent*. 2010;70(3):188-196.

33. Kuthy RA, McKernan SC, Hand JS, Johnsen DC. Dentist workforce trends in a primarily rural state: Iowa: 1997-2007. *J Am Dent Assoc.* 2009;140(12):1527-1534.

34. Schwartz MR. The pipeline from dental education to practice: the Pennsylvania experience. *J Dent Educ.* 2007;71(10):1299-1313.

35. Bazargan N, Chi DL, Milgrom P. Exploring the potential for foreign-trained dentists to address workforce shortages and improve access to dental care for vulnerable populations in the United States: a case study from Washington State. *BMC Health Serv Res*. December 10 2010;10:336.

36. Shortridge EF, Moore JR. Use of emergency departments for conditions related to poor oral

healthcare: implications for rural and low-resource urban areas for three states. *J Public Health Manag Pract*. 2009;15(3):238-245.

37. Saman DM, Johnson AO, Arevalo O, Odoi A. Geospatially illustrating regional-based oral health disparities in Kentucky. *Public Health Rep*. 2011;126(4):612-618.

38. Martin CA, McNeil DW, Crout RJ, et al. Oral health disparities in Appalachia: orthodontic treatment need and demand. *J Am Dent Assoc*. 2008;139(5):598-604; quiz 627.

39. Horton S, Barker JC. Rural Mexican immigrant parents' interpretation of children's dental symptoms and decisions to seek treatment. *Community Dent Health*. 2009;26(4):216-221.

40. Quandt SA, Chen H, Bell RA, et al. Disparities in oral health status between older adults in a multiethnic rural community: the rural nutrition and oral health study. *J Am Geriatr Soc*. 2009;57(8):1369-1375.

41. Ditmyer MM, Mobley C, Draper Q, Demopoulos C, Smith ES. Development of a theoretical screening tool to assess caries risk in Nevada youth. *J Public Health Dent.* 2008;68(4):201-208.

42. Lukes SM, Simon B. Dental services for migrant and seasonal farmworkers in US community/migrant health centers. *J Rural Health*. 2006;22(3):269-272.

43. Smith BJ, Ghezzi EM, Manz MC, Markova CP. Perceptions of oral health adequacy and access in Michigan nursing facilities. *Gerodontology*. 2008;25(2):89-98.

44. Jablonski RA, Swecker T, Munro C, Grap MJ, Ligon M. Measuring the oral health of nursing home elders. *Clin Nurs Res*. 2009;18(3):200-217.

45. Jones J, Mofidi M, Bednarsh H, Gambrell A, Tobias CR. Increasing access to oral health care for people living with HIV/AIDS in rural Oregon. *Public Health Rep*. 2012;127 Suppl 2:65-72.

46. Smith BJ, Ghezzi EM, Manz MC, Markova CP. Oral healthcare access and adequacy in alternative long-term care facilities. *Spec Care Dentist*. 2010;30(3):85-94.

47. Makhija SK, Gilbert GH, Litaker MS, et al. Association between aspects of oral health-related quality of life and body mass index in community-dwelling older adults. *J Am Geriatr Soc*. 2007;55(11):1808-1816.

48. Makhija SK, Gilbert GH, Boykin MJ, et al. The relationship between sociodemographic factors and oral health-related quality of life in dentate and edentulous community-dwelling older adults. *J Am Geriatr Soc*. 2006;54(11):1701-1712.

49. Weyant RJ, Pandav RS, Plowman JL, Ganguli M. Medical and cognitive correlates of denture wearing in older community-dwelling adults. *J Am Geriatr Soc*. 2004;52(4):596-600.

50. Skelton J, Mullins R, Langston LT, et al. CenteringPregnancySmiles: implementation of a small group prenatal care model with oral health. *J Health Care Poor Underserved*. 2009;20(2):545-553.

51. Anderson C, Harris MS, Kovarik R, Skelton J. Discovering expectant mothers' beliefs about oral health: an application of the Centering Pregnancy Smiles program. *Int Q Community Health Educ*. 2009-2010;30(2):115-140.

52. Maserejian NN, Tavares MA, Hayes C, Soncini JA, Trachtenberg FL. Prospective study of 5-year caries increment among children receiving comprehensive dental care in the New England children's amalgam trial. *Community Dent Oral Epidemiol*. 2009;37(1):9-18.

53. Thind A, Hewlett ER, Andersen RM, Bean CY. The Pipeline program at The Ohio State University College of Dentistry: Oral Health Improvement through Outreach (OHIO) Project. *J Dental Educ.* 2009;73(2 Suppl):S96-S106; discussion S106-S107.

54. Riley JL 3rd, Gilbert GH, Heft MW. Orofacial pain: patient satisfaction and delay of urgent care. *Public Health Rep.* 2005;120(2):140-149.

55. Bimstein E, Wilson J, Guelmann M, Primosch RE. The relationship between oral and demographic characteristics of children with asthma. *J Clin Pediatr Dent.* 2006;31(2):86-89.

56. Branson BG, Amyot C, Brown R. Increasing access to oral health care in underserved areas of Missouri: dental hygiene students in AHEC rotations. *J Allied Health.* 2007;36(1):e47-e65.

57. Mertz E, Mouradian WE. Addressing children's oral health in the new millennium: trends in the dental workforce. *Acad Pediatr.* 2009;9(6):433-439.

58. Chadwick DG, Hupp JR. East Carolina University School of Dentistry: impact on access disparities. *J Am Coll Dent.* 2008;75(4):35-41.

59. National Maternal and Child Oral Health Resource Center. Seal America: The Prevention

Invention. www.mchoralhealth.org/Seal/intro.html#purpose. Published 2011. Accessed July 23, 2015.

60. NORC at the University of Chicago. Rural Health Outreach Tracking and Evaluation Program. http://www.norc.org/Research/Projects/Pages/rural-health-outreach-tracking-evaluation-program.aspx. Accessed July 23, 2015.

61. Bayne A, Knudson A, Garg A, Kassahun M. Promising practices to improve access to oral health care in rural communities. *Rural Evaluation Brief.* February 2013;Y Series(7):1-6.

62. Minnesota Department of Health. Minnesota Board of Dentistry. Early impacts of dental therapists in Minnesota: report to the Minnesota legislature 2014. http://www.health.state.mn.us/divs/orhpc/workforce/dt/dtlegisrpt.pdf. Published February 2014. Accessed July 23, 2015.

63. Benson L. 'Dental therapy' takes root where dentists are scarce in Minnesota. *MPR News.* December 9, 2013. http://www.mprnews.org/story/2013/12/07/health/dental-therapy-profession. Accessed July 23, 2015.

64. McElhaney A. Dental therapists aim to fill in oral health shortfalls. *USA Today.* May 6, 2014. http://www.usatoday.com/story/news/nation/2014/05/06/dental-therapists-oral-health-disparities/7422773/. Accessed July 23, 2015.

65. Apple Tree Dental. Innovations Center. http://www.appletreedental.org/innovations/innovations_center. Accessed July 23, 2015.

66. Pew Center on the States. Washington's ABCD Program: Improving Dental Care for Medicaid-Insured Children. http://www.pewtrusts.org/~/media/legacy/uploadedfiles/wwwpewtrustsorg/reports/state_policy/ABCDbriefwebpdf.pdf. Published June 2010. Accessed July 23, 2015.

67. Washington Dental Service Foundation. Access to Baby & Child Dentistry.™ Published 2014. Accessed July 31, 2015.

Suggested Chapter Citation:

Kash BA, Hutchison L, Kaul S, Appiah P, Challa S. Rural Oral Health. In: Bolin JN, Bellamy G, Ferdinand AO, et al. eds. *Rural Healthy People 2020*. Vol. 2. College Station, TX: Texas A&M University Health Science Center, School of Public Health, Southwest Rural Health Research Center;2015:29-40.

HEALTH-RELATED QUALITY OF LIFE AND WELL-BEING

By Samuel D. Towne Jr., PhD, MPH, CPH; Chanam Lee, PhD, MLA; Matthew L. Smith PhD, MPH, CHES; Jairus Pulczinski; Suzanne M. Swierc, MPH; Rachel Coughlin, MPH; Alexandra Roach, MPH; and Marcia G. Ory PhD, MPH

SCOPE OF THE PROBLEM

- Quality of life is a multidimensional concept and is assessed across several domains and through multiple measures and standardized tools.
- Poor quality of life is associated with poor health outcomes (e.g. morbidity and mortality), which is related to greater health burden for individuals.
- Poor access to care is related to increased risk of poorer quality of life, with greater barriers (e.g. availability and access to health care providers) to health care utilization present among rural populations when compared to their urban counterparts.
- Identifying ways to improve quality of life (e.g. improvements in the built environment) may greatly affect the lives of Americans in both rural and urban settings.

Quality of life is increasingly recognized as an important factor in American life because of its myriad interactions with multiple aspects of one's existence. As such, Healthy People 2020 included health-related quality of life and well-being as a new topic area, highlighting the salience of health-related quality of life and well-being with population health. This focal area extends beyond direct measures of health (e.g. life expectancy) and emphasizes the complex interactions among health, quality of life and well-being.[1]

There are several ways in which one can measure quality of life. The Centers for Disease Control and Prevention (CDC) and the World Health Organization (WHO) define quality of life along several domains (i.e. social, environment, physical, psychological).[2,3] Measuring quality of life is complex and involves both subjective and objective measures, therefore it is challenging to identify one perfect measure covering all relevant domains. Researchers have defined quality of life in more general terms and specific to health (i.e. health-related quality of life) using standardized measures & tools (e.g. SF-36) across diverse populations.[4-11] In addition, other measures cover seven dimensions of wellness including physical, emotional, social, intellectual, spiritual, environmental, and occupational.[12,13] Thus, there are several dimensions or domains which may be considered when measuring one's quality of life. We provide an overview of the past and current status of quality of life and well-being emphasizing rural populations and where appropriate, comparisons to urban (metropolitan) areas.

Selected measures of quality of life are listed below (**Table 1**), however other measures have been identified (e.g. Patient-Reported Outcomes Measurement Information System or PROMIS).[14]

Table 1. Selected measure of quality of life.

Measures	Summary Measures	Scales (Items)
SF-36[4]		Self-Rated Health (1)
	Physical Health	Physical Functioning (10)
		Role-Physical (4)
		Bodily Pain (2)
		General Health (5)*
	Mental Health	Vitality (4)*
		Social Functioning (2)*
		Role-Emotional (3)
		Mental Health (5)
CDC HRQOL-14[15]	Healthy Days Core** (CDC HRQOL-4)	Self-Rated Health (1)
		Physically unhealthy day (1)
		Mentally unhealthy days (1)
		Mental/Physical health limited usual activities (1)

* Vitality, General Health and Social Functioning have significant correlation with both summary measures.

** Note: We focus on select measure of CDC HRQOL-14 (CDC HRQOL-4)

PREVALENCE AND DISPARITIES IN RURAL AREAS

National data suggests that rural residents are more likely to report their health as poor compared to their urban counterparts.[16] This difference is, in part, attributable to multiple individual risk factors (e.g. obesity, low incomes, and low education).[16] A study in Texas identified that residing in suburban areas was more closely associated with frequent mental distress than residing in metropolitan areas.[17] Longitudinal research suggest that with increasing rurality (from urban to more rural), U.S. adults report worse self-rated health.[18] In this longitudinal analyses, researchers identified structural disadvantage (i.e. high unemployment and low education) among rural areas, which accounted for these differences in comparison to metropolitan areas.[18]

Rurality has also been associated with worse outcomes across varied subgroups. Older adults in rural areas experienced lower quality of life (i.e. social functioning) than those residing in urban areas.[19] One small study found evidence to suggest health-related quality of life was lower among rural veterans than their urban counterparts, indicating access to care may serve as a moderator to this difference.[20] Across increasing levels of rurality (i.e. using Rural-Urban Continuum Codes), rural breast cancer survivors were more likely to report lower quality of life and lower functional well-being than urban breast cancer survivors.[21] In the same study, the authors indicate that investigations into whether lower levels of cancer resources (compared to urban areas) may be related to this difference is needed to further understanding the field.[21] Additional research indicates that fair or poor health status and unemployment (related to health reasons) was more likely among rural cancer survivors than their urban counterparts.[22] This may be, in part, the product of the compounding effect of poor health and possible loss of employer-sponsored health insurance.[22]

Analysis of smaller sub-groups also indicated disparities in quality of life for rural residents. In a study of church clergy in North Carolina, differences in physical health-related quality of life were identified across rural and urban residents.[23] Here, rural clergy had lower physical health-related quality of life than urban clergy members.[23] Rural residents diagnosed with multiple sclerosis reported poorer physical health-related quality of life than those in urban areas.[24] Here, the authors suggest barriers in accessing care among rural residents may be related to these differences.[24] Here again, access to care was cited as a possible contributor to these differences.

VARIATIONS BY RACE AND ETHNICITY

We sought to identify whether variations in quality of life and well-being were present across differing racial and ethnic groups. Racial and ethnic minority individuals experience several health-related disparities when compared to white individuals. These racial and ethnic disparities are measured in poorer access to health care or being less likely to have health insurance,[25-28] higher rates of chronic disease (e.g. diabetes), [29-32] lower educational attainment,[33-35] and lower income.[36]

Older racial and ethnic minority adults (i.e. Black and Hispanic adults) had lower quality of life than white older adults (across two dimensions of quality of life).[19] Other research confirms that Black older adults were more likely to report poor health-related quality of life than their white counterparts.[37] This disparity increases with age and is more pronounced among women.[37] Several factors mediate this disparity, including socioeconomic status, cognitive ability, and medical conditions.[37] A Detroit health survey reported lower self-reported health among Hispanics when compared to other racial groups.[38] Black, Hispanic, and Native American or Alaska Native individuals were more likely to report poorer health status than their white counterparts.[39] Variations in quality of life are also seen when comparing races with various chronic conditions. Low income Hispanic individuals with asthma report more poor mental days than low income white individuals with asthma.[40]

These differences may be heightened by the already present rural disparities in access to health care and health status. Minority individuals in rural regions with low ethnic diversity (low racial/ethnic density) are more likely to report depression and anxiety than their rural white counterparts.[41] Other evidence confirms that living in rural areas and identifying as a racial or ethnic minority individual was associated with fair or poor health.[42] Thus, rurality, may serve to compound disparities in racial and ethnic groups. More research is needed in order to determine the scope of differences in quality of life among rural and urban individuals.

IMPACT OF QUALITY OF LIFE ON MORTALITY

Quality of life extends to other aspects of one's health. Quality of life may be closely associated with

various health outcomes given its complex nature and measurement across several domains of health.[3] Thus, we sought to identify whether measures of quality of life associated with poor health outcomes, as poor self-reported health has been shown to be an independent predictor of mortality.[43-45]

A large longitudinal analysis in the United Kingdom showed associations between quality of life and all-cause mortality among adults.[46] In addition, among individuals with chronic conditions, quality of life has been shown to be associated with mortality. For example, among hemodialysis patients, heath-related quality of life was shown to be associated with increased mortality and hospitalization.[47] A number of other studies confirm that quality of life is associated with mortality and/or hospitalization among individuals with various conditions, including coronary heart disease,[48] chronic obstructive pulmonary disease (COPD),[49] arterial fibrillation,[50] type 2 diabetes,[51] and metastatic hormone-refractory prostate cancer.[52]

As stated previously, individuals with a wide range of conditions, regardless of rural or urban residence, report lower health-related quality of life, and these lower scores are generally predictive of increased mortality.[46] In previous sections, we discussed disparities in health-related quality of life in urban and rural populations. Again, rural residents were more likely to report lower self-rated quality of life,[53] especially among rural veterans[54,55] which heightens the need to investigate strategies that improve quality of life among rural populations. Even so, much of the evidence regarding rural/urban differences in health-related quality of life and quality of life in general, is dated, as such more updated research is needed to determine current trends.

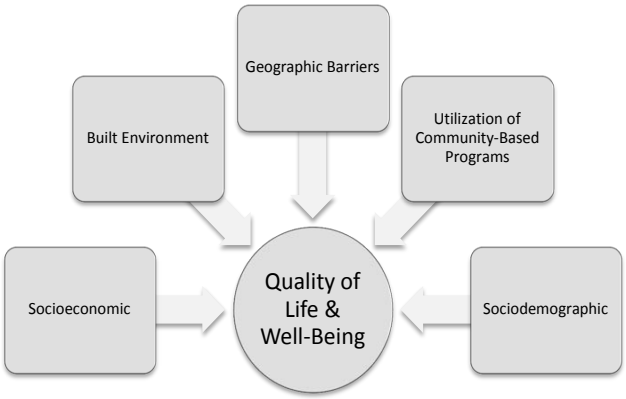


Figure 1. Interaction of Social and Environmental Determinants of Health Based on the Chapter Outline

BARRIERS AND KNOWN CAUSES OF THE CONDITION/PROBLEM

There are several factors that may affect one's quality of life (**Figure 1**). We provide a selection of factors associated with quality of life and well-being in this section. This is not meant to be comprehensive, but serves as a focus of key factors affecting rural populations.

Health Care Access

Several studies have measured health care access among rural residents in general (i.e. among rural residents only) and relative to their urban counterparts. Access to health care services is associated with quality of life.[56] Lacking health insurance has been associated with poor health status in multiple studies.[57,58] Lack of health insurance was cited as being associated with thousands of preventable deaths annually by the Institute of Medicine's report *Insuring America's Health: Principles and Recommendations*.[59] Evidence also suggests that rural residents have greater barriers in accessing care due to being more likely to be uninsured than their urban counter parts.[60] Thus, ensuring access to health care services is of critical importance for all, and especially for potentially vulnerable rural residents.

Rural areas have been shown to have greater geographic barriers to health care services across several measures related to health care provider availability (e.g. Health Professional Shortage Areas[61] or Medically Underserved Areas[62]). Absence of health professionals in rural areas is a barrier for rural residents seeking health care services.[63] For example, utilizing preventive services (i.e. for diabetes) was lower among rural residents when compared to urban residents.[64] Thus, the link between rural residence and poor access to care and by extension greater risk of poorer quality of life is of concern for rural residents and those seeking to eliminate such disparities. While access to resources is a challenge in rural areas, other factors also contribute to quality of life.

Poverty as a Confounding Issue

The rate of poverty in rural areas is higher than metropolitan areas, which may compound issues of access to resources (health care and general resources).[65] Rural residents likely have greater distances to food resources which may limit access to nutritional foods.[66,67] In addition, school education in rural areas has been shown to be poor.[68] The

combination of several social determinants of health (e.g. income and education)[69] with poor health and low access to care in rural areas[60,70] identifies rural residents as a potentially vulnerable group. Thus, more research must be done in order to have a foundation from which to seek solutions to improve quality of life amongst this potentially vulnerable group.

SOLUTIONS AND INTERVENTIONS

There are several possible solutions or interventions that may work towards the goal of improved health-related and general quality of life and well-being. We present a selection, which is not meant to be a comprehensive list of any/all possible solutions.

Built Environment

The built environment has both direct and indirect relationships with quality of life and well-being for rural residents. The indirect influences of the built environment include walking, physical activity, safety, and various dimensions of psycho-social health such as stress and social cohesion/capital. Few empirical studies have addressed direct links between the built environment and quality of life in U.S. rural communities. Studies carried out in other settings and countries can offer general insights on this topic. A survey study of older adults in New York reported that greater neighborhood safety and social cohesion were significant predictors of self-reported quality of life but perceptions of neighborhood walkability (e.g. sidewalks, crosswalks, lighting, benches) were not.[71] Another urban older adults study showed neighborhood barriers, such as 'lack of resting places or long distances'; 'noisy traffic or dangerous crossroads'; and 'hilly terrain or poor street conditions', were associated with quality of life.[72(p2154)] An exploratory study of older adults with physical disabilities found that perceptions of the built environment were associated with the socioeconomic quality of life.[73] A Columbian study examined more detailed attributes of the built environment,[74] which showed that 'safety from traffic' was a positive correlate and 'street noise' was a negative correlate of health-related quality of life. It further showed that perceived presence of safe parks was positively related with the mental dimension of health-related quality of life and the amount of park land in the neighborhood was positively associated with self-related health.[74]

Being physically activity, and not being obese, has been shown to be linked with increased health-related quality of life among children[75-77] and adults; and are further associated with lower risk of chronic conditions which may contribute to health-related quality of life.[78-80] Therefore, environmental features shown to increase physical activity and walking in general[81] and those specific to rural communities,[82] including safety (crime, traffic and falls),[83,84] access to utilitarian and recreational destinations (retails, services, parks, trails),[85-88] adequate pedestrian infrastructure (sidewalks, lighting, benches),[81,89] and visual quality (attractive scenery or greenery),[81,90,91] appear important as intervention targets for improving quality of life. Further, neighborhood built environments such as street layout, traffic, and land uses are associated with accessibility to healthcare and other public services and also with perceived stress levels.[92] In addition, in a study from Ireland, concerns about access to public services were significantly correlated with self-reported health status.[93]

The built environment has also been shown to be associated with various social domains of health, such as sense of community, social trust, social capital, and civic engagement, which can contribute to mental health and quality of life.[94] A survey study from Oregon reported a significantly higher sense of community among residents of pedestrian-oriented communities, compared to those of auto-oriented communities.[95] In another study from Ireland, evidence suggested that living in walkable mixed-used communities, compared to auto-oriented counterparts, was positively associated with all four social capital measures assessed (knowing neighbors, participating politically, trusting others, and being socially engaged).[96] A community-based participatory research study carried out in New Hampshire suggested that higher levels of walkability were associated with increased community participation and social trust.[97] Sense of community has also shown to be connected with more leisurely walking and pedestrian-oriented urban design.[98]

Natural elements of the neighborhood environments, such as plants, trees, water, and greenery, have also been shown to contribute to quality of life and mental health.[99] A Dutch study showed that living in a 'greener' environment was positively associated with general health status.[100] A literature review presented evidence to suggest that physical activity engaged in natural outdoor settings brought greater benefits to mental health well-being and greater intention for exercise adherence.[101] Another literature review suggested greater positive effects on several

measures (e.g. energy, anxiety, anger, fatigue, and sadness) gained after physical activities performed in natural environments, compared to synthetic environments.[102]

In summary, built environments offer various opportunities to improve quality of life, if they (a) can provide appropriate support for physical activity, walking, and social interaction (e.g. safety, access to destinations, pedestrian infrastructure, visual quality),[81,82] (b) are free from excessive stressors (e.g. noise, traffic, hazards/toxins, safety/security risks),[83,84] and (c) allow easy access to natural elements (e.g. plants, trees[99,100]). The built environment holds implications for many intervention targets relevant to quality of life such as safety, social capital, physical activity, and walking; and supportive built environments can increase the effectiveness of program-based interventions.[103]

Community-based Programs

The opportunity to reach individuals with evidence-based health and wellness programs extends to community settings and other settings (e.g. work, school). Effective strategies that work towards improving the health-related and general quality of life and well-being in individuals include evidence-based programs delivered in the community. A detailed description of all evidence-based programs delivered in the community is not provided, however we highlight selected programs that have been shown to improve the quality of life of participants in community settings. The *Health People 2010 Final Review* noted in terms of meeting the goal of '*increased quality and years of healthy life*,' measuring the number of years in 'good or better health,' 'free of activity limitations' and 'free of selected chronic diseases' was key.[104(pO-13)] Thus, evidence-based programs delivered in the community that target these improvements align with this effort & the overall effort of improving the health-related and general quality of life and well-being.

The Chronic Disease Self-Management Program (CDSMP),[105-108] A Matter of Balance/Volunteer Lay Leader (AMOB/VLL),[109-111] the Diabetes Self-Management Program (DSMP),[112] EnhanceFitness,[113] and several other programs involve community-based efforts to improve the quality of life of program participants (e.g. improvements with regard to self-efficacy, depression, social functioning, and self-care). These programs are available throughout the U.S. and target adults (rural and urban).

Other programs targeting youth, including the Coordinated Approach to Child Health (CATCH) focus of factors related to health (e.g. obesity) and have been successfully delivered in school settings.[114] In addition, school-based anti-bullying programs have been effective at reducing bullying among youth[115] which is also akin to improved quality of life among youth. A variety of other programs have been delivered to youth with various results (e.g. cognitive and physical benefits),[116] however more research is needed to identify effective school-based programs that improve one's health and by extension health-related quality of life and well-being.[117]

Furthermore, community-based patient-assistance programs have shown success at providing psychosocial support to breast cancer patients.[118] In addition, programs that focus on meditation and mindfulness may hold promise for improving quality of life for individuals in the community, however more research is needed to determine the full benefits of these programs for different populations.[119] Thus, several community-based programs show promise for improving health and health-related outcomes among rural and urban individuals.[120]

Additional Strategies

There are several additional strategies that may work towards improving the quality of life of rural and urban individuals. Research suggests that having adequate infrastructure (e.g. access to safe roadways and health services) contributes to quality of life.[121] Rural areas have been shown to have limited infrastructure and larger geographic coverage among health care providers including emergency medical services, when compared to urban settings.[122,123] Thus, possible targets for improvement may include infrastructure improvements in rural areas, where possible.

One strategy that may help overcome barriers in geographic distance between providers and patients in rural areas is telemedicine. The implementation of telemedicine in rural areas has been shown to be associated with benefits (e.g. delivery of effective health care/treatment and cost savings over usual care).[124-126] However, more research is needed to understand the full implications and effectiveness of telemedicine.[127] These are only a few strategies that may work towards achieving the goal of improved quality of life and well-being among rural residents.

SUMMARY AND CONCLUSIONS

Quality of life is a multidimensional measure that can be measured in several ways and with a variety of standardized tools. Poor quality of life is associated with severe complications and undesirable outcomes (i.e. morbidity and mortality)[46] as well as increased utilization of health care services (i.e. hospital care),[47] and increased health care costs.[48-52,128] In addition, poor health days are related to poorer quality of life and adversely affect one's performance related to employment.[129] Thus, identifying ways to improve the quality of life of rural and urban residents is of great interest to policy makers and researchers and to society at large, as the costs are far reaching.

Rural residents face several barriers to achieving high quality of life, however there are possible solutions and strategies to lessen the extent of these barriers. Focusing on promising solutions and strategies (e.g. the built environment, community-based evidence-based programs and innovative telemedicine solutions) as they relate to opportunities to improve quality of life has the potential to benefit Americans of all ages, and particularly vulnerable rural residents. However, there is currently a limited evidence base specifically focused on measuring quality of life among residents of rural areas and evaluating specific intervention strategies. This indicates an urgent need for more research with larger and more diverse populations in a variety of settings across the country. Heightened attention is needed to factors affecting and improving quality of life among rural residents, enabling researchers, policy makers, and rural practitioners to have greater access to timely evidence for improving the lives of rural residents.

REFERENCES

1. Healthy People 2020. Health-Related Quality of Life and Well-Being. HealthyPeople.gov. http://www.healthypeople.gov/2020/about/QoLWBabout.aspx. Accessed April 17, 2014.

2. Centers for Disease Control and Prevention (CDC). HRQOL Concepts. Health-Related Quality of Life (HRQOL). http://www.cdc.gov/hrqol/concept.htm. Updated March 17, 2011. Accessed April 13, 2014.

3. World Health Organization (WHO). WHO Quality of Life-BREF (WHOQOL-BREF). Management of Substance Abuse. http://www.who.int/substance_abuse/research_tools/whoqolbref/en/. Accessed April 13, 2014.

4. Ware JE Jr, Gandek B. Overview of the SF-36 Health Survey and the International Quality of Life Assessment (IQOLA) Project. *J Clin Epidemiol.* 1998;51(11):903-912.

5. Iudici M, Cuomo G, Vettori S, Avellino M, Valentini G. Quality of life as measured by the short-form 36 (SF-36) questionnaire in patients with early systemic sclerosis and undifferentiated connective tissue disease. *Health Qual Life Outcomes.* February 25 2013;11:23.

6. Sanson-Fisher RW, Perkins JJ. Adaptation and validation of the SF-36 Health Survey for use in Australia. *J Clin Epidemiol.* 1998;51(11):961-967.

7. Fukuhara S, Bito S, Green J, Hsiao A, Kurokawa K. Translation, adaptation, and validation of the SF-36 Health Survey for use in Japan. *J Clin Epidemiol.* 1998;51(11):1037-1044.

8. Lv XL, Jiang YH, Sun YH, et al. Short form 36-Item Health Survey test result on the empty nest elderly in China: a meta-analysis. *Arch Gerontol Geriatr.* 2013;56(2):291-297.

9. Hoffman DL, Dukes EM. The health status burden of people with fibromyalgia: a review of studies that assessed health status with the SF-36 or the SF-12. *Int J Clin Pract.* 2008;62(1):115-126.

10. Ware JE Jr, Kosinski M, Gandek B, et al. The factor structure of the SF-36 Health Survey in 10 countries: results from the IQOLA Project. International Quality of Life Assessment. *J Clin Epidemiol.* 1998;51(11):1159-1165.

11. Liem YS, Bosch JL, Arends LR, Heijenbrok-Kal MH, Hunink MG. Quality of life assessed with the Medical Outcomes Study Short Form 36-Item Health Survey of patients on renal replacement therapy: a systematic review and meta-analysis. *Value Health.* 2007;10(5):390-397.

12. Anspaugh DJ, Hamrick MH, Rosato FD. *Wellness: Concepts and Applications.* 6th ed. Boston, MA: McGraw-Hill; 2006.

13. Hales D. *An Invitation to Health.* 11th ed. Belmont, CA: Thompson & Wadsworth; 2005.

14. National Institutes of Health. PROMIS: Patient-Reported Outcomes Measurement Information System. http://commonfund.nih.gov/promis/index. Updated February 18, 2014. Accessed March 17, 2014.

15. Moriarty DG, Zack MM, Kobau R. The Centers for Disease Control and Prevention's Healthy Days Measures - population tracking of perceived physical and mental health over time. *Health Qual Life Outcomes.* September 2 2003;1:37.

16. Bethea TN, Lopez RP, Cozier YC, White LF, McClean MD. The relationship between rural status, individual characteristics, and self-rated health in the Behavioral Risk Factor Surveillance System. *J Rural Health.* 2012;28(4):327-338.

17. Rohrer JE, Borders TF, Blanton J. Rural residence is not a risk factor for frequent mental distress: a behavioral risk factor surveillance survey. *BMC Public Health.* May 16 2005;5(1):46.

18. Monnat SM, Beeler Pickett C. Rural/urban differences in self-rated health: examining the roles of county size and metropolitan adjacency. *Health Place.* 2011;17(1):311-319.

19. Baernholdt M, Yan G, Hinton I, Rose K, Mattos M. Quality of life in rural and urban adults 65 years and older: findings from the National Health and Nutrition Examination survey. *J Rural Health.* 2012;28(4):339-347.

20. Wallace AE, Lee R, Mackenzie TA, et al. A longitudinal analysis of rural and urban veterans' health-related quality of life. *J Rural Health.* 2010;26(2):156-163.

21. Reid-Arndt SA, Cox CR. Does rurality affect quality of life following treatment for breast cancer? *J Rural Health.* 2010;26(4):402-405.

22. Weaver KE, Palmer N, Lu L, Case LD, Geiger AM. Rural-urban differences in health behaviors and implications for health status among US cancer survivors. *Cancer Causes Control.* 2013;24(8):1481-1490.

23. Miles A, Proescholdbell RJ, Puffer E. Explaining rural/non-rural disparities in physical health-related quality of life: a study of United Methodist clergy in North Carolina. *Qual Life Res.* 2011;20(6):807-815.

24. Buchanan RJ, Zhu L, Schiffer R, Radin D, James W. Rural-urban analyses of health-related quality of life among people with multiple sclerosis. *J Rural Health.* 2008;24(3):244-252.

25. DeNavas-Walt C, Proctor BD, Smith JC. *Income, Poverty, and Health Insurance Coverage in the United States: 2009.* Washington, DC: U.S. Government Printing Office, U.S. Census Bureau; 2010:60-238.

26. U.S. Census Bureau. Income, Poverty and Health Insurance Coverage in the United States: 2010. Newsroom Archive. http://www.census.gov/newsroom/releases/archives/income_wealth/cb11-157.html#tablec. Published September 13, 2011. Accessed January 24, 2013.

27. ASPE Office of Health Policy. *Overview of the Uninsured in the United States: A Summary of the 2011 Current Population Survey.* Washington, DC: Department of Health and Human Services; 2011.

28. Mead H, Cartwright-Smith L, Jones K, Ramos C, Woods K, Siegel B. *Racial and Ethnic Disparities in U.S. Health Care: A Chartbook.* New York, NY: The Commonwealth Fund; 2008.

29. U.S. Department of Health and Human Services. Diabetes and African Americans. Office of Minority Health. http://minorityhealth.hhs.gov/omh/browse.aspx?lvl=4&lvlid=18. Accessed June 25, 2015.

30. U.S. Department of Health and Human Services. Diabetes and American Indians/Alaska Natives. Office of Minority Health. http://minorityhealth.hhs.gov/omh/browse.aspx?lvl=4&lvlid=33. Accessed June 25, 2015.

31. Centers for Disease Control & Prevention (CDC). *National Diabetes Fact Sheet: National Estimates and General Information on Diabetes and Prediabetes in the United States, 2011.* Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention; 2011.

32. Taylor CA, Keim KS, Fuqua DR, Johnson CA. A diabetes prevention assessment tool for American Indians. *Prev Chronic Dis.* 2005;2(4):A06.

33. Glover S, Moore CG, Samuels ME, Probst JC. Disparities in access to care among rural working-age adults. *J Rural Health.* 2004;20(3):193-205.

34. Ryan CL, Siebens J. *Educational attainment in the United States: 2009*. Washington, DC: U.S. Census Bureau, U.S. Department of Commerce, Economics and Statistics Administration; 2012.

35. Liao Y, Bang D, Cosgrove S, et al. Surveillance of health status in minority communities - Racial and Ethnic Approaches to Community Health Across the U.S. (REACH U.S.) Risk Factor Survey, United States, 2009. *MMWR Surveill Summ.* 2011;60(6):1-41.

36. DeNavas-Walt C, Proctor BD, Smith JC. *Income, Poverty, and Health Insurance Coverage in the United States: 2010.* Washington, DC: U.S. Government Printing Office, U.S. Census Bureau; 2011:60-239.

37. Skarupski KA, de Leon CF, Bienias JL, et al. Black-white differences in health-related quality of life among older adults. *Qual Life Res.* 2007;16(2):287-296.

38. Kieffer EC, Sinco BR, Rafferty A, et al. Chronic disease - related behaviors and health among African Americans and Hispanics in the REACH Detroit 2010 communities, Michigan, and the United States. *Health Promot Pract.* 2006;7(3):256S-264S.

39. Chowdhury PP, Balluz L, Strine TW. Health-related quality of life among minority populations in the United States, BRFSS 2001-2002. *Ethn Dis.* 2008;18(4):483-487.

40. Bandiera FC, Pereira DB, Arif AA, Dodge B, Asal N. Race/ethnicity, income, chronic asthma, and mental health: a cross-sectional study using the behavioral risk factor surveillance system. *Psychosom Med.* 2008;70(1):77-84.

41. Bonnar KK, McCarthy M. Health related quality of life in a rural area with low racial/ethnic density. *J Community Health.* 2012;37(1):96-104.

42. Sharkey JR, Johnson CM, Dean WR. Relationship of household food insecurity to health-related quality of life in a large sample of rural and urban women. *Women Health.* 2011;51(5):442-460.

43. Bopp M, Braun J, Gutzwiller F, Faeh D; Swiss National Cohort Study Group. Health risk or resource? Gradual and independent association between self-rated health and mortality persists over 30 years. *PloS One.* 2012;7(2):e30795.

44. Idler EL, Benyamini Y. Self-rated health and mortality: a review of twenty-seven community studies. *J Health Soc Behav.* 1997;38(1):21-37.

45. Singh-Manoux A, Guéguen A, Martikainen P, Ferrie J, Marmot M, Shipley M. Self-rated health and mortality: short- and long-term associations in the Whitehall II study. *Psychosom Med.* 2007;69(2):138-143.

46. Netuveli G, Pikhart H, Bobak M, Blane D. Generic quality of life predicts all-cause mortality in the short term: evidence from British Household Panel Survey. *J Epidemiol Community Health.* 2012;66(10):962-966.

47. Mapes DL, Lopes AA, Satayathum S, et al. Health-related quality of life as a predictor of mortality and hospitalization: the Dialysis Outcomes and Practice Patterns Study (DOPPS). *Kidney Int.* 2003;64(1):339-349.

48. Spertus JA, Jones P, McDonell M, Fan V, Fihn SD. Health status predicts long-term outcome in outpatients with coronary disease. *Circulation.* 2002;106(1):43-49.

49. Domingo-Salvany A, Lamarca R, Ferrer M, et al. Health-related quality of life and mortality in male patients with chronic obstructive pulmonary disease. *Am J Respir Crit Care Med.* 2002;166(5):680-685.

50. Chapa DW, Akintade B, Schron E, Friedmann E, Thomas SA. Is health-related quality of life a predictor of hospitalization or mortality among women or men with atrial fibrillation? *J Cardiovasc Nurs.* 2014;29(6):555-564.

51. Kleefstra N, Landman GW, Houweling ST, et al. Prediction of mortality in type 2 diabetes from health-related quality of life (ZODIAC-4). *Diabetes Care.* 2008;31(5):932-933.

52. Sullivan PW, Nelson JB, Mulani PM, Sleep D. Quality of life as a potential predictor for morbidity and mortality in patients with metastatic hormone-refractory prostate cancer. *Qual Life Res.* 2006;15(8):1297-1306.

53. Goins RT, Mitchell J. Health-related quality of life: does rurality matter? *J Rural Health*. 1999;15(2):147-156.

54. Weeks WB, Kazis LE, Shen Y, et al. Differences in health-related quality of life in rural and urban veterans. *Am J Public Health.* 2004;94(10):1762-1767.

55. Weeks WB, Wallace AE, Wang S, Lee A, Kazis LE. Rural-urban disparities in health-related quality of life within disease categories of Veterans. *J Rural Health.* 2006;22(3):204-211.

56. Healthy People 2020. Access to Health Services. HealthyPeople.gov. http://www.healthypeople.gov/2020/topicsobjectives2020/overview.aspx?topicid=1. Accessed March 13, 2014.

57. Hadley J. Insurance coverage, medical care use, and short-term health changes following

an unintentional injury or the onset of a chronic condition. *JAMA.* 2007;297(10):1073-1084.

58. Centers for Disease Control and Prevention (CDC). Self-assessed health status and selected behavioral risk factors among persons with and without health-care coverage--United States, 1994-1995. *MMWR Morb Mortal Wkly Rep.* 1998;47(9):176-180.

59. Institute of Medicine. Insuring America's health: principles and recommendations. *Acad Emerg Med.* 2004;11(4):418-422.

60. Probst JC, Moore CG, Glover SH, Samuels ME. Person and place: the compounding effects of race/ethnicity and rurality on health. *Am J Public Health.* 2004;94(10):1695-1703.

61. Bennett KJ, Olatosi B, Probst JC. *Health Disparities: A Rural-Urban Chartbook.* Columbia, SC: South Carolina Rural Health Research Center; 2008.

62. Lengerich EJ, Wyatt SW, Rubio A, et al. The Appalachia Cancer Network: cancer control research among a rural, medically underserved population. *J Rural Health.* 2004;20(2):181-187.

63. Doescher M, Skillman S, Rosenblatt R. *The Crisis in Rural Primary Care*. Seattle, WA: University of Washington, WWAMI Rural Health Research Center; 2009.

64. Krishna S, Gillespie KN, McBride TM. Diabetes burden and access to preventive care in the rural United States. *J Rural Health.* 2010;26(1):3-11.

65. U.S. Department of Agriculture Economic Research Service. Rural Poverty & Well-Being. http://www.ers.usda.gov/topics/rural-economy-population/rural-poverty-well-being/geography-of-poverty.aspx#.U5XcwCjt-1l. Accessed April 17, 2014.

66. Sharkey JR, Horel S. Neighborhood socioeconomic deprivation and minority composition are associated with better potential spatial access to the ground-truthed food environment in a large rural area. *J Nutr.* 2008;138(3):620-627.

67. Powell LM, Slater S, Mirtcheva D, Bao Y, Chaloupka FJ. Food store availability and neighborhood characteristics in the United States. *Prev Med.* 2007;44(3):189-195.

68. Arnold ML, Newman JH, Gaddy BB, Dean CB. A look at the condition of rural education research: Setting a direction for future research. *J Res Rural Educ.* 2005;20(6):20-26.

69. Marmot M, Wilkinson R. *Social Determinants of Health.* Oxford: Oxford University Press; 2005.

70. Gamm LD, Hutchison LL, Dabney BJ, Dorsey AM, eds. *Rural Healthy People 2010: A Companion Document to Healthy People 2010. Volume 1.* College Station, TX: The Texas A&M University System Health Science Center, School of Rural Public Health, Southwest Rural Health Research Center; 2003:3-18.

71. Friedman D, Parikh NS, Giunta N, Fahs MC, Gallo WT. The influence of neighborhood factors on the quality of life of older adults attending New York City senior centers: results from the Health Indicators Project. *Qual Life Res.* 2012;21(1):123-131.

72. Rantakokko M, Iwarsson S, Kauppinen M, Leinonen R, Heikkinen E, Rantanen T. Quality of life and barriers in the urban outdoor environment in old age. *J Am Geriatr Soc.* 2010;58(11):2154-2159.

73. Levasseur M, Desrosiers J, Noreau L. Relationships between environment and quality of life of older adults with physical disabilities. *Phys Occup Ther Geriatr.* 2004;22(3):37-53.

74. Parra DC, Gomez LF, Sarmiento OL, et al. Perceived and objective neighborhood environment attributes and health related quality of life among the elderly in Bogotá, Colombia. *Soc Sci Med.* 2010;70(7):1070-1076.

75. Perry TT, Moore PC, Redwine KM, Robbins JM, Weber JL. Physical activity, screen time and pediatric health-related quality of life in the Mississippi Delta. *Open J Prev Med.* 2012;2(1):105-111.

76. Schwimmer JB, Burwinkle TM, Varni JW. Health-related quality of life of severely obese children and adolescents. *JAMA.* 2003;289(14):1813-1819.

77. de Beer M, Hofsteenge GH, Koot HM, Hirasing RA, Delemarre-van de Waal HA, Gemke RJ. Health-related-quality-of-life in obese adolescents is decreased and inversely related to BMI. *Acta Paediatr.* 2007;96(5):710-714.

78. Hu FB, Stampfer MJ, Colditz GA, et al. Physical activity and risk of stroke in women. *JAMA.* 2000;283(22):2961-2967.

79. Hakim AA, Curb JD, Petrovitch H, et al. Effects of walking on coronary heart disease in elderly men: the Honolulu Heart Program. *Circulation.* 1999;100(1):9-13.

80. Gregg EW, Gerzoff RB, Caspersen CJ, Williamson DF, Narayan KM. Relationship of walking to mortality among US adults with diabetes. *Arch Intern Med.* 2003;163(12):1440-1447.

81. Saelens BE, Handy SL. Built environment correlates of walking: a review. *Med Sci Sports Exerc.* 2008;40(7 Suppl):S550-S566.

82. Frost SS, Goins RT, Hunter RH, et al. Effects of the built environment on physical activity of adults living in rural settings. *Am J Health Promot.* 2010;24(4):267-283.

83. Nagel CL, Carlson NE, Bosworth M, Michael YL. The relation between neighborhood built environment and walking activity among older adults. *Am J Epidemiol.* 2008;168(4):461-468.

84. Wijlhuizen GJ, de Jong R, Hopman-Rock M. Older persons afraid of falling reduce physical activity to prevent outdoor falls. *Prev Med.* 2007;44(3):260-264.

85. Cao X, Handy SL, Mokhtarian PL. The influences of the built environment and residential self-selection on pedestrian behavior: evidence from Austin, TX. *Transportation.* 2006;33(1):1-20.

86. Li F, Fisher KJ, Brownson RC, Bosworth M. Multilevel modelling of built environment characteristics related to neighbourhood walking activity in older adults. *J Epidemiol Community Health.* 2005;59(7):558-564.

87. Lee C, Ory MG, Yoon J, Forjuoh SN. Neighborhood walking among overweight and obese adults: age variations in barriers and motivators. *J Community Health.* 2013;38(1):12-22.

88. Badland H, Schofield G. Understanding the relationship between town size and physical activity levels: a population study. *Health Place.* 2006;12(4):538-546.

89. Giles-Corti B, Donovan RJ. Socioeconomic status differences in recreational physical activity levels and real and perceived access to a supportive physical environment. *Prev Med.* 2002;35(6):601-611.

90. Ball K, Bauman A, Leslie E, Owen N. Perceived environmental aesthetics and convenience and company are associated with walking for exercise among Australian adults. *Prev Med.* 2001;33(5):434-440.

91. Michael Y, Beard T, Choi D, Farquhar S, Carlson N. Measuring the influence of built neighborhood environments on walking in older adults. *J Aging Phys Act.* 2006;14(3):302-312.

92. Barile J. *Health Disparities in a Diverse County: Investigating Interactions between Residents and Neighborhoods* [dissertation]. Atlanta, GA: Department of Psychology, Georgia State University; 2010.

93. Tay JB, Kelleher CC, Hope A, Barry M, Gabhainn SN, Sixsmith J. Influence of sociodemographic and neighbourhood factors on self rated health and quality of life in rural communities: findings from the Agriproject in the Republic of Ireland. *J Epidemiol Community Health.* 2004;58(11):904-911.

94. Phongsavan P, Chey T, Bauman A, Brooks R, Silove D. Social capital, socio-economic status and psychological distress among Australian adults. *Soc Sci Med.* 2006;63(10):2546-2561.

95. Lund H. Pedestrian environments and sense of community. *J Plan Educ Res.* 2002;21(3):301-312.

96. Leyden KM. Social capital and the built environment: the importance of walkable neighborhoods. *Am J Public Health.* 2003;93(9):1546-1551.

97. Rogers S, Aytur S, Gardner K, Carlson C. Measuring community sustainability: exploring the intersection of the built environment & social capital with a participatory case study. *J Environ Stud Sci.* 2012;2(2):143-153.

98. Wood L, Frank LD, Giles-Corti B. Sense of community and its relationship with walking and neighborhood design. *Soc Sci Med.* 2010;70(9):1381-1390.

99. Frumkin H. Beyond toxicity: human health and the natural environment. *Am J Prev Med.* 2001;20(3):234-240.

100. De Vries S, Verheij RA, Groenewegen PP, Spreeuwenberg P. Natural environments -- healthy environments? An exploratory analysis of the relationship between greenspace and health. *Environ Plan A.* 2003;35(10):1717-1731.

101. Thompson Coon J, Boddy K, Stein K, Whear R, Barton J, Depledge MH. Does participating in physical activity in outdoor natural environments have a greater effect on physical and mental wellbeing than physical activity indoors? A systematic review. *Environ Sci Technol.* 2011;45(5):1761-1772.

102. Bowler DE, Buyung-Ali LM, Knight TM, Pullin AS. A systematic review of evidence for the added benefits to health of exposure to natural environments. *BMC Public Health.* August 4 2010;10:456-465.

103. Haggis C, Sims-Gould J, Winters M, Gutteridge K, McKay HA. Sustained impact of community-based physical activity interventions: key elements for success. *BMC Public Health. September 27* 2013;13:892.

104. National Center for Health Statistics. *Healthy People 2010 Final Review.* Hyattsville, MD: U.S. Department of Health and Human Services; 2012.

105. Ory MG, Ahn S, Jiang L, et al. Successes of a national study of the Chronic Disease Self-Management Program: meeting the triple aim of health care reform. *Med Care.* 2013;51(11):992-998.

106. Lorig KR, Sobel DS, Stewart AL, et al. Evidence suggesting that a chronic disease self-management program can improve health status while reducing hospitalization: a randomized trial. *Med Care.* 1999;37(1):5-14.

107. Lorig KR, Ritter P, Stewart AL, et al. Chronic disease self-management program: 2-year health status and health care utilization outcomes. *Med Care.* 2001;39(11):1217-1223.

108. Lorig KR, Ritter PL, Laurent DD, Plant K. Internet-based chronic disease self-management: a randomized trial. *Med Care.* 2006;44(11):964-971.

109. Smith ML, Hochhalter AK, Cheng Y, Wang S, Ory MG. Programmatic influences on outcomes of an evidence-based fall prevention program for older adults: a translational assessment. *Transl Behav Med.* 2011;1(3):384-393.

110. Ory MG, Smith ML, Wade A, Mounce C, Wilson A, Parrish R. Implementing and disseminating an evidence-based program to prevent falls in older adults, Texas, 2007-2009. *Prev Chronic Dis.* 2010;7(6):A130.

111. Smith ML, Ahn SN, Sharkey JR, Horel S, Mier N, Ory MG. Successful falls prevention programming for older adults in Texas: rural–urban variations. *J Appl Gerontol.* 2012;31(1):3-27.

112. Lorig K, Ritter PL, Villa FJ, Armas J. Community-based peer-led diabetes self-management: a randomized trial. *Diabetes Educ.* 2009;35(4):641-651.

113. Wallace JI, Buchner DM, Grothaus L, et al. Implementation and effectiveness of a community-based health promotion program for older adults. *J Gerontol A Biol Sci Med Sci.* 1998;53(4):M301-M306.

114. Springer AE, Kelder SH, Byrd-Williams CE, et al. Promoting energy-balance behaviors among ethnically diverse adolescents: overview and baseline findings of The Central Texas CATCH Middle School Project. *Health Educ Behav.* 2013;40(5):559-570.

115. Ttofi MM, Farrington DP. Effectiveness of school-based programs to reduce bullying: a systematic and meta-analytic review. *J Exp Criminol.* 2011;7(1):27-56.

116. Martin A, Saunders DH, Shenkin SD, Sproule J. Lifestyle intervention for improving school achievement in overweight or obese children and adolescents. *Cochrane Database Syst Rev.* 2014;3:CD009728.

117. Dobbins M, Husson H, DeCorby K, LaRocca RL. School-based physical activity programs for promoting physical activity and fitness in children and adolescents aged 6 to 18. *Cochrane Database Syst Rev.* March 14 2014 2013;2:CD007651.

118. Bickell NA, Geduld AN, Joseph KA, et al. Do community-based patient assistance programs affect the treatment and well-being of patients with breast cancer? *J Oncol Pract.* 2014;10(1):48-54.

119. Kaszniak AW. Meditation, mindfulness, cognition, and emotion: implications for community-based older adult programs. In: Hartman-Stein PE, La Rue A, eds. *Enhancing Cognitive Fitness in Adults: A Guide to the Use and Development of Community-Based Programs*. New York, NY: Springer; 2011:85-104.

120. Gamm L, Castillo G, Williams L. Educational and community-based programs in rural areas. In: Gamm L, Hutchison L, eds. *Rural Healthy People 2010: A companion document to Healthy People*

2010, Volume 3. College Station, TX: The Texas A&M University System Health Science Center, School of Rural Public Health, Southwest Rural Health Research Center; 2004:167-186.

121. Murawski L, Church RL. Improving accessibility to rural health services: the maximal covering network improvement problem. *Socioecon Plann Sci.* 2009;43(2):102-110.

122. Freeman VA, Slifkin RT, Patterson PD. Recruitment and retention in rural and urban EMS: results from a national survey of local EMS directors. *J Public Health Manag Pract.* 2009;15(3):246-252.

123. Genovesi AL, Hastings B, Edgerton EA, Olson LM. Pediatric emergency care capabilities of Indian Health Service emergency medical service agencies serving American Indians/Alaska Natives in rural and frontier areas. *Rural Remote Health.* 2014;14(2):2688.

124. Gamble JE, Savage GT, Icenogle ML. Value-chain analysis of a rural health program: toward understanding the cost benefit of telemedicine applications. *Hosp Top.* 2004;82(1):10-17.

125. Purcell R, McInnes S, Halcomb EJ. Telemonitoring can assist in managing cardiovascular disease in primary care: a systematic review of systematic reviews. *BMC Fam Pract.* March 7 2014;15:43.

126. Marcin JP, Ellis J, Mawis R, Nagrampa E, Nesbitt TS, Dimand RJ. Using telemedicine to provide pediatric subspecialty care to children with special health care needs in an underserved rural community. *Pediatrics.* 2004;113(1 Pt 1):1-6.

127. Ekeland AG, Bowes A, Flottorp S. Effectiveness of telemedicine: a systematic review of reviews. *Int J Med Inform.* 2010;79(11):736-771.

128. Goetzel RZ, Long SR, Ozminkowski RJ, Hawkins K, Wang S, Lynch W. Health, absence, disability, and presenteeism cost estimates of certain physical and mental health conditions affecting U.S. employers. *J Occup Environ Med.* 2004;46(4):398-412.

129. Centers for Disease Control and Prevention (CDC). *Measuring Healthy Days: Population Assessment of Health-Related Quality of Life*. Atlanta, GA: U.S. Department of Health and Human Services, National Center for Chronic Disease Prevention and Health Promotion; 2000.

Suggested Chapter Citation:

Towne SD Jr, Lee C, Smith ML, Pulczinski J, Swierc SM, Coughlin R, Roach A, Ory MG. Health-related Quality of Life and Well-Being. In: Bolin JN, Bellamy G, Ferdinand AO, et al. eds. *Rural Healthy People 2020*. Vol. 2. College Station, TX: Texas A&M University Health Science Center, School of Public Health, Southwest Rural Health Research Center; 2015:41-52.

IMMUNIZATION AND INFECTIOUS DISEASES IN RURAL AMERICA

By Alva O. Ferdinand, DrPH, JD, and Linnae Hutchison, MBA, MT

SCOPE OF THE PROBLEM

- Immunization and infectious diseases were ranked as the 15th most often identified rural health priority in a 2010 survey of rural health stakeholders.[1]
- Differences in rural and urban vaccination coverage among children for the 4:3:1:3:3:1 vaccination series have decreased with reductions below significant levels.[2]
- Certain subpopulations remain at heightened risk for vaccine-preventable illnesses and diseases including Alaskan Natives, American Indians, Hispanics, and African Americans.
- Intent to vaccinate and health beliefs serve as predictors of vaccine uptake, particularly for adolescent immunizations.

Substantial improvements have been made in the areas of infectious diseases and immunizations over the last century in the United States. Both the control of infectious diseases and immunizations have been lauded as two of the ten great public health achievements in the 20th century.[3] These two public health achievements have been credited for significant reductions in infectious disease mortality, disability, and death.[4] Vaccines have been the most effective mediums for infectious disease prevention. They are unique among other medical products in that they prevent, rather than treat, diseases. The effect of vaccines also extends beyond the individual to the community, thus making them even more unique.[5,6] The incidence of vaccine-preventable diseases generally continued on a downward slope over the last decade, with no reported incidence of two diseases – smallpox and diphtheria – over the last decade.[6] A comparison of annual vaccine-preventable disease morbidity in the 20th century and in 2009 is presented in **Table 1**.

Not only do vaccines and their subsequent immunization benefits have positive implications for population health, but they additionally alleviate

Table 1. Comparison of estimated annual morbidity and 2009 morbidity of selected vaccine-preventable diseases in the United States.[6]

Disease	20th Century Annual Morbidity	2009 Reported Cases	Decrease (%)
Smallpox	29,005	0	100
Diphtheria	21,053	0	100
Measles	530,217	71	>99
Mumps	162,344	1,991	>99
Pertussis	200,752	16,858	92
Polio (paralytic)	16,316	1	>99
Rubella	47,745	3	>99
Tetanus	580	18	97
Hepatitis A	117,333	11,049	91
Hepatitis B (acute)	66,232	11,269	83
Varicella (chickenpox)	4,085,120	449,363	89

Source: Schuchat A, 2011.[6]

substantial economic burdens associated with infectious diseases. More specifically, it has been estimated that 33,000 premature deaths and 14 million cases of disease are averted for each U.S. birth cohort receiving vaccines in compliance with the routine immunization schedule.[4] Furthermore, it has been estimated that vaccines reduce direct healthcare costs by $9.9 billion and saves more than $33 billion in indirect societal costs, such as productivity lost from missed work days.[4,6]

Despite the effectiveness of vaccines in improving individual and population health, and in reducing economic burdens associated with infectious disease, roughly 300 children and 42,000 adults die in the U.S. each year due to vaccine-preventable diseases.[4] This is particularly due to underimmunized children, adolescents and adults, and the resulting decreased herd immunity.[7] Moreover, in recent years, there have been reports of multiple strains of infectious disease pathogens for which current vaccines are not efficacious. For example, the incidence of pertussis has gradually increased with substantial outbreaks in 2005, 2010, 2012, and 2014.[8] Given limitations in healthcare providers, resources, transportation, and general access to care, infectious disease outbreaks can have crippling effects in rural communities.

HEALTHY PEOPLE 2020 GOALS AND OBJECTIVES

Improvements to immunization coverage and control of infectious diseases are among the priorities of Healthy People 2020, with the specific goal being, "Increase immunization rates and reduce preventable infectious diseases." [4] This literature review will address a subset of the Healthy People 2020 objectives as they relate to immunizations and infectious diseases as follows:

- **IID-1** Reduce, eliminate, or maintain elimination of cases of vaccine-preventable diseases
- **IID-7** Achieve and maintain effective vaccination coverage levels for universally recommended vaccines amount young children
- **IID-8** Increase the percentage of children aged 19 to 35 months who receive the recommended doses of DTaP [diphtheria-tetanus-pertussis], polio, MMR [measles-mumps-rubella], Hib [Haemophilus influenza type B], hepatitis B, varicella, and pneumococcal conjugate vaccine (PCV)
- **IID-9** Decrease the percentage of children in the United States who receive 0 doses of recommended vaccines by age 19 to 35 months
- **IID-10** Maintain vaccination coverage levels for children kindergarten
- **IID-11** Increase routine vaccination coverage for adolescents
- **IID-12** Increase the percentage of children and adults who are vaccinated against seasonable influenza
- **IID-16** Increase the scientific knowledge on vaccine safety and adverse events
- **IID-29** Reduce tuberculosis (TB)

As noted above, the reviewed literature does not cover the gamut of Healthy People 2020 Immunization and Infectious Diseases objectives but, rather, focuses on a more limited subset of objectives including immunization rates in children, seasonal influenza, H1N1 (a variation of influenza A), and human papillomavirus (HPV) immunization update rates which will serve as the primary focus of this review.

RURAL HEALTHY PEOPLE 2020 SURVEY OUTCOMES

The area of "Immunization and Infectious Diseases" was ranked 13th among the top Rural Healthy People Priorities in a 2003 survey of key rural health stakeholders. This prioritization has remained relatively constant over time as reflected in an updated Rural Healthy People survey (conducted between December 2011 and August 2012), in which key rural health stakeholders ranked immunization and infectious diseases as the 15th most important health concern that needs to be addressed in rural America.[1] Some respondents commented that transportation to obtain vaccinations is often a significant hurdle for rural residents.[9] Others commented that resistance to vaccinations is deep-seated among certain rural subpopulations, such as those of the Amish. Additionally, several respondents mentioned that vaccinations were cost-prohibitive for rural residents. These and other factors have critical implications for risk and incidence of infectious disease outbreaks in rural areas.

PREVALENCE AND DISPARITIES IN RURAL AREAS

Although vaccines have significantly reduced, and in some cases eliminated, the prevalence of many diseases, a significant percentage of children and adults in the U.S. continue to contract vaccine-preventable diseases.[10] Underimmunized children and adults foster the potential for disease outbreaks.[7] This is significant in rural areas where frequent mobility (particularly among migrant farmworkers), poverty, underimmunization, cultural practices, and poor sanitation at work and home may be found.[11] The following paragraphs will address specific infectious diseases and the immunization dynamics as they relate to racial, ethnic, and geographic disparities in rural areas.

Childhood Immunization Series

The near eradication of many childhood diseases is considered one of the foremost public health achievements of the last century. While significant strides have been made toward increasing and maintaining high vaccination rates among rural and urban population rates, the reemergence of previously near eradicated diseases, as well as emergence of new diseases coupled with increasing globalization, reinforces the fundamental need for continued immunization education, access, and promotion efforts. In an analysis of the 2009 National Immunization Survey, investigators examined progress toward meeting the Healthy People 2010 goals for childhood immunizations for children ages 19 to 35 months. Approximately half of the children in the study were eligible for the Vaccines for Children (VFC) Program. The study found that VFC eligible children were significantly more likely to be Hispanic or non-Hispanic Black and significantly more likely to receive vaccinations in a public clinic.[12] The study also found that while vaccinations coverage for DTAP, polio, MMR, Hib, VAR, PCV7, and seasonal influenza were significantly lower for VFC eligible than non-VFC eligible children, both groups achieved the 90 percent coverage recommended by Healthy People 2010.[12] In an examination of disparities in immunization rates, the authors examined 185,516 children included the 2000-2008 National Immunization Surveys and found significant progress toward reducing disparities in the 4:3:1:3:3:1 vaccination series (four doses of DTAP, three poliovirus, one MMR, three hepatitis B, three Hib, and one varicella vaccine.[2] The study found disparities in immunization rates by racial and geographic location (urban, suburban, and rural) were reduced to below significant levels with the rural/suburban immunization rates reduced by 0.5 percent annually.[2]

Influenza

Influenza is consistently ranked in the top ten leading causes of death in the U.S., with most deaths occurring in population groups over age 65.[13] However, the highest *rates* of influenza occur among school age children and they are also the primary transmitters of the disease to at-risk populations.[13] In 2008, the U.S. Advisory Committee on Immunization Practices recommended influenza vaccination for all children older than six months.[14] Influenza vaccination rates of children and adolescents present unique challenges. Unlike the standardized pediatric immunization series which is timed based on age, influenza vaccinations are seasonal and consequently a greater burden is placed on parents, patients, and providers to ensure seasonal immunizations are routinely obtained. Studies have found disparities in influenza immunization among racial and socioeconomic groups.[14] In a study of 174 geographical diverse pediatric offices across the U.S., researchers found that the rates of influenza vaccinations were higher in urban and suburban practices than in rural areas, those practices with larger staffs, practices with lower numbers of patients, practices that offer evening and weekend immunization clinics, and those that provide an extended period for vaccination availability.[14] A number of articles examined adolescent influenza immunization rates in rural areas, specifically focusing on parental and adolescent attitudes toward immunization as a predictor of intent to seek immunization.[13,15] Two studies in rural Georgia found an association between school-based interventions and increased immunization rates and suggested immunizations out of the medical home may be effective in targeting hard-to-reach rural adolescents.[15,16]

Educators, like healthcare workers, are at heightened risk for influenza contraction and transmission by virtue of their close contact with children. In a study of two counties in rural Georgia, attitudes among teachers and immunization uptake rates were examined.[17] The study found a strong correlation between intent to receive seasonal and H1N1 vaccinations and actual receipt.[17] The study also found rates of vaccine uptake by teachers was similar to that of healthcare workers in 2009 (<50 percent for seasonal flu and less than 22 percent for H1N1).

Low influenza vaccination rates among children, and high transmission rates of the group, pose important implications for controlling the spread of seasonal flu particularly given the relatively low rate of immunization among adults. Vaccination rates for seasonal influenza in adults are below the 70 percent Healthy People 2020 target levels with only 28 percent of non-high risk adults receiving the seasonal vaccination in the 2009-2010 influenza season.[4,14,17]

Influenza vaccination of healthcare workers is critical in ensuring a healthy workforce and preventing the spread of influenza. Nonetheless, vaccination rates of healthcare workers remain below the recommended vaccination of all healthcare workers.[18] In a study of 601 emergency medical service (EMS) professionals in 14 EMS systems in North Carolina, variation was found among rural, suburban, and urban respondents with more than 50 percent of urban-practicing emergency medical technicians (EMTs) reporting vaccination receipt compared to only 35.5 percent of EMTs practicing in rural areas.[19] Beliefs regarding vaccine effectiveness were found to be predictive of vaccination. Nearly half of those who did not receive the vaccination did not believe the vaccination was effective.[19]

In June 2009, influenza A (specifically H1N1) was a declared a global pandemic by the World Health Association.[20,21] Research indicates that certain populations are disproportionately impacted by pandemics such as American Indians and Alaskan Natives as well as populations in rural areas.[20,22] Alaskan natives experience higher rates of pneumonia and influenza-related morbidity and mortality than non-Alaskan natives.[23] It is suggested that the increased risk is related to crowded conditions during the fall and winter.[22] In an examination of three syndromic data monitoring systems in Alaska, investigators found that Alaskan Natives experienced the highest rates of H1N1 related hospitalizations – two to four times higher than those experienced by whites in Alaska.[22] Of the Alaskan Native and non-Alaskan Native hospitalized patients, there was no significant difference in the percentage receiving anti-viral treatment before hospitalization. However, most H1N1 hospitalized patients had underlying medical condition. Given that Alaskan Natives have higher rates of heart disease and obesity, these co-morbidities may have contributed to the increased rate of hospitalization of indigenous populations.[22] This study supports the need for preparedness planning efforts targeted at certain at-risk populations.[22] Another study examined the spread and impact of H1N1 among American Indians in four southwestern U.S. communities and similar to Alaskan Natives, American Indians experienced a higher hospitalization rate than other populations.[20] The investigation found that 93 percent of those hospitalized with H1N1 had one or more comorbidities conferring high risk, such as obesity, lung disease, and diabetes.[20] These findings are consistent with national findings of higher H1N1 hospitalization rates among minorities, Hispanics, and Blacks.

In a study of low-income, rural, and minority adolescents in two counties in rural Georgia, investigators found a significant link between parental acceptance of the H1N1 vaccination and adolescent acceptance of the vaccination.[24] Understanding the factors motivating vaccine uptake by parents and adolescents are important in designing interventions and programs.[24] Parents and adolescents, unlike parents and younger children, are often jointly involved in healthcare decisions.[24]

Minnesota has historically had high rates of influenza vaccination rates for adults and children which may be attributed to a tiered approach to vaccinations targeting high-risk populations first.[25] In a review of Minnesota vaccination rates during the H1N1 outbreak in 2009-2010, investigators examined rates of H1N1 uptake and socioeconomic and geographic stratification. The review found higher median income rates were associated with increased H1N1 vaccination rates in urban areas; minority and poverty status where not associated with higher vaccination rates. However, in rural areas, minority status was associated with higher vaccination rates, which differs from other studies.[25] One reason that rural minority groups had higher immunization rates is Minnesota has more public health clinics per capita than urban areas and Minnesota's population in general is less diverse making outreach easier.[25]

Previous research has shown that there are associations between demographics and socioeconomic status in influenza vaccination uptake.[26] In their study on H1N1 vaccination uptake, Galarce and colleagues found that urban residents were significantly more likely to have been vaccinated than their rural counterparts. The study's findings also showed that individuals who had not attended college were less likely to have been vaccinated.[26] Moreover, the researchers found that of the study participants who said that they would get the vaccine, but had not attempted to obtain the shot yet, most were older individuals, Hispanic, and

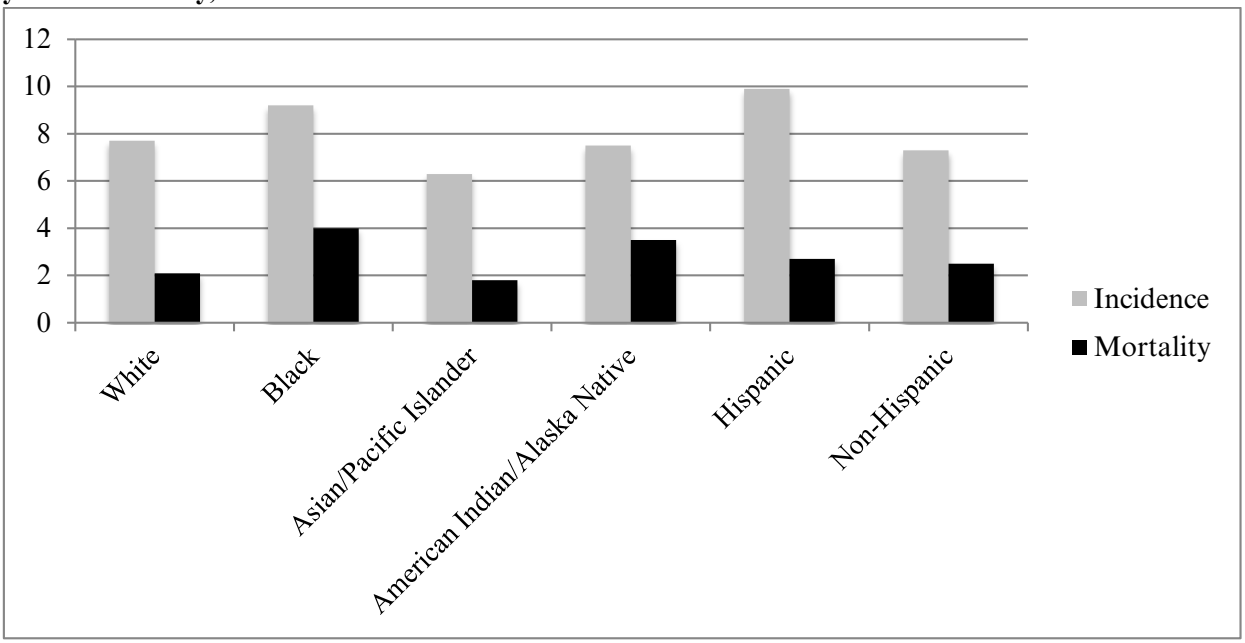
living under the federal poverty line in rural areas. Additionally, the study found that Black participants with less than a bachelor's degree were more likely to report attempting to get the vaccine, but finding it to be unavailable.[26] These findings demonstrate that strategies for increased immunization among rural ethnic minorities should continue to be explored.

HPV

Human papillomavirus is the most common sexually transmitted infection and a leading cause of cervical cancer in the U.S. and worldwide, with certain strains responsible for 70 percent of cervical cancer[27,28] and 90 percent of genital warts.[29] It is estimated that one-third of those diagnosed with cervical cancer will die from the disease.[30] Human papillomavirus is also associated with vaginal, vulvar, and anal cancers.[31] Although cervical cancer incidence and morbidity have been declining overall, there is variation by race and socioeconomic status.[32] In 2007, the Food and Drug Administration approved the first vaccine to prevent the most common types of HPV infection.[33] Three doses of quadrivalent HPV (HPV4) vaccine are recommended by the United States Advisory Committee on Immunization Practices for females 11 to 12 years of age, as well catch-up doses for women ages 13 to 26.[31] In 2009, the Food and Drug Administration licensed quadrivalent HPV vaccine for individuals nine to 26 years of age.[34] In 2011, the Advisory Committee on Immunization Practices recommended HPV4 for males ages 11 to 26 years old.[35] The majority of the articles examined for this review focus on updates of the vaccine in women and adolescent girls.

The launch and uptake of HPV vaccine among women and adolescents has been analyzed extensively in the literature including a number of studies focusing on rural and underserved communities, which include many high-risk groups for cervical cancer. Included among these disproportionately high prevalence groups are American Indian women, Appalachian women, Hispanics, and African Americans (**Figure 1**). In a study of American Indians in two rural reservation clinics serving American Indian women, and one urban clinic serving primarily white women in the Northern Plains, researchers found that the rate of HPV infection rates were nearly twice as high in American Indians (42 percent) women than in the white women (23 percent).[33] Further compounding measures to address increased cervical cancer rates in this particularly at-risk population group, the study found a disproportionately high prevalence of HPV oncogenic types that are not treatable by currently available HPV vaccines.[33] Investigators posit that the disproportionately high rate of HPV, including types not susceptible to the HPV vaccines, may contribute to the increased incidence of cervical cancer among American Indian women (11.3 per 100,000) compared to white women (7.5 per 100,000).[33]

Figure 1. Racial and Ethnic Disparities in Cervical Cancer: Cervical Cancer Incidence and Mortality by Race/Ethnicity, 2007 – 2011



Source: National Cancer Institute, SEER Stat Fact Sheets: Cervix Uteri Cancer.[30]
Note: Data presented are age-adjusted rates per 100,000 persons.

In a study of rural and urban populations in Kentucky, young rural women were found to be significantly less likely to complete the HPV series than urban women.[36,37] Certain regions of rural Appalachia experience the highest rates of cervical cancer in the U.S.[38,39] According to the Kentucky 2010 Cancer Registry, the cervical cancer rate was nine women per 100,000 for Kentucky and for Appalachia Kentucky the cervical cancer incidence rate was even higher at 10.8 per 100,000 women.[36] Geographic isolation, poverty, and lack of access to obstetrician or gynecological services contribute to the higher incidence rates of cervical cancer.[36] A variety of health beliefs have been examined in predicting HPV vaccine uptake which may be further exacerbated by cultural and socioeconomic determinants in rural areas. In a study of women visiting five regional health clinics in five rural counties in Appalachian Kentucky, as well as at a Kentucky community college, investigators found that women engaging in behaviors that increase risk of HPV transmission were less likely to accept the HPV vaccine compared to women engaging in more protective behaviors such as routine Pap testing.[40] Moreover, the participants reporting abnormal Pap tests, or never having a Pap test, were more likely to decline the vaccine than women with normal Pap tests. This study points to the need for providers to target women engaged in high-risk behavior in order to increase HPV vaccine update.[40]

Another study of rural Appalachia focused on perception of HPV and Pap testing. The study found perceived pain of the shot, barriers to adhering to the three-dose schedule, misconceptions regarding HPV in general and the role of vaccination, cost of the vaccine, and privacy issues all impacted decisions regarding completion of the vaccination series and Pap testing.[36] A study of rural Appalachian women in one county found greater acceptance of the vaccine when framed as a cervical cancer vaccine.[41] Respondents were also more likely to vaccinate adolescents than themselves.[41] These findings provide valuable insights into reducing cervical cancer in rural Appalachia.

African American women experience a cervical cancer rate twice that of that of white women.[42] In a study focused on HPV acceptance among rural southern women in one county in North Carolina in which the majority of the respondents were African American women, researchers found acceptance of the HPV vaccine for adolescent daughters was correlated to the mothers' healthcare beliefs.[43] While most women in the study reported their intention to vaccinate their daughters, African Americans reported lower rates of intention to obtain the vaccination for their daughters.[43] Other studies focusing on acceptability of vaccinations found no differences in vaccination coverage by racial status.[43] Similar to other studies, health beliefs regarding HPV, HPV vaccine, cervical cancer are associated with vaccine acceptability supporting the need for educational efforts to address misconceptions, particularly in high-risk groups.[45] Cost was also a key consideration in the intent to obtain vaccination.[43]

Hispanic women are considered among the highest risk for cervical cancer with incidence rates 70 percent higher compared to non-Hispanic Whites.[44] In one of the first studies focusing on the relationship between attitudes toward HPV and uptake of the vaccine by daughters of rural Hispanics, investigators found that higher levels of vaccine awareness, availability, and acceptance of the vaccine by fathers were highly correlated with intent to vaccinate daughters of Hispanic women. The study points to the need to engage mothers, as well as fathers, in educational efforts to target Hispanic adolescents to improve HPV uptake.[44]

Parental perception of HPV vaccine has been demonstrated as a key predictor of vaccine uptake[45] and studies have found increased skepticism regarding the HPV vaccine among Hispanics and African American women.[46,47] In a study of three rural counties in Georgia, investigators analyzed the predictors of HPV update among children and attempted to identify culturally appropriate interventions to increase update.[46] The study found cultural norms, religious affiliation, and parent education were all points of intervention.[46] Religion was found to be the most significant predictor of HPV uptake.[46] In another study of four rural counties and one urban county in North Carolina, investigators found provider recommendation, and parental perceptions regarding probability of daughters developing cervical cancer and vaccine safety were the strongest predictors of vaccine initiation by adolescents in both rural and urban participants although each group rated the relative importance of the predictors differently. Parental perception regarding insurance coverage was also highly correlated with vaccine initiation in both rural and urban groups.[48]

Another study of safety net providers in Kansas focused on determining if differences existed in HPV4 dosing schedules between vulnerable women receiving care in rural and urban core safety net

providers.[49] The study found that there was no difference in the two populations. This study is important given 60 percent of cervical cancers occur in uninsured and underinsured women.[49]

Currently, two vaccines are approved to prevent cancer occurrence: HPV vaccine for cervical cancer and Hepatitis B for liver cancer.[50] In an analysis of the initial uptake pattern between Hepatitis B vaccine and HPV vaccine, HPV vaccine has experienced a flatter uptake trajectory compared to the launch of Hepatitis B vaccine. A variety of complex reasons for the difference in uptake between vaccines are suggested such as cost (HPV vaccines are considerably more expensive than Hepatitis B vaccines), launch efforts by pharmaceutical companies less targeted toward at-risk women, safety concerns, and familial beliefs and concerns regarding adolescents and sexual behavior.[50] Other studies have found that some parents are skeptical of HPV health information provided by pharmaceutical companies.[51]

While many of the studies have focused on patient intentions to receive HPV vaccine, provider perspectives are important in understanding HPV vaccine uptake and adherence patterns. In a small study of rural provider attitudes (eight Appalachian Kentucky providers sampled), providers indicated key barriers to vaccine uptake. Reticence to receive the shot, perceptions regarding pain of the shot, and not understanding HPV vaccine's importance in prevention of cervical cancer were identified by the providers as key patient barriers. The providers indicated increased educational efforts were needed with a specific focus on high-risk rural patients.[36] The providers also indicated that patients in their practices did not understand the importance of completing the series, and failure to complete the series is further exacerbated by record scatter.[36] Providers suggested a number of proactive measures to improve HPV immunization rates including addressing missed opportunities during routine visits, implementation of reminder systems (text messaging) to improve vaccine series completion rates, and improved patient knowledge regarding the streamlined process to complete the series (i.e., combating the "inconvenience" perception that the series completion requires time intensive visits instead of three quick visits).[36] The providers also acknowledged the importance of a "proactive" approach to addressing these barriers.[36] These results are echoed in other provider studies which found HPV vaccination rates can be improved by considering cultural, geographic, religious, and socioeconomic conditions in identifying means to increase vaccine uptake.[52] A study of three rural counties in Georgia found that perceived benefits and barriers predicted vaccination for boys and girls.[52]

Rotavirus

The gastrointestinal virus, rotavirus, was a leading cause of hospitalizations and emergency visits among children in the U.S. until 2006 with the advent of the rotavirus vaccine. Healthcare utilization attributed to the virus has decreased markedly after the release of the vaccine with an estimated 40,000 to 50,000 hospitalizations prevented each year.[53,54] Healthy People 2020 recommends that 80 percent of children receive two doses of the vaccine. Type of physician visited, race, socioeconomic status, and geographic area are all identified as predictors of update.[53,55-58] A national study of infant hospitalizations related to rotavirus for the period 2006-2010 using MarketScan Data, showed a rapid uptake of the vaccine from 25 percent in 2006 to 81 percent in 2009; however, rates have leveled off with no significant increases. The study found that infants in non-metropolitan areas were less likely to complete the series; however, geographic region was not a significant predictor of vaccine series completion. The study found receipt of DTaP and receipt of care from a pediatrician were the most significant predictors of rotavirus series completion.[53] The study suggests that continued quality improvement efforts to promote vaccine completion in children in general will improve rotavirus vaccination rates. Other campaign efforts targeting rural and racially diverse populations have involved high-risk groups in the production of educational materials.[51]

VARIATION BY RURAL REGION

The literature has shown that the gap between rural and urban immunization rates among children for the childhood immunization series has been decreasing each year. Nevertheless, it has been shown that rural adolescents are often less likely than their urban counterparts to receive appropriate vaccinations.[44,59] In their study of parental attitudes toward, and acceptance of, adolescent vaccinations in Appalachian Kentucky, Cohen and Head found that parents in that region misunderstood the process of vaccination, even the ones that had their adolescents vaccinated.[59] In other studies of the uptake and completion of the HPV vaccine, researchers have found that rural women were less likely than urban women to return for follow-up doses subsequent to initial uptake.[37] In another study of a sample of young Appalachian Kentucky women, Vanderpool

and colleagues found that limited uptake and completion of the HPV vaccine were, in part, a function of fatalism, which is the belief that mortality from cancer is outside of one's control.[60] In their qualitative study of limited uptake and completion of the HPV vaccine in Appalachian Kentucky, Head and colleagues also found that women in that area were still reluctant to receive the vaccine even when cost was eliminated as a barrier.[36] In the same study, health providers also reported that generally speaking, women in the area do not understand or buy into the connection between the HPV and cervical cancer, and therefore do not see value in taking steps to protect themselves against this sexually transmitted infection.[36]

Moreover, as noted previously, disparities among adults are seen in certain populations such as Alaskan Natives, American Indians, Hispanics, African Americans, and in geographic areas such as rural Appalachia. Improving immunization rates requires addressing a variety of complex issues related to access, cost, education, health beliefs, and cultural mores.

BARRIERS

Achieving the full range of Healthy People 2020 objectives requires addressing a myriad of socioeconomic, geographic, and racial barriers. As noted in the literature, barriers to immunization include health beliefs such as perceived health risks and benefits, access to services, costs, knowledge regarding intent and benefits of immunizations, particularly for new and emerging vaccines.

One emerging barrier to full vaccination coverage is the increase in exception requests. Mandatory vaccinations for school children began in 1960 and led to a near eradication of diseases including polio, measles, and most recently varicella zoster.[61] While states may mandate mandatory vaccinations, the Supreme Court ruled in 1905 that medical exemptions must be allowed.[61,62] Forty-eight states allow religious exemptions and 20 states offer philosophical exemptions.[61,63] There is a correlation between higher exemption rates and increased occurrence of vaccine-preventable illnesses. In a statewide study of Wyoming school-age children ages kindergarten through 12th grade, researchers examined the prevalence and characteristics of exemptions in order to assist the Wyoming Health Department in identifying at-risk populations, monitor disparities, and evaluate vaccine update.[61] The study found an increase in the exemption rates between 2009 and 2011 with 18 percent classified as medical exemptions and the remaining 82 percent as religious exemptions. Nearly three-quarters of the single vaccination exemptions were exemptions from the varicella zoster vaccination. The study found exemption rates were higher in rural areas, although this is contrary to other studies that found that they were higher in more metropolitan areas.[61,64] In the event of an outbreak of measles, exempted children have a 35-fold increase in contracting the disease.[61] Wyoming's experience with the varicella zoster uptake points to the importance of education and support prior to roll-out of new vaccine requirements.[61] The prevalence and nature of exemptions is an important area of consideration in addressing the reemergence of many vaccine-preventable illnesses.

Many studies examined predictors of vaccination update and barriers in efforts to develop more effective and targeted education programs. One study found programs focusing on perceived risk, safety, and social norms may be more effective in increasing influenza vaccinations.[17] Other studies found associations between parental acceptance and adolescent acceptance of H1N1 influenza vaccinations and HPV vaccine.[24,65,66] Cost was identified as an issue in HPV vaccination for adults; however, HPV vaccine was added to the list of vaccines available through the Vaccines for Children program thereby decreasing the cost for children and adolescents. There continues to be debate among state legislatures regarding requiring HPV vaccines and the associated costs.[67]

Finally, regardless of the type of vaccines, there is also the continued challenge of record scatter.[12] This is particularly problematic for immunization series such as HPV which require reminder systems in order to complete the full series. Immunization registries are a means to more effectively track vaccination coverage across provider types.[12]

PROPOSED SOLUTIONS OR INTERVENTIONS

As noted earlier, Hispanic women are at heightened risk of cervical cancer. While routine Pap testing and receipt of the HPV vaccine are preventive and protective factors, effective programs should address language and cultural barriers in order to improve vaccination rates. One method shown to be effective for improving communication and education efforts is the use of radio or television novelas or short stories.[68] In a randomized study of largely Hispanic

parents in the Lower Yakima Valley, Washington, the use of novelas to promote interest and awareness of HPV vaccine was studied.[68] The area is largely agrarian with a Hispanic population of more than 50 percent. Investigators found the radionovelas, developed with community input, were effective in increasing Hispanic knowledge regarding HPV and the vaccine benefits. The research observed a relationship between levels of acculturation and impact of the radionovelas with the highest impact of the radionovelas among parents with low levels of acculturation.[68] The study supports the need for educational efforts tailored to the unique cultural and community norms of the targeted population.[68] Another study examined the use of lay health leaders (promotoras) to develop and deliver a cancer education curriculum to rural Hispanics in southern Georgia.[69] The study found a significant increase in pre/post knowledge regarding HPV, HPV vaccine, and cervical cancer among study participants.[69]

Other studies have found perceived barriers and benefits to be significantly associated with intent to receive HPV vaccination. The researchers recommend screening the patients regarding familiarity with HPV vaccine and begin educating parents about HPV when other vaccines, such as Hepatitis B, are delivered.[52]

COMMUNITY MODELS KNOWN TO WORK

Healthy Families Arkansas addresses the challenges common to rural and underserved communities such as reduced health education, reduced access to primary care, and increased teen pregnancy.[70] Rural Polk County, with high poverty rates and many families headed by young, poor, single mothers, exemplifies the success stories of Healthy Families Arkansas. Teen pregnancy had contributed to the high school dropout rate in Polk County – furthering the cycle of poverty and low socioeconomic status. In 1998, to address this issue, nine local organizations collaborated to provide services to parents and expectant mothers younger than 25 years. Referrals were made to Healthy Connections, Inc.,[71] whose case management team provided transportation, parenting education through direct interaction and video tapes, and follow-up contacts to ensure compliance with doctor visits and immunizations. Over the course of the initial three-year program, all of the enrolled children received 100 percent of their well-baby checkups and immunizations, exceeding the target objectives identified in Healthy People 2010.

Immunization rates were low in rural Nelson County, Virginia, until the **Nelson County School Nurse Program** was started.[72] This partnership between the Blue Ridge Medical Center, the school district, and the county health department was formed in 1998. The group initially received a grant from the Health Resources and Service Administration's Federal Office of Rural Health Policy to place registered nurses in the county's public schools. The program has subsequently been funded by the county, rather than create a burden on the school district budget. The program's healthcare services are numerous, including tracking for immunization compliance and contacting parents to encourage child immunizations. The program has a reported immunization compliance rate of more than 99 percent among school children in Nelson County.

Sickness Prevention Achieved through Regional Collaboration (SPARC) is a program designed to help adults receive vaccinations and preventative screenings.[73,74] It began as a program to improve these services in parts of New York, Massachusetts, and Connecticut. Examples of SPARC programs include: providing Hepatitis B immunizations through schools, a "Vote and Vax" program to provide vaccinations at voter polling sites on election days, and a "5 over 50" program to encourage older adults to receive five key prevention services including influenza and pneumonia vaccinations. All three of these SPARC programs have contributed to increased immunizations, with the Vote and Vax program having been implemented in 42 states, where it has been reported to be responsible for more than 21,000 influenza vaccines.[75]

SUMMARY AND CONCLUSIONS

The control of infectious diseases and immunization coverage has improved over the last several decades. Nevertheless, they remain a challenge in rural areas due to mobility among certain subpopulations such as migrant farmworkers, poor access to care, impoverished communities, and the elderly comprising a large proportion of rural populations. Our review of the literature revealed that in order to meet Healthy People 2020 targets, continued efforts are needed to increase immunization coverage among preschool children, adolescents, adults, and racial and ethnic minorities. Given the cultural mores, misunderstandings about how vaccines work, and skepticism about the effectiveness of vaccines among certain rural subpopulations, culturally appropriate educational outreach efforts should be employed to improve the control of infectious diseases in these

communities. Moreover, lay health workers from these communities may prove to be effective in conveying the importance of child, adolescent, and adult vaccinations. Furthermore, healthcare providers in rural areas should consider screening patients for their knowledge of important vaccinations. This would give providers the opportunity to provide information and/or dispel doubts about the efficacy of vaccinations.

REFERENCES

1. Bolin JN, Bellamy GR, Ferdinand AO, et al. Rural Healthy People 2020: New Decade, Same Challenges. *J Rural Health*. 2015;30(3):326-333.

2. Zhao Z, Luman ET. Progress toward eliminating disparities in vaccination coverage among U.S. children, 2000-2008. *Am J Prev Med*. 2010;38(2):127-137.

3. Centers for Disease Control and Prevention (CDC). Ten Great Public Health Achievements in the 20th Century. http://www.cdc.gov/about/history/tengpha.htm. Updated April 26, 2013. Accessed May 28, 2015.

4. Office of Disease Prevention and Health Promotion. Immunization and Infectious Diseases. http://www.healthypeople.gov/2020/topics-objectives/topic/immunization-and-infectious-diseases. Accessed May 28, 2015.

5. U.S. Department of Health and Human Services. The State of the National Vaccine Plan: 2013 Annual Report. http://www.hhs.gov/nvpo/vacc_plan/annual-report-2013/nvpo-annual-report2013.pdf. Accessed May 28, 2015.

6. Schuchat A. Human vaccines and their importance to public health. *Procedia Vaccinol*. 2011;5:120-126.

7. Centers for Disease Control and Prevention (CDC). Vaccines and Preventable Diseases. http://www.cdc.gov/vaccines/vpd-vac/. Updated March 14, 2012. Accessed May 28, 2015.

8. Centers for Disease Control and Prevention (CDC). Pertussis Outbreak Trends. http://www.cdc.gov/pertussis/outbreaks/trends.html. Updated March 11, 2015. Accessed May 28, 2015.

9. Southwest Rural Health Research Center, Rural Healthy People 2020 National Survey. 2015, Texas A&M Health Science Center. Unpublished data. Accessed June 11,2015.

10. Kimmel SR, Burns IT, Wolfe RM, Zimmerman RK. Addressing immunization barriers, benefits, and risks. *J Fam Pract*. 2007;56(2 Suppl Vaccines):S61-S69.

11. McLaurin J. Migrant Farmworker Health. In: Warren JC, Smalley KB, eds. *Rural Public Health: Best Practices and Preventive Models*. New York, NY: Springer Publishing Company; 2014:227-239.

12. Smith PJ, Lindley MC, Rodewald LE. Vaccination coverage among U.S. children aged 19–35 months entitled by the Vaccines for Children program, 2009. *Public Health Rep*. 2011;126 Suppl 2:109-123.

13. Painter JE, Sales JM, Pazol K, et al. Psychosocial correlates of intention to receive an influenza vaccination among rural adolescents. *Health Educ Res*. 2010;25(5):853-864.

14. Lin CJ, Nowalk MP, Toback SL, Ambrose CS. Factors associated with in-office influenza vaccination by U.S. pediatric providers. *BMC Pediatr*. November 6 2013;13:180.

15. Sales JM, Painter JE, Pazol K, et al. Rural parents' vaccination-related attitudes and intention to vaccinate middle and high school children against influenza following educational influenza vaccination intervention. *Hum Vaccin*. 2011;7(11):1146-1152.

16. Gargano LM, Pazol K, Sales JM, et al. Multicomponent interventions to enhance influenza vaccine delivery to adolescents. *Pediatrics*. 2011;128(5):e1092-1099.

17. Gargano LM, Painter JE, Sales JM, et al. Seasonal and 2009 H1N1 influenza vaccine uptake, predictors of vaccination, and self-reported barriers to vaccination among secondary school teachers and staff. *Hum Vaccin*. 2011;7(1):89-95.

18. Polgreen PM, Polgreen LA, Evans T, Helms C. A statewide system for improving influenza vaccination rates in hospital employees. *Infect Control Hosp Epidemiol*. 2009;30(5):474-478.

19. Hubble MW, Zontek TL, Richards ME. Predictors of influenza vaccination among emergency medical services personnel. *Prehosp Emerg Care*. 2011;15(2):175-183.

20. Suryaprasad A, Redd JT, Hancock K, et al. Severe acute respiratory infections caused by 2009 pandemic influenza A (H1N1) among American Indians--

southwestern United States, May 1-July 21, 2009. *Influenza Other Respir Viruses*. 2013;7(6):1361-1369.

21. Dearinger AT, Howard A, Ingram R, et al. Communication efforts among local health departments and health care professionals during the 2009 H1N1 outbreak. *J Public Health Manag Pract*. 2011;17(1):45-51.

22. Wenger JD, Castrodale LJ, Bruden DL, et al. 2009 Pandemic influenza A H1N1 in Alaska: temporal and geographic characteristics of spread and increased risk of hospitalization among Alaska Native and Asian/Pacific Islander people. *Clin Infect Dis*. 2011;52 Suppl 1:S189-S197.

23. Groom AV, Jim C, Laroque M, et al. Pandemic influenza preparedness and vulnerable populations in tribal communities. *Am J Public Health*. 2009;99 Suppl 2:S271-S278.

24. Painter JE, Gargano LM, Sales JM, et al. Correlates of 2009 H1N1 influenza vaccine acceptability among parents and their adolescent children. *Health Educ Res*. 2011;26(5):751-760.

25. Muscoplat MH, Roddy M, Parilla E, et al. 2009 H1N1 vaccination in Minnesota: an evaluation by ZIP code. *Minn Med*. 2013;96(9):49-54.

26. Galarce EM, Minsky S, Viswanath K. Socioeconomic status, demographics, beliefs and A(H1N1) vaccine uptake in the United States. *Vaccine*. 2011;29(32):5284-5289.

27. Chaturvedi AK. Beyond cervical cancer: burden of other HPV-related cancers among men and women. *J Adolesc Health*. 2010;46(4 Suppl):S20-S26.

28. Markowitz LE, Dunne EF, Saraiya M, et al. Human papillomavirus vaccination: recommendations of the Advisory Committee on Immunization Practices (ACIP). *MMWR Recomm Rep*. 2014;63(RR-05):1-30.

29. Vanderpool RC, Casey BR, Crosby RA. HPV-related risk perceptions and HPV vaccine uptake among a sample of young rural women. *J Community Health*. 2011;36(6):903-909.

30. National Cancer Institute. SEER Stat Fact Sheets: Cervix Uteri Cancer. http://seer.cancer.gov/statfacts/html/cervix.html. Accessed June 2, 2015.

31. Markowitz LE, Dunne EF, Saraiya M, et al. Quadrivalent Human Papillomavirus Vaccine: Recommendations of the Advisory Committee on Immunization Practices (ACIP). *MMWR Recomm Rep*. 2007;56(RR-2):1-24.

32. Prasad SR, Hill R. Cost-benefit analysis on the HPV vaccine in Medicaid-enrolled females of the Appalachian region of Kentucky. *J Ky Med Assoc*. 2008;106(6):271-276.

33. Schmidt-Grimminger DC, Bell MC, Muller CJ, Maher DM, Chauhan SC, Buchwald DS. HPV infection among rural American Indian women and urban white women in South Dakota: an HPV prevalence study. *BMC Infect Dis.* September 24 2011;11:252.

34. Centers for Disease Control and Prevention (CDC). FDA licensure of quadrivalent human papillomavirus vaccine (HPV4, Gardasil) for use in males and guidance from the Advisory Committee on Immunization Practices (ACIP). *MMWR MorbMortal Wkly Rep*. 2010;59(20):630-632.

35. Centers for Disease Control and Prevention (CDC). Recommendations on the use of quadrivalent human papillomavirus vaccine in males--Advisory Committee on Immunization Practices (ACIP), 2011. *MMWR Morb Mortal Wkly Rep.* 2011;60(50):1705-1708.

36. Head KJ, Vanderpool RC, Mills LA. Health care providers' perspectives on low HPV vaccine uptake and adherence in Appalachian Kentucky. *Public Health Nurs*. 2013;30(4):351-360.

37. Crosby RA, Casey BR, Vanderpool R, Collins T, Moore GR. Uptake of free HPV vaccination among young women: a comparison of rural versus urban rates. *J Rural Health*. 2011;27(4):380-384.

38. Tiggelaar SM, Rafalski M, Davidson MA, Hu Y, Burnett L. HPV knowledge and vaccine acceptability in Appalachian Tennessee and Kentucky, USA. *J Fam Plann Reprod Health Care*. 2014;40(1):75-76.

39. Horner MJ, Altekruse SF, Zou Z, Wideroff L, Katki HA, Stinchcomb DG. U.S. geographic distribution of prevaccine era cervical cancer screening, incidence, stage, and mortality. *Cancer Epidemiol Biomarkers Prev*. 2011;20(4):591-599.

40. Mills LA, Vanderpool RC, Crosby RA. Sexually related behaviors as predictors of HPV vaccination

among young rural women. *J Womens Health (Larchmt)*. 2011;20(12):1909-1915.

41. Sperber NR, Brewer NT, Smith JS. Influence of parent characteristics and disease outcome framing on HPV vaccine acceptability among rural, Southern women. *Cancer Causes Control*. 2008;19(1):115-118.

42. Saraiya M, Ahmed F, Krishnan S, Richards TB, Unger ER, Lawson HW. Cervical cancer incidence in a prevaccine era in the United States, 1998-2002. *Obstet Gynecol*. 2007;109(2 Pt 1):360-370.

43. Fazekas KI, Brewer NT, Smith JS. HPV vaccine acceptability in a rural Southern area. *J Womens Health (Larchmt)*. 2008;17(4):539-548.

44. Kepka DL, Ulrich AK, Coronado GD. Low knowledge of the three-dose HPV vaccine series among mothers of rural Hispanic adolescents. *J Health Care Poor Underserved*. 2012;23(2):626-635.

45. Bynum SA, Brandt HM, Annang L, Friedman DB, Tanner A, Sharpe PA. Do health beliefs, health care system distrust, and racial pride influence HPV vaccine acceptablity among African American college females? *J Health Psychol*. 2012;17(2):217-226.

46. Thomas TL, Strickland OL, DiClemente R, Higgins M, Haber M. Rural African American parents' knowledge and decisions about human papillomavirus vaccination. *J Nurs Scholarsh*. 2012;44(4):358-367.

47. Constantine NA, Jerman P. Acceptance of human papillomavirus vaccination among Californian parents of daughters: a representative statewide analysis. *J Adolesc Health*. 2007;40(2):108-115.

48. Reiter PL, Brewer NT, Gottlieb SL, McRee AL, Smith JS. Parents' health beliefs and HPV vaccination of their adolescent daughters. *Soc Sci Med*. 2009;69(3):475-480.

49. Sandri KJ, Verdenius I, Bartley MJ, et al. Urban and rural safety net health care system clinics: no disparity in HPV4 vaccine completion rates. *PLoS One*. 2014;9(5):e96277.

50. Dickerson JB, Smith ML, Ory MG. Increasing uptake of Gardasil among American adolescents: comparisons with the history of Hepatitis B vaccination. *Hum Vaccin*. 2011;7(2):211-219.

51. Shafer A, Cates JR, Diehl SJ, Hartmann M. Asking mom: formative research for an HPV vaccine campaign targeting mothers of adolescent girls. *J Health Commun*. 2011;16(9):988-1005.

52. Thomas TL, Strickland O, Diclemente R, Higgins M. An opportunity for cancer prevention during preadolescence and adolescence: stopping human papillomavirus (HPV)-related cancer through HPV vaccination. *J Adolesc Health*. 2013;52(5 Suppl):S60-S68.

53. Panozzo CA, Becker-Dreps S, Pate V, et al. Patterns of rotavirus vaccine uptake and use in privately-insured US infants, 2006-2010. *PLoS One*. 2013;8(9):e73825.

54. Shah S, Hoffman RE, Wake L, Marine WM. Adolescent suicide and household access to firearms in Colorado: results of a case-control study. *J Adolesc Health*. 2000;26(3):157-163.

55. Kempe A, Patel MM, Daley MF, et al. Adoption of rotavirus vaccination by pediatricians and family medicine physicians in the United States. *Pediatrics*. 2009;124(5):e809-e816.

56. Centers for Disease Control and Prevention (CDC). National, state, and local area vaccination coverage among children aged 19-35 months -- United States, 2011. *MMWR Morb Mortal Wkly Rep.* September 7 2012;61:689-696.

57. Centers for Disease Control and Prevention (CDC). National and state vaccination coverage among children aged 19-35 months -- United States, 2010. *MMWR Morb Mortal Wkly* Rep. 2011;60(34):1157-1163.

58. Centers for Disease Control and Prevention (CDC). National, state, and local area vaccination coverage among children aged 19 - 35 months -- United States, 2009. 2010;59(36):1171-1177.

59. Cohen EL, Head KJ. Identifying knowledge-attitude-practice gaps in parental acceptance of adolescent vaccinations in Appalachian Kentucky: Implications for communication interventions. *J Commun Healthc*. 2014;7(4):295-302.

60. Vanderpool RC, Dressler EV, Stradtman LR, Crosby RA. Fatalistic beliefs and completion of the HPV vaccination series among a sample of young Appalachian Kentucky women. *J Rural Health*. 2015;31(2):199-205.

61. Pride KR, Geissler AL, Kolasa MS, et al.

Assessment of vaccine exemptions among Wyoming school children, 2009 and 2011. *J Sch Nurs*. 2014;30(5):332-339.

62. Thompson JW, Tyson S, Card-Higginson P, et al. Impact of addition of philosophical exemptions on childhood immunization rates. *Am J Prev Med*. 2007;32(3):194-201.

63. Centers for Disease Control and Prevention (CDC). Vaccination coverage among children in kindergarten -- United States, 2011-12 school year. 2012;61(33)647-652.

64. Smith PJ, Chu SY, Barker LE. Children who have received no vaccines: who are they and where do they live? *Pediatrics.* 2004;114(1):187-195.

65. Nan X, Zhao X, Briones R. Parental cancer beliefs and trust in health information from medical authorities as predictors of HPV vaccine acceptability. *J Health Commun*. 2014;19(1):100-114.

66. Dempsey AF, Zimet GD, Davis RL, Koutsky L. Factors that are associated with parental acceptance of human papillomavirus vaccines: a randomized intervention study of written information about HPV. *Pediatrics*. 2006;117(5):1486-1493.

67. National Conference of State Legislatures. HPV Vaccine Policies. http://www.ncsl.org/research/health/hpv-vaccine-state-legislation-and-statutes.aspx. Published 2009. Accessed June 1, 2015.

68. Kepka D, Coronado GD, Rodriguez HP, Thompson B. Evaluation of a radionovela to promote HPV vaccine awareness and knowledge among Hispanic parents. *J Community Health*. 2011;36(6):957-965.

69. Luque JS, Raychowdhury S, Weaver M. Health care provider challenges for reaching Hispanic immigrants with HPV vaccination in rural Georgia. *Rural Remote Health*. 2012;12(2):1975.

70. Rural Assistance Center. Healthy Families Arkansas (HFAR). https://www.raconline.org/success/project-examples/49. Published July 13, 2005. Accessed June 11, 2015.

71. Healthy Connections. Healthy Connections: Helping Families Build A Better Tomorrow. http://www.healthy-connections.org. Accessed June 11, 2015.

72. Rural Assistance Center. Nelson County School Nurse Program. https://www.raconline.org/success/project-examples/58. Published July 14, 2005. Updated January 14, 2015. Accessed June 11, 2015.

73. Centers for Disease Control and Prevention (CDC). The SPARC Program. http://www.cdc.gov/aging/states/sparc.htm. Published September 7, 2011. Accessed June 24, 2015.

74. Shenson D, Benson W, Harris AC. Expanding the delivery of clinical preventive services through community collaboration: the SPARC model. *Prev Chronic Dis*. 2008;5(1):A20.

75. Rural Assistance Center. SPARC - Sickness Prevention Achieved through Regional Collaboration. https://www.raconline.org/success/project-examples/404. Published June 12, 2007. Updated August 14, 2013. Accessed June 11, 2015.

Suggested Chapter Citation:

Ferdinand AO, Hutchison L. Immunization and Infectious Diseases in Rural America. In: Bolin JN, Bellamy G, Ferdinand AO, et al. eds. *Rural Healthy People 2020*. Vol. 2. College Station, TX: Texas A&M University Health Science Center, School of Public Health, Southwest Rural Health Research Center; 2015:53-65.

RURAL PUBLIC HEALTH INFRASTRUCTURE

By Barbara J. Quiram, PhD; Nida M. Ali, MPH; and Kimberly M. Babicz, MHA

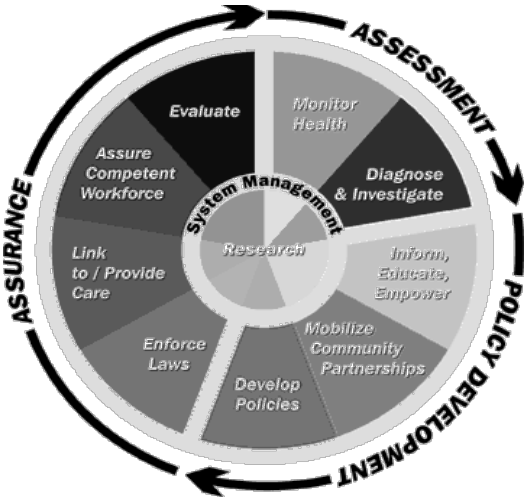
SCOPE OF PROBLEM

- According to Association of Schools of Public Health (ASPH) estimates, by 2020, the nation will be facing a shortfall of more than 250,000 public health workers. Shortages of public health physicians, public health nurses, epidemiologists, health care educators, and administrators are anticipated.[1]
- According to the *Healthy People 2010: Final Review* published in 2012, eight of the Healthy People 2010 public health infrastructure objectives moved (negatively), away from their targets, in the following areas: 1) local health agency health improvement plans, 2) disease prevention control and surveillance, 3) integrated data management, environmental and health protection, 4) laboratory capacity, and 5) emergency preparedness and response. A statistically significant difference between the baseline and final data points was observed for one objective (23-8b).[2]
- Public health infrastructure needs are expected to increase in this decade as more than 100,000 government public health workers-approximately one-quarter of the current public sector workforce-will be eligible to retire by 2012.[3]
- "Over 50 percent of local public health agencies serve small populations (0-24,999 residents) whereas only three percent serve populations of one million or more." [4]
- Only one-third of the U.S. population is effectively served by public health agencies.[5]
- Less than half of the state and local public health agencies have adequate communications and information systems.[6]
- Sixty-three percent of local health departments, (LHD)s served small jurisdictions (populations of less than 50,000), but these small jurisdictions account for only eleven percent of the U.S. population.[7]
- Data collection and data resources continue to be a challenge in rural and remote regions and, in particular in areas serving Tribal agencies.[2]

The Healthy People 2020 goal for public health infrastructure (PHI) remains consistent with the Healthy People 2010 goal. The overarching goal is to ensure that federal, tribal, state, and local health agencies have the infrastructure that is necessary to provide essential public health services effectively.[8]

In order to capture the differences that exist and the changes that have evolved overtime in public health infrastructure between rural and urban areas, it is important to examine aspects that build the foundation for public health infrastructure (**Figure 1**).[9] That is, a competent workforce, adequate and up-to-date data and information systems, and public health organizations that are well equipped to meet the health needs of communities. Equally important is the fact that various issues such as finance and other emerging issues such as public health law and

Figure 1. Aspects of Public Health Infrastructure



Source[9]: Public Health Functions Steering Committee, Adopted Fall 1994. Available at: http://www.cdc.gov/nphpsp/essentialservices.html

policy are integral to this framework and are closely intertwined with the three crucial aspects. The purpose of this literature review is to address the following three areas and related objectives:[10]

Workforce

- **PHI-1** Increase the proportion of Federal, Tribal, State, and local public health agencies that incorporate Core Competencies for Public Health Professionals into job descriptions and performance evaluations
- **PHI-3** Increase the proportion of Council on Education for Public Health (CEPH) accredited schools of public health, CEPH accredited academic programs, and schools of nursing (with a public health or community health component) that integrate Core Competencies for Public Health Professionals into curricula

Data and Information Systems

- **PHI-8** (Developmental) Increase the proportion of Healthy People 2020 objectives that are tracked regularly at the national level
- **PHI-10** Increase the number of States that record vital events using the latest U.S. standard certificates and report

Public Health Organizations

- **PHI-11** Increase the proportion of Tribal and State public health agencies that provide or assure comprehensive laboratory services to support essential public health services
- **PHI-13** Increase the proportion of Tribal, State, and local public health agencies that provide or assure comprehensive epidemiology services to support essential public health services
- **PHI-14** Increase the proportion of State and local public health jurisdictions that conduct a public health system assessment using national performance standards
- **PHI-17** (Developmental) Increase the proportion of Tribal, State, and local public health agencies that are accredited

PREVALENCE AND DISPARITIES IN RURAL AREAS

Public Health infrastructure serves many purposes. "The public health infrastructure is responsible for protecting people's health and safety, providing credible information for better health decisions, and promoting good health through a network of partnerships." [11] Rural health disparities in public health infrastructure are prominent in comparison to urban settings. Several limitations exist within rural public health organizations, these include: small workforce, restricted finances, inadequate data and information systems, lack of standardization in law and policy, and an absence of formalized structure in public health. [12]

The U.S. public health infrastructure suffers from "vulnerable and outdated health information systems and technologies, an insufficient and inadequately trained public health workforce, antiquated laboratory capacity, a lack of real time surveillance and epidemiological systems, ineffective and fragmented communications networks, incomplete domestic preparedness and emergency response capabilities, and communities without access to essential public health services." [13(p3)] However, in reality rural areas bear this burden at overwhelmingly higher rates than their urban counterparts. As such there is a need to strengthen public health infrastructure in order to improve health and reduce disparities in rural areas. A highly functioning public health system successfully incorporates the ten essential services of public health.

Workforce

Public health workforce varies dramatically between urban and rural settings. There continues to be a gap in research on *rural* public health workforce. The Council on Linkages between Academia and Public Health Practice reported that in 2002 about 450,000 individuals made up the total (national), public health workforce (local, state, and federal levels, and private.)[14] Public health workforce is comprised of multiple disciplines. These include nurses, physicians, dentists, environmental specialist, laboratorians, health educators, epidemiologists, outreach workers, and managers, among others.[15] Rural public health agencies tend to have a fewer staff members who often assume multiple roles. However, over time it has become difficult to assess the number of workers in public health agencies, specifically in resource deficient areas, such as rural communities.

Budget constraints directly impact worker shortages in rural areas and hinder the availability of opportunities to provide continuing education and training. Lack of resources and health infrastructure directly impacts current workforce issues in rural

public health organizations. Establishing public health workforce capacity is an essential and ongoing priority for rural areas. Some of the most common problems related to workforce include health care provider shortages, specifically public health nurses, doctors, dentists, an aging workforce, lack of formal and graduate training, and an absence of licensure in public health. There is now a voluntary Certified in Public Health (CPH) examination in place to begin to address practice standards for public health professionals.

"Rural health departments face a continuing problem attracting and retaining the proper mix of public health professionals. Further, there is a growing need to improve continuing education opportunities…" [6] Rural areas are affected most by worker shortages due to geographic distribution of population centers. Since the population density is disproportionately lower in rural areas it is difficult to access proper healthcare services. Due to a limited number of primary care providers that serve rural areas, local public health agencies become an all-encompassing venue for addressing health issues. Public health nurses are integral to local public health agencies, often serving in various capacities.[4]

There is a dire need for a skilled workforce that is formally educated and trained. Public health is a multidisciplinary field, therefore it is difficult to just have one formalized training and accreditation process due to the range of specialties. Continuing education is the most important training need for the workforce. With a number of undergraduate public health programs surfacing, this not only addresses the lack of formalized training and education in public health, but it also provides a solution to the issues of an aging workforce. "More than 100,000 government public health workers–approximately one-quarter of the current public sector workforce–will be eligible to retire by 2012." [3]

The National Association of County and City Health Officials (NACCHO) captured the education of local health department (LHD) top agency executives by highest degree and area in 2013 (**Table 1**).[16] They reported that sixty percent of LHD top executives have earned a master's or doctoral degree. Less than one-third of LHD top executives have earned a degree in public health (22 percent), nursing (32 percent), or medical (12 percent) areas.[16]

Public health accreditation systems must be implemented in order to improve the functional needs of local public health agency. Not only would such systems assess capacity and performance against standards, but it also ensures accountability for local public health agencies.[13] Although there are no well documented processes of LHD accreditation systems being implemented in rural areas, urban LHDs have demonstrated effectiveness in utilizing the shift towards a need for a national process of accreditation.

Data and Information Systems

In order to assess and determine population health needs, establishing an ongoing systematic collection, analysis and interpretation of health related data is critical. Scarcity of data was noted as a significant unmet objective in the Healthy People 2010 Final Report, and many objectives remained developmental due to lack of data to measure progress.[2] By incorporating surveillance systems, public health agencies are more equipped to monitor disease and identify emerging threats in order to disseminate this information in a timely manner.

Surveillance systems are necessary in order to track and communicate patterns, trends, and causes for injury and disease. While there are state specific mandates for reporting health related conditions, national reporting of disease is voluntary. There is a lack of standardization in reporting.[5]

According to the U.S. Department of Health and Human Services, "By 2010, each health department will be able to electronically access and distribute up to date public health information, emergency health alerts, monitor the health of communities, and assist in the detection of emerging public health problems."[5] The need to access the internet and related

Table 1. Education of LHD top agency executives (n=1,889) by highest degree and Area.

Degree Types and Specialty Areas	LHDs (%)
Highest Degree	
Associate's	8
Bachelor's	32
Master's	45
Doctoral	15
Specialty Area	
Public Health[1]	22
Nursing[2]	32
Medical[3]	12

Source:[16]
[1] Public Health degrees: BSPH, MPH, DrPH, & PhD in Public Health
[2] Nursing degrees: ASN, AND, BSN, BAN, MN, MSN, DNP, & PhD in Nursing
[3] Medical degrees: MD, DO, DDS, & DVM

electronic information are central to the networks between local, state and federal surveillance systems to monitor disease. However, current surveillance systems vary drastically between jurisdictions.

Less than half of the state and local public health agencies have adequate communications and information systems. One recent Hawaiian study indicated that although 85 percent rural health workers had access to computers, only a small minority had modems, and even fewer used online resources, or could access the free electronic databases at public and university libraries.[6]

There is a need to strengthen disease surveillance. In 2007, 16 states did not report any plans to electronically exchange health data with regional health information organizations. [17] Additionally, public health agencies must develop an adequate legal framework prior to a disaster in order to ensure that critical public health information can be shared with other jurisdictions.[17] Consequently, surveillance systems are nearly nonexistent in rural areas where there are functional deficiencies in the capacity to access adequate information systems.

Telehealth is defined by the Health Resources and Services Administration (HRSA) as, "the use of electronic information and telecommunications technologies to support long distance clinical health care, patient and professional health-related education, public health and health administration." [18] Telehealth has the ability to link rural communities with other organizations that can provide additional support and resources in addressing public health issues. However "many rural communities that are most in need of recent advances in the field of telecommunications technology may be least equipped to take advantage of it." [6]

Public Health Organizations

Public health organizations include a network of not only federal, state, local health departments and laboratories, but they also work with a range of other public and private sectors to improve population health. There are several jurisdictional areas that local public health agencies in the United States serve, with populations ranging from less than 1,000 to nearly ten million. Governance varies drastically across and within jurisdictions.[16]

Organizational capacity is the ability to mobilize community partnerships, information and equipment to perform the ten essential services of public health. Public health organizations rely heavily on its facilities, laboratories, and financing mechanisms.[19] Studies performed in 1998 and 2000, highlighted differences in health department performance. Both of these studies illustrated that the "…state public health departments have half or less of the organizational capacity they need to optimally perform essential public health services." [19] Based on these studies, the median score of local public health agencies was relatively higher than the median performance score for state public health systems. Additionally, there appears to be very little research which has focused on organizational capacity since the turn of the century. However, the demand for adequate public health systems continues to grow.

In order to sustain organizational capacity, there is a need to acquire realistic financial resources, upgrade information systems and laboratories, and provide ongoing staff trainings. Technological advancements and varying jurisdictional needs create barriers to reach a consensus with performance demands. Sixty-three percent of LHDs served small jurisdictions (populations of less than 50,000), but these small jurisdictions account for only eleven percent of the U.S. population.[7] Within smaller jurisdictions typically serving rural communities, the workforce is forced to wear multiple hats and assume roles that they might not otherwise be trained to perform. For example, in rural counties serving 10,000 or fewer people, a local health department might be staffed with a public health nurse, and an environmental health worker. This illustrates the importance of establishing multiple partnerships and engaging community stakeholders. In 2013, approximately half of LHDs serving less than 500,000, and one-third (35 percent) of LHDs serving more than 500,000 people regularly shared resources, such as staff, equipment, or funding, with other LHDs.[16]

According to a NACCHO longitudinal analysis, laboratory services were one of the three services most frequently added by LHDs between 2008 and 2010. Additionally, laboratory services showed consistently positive changes in frequency of provision between 2005 and 2010.[20] Cross-jurisdictional collaboration is essential in linking resources, services and workforce to public health agencies that want to successfully meet population health needs.

BARRIERS

As mentioned throughout this chapter, funding is a primary hindrance to public health infrastructure. It directly affects recruiting and retaining workforce, acquiring updated information systems, and meeting public organizational capacity. Annual expenditures for LHDs in 2013, range from $800,000 to $128

million. Larger public health agencies are able to create reserve funds, which they would be able to access during economic hardships. Rural populations do not have the luxury to utilize the reserve funds because they are already sharing limited resources across jurisdictions.[16]

Despite improvements in competencies and curricula for public health training, challenges exist around ensuring that a well-rounded workforce is capable of performing the essential services of public health. Efforts should be focused on enhancing continuing education opportunities.[4] Disparities in the public health workforce is becoming more apparent. While there is a growing minority population, the workforce lacks the diversity to meet the unique needs of such populations.[8] However, proliferation of public health schools and programs provides hope for addressing workforce needs and the looming retirement crisis in public health. As such, there lies great potential to address untapped opportunities in leadership, policy, and strategic planning among others in public health.

The new voluntary national accreditation program was established to standardize services and improve quality performance by public health agencies. However, the voluntary nature of the program does not require compliance to established accreditation standards. As a result not all public health agencies choose to participate in this movement. Not all public health agencies have the functional capacities to support accreditation efforts.[8] Various legal and political difficulties are arising as a result of new and re-emerging infectious diseases and alarming levels of chronic disease. Therefore, there is a need to understand and develop new policies that attempt to improve public health while also respecting constitutional liberties.

PROPOSED SOLUTIONS

The process of strengthening public health infrastructure in rural areas will be challenging. However, there are multiple solutions that can be adapted to meet various jurisdictional needs. Measures proposed to strengthen the public health workforce have included distance-learning technologies; improving linkages between academia and practice; and creating incentives and certification programs. Given the lack of diverse skill sets in rural areas among public health workers, workforce training should be implemented to build community capacity thereby developing public health infrastructure. Essentially, workforce training can create a framework which can inform future activities that deliver the core functions and ten essential services.[4]

Public health agencies need to have common directional strategies that are mission, vision and values. Creating a strategic plan, inclusive of these directional strategies can be tailored to meet the unique needs of varying jurisdictions, specifically within rural populations. Involving and engaging stakeholders can create opportunities to leverage community assets and resources in meeting community health needs. Specifically, partnering with a range of public and private sectors can help to coordinate public health activities and facilitate collaboration cross-jurisdictionally to expand the availability of public health services and community level buy-in for public health endeavors. While coordinating activities among partners may be difficult, leveraging such partnerships can result in more cost effective and efficient public health service delivery.

Community health assessments and health improvement plans should be conducted and disseminated periodically in order to identify community partners and focus public health activities, to meet the unique health needs of citizens. Health assessment and health improvement planning activities also ensured efficient use of resources, given budget constraints. Performing health assessments and establishing health improvement plans also ensures adequate representation of a rural community's geographical service area in state public health assessments, profiles, and improvement plans. Health assessments and health improvement plans are essential prerequisites for national voluntary accreditation programs which allow rural areas to pursue public health agency accreditation in meeting performance standards.[21]

MODELS FOR PRACTICE

This section highlights community-based examples provided to facilitate effective rural public health infrastructure.

The Michigan Endeavor: Together We Can Initiative

In 2010, the Central Michigan District Health Department (CMDHD) initiated the Together We Can program. This effort strives to improve the overall health of more than 190,000 people within Central Michigan's health district, which includes six primarily rural counties with high levels of unemployment and poverty.[22] The *County Health Rankings* ranked these six counties as the "unhealthiest" in the state, which motivated the need for this initiative. The *County Health Rankings* is one of many tools used in mobilizing action toward

community health for communities to identify strengths and weaknesses in health outcomes and health factors.[22] Using these rankings as a foundation, CMDHD engaged and mobilized stakeholders throughout the region, including both public and private sectors, to address health needs, identify health priorities, and increase resources within these communities.[22] In doing so, the initiative works to strengthen a weakened public health infrastructure for improved health outcomes.

The Maine Case Study

The state of Maine set out to restructure its weakened public health infrastructure in an effort to reach rural jurisdictions. The issue in this case revolved around the idea that "little collaboration was taking place within or between governmental and nongovernmental public health partners and the system lacked mechanisms to direct state and federal resources to the local level." [19] In order to address this issue, the primary approach was to organize and leverage existing resources and partners involved in service delivery to the residents in the state of Maine. This included increased efforts to strengthen workforce training and community health coalition building. Spanning over ten years, several infrastructure development initiatives helped to provide the capacity to sustain a more robust public health infrastructure.[21]

The Nebraska Experience

In 2001, the state of Nebraska was able to leverage Tobacco settlement dollars to strengthen a weakened and fragmented public health infrastructure that is capable of responding to public health emergencies.[23,24] In strengthening this system, multiple counties collaborated to establish regional health departments. [23] A collaborative regionalized approach promotes capacity building among departments to plan for and respond to emergencies more effectively. The regional departments adopted the National Electronic Disease Surveillance System (NEDSS) in order "to monitor and access disease trends, guide prevention and intervention programs, identify issues needing research, and provide information for the development of public health policy." [24] Adopting NEDSS has established a standardized surveillance system that has the capability to track disease patterns and trends more accurately.[24]

SUMMARY AND CONCLUSIONS

Some of the most pronounced challenges in addressing public health infrastructure issues include inadequate funding streams, geographic location (rurality), lack of a required performance standards, focused attention on strengthening law and policy related to public health issues. Despite several issues related to public health infrastructure that currently exists in rural communities; cross-collaboration across jurisdictions can help to leverage community assets and resources.

A strong public health infrastructure that includes rural regions and counties, will address three main components: a skilled and competent workforce, adequate data and information systems, and sustainable public health agencies that can carry out the essential services of public health, thereby assuring conditions that create opportunities for community members to lead healthy lives (**Figure 1**).[9] "A continually expanding public health agenda in an era of shrinking governmental resources diminishes the ability of many local health departments to meet basic community health needs….the successful public health department of the future will develop multiple funding sources, advocate effectively for resources to meet community needs, and build strong collaborative linkages with other community health agencies and the illness care system." [25] Therefore, in order to ensure a sustainable public health infrastructure in rural areas, there is a need to address simultaneously all three components.

REFERENCES

1. Rosenstock L, Silver GB, Helsing K, et al. Confronting the public health workforce crisis: ASPH statement on the public health workforce. *Public Health Rep*. 2008;123(3):395-398.

2.National Center for Health Statistics. *Healthy People 2010: Final Review*. Hyattsville, MD: 2012.

3. Associations of Schools of Public Health. *ASPH Policy Brief: Confronting the Public Health Workforce Crisis*. Washington, DC: Associations of Schools of Public Health; 2008.

4. Hajat A, Stewart K, Hayes KL. The local public health workforce in rural communities. *J Public Health Manag Pract*. 2003;9(6):481-488.

5. U.S. Department of Health and Human Services. *Public Health's Infrastructure: A Status Report*. Washington, DC: Centers for Disease Control and

Prevention (CDC), U.S. Department of Health and Human Services; 2001.

6. Johnson R. *Rural Public Health: Issues and Considerations.* Rockville, MD: The National Advisory Committee on Rural Health, U.S. Department of Health and Human Services; 2000. http://www.hrsa.gov/advisorycommittees/rural/publichealthfeb2000.pdf. Published 2000. Accessed April 25, 2014.

7. National Association of County & City Health Officials (NACCHO). 2010 National Profile of Local Health Departments. http://nacchoprofilestudy.org/wpcontent/uploads/2014/01/2010_Profile_main_report-web.pdf. Published August 2011. Accessed April 25, 2014.

8. U.S. Department of Health and Human Services. Healthy People 2020: Public Health Infrastructure. HealthyPeople.gov. http://www.healthypeople.gov/2020/topicsobjectives2020/overview.aspx?topicId=35. Published 2013. Accessed April 25, 2014.

9. Centers for Disease Control and Prevention (CDC). Public Health Functions Steering Committee, Adopted Fall 1994. The 10 Essential Public Health Services. http://www.cdc.gov/nphpsp/essentialservices.html. Accessed July 31, 2015.

10. U.S. Department of Health and Human Services. Healthy People 2020: Public Health Infrastructure. HealthyPeople.gov. http://www.healthypeople.gov/2020/topics-objectives/topic/public-health-infrastructure/objectives. Published 2013. Accessed April 25, 2014.

11. Center for Disease Control and Prevention (CDC). Fact Sheet: Public Health Infrastructure. Office of Enterprise Communication. http://www.cdc.gov/media/pressrel/fs020514.htm. Updated May 14, 2002. Accessed April 25, 2014.

12. NORC Walsh Center for Rural Health Analysis. Final Report: Establishing and Maintaining Public Health Infrastructure in Rural Communities. http://www.norc.org/PDFs/Walsh%20Center/NRHA_FinalReport_4%2027%2012_FINAL%20(2).pdf. Published February 24, 2012. Accessed April 25, 2014.

13. Institute of Medicine of the National Academies. *The Future of the Public's Health in the 21st Century.* Washington, DC: Institute of Medicine, The National Academies Press; 2003.

14. Council on Linkages between Academia and Public Health Practice. *Core Competencies for Public Health Professionals*. http://www.trainingfinder.org/competencies. Updated 2002. Accessed April 25, 2014.

15. Association of Schools of Public Health. "U.S. Public Health Infrastructure." *Association of Schools of Public Health.* [PowerPoint]. January 2011. http://www.asph.org/document.cfm?page=1012.

16. National Association of County & City Health Officials (NACCHO). 2013 National Profile of Local Health Departments. http://nacchoprofilestudy.org/wpcontent/uploads/2014/02/2013_National_Profile021014.pdf. Published January 2014. Accessed April 25, 2014.

17. Centers for Disease Control and Prevention (CDC). Public Health Preparedness: Mobilizing State by State. Emergency Preparedness and Response. http://www.bt.cdc.gov/publications/feb08phprep. Updated February 20, 2008. Accessed 2014.

18. U.S. Department of Health and Human Services. Telehealth. Health Resources and Services Administration: Rural Health. http://www.hrsa.gov/ruralhealth/about/telehealth. Published 2012. Accessed 2014.

19. DeBuono B. U.S. Public Health Infrastructure: Looking Back. In: DeBuono B. *Milestones in Public Health: Accomplishments in Public Health Over the Last 100 years.* New York, NY: Pfizer Global Pharmaceuticals; 2006:213-232.

20. National Association of County & City Health Officials (NACCHO). Changes in Local Health Department Services and Activities: Longitudinal Analysis of 2008 and 2010 Profile Data. http://www.naccho.org/topics/infrastructure/profile/resources/upload/ResearchBrief-Activities-final_01-25-2012.pdf. Published January 2012. Accessed April 25, 2014.

21. Meit M, Hernandez N, Kronstadt J. Establishing and Maintaining Rural Public Health Infrastructure. http://www.norc.org/PDFs/Walsh%20Center/MainePolicyBrief_Web_3%2023%2012.pdf. Published March 2012. Accessed April 25, 2014.

22. Central Michigan District Health Department. Together We Can Build a Healthier Community. http://www.together-we-can.org/. Updated 2013. Accessed May 27, 2014.

23. De Milto L. Nebraska Develops a Responsive Public Health System. Robert Wood Johnson Foundation. http://www.rwjf.org/en/research-publications/find-rwjf-research/2008/05/nebraska-develops-a-responsive-public-health-system.html. Published May 13, 2008. Accessed April 25, 2014.

24. Palm D, Svoboda C. A regional approach to organizing local public health systems and the impact on emergency preparedness: the Nebraska experience. *Public Health Rep*. 2008;123(4):419.

25. Keck W. U.S. Public Health Infrastructure: Looking Ahead. In: DeBuono B. *Milestones in Public Health: Accomplishments in Public Health Over the Last 100 Years.* New York, NY: Pfizer Global Pharmaceuticals; 2006:227.

Suggested Chapter Citation:

Quiram BJ, Ali NM, Babicz KM. Rural Public Health Infrastructure. In: Bolin JN, Bellamy G, Ferdinand AO, et al. eds. *Rural Healthy People 2020*. Vol. 2. College Station, TX: Texas A&M University Health Science Center, School of Public Health, Southwest Rural Health Research Center; 2015:67-74.

SEXUAL HEALTH AND FAMILY PLANNING IN RURAL UNITED STATES: UPDATES AND CHALLENGES

By Darcy McMaughan, PhD; Laura Hugill-Warren, MPH; and Carlos A.O. Pavão, MPA

SCOPE OF THE PROBLEM

- The birth rate for rural teens is nearly one-third higher than for urban teens.[1] Overall, one in five (20 percent) of unintended pregnancies each year is among teens.[2]
- The rate of teen births in 2010 in rural populations overall was 40 percent compared to just 16 percent for large central-Metro populations. The overall rates of teen births in rural areas alone was 63 percent for non-Hispanic whites, 16 percent for non-Hispanic Blacks, and 16 percent for Hispanics.[1]
- The need for teen pregnancy prevention efforts is particularly great among rural teens, and teens living in rural areas are at higher risk of pregnancy.[1]
- Rural cases of HIV are increasing at faster rates than in metropolitan areas[3] with alarming trends suggestive of HIV/AIDS epidemic across the rural South.[4,5]
- Rural lesbian, gay, bisexual, and transgendered individuals face additional barriers to health because of isolation and a lack of social services and culturally competent providers.[6]
- Rural populations are significant less likely to be screened for sexually transmitted diseases and are often the same group for whom access to, or use of, health services is most limited.[7,8]

Healthy People 2020, published by the federal Office of Disease Prevention and Health Promotion, sets priorities and goals in ten-year increments for improving the health of the United States population. One leading health indicator (LHI), highlighted in Healthy People 2020 as a high-priority topic, was reproductive and sexual health. Under this LHI, Healthy People 2020 identified several specific public health issues that must be addressed in order to achieve a healthy population in the United States. The issues include: (1) reducing the number of unwanted pregnancies, (2) addressing income inequality related to reproductive health, (3) reducing the number of sexually transmitted diseases (STDs) and infections, and; (4) improving the sexual and reproductive health of special populations, such as lesbian, gay, bisexual, and transgendered (LGBT) individuals. These public health goals are to be achieved through: increased use of and access to contraceptives, including emergency contraception (EC) increased access to family planning clinics; and increased education on sexual and reproductive health.[9,10] Another goal of Healthy People 2020 was to focus on LGBT health as an important step in eliminating health disparities linked to societal stigma, discrimination, and denial of civil and human rights. The following Healthy People 2020 goals are discussed in this chapter, relative to rural Americans:

- **FP-3** Increase the proportion of publicly funded family planning clinics that offer the full range of Federal Drug Administration-approved methods of contraception, including emergency contraception
- **FP-7** Increase the proportion of sexually experienced persons who received reproductive health services
- **FP-8** Reduce pregnancies among adolescent women
- **HIV-2** Reduce the number of new HIV infections among adolescents and adults
- **HIV-3** Reduce the rate of HIV transmission among adolescents and adults
- **HIV-14** Increase the proportion of adolescents and adults who have been tested for HIV in the past 12 months
- **LGBT-1** (Developmental) Increase the number of population-based data

systems used to monitor Healthy People 2020 objectives that include in their core a standardized set of questions that identify LGBT populations

None of these objectives can be achieved without a clear understanding of what constitutes sexual and reproductive health. Sexual and reproductive health is more than simply the absence of sexual and reproductive disease and dysfunction. A healthy sexual and reproductive state encompasses physical, emotional, mental, and social well-being as it relates to sexuality. Improving and maintaining sexual and reproductive health requires protecting sexual rights, encouraging positive frameworks of sexuality, and eradicating violence and coercion related to sex and reproduction.[11] This implies respect for the freedom of people to have: a "responsible, satisfying, and safe sex life";[12] choice and capacity to choose reproductive activity is often referred to as "agency in reproduction" which is often defined as having a having choice in when, how, and how often to reproduce, as well as access to health care services that facilitate sexual and reproductive health.[12] With respect to "choice and capacity to choose reproductive decisions, rural Americans tend to face greater challenges in achieving sexual and reproductive health. This "incapacity is often demonstrated with, for example, higher rates of STDs and less access to contraceptives compared to urban Americans. This chapter focuses on those challenges, and the factors related to those challenges, in rural American communities.

RURAL HEALTHY PEOPLE 2020 SURVEY OUTCOMES

The Rural Healthy People 2020 (RHP2020) national survey of priorities found that "Family Planning and Sexual Health" remains a top 20 health priority for rural America.[13] This finding held constant across geographical regions. Access to reproductive health services continued to rank highest among identified sub-priorities (23 percent) followed by lack of sexual education and awareness of all sexual risks among rural populations (15 percent), followed by accessible and affordable health care services, and closely followed by sexual health in general and teen pregnancy (ten percent respectively). In addition to comments were offered by respondents about the affordability of health care and the high proportion of rural residents lacking health insurance in rural areas thus constraining access to reproductive and sexual health services.[14] Many respondents highlighted problems of retention of primary health care providers in rural areas. Others mentioned the significant distances between rural dwellers and basic care services, and the transportation issues often involved in traveling those distances.

PREVALENCE IN RURAL AREAS

Sexual Health

In 2008 an estimated 19.7 million cases of STDs resulted in about $15.6 billion of direct medical costs, with most of the costs (81 percent) associated with HIV infections.[15,16] Geographic variation in STDs is strong in the United States. The Southern United States (encompassing 17 states and the District of Columbia) has higher rates of HIV, chlamydia, gonorrhea, and syphilis compared to the rest of the United States.[4,5] The South also comprises a vast amount of America's rural communities. Although urban residence is typically associated with increased risk for STDs, rates of STD transmission tend to be higher in rural areas and particularly in the American south.[17] This may be partly due to an inter-connectedness between urban and rural communities, where infections spread from core areas in urban environments to rural settings by travel.[18] Research also suggests that individuals living in rural communities experience challenges in regards to access to care (specifically reproductive health care), poverty, and lack of anonymity in clinical settings.[18,19] These challenges likely impact the timely diagnosis, treatment, and ultimately prevention of the spread of STDs in rural environments, and combined with the transmission of infection from urban to rural areas, lead to the documented increased risk for STDs in rural America. This difficulty in accessing health services may be seen in some phenomenon related to sexual health and rurality. For example, people living in rural areas who contract HIV are more likely to establish first contact with the health care system in the later stages of the disease than urban residents with HIV, also suggesting a trend of later diagnosis for rural residents.[20,21] This later diagnosis may be associated with lower rates of prior HIV testing in rural residents compared to urban residents.[22]

Family Planning

Rural women have more children than urban women, and have their first child at younger ages, than urban women; rural teenagers have pregnancy rates 30 to 40 percent higher than urban teenagers.[23,24]

Such differences in childbearing may result from the differences in contraception practices that exist between rural and urban women.[25-28] Rural areas may have limited or no family planning options for women in their communities.[29] As a possible byproduct of limited contraceptive options, rural women, particularly those with lower educational levels, are more likely than urban women to choose sterilization.[25,27,30] While sterilization is a very effective contraceptive method, it is a method that leaves no room for long-term choices in family planning, leaving some women to regret being sterilized.[31,32] Other reversible and less invasive methods exist. However, rural women may lack access to education supporting these methods. Access issues may also be compounded by, not only a lack of education about contraceptives, but also higher rates of alcohol use, and lack of planning around sex and contraceptives.[33]

Long-Acting Reversible Contraception. Long-acting reversible contraception (LARC) includes intrauterine devices and contraceptive implants. LARCs are highly effective at reducing unintended pregnancies.[34,35] Federally Qualified Health Centers (FQHCs) are one of the largest providers of health care to underserved populations – including residents of rural areas. FQHCs are required to provide access to family planning services. However, women living in rural areas and relying on FQHCs for LARC are at a disadvantage compared to similar urban women. Even though a large proportion of FQHCs provide LARC, FQHCs in rural areas are less likely to offer LARC compared to non-rural FQHCs.[36]

Emergency Contraception. One avenue for reducing unintended pregnancy is EC. Emergency contraception is generally in the form of a high dose progestin-only birth control pill taken up to five days after unprotected vaginal intercourse between a man and a woman. In 2006, the United States FDA allowed over-the-counter access (also called pharmacy access or direct access) to EC in the U.S. Women over the age of eighteen can purchase EC (also known as Plan B) in pharmacies without a prescription and without pharmacist consultation. Considering the saturation of pharmacies in rural areas of the United States, the distribution of direct access EC in pharmacies has the potential to reduce the number of unintended pregnancies among rural women.[37] In addition, rural and frontier pharmacies appear just as likely to carry EC as urban pharmacies.[38-41] However, urban pharmacies also have a shortage ofEC, so using urban pharmacies as a benchmark against which to compare rural pharmacies may not adequately represent the scope of the problem. Even if rural pharmacies are able to order the same emergency contraception as urban pharmacies, there may still be an unmet need in rural areas due to differences in insurance coverage of these medications, or alternatively, physicians who will prescribe emergency contraception.[38]

LGBT Health

Another goal of Healthy People 2020 is to focus on LGBT health as an important step in eliminating health disparities linked to societal stigma, discrimination, and denial of civil and human rights. Efforts to improve LGBT health include dissemination of effective HIV and STD interventions, implementing anti-bullying policies in schools, providing social services to reduce suicide and homelessness risk among youth, providing culturally competent care through better education of medical providers, and expansion of domestic partner health insurance coverage.[42]

Lesbian, gay, bisexual, and transgender health disparities have been primarily defined through the experiences of the LGBT communities in urban centers.[43,44] The urban focus on LGBT health disparities is connected to how LGBT communities organized themselves post World War II to minimize stigma and acceptance.[43,45] After the war, there were many gay ghettos or enclaves[46] situated on the West and East Coasts. Today with a broader acceptance of LGBT rights, many LGBT people are becoming more visible in rural areas which is influencing how culturally competent health care services should be provided for sexual minorities.[47,48]

How healthcare providers ask questions, react to sexual orientation, identity patient information, and how a healthcare facility is presented aesthetically can greatly affect a patient's comfort level and subsequent communication with clinicians.[48-51] Increasing awareness by healthcare providers to address health disparities for LGBT communities has become a national priority to provide patient centered healthcare.[52] With the advent of the revised Culturally and Linguistically Appropriate Services (CLAS) Standards and the 2011 Joint Commission recommendations, healthcare facilities have instituted and implemented new policies and practices in how to make their processes and facilities more LGBT friendly. However, new policies do not necessarily mean there has been a positive shift in providing healthcare for LGBT patients. There is still a gap in

how to provide LGBT inclusive healthcare.[53-55] This gap is experienced more in rural than urban areas.

There are national recommendations that are a source of guidance for clinicians. For example, the National Standards on CLAS is a roadmap for healthcare organizations to provide competent linguistics and culturally appropriate healthcare. In April, 2013, these 15 standards were revised to become LGBT inclusive. These revisions represented current evidence-based practices and policies.[56] The Joint Commission has also been proactive to ensure that LGBT patients are included in healthcare nondiscrimination policies.[1] Recent revisions to the CLAS standards and the enforcement by the Joint Commission are designed to enhance Affordable Care Act implementation. These recent new recommendations are rooted in the *Healthy People 2010: Companion Document for LGBT Health*; the 2011 Institute of Medicine's (IOM) report on *The Health of Lesbian, Gay, Bisexual, and Transgender People: Building a Foundation for Better Understanding*; and the IOM 2001 report, *Crossing the Quality Chasm: A New Health System for the 21st Century*.[52,57,58]

VARIATION BY RACE AND ETHNICITY

We do find, in the literature, evidence of variation in sexual and reproductive health along racial and ethnic lines in American communities, which often overlap with characteristics common in rural communities (such as lower income and lack of health insurance).[59-61] The incidence of STDs is higher among low-income Blacks compared to other racial and ethnic groups of the same economic status.[62,63] According to the Centers for Disease Control and Prevention (CDC), 48 percent of the incidence of chlamydia were reported in Blacks, which was eight times the rate observed in whites. Similarly, Blacks reported 70 percent of the new cases of gonorrhea, which was 19 times the rate observed in whites.[63] Black women also experience more trichomoniasis than whites and Hispanics.[63,64] Young women and adolescents who are Black, Hispanic, or poor have higher rates of unintended pregnancies and STDs compared to white women or women at a higher income level.[2,65,66] Unfortunately, women of color are also more likely to die from pregnancy-related causes, which is a major reproductive health issue.[67] These variations by race and ethnicity, in general, may translate into race/ethnicity differences within rural communities. Variations in rates of HIV is a good example. The virus is more prevalent among Black and Hispanic men than other racial and ethnic identities.[68] About 43 percent of people living with HIV are Black, 35 percent are white, and 19 percent are Hispanic – even though Blacks and Hispanics make up only 12 percent and 16 percent of the population, respectively.[4] In urban areas, where certain urbanized Black and Hispanic neighborhoods are epicenters for microepidemics, these differences may be attributed to differences in poverty level between whites, Blacks and Hispanics.[69,70] In rural areas, however, these differences are not associated with poverty levels, but are instead associated with indicators such as health insurance coverage and per capita health expenditures.[70] Other examples of racial and ethinic differences within rural communities are also documented. Racial and ethnic minorities in California were are also less likely to have knowledge of emergency contraception compared to white Californians.[71] Also not a difference per se, it is noteworthy that, when questioned, in one study a high percentage of heterosexual women of color in rural communities (up to around 90 percent of the study sample) reported risky sexual behavior, such as unprotected sex.[72]

RISK FACTORS

Risk factors associated with poor sexual and reproductive health are generally delineated along two lines: behavioral risk factors and sociodemographic risk factors. Behavioral risk factors for STDs include multiple sexual partners, inconsistent condom use, and frequent use of alcohol and other drugs along with sociodemographic risk factors including younger age, female sex, and Black race.[19,73] Young women, ages 15 to 24 years, are often at greater risk for common bacterial infections such as chlamydia and gonorrhea. Seeking sexual partners via the Internet is also a risk factor for STDs.[74] These risk factors can vary based on the STD or the reproductive health issue. Risk factors for HPV infections in women include younger age, ethnicity (with Black and Hispanic women being at greater risk than white women), number of male sex partners, and whether their partner is part of a 'risky' demographic (e.g., a college student).[75]

[1]In 2011, the Joint Commission published *Advancing Effective Communication, Cultural Competence, and Patient- and Family-Centered Care for the Lesbian, Gay, Bisexual, and Transgender (LGBT) Community* to encourage healthcare facilities to become more inclusive.

IMPACT ON MORTALITY, MORBIDITY, AND OTHER HEALTH PROBLEMS

Sexual and reproductive health does, by definition, have an immediate effect on mortality and morbidity in the American population. Poor sexual and reproductive health implies higher rates of morbidity through sexually transmitted infections such as HIV. This can be particularly true for vulnerable populations in the United States. Although American Indians and Alaskan Natives have lower comparative rates of HIV infections, once infected, American Indians and Alaskan Natives have a much lower survival rate compared to other populations.[76] Thus, the link between sexual and reproductive health and mortality and morbidity is often associated with STDs, which may lead to more serious reproductive health issues including pelvic inflammatory disease, tubal infertility, ectopic pregnancy, chronic pain, and increased exposure to HIV.[19] Sexually transmitted diseases in women can also lead to adverse pregnancy outcomes.

Chlamydia has been associated with low birth weight, and gonorrhea with preterm birth.[77] This is significant, as infant mortality is commonly considered the primary and international measure of a society's ability to provide food, housing, income, education, employment, and health care to its citizens.[78] There has been a shift toward focusing on measures of low birth weight and prematurity, as well as including both fetal and maternal mortality as indicators of continuing healthcare disparities. Public health and clinical strategies to improve fetal-infant and maternal mortality include comprehensive sexuality education, both pre and inter-conception, as well as well-women care, family planning and abortion access, genetic counseling, pre-pregnancy prevention, and adolescent pregnancy prevention programming.[78]

BARRIERS

Contextual conditions specific to the rural United States may impede rural women's access to sexual health care and family planning services.[79] Conservatism, isolation, lack of privacy, and stigma may affect access by limiting services provided. Conservative beliefs may lead to doctors or pharmacists choosing to not supply EC, or by making rural women uncomfortable in seeking available options. For example, in a small, rural town women may experience dual relationships with health care professionals and thus worry about lack of privacy and stigma.[80] Furthermore, rural providers may be ill-prepared to promote or provide certain types of contraception, such as LARC, compared to urban providers.[81]

In a study of adolescent sexual health in rural Minnesota, behaviors of adolescent boys (particularly inconsistent condom use), self-esteem (particularly low self-esteem as evidenced by 'feeling overweight'), and rural community health and safety (feeling unsafe in the community and higher county level mortality rates) were associated with higher rates of teen pregnancy and chlamydia.[82] Rural women were less likely to have knowledge of and use EC compared to urban women, indicating a potential barrier to use among rural women.[71,83] This lack of education can be compounded by language barriers for ethnic minorities living in rural areas. In California, where adolescents can access EC without a prescription, Spanish-speaking women had a more difficult time obtaining EC from rural pharmacies than English-speaking women (the women were study subjects posing as adolescents needing EC).[84]

PROPOSED SOLUTIONS OR INTERVENTIONS

Primary prevention strategies rely on changing the behaviors that put an individual at risk for STDs. Several of these strategies include: practicing abstinence, choosing low-risk partners, discussing partners' sexual history, using condoms consistently, and not having multiple partners.[85] Attitudes regarding these behaviors and sex itself often play a role in whether or not an individual will utilize a primary prevention method. Amongst teens, when sex is perceived as more normal than abstinence, and partner cooperation is necessary to implement primary prevention strategies, ineffective methods such as a evaluating a partner's physical appearance are more typically used to determine risk. Thus, STD prevention messages should begin early, in preadolescence and early adolescence.[85] Studies also recommend that aggressive STD screening programs for sexually active adolescents and young adults be implemented in rural settings, and that barriers to health care must be addressed for screening to be successful.[19]

Efforts to improve LGBT health include dissemination of effective HIV and STD interventions, implementing anti-bullying policies in schools, providing social services to reduce suicide and homelessness risk among youth, providing culturally competent care through better education of medical providers, and expansion of domestic partner health insurance coverage.[42]

To address cost barriers to sexual health and family planning, an increase in public funding (through Title X) to health care providers for LARC should occur, and include provision of LARC as a quality indicator.[86] Low or no-cost LARC should be provided, without a prescription, at rural FQHCs. Once cost barriers are removed, LARC has been shown to be the contraception of choice for underserved women, and is very effective at preventing pregnancy.[35] Rural and frontier pharmacies should be encouraged to provide access to EC.

Contraception counseling and family planning education should be sensitive to contextual and cultural issues. Rural Hispanics may particularly benefit from targeted, appropriate counseling and education.[87]

COMMUNITY MODELS KNOWN TO WORK IN RURAL SETTINGS

Group-based comprehensive risk-reduction programs (not including abstinence education) have shown promise as community interventions to reduce pregnancy, HIV, and STDs in American adolescents.[88,89] Likewise, single-session behavioral interventions (which require less financial and human resources to implement than more traditional interventions) may also help reduce transmission of STDs.[90] Below are several examples:

Strong African American Families-Teen (SAAF-T)

The SAAF-T program focuses on preventing behavioral issues, largely for rural African American adolescents and teens. There is a particular focus on minimizing sexual risk-taking that can lead to HIV and other STDs. The program consists of five, two-hour meetings provided by locally trained leaders, navigators, and community health workers. Content is focused on reducing risks, especially risks associated with sexual behavior, which could interfere with positive development. Individuals who participated in the intervention reported increased condom efficacy and reduced frequency of unprotected intercourse.[91]

Rapid HCV testing as a HIV Testing Strategy in Rural Areas

This intervention, based in southeast Missouri, aimed to reduce the stigma associated with HIV testing by providing Hepatitis C Virus (HCV) rapid tests, and subsequently offer HIV testing. Services were offered at local health departments, in treatment centers and shelters for domestic violence, and by drug courts. This strategy resulted in an increase in the number of people who were tested for HCV and HIV.[92]

Healthy Families Arkansas (HFAR)

Arkansas's rural Polk County implemented the HFAR program to provide prenatal check-ups, education, transportation, and well-baby checks. This program spans family planning, healthy pregnancy, prenatal care, and prevention of child and maternal abuse. Among the program results were: increased first trimester prenatal care rates, increased immunization rates, and decreased cases of child abuse.[93]

SUMMARY AND CONCLUSIONS

The contraceptive practices of rural women differ from those of urban women. Education disparities, language barriers, local behavior norms, healthcare access limitations, and other sociodemographic factors contribute to the sexual and reproductive health status of rural settings. While many home contraceptive methods (open communication and condoms) are effective, financial barriers such as wealth and insurance coverage may limit the availability of clinical contraceptive options, for instance LARC and EC. Potential solutions and interventions aimed at improving the sexual and reproductive health of rural communities include educating sexual behavior changes and communication with partners, implementing aggressive STD screening programs, providing social services for the LGBT community, expanding access to preventative reproductive health services through increased public funding, and contraceptive counseling coupled with culturally sensitive family planning education.

REFERENCES

1. Ng AS, Kaye K. *Science Says #47: Teen Childbearing in Rural America*. http://thenationalcampaign.org/resource/science-says-47. Published January 2013. Accessed July 31, 2015.

2. Finer LB, Henshaw SK. Disparities in rates of unintended pregnancy in the United States, 1994 and 2001. *Perspect Sex Reprod Health*. 2006;38(2):90-96.

3. Centers for Disease Control and Prevention (CDC). HIV/AIDS Statistics Center: HIV and AIDS in the United States by geographic distribution. http://www.cdc.gov/hiv/statistics/basics/

geographicdistribution.html. Updated May 11, 2015. Accessed July 31, 2015.

4. Centers for Disease Control and Prevention (CDC). *Sexually Transmitted Disease Surveillance 2011*. Atlanta, GA: U.S. Department of Health and Human Services; 2012.

5. Prejean J, Tang T, Hall HI. HIV diagnoses and prevalence in the southern region of the United States, 2007–2010. *J Community Health.* 2013;38(3):414-426.

6. Cahill S, South K, Spade J. *Outing Age: Public Policy Issues Affecting Gay, Lesbian, Bisexual and Transgender Elders*. Washington: National Gay and Lesbian Task Force; 2000.

7. Sanchez NF, Rabatin J, Sanchez JP, Hubbard S, Kalet A. Medical students' ability to care for lesbian, gay, bisexual, and transgendered patients. *Fam Med*. 2006;38(1):21-27.

8. Steele LS, Tinmouth JM, Lu A. Regular health care use by lesbians: a path analysis of predictive factors. *Fam Pract*. 2006;23(6):631-636.

9. U.S. Department of Health and Human Services. Healthy People 2020: Family planning. HealthyPeople.gov. http://www.healthypeople.gov/2020/topics-objectives/topic/family-planning/objectives. Updated July 29, 2015. Accessed July 31, 2015.

10. U.S. Department of Health and Human Services. Healthy People 2020: Leading Health Indicators (LHI). HealthyPeople.gov. https://www.healthypeople.gov/2020/Leading-Health-Indicators. Updated July 29, 2015. Accessed July 31, 2015.

11. World Health Organization (WHO). Sexual and reproductive health: defining sexual health. http://www.who.int/reproductivehealth/topics/sexual_health/sh_definitions/en/. Accessed July 31, 2015.

12. World Health Organization (WHO). Health topics: reproductive health. http://www.who.int/topics/reproductive_health/en/. Accessed July 31, 2015.

13. Bolin JN, Bellamy GR, Ferdinand AO, et al. Rural Healthy People 2020: new decade, same challenges. *J Rural Health*. 2015;31(3):326-333.

14. Southwest Rural Health Research Center, Rural Healthy People 2020 National Survey. 2015, Texas A&M Health Science Center. Unpublished data. Accessed June 11,2015.

15. Hall HI, Song R, Rhodes P, et al. Estimation of HIV incidence in the United States. *JAMA*. 2008;300(5):520-529.

16. Owusu-Edusei K Jr, Chesson HW, Gift TL, et al. The estimated direct medical cost of selected sexually transmitted infections in the United States, 2008. *Sex Transm Dis.* 2013;40(3):197-201.

17. Rural HIV/STD Prevention Work Group. *Tearing Down Fences: HIV/STD Prevention in Rural America*. Bloomington, IN: Rural Center for AIDS/STD Prevention; 2009.

18. Gesink DC, Sullivan AB, Norwood TA, Serre ML, Miller WC. Does core area theory apply to sexually transmitted diseases in rural environments? *Sex Transm Dis*. 2013;40(1):32-40.

19. Boyer CB, Shafer MA, Pollack LM, Canchola J, Moncada J, Schachter J. Sociodemographic markers and behavioral correlates of sexually transmitted infections in a nonclinical sample of adolescent and young adult women. *J Infect Dis*. 2006;194(3):307-315.

20. Ohl M, Tate J, Duggal M, et al. Rural residence is associated with delayed care entry and increased mortality among veterans with human immunodeficiency virus infection. *Med Care.* 2010;48(12):1064-1070.

21. Weis KE, Liese AD, Hussey J, Gibson JJ, Duffus WA. Associations of rural residence with timing of HIV diagnosis and stage of disease at diagnosis, South Carolina 2001-2005. *J Rural Health.* 2010;26(2):105-112.

22. Ohl ME, Perencevich E. Frequency of human immunodeficiency virus (HIV) testing in urban vs. rural areas of the United States: results from a nationally-representative sample. *BMC Public Health.* September 1 2011;11:681.

23. Mulder L, Shellenberger S, Streiegel R, et al. The behavioral health care needs of rural women. http://www.apa. org/rural/ruralwomen.pdf. Accessed December 3, 2006.

24. Lishner DM, Larson EH, Rosenblatt RA, Clark SJ. Rural maternal and perinatal health. In: Ricketts TC, ed. *Rural Health in the United States*. New York, NY: Oxford University Press; 1999:134-149.

25. Hartlage SA, Breaux C, Gehlert S, Fogg L. Rural and urban Midwestern United States contraception practices. *Contraception*. 2001;63(6):319-323.

26. Chandra A, Martinez GM, Mosher WD, Abma JC, Jones J. Fertility, family planning, and reproductive health of U.S. women: data from the 2002 National Survey of Family Growth. *Vital Health Stat 23*. December 2005;(25):1-160.

27. Tobar A, Lutfiyya MN, Mabasa Y, et al. Comparison of contraceptive choices of rural and urban US adults aged 18–55 years: an analysis of 2004 behavioral risk factor surveillance survey data. *Rural Remote Health*. 2009;9(3):1186.

28. McCall-Hosenfeld JS, Weisman CS. Receipt of preventive counseling among reproductive-aged women in rural and urban communities. *Rural Remote Health*. 2011;11(1):1617.

29. Dobie SA, Gober L, Rosenblatt RA. Family planning service provision in rural areas: a survey in Washington State. *Fam Plann Perspect*. 1998;30(3):139-142, 147.

30. Lunde B, Rankin K, Harwood B, Chavez N. Sterilization of rural and urban women in the United States. *Obstet Gynecol.* 2013;122(2 Pt 1):304-311.

31. Hillis SD, Marchbanks PA, Tylor LR, Peterson HB. Poststerilization regret: findings from the United States Collaborative Review of Sterilization. *Obstet Gynecol*. 1999;93(6):889-895.

32. Curtis KM, Mohllajee AP, Peterson HB. Regret following female sterilization at a young age: a systematic review. *Contraception*. 2006;73(2):205-210.

33. Campo S, Askelson NM, Spies EL, Losch M. Preventing unintended pregnancies and improving contraceptive use among young adult women in a rural, Midwestern state: health promotion implications. *Women Health.* 2010;50(3):279-296.

34. Raine TR, Harper CC, Rocca CH, et al. Direct access to emergency contraception through pharmacies and effect on unintended pregnancy and STIs: a randomized controlled trial. *JAMA*. 2005;293(1):54-62.

35. Peipert JF, Madden T, Allsworth JE, Secura GM. Preventing unintended pregnancies by providing no-cost contraception. *Obstet Gynecol*. 2012;120(6):1291-1297.

36. Beeson T, Wood S, Bruen B, Goldberg DG, Mead H, Rosenbaum S. Accessibility of long-acting reversible contraceptives (LARCs) in Federally Qualified Health Centers (FQHCs). *Contraception*. 2014;89(2):91-96.

37. Knapp KK. Pharmacy manpower: implications for pharmaceutical care and healthcare reform. *Am J Hosp Pharm*. 1994;51(9):1212-1220.

38. Chuang CH, Shank LD. Availability of emergency contraception at rural and urban pharmacies in Pennsylvania. *Contraception*. 2006;73(4):382-385.

39. Bigbee JL, Abood R, Landau SC, Maderas NM, Foster DG, Ravnan S. Pharmacy access to emergency contraception in rural and frontier communities. *J Rural Health*. 2007;23(4):294-298.

40. Ogburn JA, Espey E, Benjamin A. Emergency contraception availability in New Mexico: impact of direct pharmacy access. *J Am Pharm Assoc (2003)*. 2008;48(3):388-392.

41. Samson FD, Loren R, Downing N, Schroeppel S, Kelly PJ, Ramaswamy M. Availability of emergency contraception in rural and urban pharmacies in Kansas. *J Rural Health*. 2013;29(1):113-118.

42. U.S. Department of Health and Human Services. Healthy People 2020: Lesbian, Gay, Bisexual, and Transgender Health. HealthyPeople.gov. http://www.healthypeople.gov/2020/topics-objectives/topic/lesbian-gay-bisexual-and-transgender-health. Updated July 29, 2015. Accessed July 31, 2015.

43. Marcus E. *Making History: The Struggle for Gay and Lesbian Equal Rights, 1945-1990: An Oral History*. New York, NY: HarperCollins Publishers; 1992.

44. Rose ID, Friedman DB. We need health information too: a systematic review of studies examining the health information seeking and communication practices of sexual minority youth. *Health Educ J.* 2013;72(4):417-430.

45. Miller N. *Out of the Past: Gay and Lesbian History from 1869 to the Present*. New York, NY: Vintage Books; 1995:112247.

46. Levine MP. Gay ghetto. *J Homosex*. 1979;4(4):363-377.

47. Rounds KE, McGrath BB, Walsh E. Perspectives on provider behaviors: a qualitative study of sexual

and gender minorities regarding quality of care. *Contemp Nurse*. 2013;44(1):99-110.

48. Snowdon S. Equal and respectful care for LGBT patients. The importance of providing an inclusive environment cannot be underestimated. *Healthc Exec*. 2013;28(6):52,54-55.

49. Tabar P. How LGBT-friendly is your facility? Long-term care is adapting policies and services that bring care equity to LGBT residents. *Long-Term Living*. 2012;61(9):38.

50. Adams J, McCreanor T, Braun V. Gay men's explanations of health and how to improve it. *Qual Health Res*. 2013;23(7):887-899.

51. Snowdon, S. Recommendations for Enhancing the Climate for LGBT Students and Employees in Health Professional Schools. Washington DC: Gay and Lesbian Medical Association (GLMA); 2013.

52. Institute of Medicine (IOM). *The Health of Lesbian, Gay, Bisexual, and Transgender People: Building a Foundation for Better Understanding*. Washington, DC: The National Academies Press; 2011.

53. Perrin EC, Cohen KM, Gold M, Ryan C, Savin-Williams RC, Schorzman CM. Gay and lesbian issues in pediatric health care. *Curr Probl Pediatr Adolesc Health Care*. 2004;34(10):355-398.

54. Gee R. Primary care health issues among men who have sex with men. *J Am Acad Nurse Pract*. 2006;18(4):144-153.

55. Xavier J, Honnold J, Bradford J. *The Health, Health-Related Needs, and Lifecourse Experiences of Transgender Virginians*. Richmond, VA: Virginia HIV Community Planning Committee and Virginia Department of Health; 2007.

56. U.S. Department of Health and Human Services: Office of Minority Health. National Standards for Culturally and Linguistically Appropriate Services in Health and Health Care. http://www.minorityhealth.hhs.gov/omh/browse.aspx?lvl=2&lvlid=53. Updated June 23, 2015.

57. Institute of Medicine (IOM). *Crossing the Quality Chasm: A New Health System for the 21st Century*. Washington, DC: The National Academies Press; 2001.

58. Gay and Lesbian Medical Association (GLMA). *Healthy People 2010: Companion Document for Lesbian, Gay, Bisexual, and Transgender (LGBT) Health*. San Francisco, CA: Gay and Lesbian Medical Association. Accessed July 31, 2015.

59. Ventura SJ, Mathews TJ, Hamilton BE, Sutton PD, Abma JC; Centers for Disease Control and Prevention (CDC). Adolescent pregnancy and childbirth - United States, 1991–2008. *MMWR Surveill Summ.* 2011;60 Suppl:105-108.

60. Hall KS, Moreau C, Trussell J. Determinants of and disparities in reproductive health service use among adolescent and young adult women in the United States, 2002-2008. *Am J Public Health.* 2012;102(2):359-367.

61. Harling G, Subramanian S, Bärnighausen T, Kawachi I. Socioeconomic disparities in sexually transmitted infections among young adults in the United States: examining the interaction between income and race/ethnicity. *Sex Transm Dis.* 2013;40(7):575-581.

62. Krueger LE, Wood RW, Diehr PH, Maxwell CL. Poverty and HIV seropositivity: the poor are more likely to be infected. *AIDS.* 1990;4(8):811-814.

63. Centers for Disease Control and Prevention (CDC). Cases of HIV infection and AIDS in urban and rural areas of the United States, 2006. *HIV/AIDS Surveillance Supplemental Report.* 2008;13(2):1-25.

64. Shafir SC, Sorvillo FJ, Smith L. Current issues and considerations regarding trichomoniasis and human immunodeficiency virus in African-Americans. *Clin Microbiol Rev*. 2009;22(1):37-45.

65. Centers for Disease Control and Prevention (CDC). *Sexually Transmitted Disease Surveillance 2009*. Atlanta, GA: U.S. Department of Health and Human Services; 2010.

66. Pflieger JC, Cook EC, Niccolai LM, Connell CM. Racial/ethnic differences in patterns of sexual risk behavior and rates of sexually transmitted infections among female young adults. *Am J Public Health.* 2013;103(5):903-909.

67. Creanga AA, Berg CJ, Syverson C, Seed K, Bruce FC, Callaghan WM. Race, ethnicity, and nativity differentials in pregnancy-related mortality in the United States: 1993-2006. *Obstet Gynecol.* 2012;120(2 Pt 1):261-268.

68. Centers for Disease Control and Prevention (CDC). Disparities in diagnoses of HIV infection

between blacks/ African Americans and other racial/ ethnic populations--37 states, 2005-2008. *MMWR Morb Mortal Wkly Rep*. 2011;60(4):93-98.

69. Nunn A, Yolken A, Cutler B, et al. Geography should not be destiny: focusing HIV/AIDS implementation research and programs on microepidemics in US neighborhoods. *Am J Public Health*. 2014;104(5):775-780.

70. Vaughan AS, Rosenberg E, Shouse RL, Sullivan PS. Connecting race and place: a county-level analysis of White, Black, and Hispanic HIV prevalence, poverty, and level of urbanization. *Am J Public Health*. 2014;104(7):e77-e84.

71. Baldwin SB, Solorio R, Washington DL, Yu H, Huang YC, Brown ER. Who is using emergency contraception? Awareness and use of emergency contraception among California women and teens. *Womens Health Issues*. 2008;18(5):360-368.

72. McLellan-Lemal E, O'Daniels CM, Marks G, et al. Sexual risk behaviors among African-American and Hispanic women in five counties in the Southeastern United States: 2008-2009. *Womens Health Issues.* 2012;22(1):e9-e18.

73. Hughes TL. Alcohol use and alcohol-related problems among lesbians and gay men. *Ann Rev Nurs Res*. 2005;23:283-325.

74. McFarlane M, Bull SS, Rietmeijer CA. The Internet as a newly emerging risk environment for sexually transmitted diseases. *JAMA*. 2000;284(4):443-446.

75. Burk RD, Ho GY, Beardsley L, Lempa M, Peters M, Bierman R. Sexual behavior and partner characteristics are the predominant risk factors for genital human papillomavirus infection in young women. *J Infect Dis*. 1996;174(4):679-689.

76. Centers for Disease Control and Prevention (CDC). Diagnoses of HIV infection in the United States and dependent areas, 2011. *HIV Surveillance Report*. 2013;23:1-84.

77. Johnson HL, Ghanem KG, Zenilman JM, Erbelding EJ. Sexually transmitted infections and adverse pregnancy outcomes among women attending inner city public sexually transmitted diseases clinics. *Sex Transm Dis.* 2011;38(3):167-171.

78. Handler A. Reflections on Improving the Health of Women and Infants. http://www.ilmaternal.org/csomb/summit2012/AHandler.pdf. 2012. Accessed April 28, 2015.

79. Chuang CH, Hwang SW, McCall-Hosenfeld JS, Rosenwasser L, Hillemeier MM, Weisman CS. Primary care physicians' perceptions of barriers to preventive reproductive health care in rural communities. *Perspect Sex Reprod Health.* 2012;44(2):78-83.

80. Noone J, Young HM. Preparing daughters: the context of rurality on mothers' role in contraception. *J Rural Health*. 2009;25(3):282-289.

81. Vaaler ML, Kalanges LK, Fonseca VP, Castrucci BC. Urban-rural differences in attitudes and practices toward long-acting reversible contraceptives among family planning providers in Texas. *Womens Health Issues*. 2012;22(2):e157-e162.

82. Kozhimannil KB, Enns E, Blauer-Peterson C, Farris J, Kahn J, Kulasingam S. Behavioral and community correlates of adolescent pregnancy and Chlamydia rates in rural counties in Minnesota. *J Community Health*. 2015;40(3):493-500.

83. Fagan EB, Boussios HE, Moore R, Galvin SL. Knowledge, attitudes, and use of emergency contraception among rural western North Carolina women. *South Med J*. 2006;99(8):806-810.

84. Sampson O, Navarro SK, Khan A, et al. Barriers to adolescents' getting emergency contraception through pharmacy access in California: differences by language and region. *Perspect Sex Reprod Health*. 2009;41(2):110-118.

85. Akers AY, Gold MA, Coyne-Beasley T, Corbie-Smith G. A qualitative study of rural black adolescents' perspectives on primary STD prevention strategies. *Perspect Sex Reprod Health.* 2012;44(2):92-99.

86. Park HY, Rodriguez MI, Hulett D, Darney PD, Thiel de Bocanegra H. Long-acting reversible contraception method use among Title X providers and non-Title X providers in California. *Contraception*. 2012;86(5):557-561.

87. Warren JT, Harvey SM, Bovbjerg ML. Characteristics related to effective contraceptive use among a sample of nonurban Latinos. *Perspect Sex Reprod Health*. 2011;43(4):255-262.

88. Lyons T, Chandra G, Goldstein J. Stimulant use and HIV risk behavior: the influence of peer support group participation. *AIDS Educ Prev.* 2006;18(5):461-473.

89. Chin HB, Sipe TA, Elder R, et al. The effectiveness of group-based comprehensive risk-reduction and abstinence education interventions to prevent or reduce the risk of adolescent pregnancy, human immunodeficiency virus, and sexually transmitted infections: two systematic reviews for the Guide to Community Preventive Services. *Am J Prev Med*. 2012;42(3):272-294.

90. Eaton LA, Huedo-Medina TB, Kalichman SC, et al. Meta-analysis of single-session behavioral interventions to prevent sexually transmitted infections: implications for bundling prevention packages. *Am J Public Health*. 2012;102(11):e34-e44.

91. U.S. Department of Health and Human Services. Strong African American Families-Teen (SAAF-T). Rural Assistance Center, https://www.raconline.org/success/project-examples/788. Published March 17, 2015. Accessed August 10, 2015.

92. U.S. Department of Health and Human Services. Rapid HCV Testing as an HIV Testing Strategy in Rural Areas. Rural Assistance Center, https://www.raconline.org/success/project-examples/735. Updated October 1, 2014. Accessed August 10, 2015.

93. U.S. Department of Health and Human Services. Healthy Families Arkansas (HFAR). Rural Assistance Center, https://www.raconline.org/success/project-examples/49. Updated June 2, 2015. Accessed August 10, 2015.

Suggested Chapter Citation:

McMaughan D, Hugill-Warren L, Pavão C.A.O. Sexual Health and Family Planning in Rural United States: Updates and Challenges. In: Bolin JN, Bellamy G, Ferdinand AO, et al. eds. *Rural Healthy People 2020.* Vol. 2. College Station, TX: Texas A&M University Health Science Center, School of Public Health, Southwest Rural Health Research Center; 2015:75-85.

INJURY AND VIOLENCE PREVENTION IN RURAL AMERICA

By Darcy McMaughan, PhD, and Szu-Hsuan Lin, PhD

SCOPE OF THE PROBLEM

- Over 30 million nonfatal injuries occurred in 2013,[1] and almost two hundred thousand people (190,385) died from injuries in 2012.[2] Rates of agricultural injuries are higher in rural areas.
- Death notwithstanding, injuries and violence are also responsible for disability, poor mental health, higher health care costs, and lost work productivity.[3] Due to lack of access to health care, rural residents are more likely to go untreated for such injuries.
- The age-adjusted rate of death due to homicide declined between 2007 and 2013 to 5.2 per 100,000 populations.[4]
- Accidents and suicide (intentional self-harm) still rank among the top 15 causes of death; accidents rank fifth among all causes of death and suicide ranks tenth.[2,5]
- In order of magnitude, poisoning, motor-vehicle related injuries, firearm injuries, and falls accounted for the majority of fatal accidents (75 percent of all injury-related deaths).[5]
- Many forms of injury and violence are delineated along socio-economic disparities related to such characteristics as geographic location (rurality), sex, race, ethnicity, and socio-economic status,[6] and compounded by rural and urban differences.[7,8]

Far too many people in the United States are injured or die due to accidents, suicide, and violence, especially considering the preventable nature of many injuries and acts of violence. Injuries and violence exact a high toll on the American population, a toll that is potentially preventable. Thus, a goal of Healthy People 2020 is to prevent unintentional injuries and violence, and to reduce their consequences through: (1) modifying individual and social behaviors, (2) shaping the physical environment, and (3) increasing access to appropriate preventative and tertiary services.[3] Each of these target points for change are also important for rural America, as individual behaviors and social norms, the physical environment, and access to services are often cited as facilitating factors in health disparities between rural and urban areas.[9-11]

As a nation, the United States has made some gains in reducing the impact of unintentional injuries and violence. Homicide has, for the first time since 1965, fallen off the Centers for Disease Control and Prevention's list of top fifteen causes of death.[2] However, disparities still exist in the frequency and outcomes of injuries and violence.

The cost associated with nonfatal injuries and deaths in the United States is enormous. In 2010, the total costs for non-fatal hospitalized injuries were higher compared to costs for death and nonfatal treat-and-release injuries seen in the emergency room.[12] Injury not only impacts medical costs, but also costs due to lost work, for those who are at working age. In 2010, the estimated total medical cost for nonfatal hospitalized injuries was over 80 billion dollars, and the cost caused by lost work was estimated to be over 150 billion dollars.[12] Combined with death and nonfatal emergency room treat-and-release costs, 586 billion dollars was estimated for injuries and death.[12]

The following Healthy People 2020 goals are addressed in this chapter:

- **IVP-1** Reduce fatal and nonfatal injuries
- **IVP-11** Reduce unintentional injury deaths
- **IVP-12** Reduce nonfatal unintentional injuries
- **IVP-13** Reduce motor vehicle crash-related deaths
- **IVP-30** Reduce firearm-related deaths
- **IVP-33** Reduce physical assaults

- **OSH-1** Reduce deaths from work-related injuries
- **OSH-2** Reduce nonfatal work-related injuries

RURAL HEALTHY PEOPLE 2020 SURVEY OUTCOMES

A national survey of rural stakeholders (n=1214) was conducted in 2010 to identify the Healthy People 2020 objectives that were of highest importance for rural Americans.[13] Results of this survey provide the basis for the literature reviews found in volumes one[14] and two of *Rural Healthy People 2020* (RHP2020).

In a report based on results of the survey, Bolin and colleagues reported that "Injury and Violence Protection" was selected as a top ten health priority by 22 percent of respondents, ranking it as the 18th highest health priority for rural Americans.[13] There appeared to be little difference in the priority ranking of injury and violence prevention across the four United States Census Bureau (USCB) regions. In the ten Department of Health and Human Services (DHHS) regions, selection of the topic as a top ten priority was highest in Regions 10, 4 and 1 (33.3, 29.8, and 29.2 percent, respectively) and lowest in Regions 9, 6, and 2 (12.1, 13.9, and 15.8 percent, respectively). In a similar survey almost a decade ago, with a much smaller number of respondents, 26 percent of respondents had identified injury and violence protection as an important rural health priority, placing it in a two-way tie for the 13th most important priority.[15,p.5]

Respondents to the RHP2020 survey also identified important sub-objectives related to injury and violence prevention. Perceptions about the importance of the sub-objectives for rural Americans were recorded, as well as the feasibility of accomplishing the sub-objectives by 2020. Respondents indicated that the most important priority area for injury and violence prevention was domestic/sexual violence (23.6 percent), followed by sub-objectives related to education and prevention (13.8 percent) and motor vehicle and all-terrain vehicle accidents (13.8 percent).[16]

PREVALENCE AND DISPARITIES IN RURAL AREAS

The social and environmental context of rural communities in the United States can contribute to disparities in occurrences of injuries, violence, and death. Rural communities in the United States are unique (compared to America's more urban communities) in separateness. This separateness extends the physical distance between communities, and among residents within communities, and results in a loss of economic and social capital scale.[10] Travel distances, relative isolation, and difficulties in diffusing knowledge and innovation (related to separateness and lack of infrastructure) diminish the social connectedness and economic resources that can protect against injury and violence, and the associated negative outcomes. (See Cubbin, LeClere, and Smith,[9] 2000, and Link and Phelan,[11] 1995, for discussions on the relationship between social connectedness, economic status, injuries, and health).

In many instances, rural regions in the United States face higher rates of injury and violence than more urbanized areas. This is particularly true for intimate partner violence, suicide, fire-related death, accidental poisoning, and highway-related death. There are also variations in the epidemiology of injury and violence along race and ethnic origin, sometimes further defined within a rural population. In recent years, the Black population in the United States realized gains in life expectancy, narrowing the Black/white life expectancy gap. These gains result primarily from reduction in the death rates from health conditions such as heart disease, and also reductions in the rate of death due to unintentional injury.[2] Currently, the risk of death from unintentional injury is higher among whites compared to Blacks (the age-adjusted ratio is 0.8). Blacks are at a higher risk of premature death due to homicide compared to whites.[17]

Intimate Partner Violence

While there may be a general trend towards declining intimate partner homicides across the United States as a whole, some evidence points to an increasing trend of intimate partner homicide in rural America.[18] Rates of intimate partner violence during pregnancy among American women range from 0.9 percent to 20.1 percent; rates for women living in Appalachia were 14.6 percent to 28 percent.[19] Older women living in Southern, rural areas may be at a greater risk of experiencing severe intimate partner violence compared to younger rural women. In urban areas, however, younger women are at a greater risk compared to older women, although this may be an artifact of older women's willingness to report intimate partner violence.[20] Also, rural Hispanic women who experience intimate partner violence

may be more likely than rural non-Hispanic women to lack social support and to have dependent children in the home.[21] This may stem from perceptions of intimate partner violence among Hispanic men and women. Hispanic residents in rural America may not perceive intimate partner violence as a problem, or have knowledge of local domestic violence services (including how to obtain a protective order).[22] Black and multi-racial women still experience higher rates of physical and sexual violence than white women.[23]

Maternal injury and violence during pregnancy (generally reported in criminal files documenting intimate partner violence and abuse committed against pregnant women), documents that when a mother or infant is subjected to such violence there are higher risk factors for a myriad of poor health outcomes for both the mother and the infant (such as preterm labor and low birthweight).[24,25] Rural women who experience intimate partner violence are more likely to smoke tobacco or marijuana, drink alcohol, and use illicit drugs before and during pregnancy.[26]

Suicide

Suicide is the eleventh leading cause of death in the United States, with an age-adjusted mortality rate of 11.3 per 100,000 people.[27] The risk of death from suicide is higher (more than double) for whites compared to Blacks.[2] Suicide rates are higher in rural communities compared to urban communities.[28] People living in rural communities in the United States are 1.5 times more likely to die from suicide compared to people living in urban areas.[27] Not only are suicide rates higher in rural communities compared to urban communities, but the magnitude of the difference is far greater for suicide compared to other causes of mortality.[29] This difference in suicide rates between rural and urban areas remains even after adjusting for age, gender, race, mental health conditions, and access to mental health services.[30] Even so, rural residents who die from suicide are less likely to have had a prior mental health diagnosis or to have documented mental health care than urban resident who die from suicide, and rural residents are more likely to use a firearm to commit suicide.[31] Suicide rates are strongly related to rates of households with firearms.[32] Using local-level law enforcement agencies to perform background checks prior to firearm purchasing can reduce firearm related suicides.[33]

Alcohol plays a large role in suicide, with suicide completion associated with a higher likelihood of alcohol intoxication prior to death.[34] Rural residents, in general, have higher rates of alcohol consumption, making it imperative to address alcohol and substance use and abuse along with suicide prevention.[35] It is important to also note that about 4 percent of all deaths of men and about 1.5 percent of all deaths of women are due to injuries related to alcohol consumption. These rates may change based on population – populations that have higher drinking rates are at a greater risk of alcohol related deaths.[36]

Fire-related Death

Rural communities (in this instance, identified by the United States Census Bureau's definition of communities with less than 2,500 inhabitants) also have an arson or fire-related death rate that is twice as high as the national fire-related death average.[10] Rural residential fires are more likely to be caused by devices residents use to heat their homes and cook their meals, with 36 percent of rural residential fires caused by heating and 13 percent by cooking.[10] However, residential fire mortality in rural areas, while also most likely caused by heating (26 percent), are also frequently caused by smoking (23 percent) and electrical wiring (17 percent). Nearly three-quarters of these rural residential fires occur in homes with no working smoke detectors (73 percent) – slightly more than half of the homes (58 percent) had no smoke detector at all, and about 15 percent had smoke detectors that didn't work. In contrast, urban residential fires are most likely caused by smoking (28 percent), arson (17 percent), and then heating (12 percent), and urban homes are more likely to have smoke detectors (58 percent).[10]

AccidentalPoisoning

Accidental poisoning rates have risen in the United States from 9.0 per 100,000 population in 1999 to 15.6 per 100,000 population in 2006.[37] Death rates for accidental poisoning through drug use, particularly prescription medications and especially prescription opioids, have increased faster in rural areas (defined using metropolitian vs. nonmetropolitan county designations devised by the National Center for Health Statistics) compared to urban areas.[38] However, when exploring drug poisonings and geography using small-area techniques, the relationship becomes less clear. Certain rural areas (namely, Appalachia, parts of Northern California, Nevada, Arizona and New Mexico, Oklahoma, Florida, and parts of the Gulf Coast) have very high rates of drug poisonings, whereas other rural areas (such as North-Central United States and parts of Texas) have lower rates of drug poisoning).[39]

Highway-related Vehicular Deaths

Mortality due to motor vehicle accidents is consistently higher on rural highways compared to non-rural highways.[40,41] In a study of police-reported crashes between 2005 and 2007 in 11 states, crashes were more often associated with death for counties classified as rural or very rural.[41] Winding or high-speed, two-lane roads are often found in rural counties and may contribute to the higher numbers of blunt trauma injuries in rural areas. Motorists who are severely injured in crashes in rural counties are also more likely to die,[42] perhaps due in part to reduced access to emergency services in rural locations and longer distances to closest emergency care.

KNOWN CAUSES OF THE CONDITION/ PROBLEM

Many barriers to preventing or reducing injury and violence in rural America relate to contextual issues stemming from the geographic spread of rural communities. Studies show rural women have greater physical barriers to obtaining restraining orders, compared to urban women.[43] The distance to both socio-medical resources and criminal justice resources (i.e. police and courts) potentially diminishes the safety of rural women faced with intimate partner violence.[20] There are fewer support services such as women's shelters and homeless shelters in rural areas. This physical distance is compounded by additional barriers (such as inconsistent or biased processes) faced by rural women attempting to protect themselves from violence through the court system.[44]

Social Environment

Instances of injury, violence, and death are often quick and unexpected. The rapid and shocking nature of injury, violence, and death leads us to emphasize the immediate causes, and perhaps overlook the variety of social characteristics (such as marital and socioeconomic status) and conditions that affect the risk of injury and death.[45-47] Contextual issues also play a role in the increased risk of injury, violence, and death among rural residents. For example, gender inequality and patriarchy in male-dominated rural American communities may contribute to violence against rural women.[48,49]

Access to Services

Exploring characteristics among rural and urban suicide deaths, Searles and collegues (2014) found rural residents who completed suicide, while no more likely to have a mental health issue than urban residents who completed suicide. However, rural residents were more likely to lack access to mental health care and more likely to use a firearm for self-injury.[31] Similarly, rural women are as likely or sometimes more likely to experience intimate partner violence, but are less likely to have access to emergency medical or mental health care treatments or social supports.[50-55]

Physical Environment

Job or occupation is also a factor in unintentional injury. One of the main rural industries, agriculture, has one of the highest occupational fatality rates, and injury from farm machinery is a source of injury among rural inhabitants.[56,57] Agricultural-related injuries extend to children in rural areas, as family farm operations are exempt from many federal labor and safety regulations as they apply to children.[58,59] The risk of injury among children performing agricultural work increases as children perform developmentally inappropriate farm chores (meaning, they are at least two to three years younger than the suggested age for the chore).[60] Children in rural areas also have higher rates of firearms-related suicide and unintentional death than children living in urban areas. Children in urban areas, however, have higher rates of firearm-related homicides compared to rural children.[61]

PROPOSED SOLUTIONS OR INTERVENTIONS

Special-topic occupational therapy education programs, like the agricultural work-focused curriculum program developed at the **University of South Dakota**, train occupational therapists to: (1) work with agricultural workers with disabilities due to agricultural work injuries, and (2) educate agricultural workers on safer work practices.[62]

Using community-based education centers such as **Head Start** centers to disseminate violence prevention curriculum is another education-based avenue. Parents and family advocates have viewed the **Connected Kids: Safe, Strong, Secure** program presented through local Health Start centers in a favorable light.[63]

The **Pee Dee Coalition Against Domestic Violence and Sexual Assault** provides inter-personal violence support in several rural southwest clinics. Screening for intimate partner violence, especially among

pregnant women, can assist in understanding the extent of intimate partner violence in the community and available resources.[64] Of course, this necessitates filling in the many gaps in resource availability for rural women subjected to intimate partner violence. The **Pee Dee Coalition** support includes needs assessments, safety planning, education, and referrals to community services. The **Pee Dee Coalition** clinic-based program resulted in reductions in depression (measured through depression symptoms) and interpersonal violence (measured through scores on an interpersonal violence inventory).[65]

School nurses have an important role in identifying children who are potential victims of violence as they are often the sole primary health care source for school age children,.[66] School nurses are legally tasked to identify signs and symptoms of abuse, and assist students in obtaining necessary assistance. Continuing education models and training are available for school nurses.[66]

SUMMARY AND CONCLUSION

While the United States has made progress in reducing the impact of accidental injuries and violence, it still remains a critical public health issue despite its preventable nature. Like many public health issues, a number of societal and disparity-related factors influence the impact of this problem, such as the geographic (rural) status, social and physical environment, disparities in access to services, or race and ethnicity factors. Rural regions, in particular, show greater susceptibility to injury and violence than urban populations, primarily due to agriculture-based occupational hazards, as well as limited availability of socio-medical and criminal justice resources. Injuries and violence also contributes to other health issues, such as disabilities, poor mental health, higher healthcare costs, and lost work productivity. Programs designed to reduce the occurrence of injuries and violence in rural communities must consider individual behaviors and social norms, the physical environment, and access to services.

REFERENCES

1. Centers for Disease Control and Prevention (CDC). Nonfatal injury reports, 2001-2013. WISQARS. http://webappa.cdc.gov/sasweb/ncipc/nfirates2001.html. Updated March 28, 2013. Accessed January 14, 2015.

2. Murphy SL, Xu J, Kochanek KD. Deaths: final data for 2010. *Natl Vital Stat Rep*. 2013;61(4):1-117.

3. U.S. Department of Health and Human Services. Healthy People 2020 topics & objectives: Injury and violence prevention. HealthyPeople.gov. http://www.healthypeople.gov/2020/topics-objectives/topic/injury-and-violence-prevention. Accessed January 18, 2015.

4. U.S. Department of Health and Human Services. Healthy People 2020 leading health indicator topics: Injury and violence. HealthyPeople.gov. http://www.healthypeople.gov/2020/leading-health-indicators/2020-lhi-topics/Injury-and-Violence/data. Accessed July 20, 2015.

5. Centers for Disease Control and Prevention (CDC). Ten leading causes of death and injury-2014. Injury Prevention & Control: Data & Statistics (WISQARS). http://www.cdc.gov/injury/wisqars/leadingcauses.html. Accessed January 14, 2015.

6. Tolin DF, Foa EB. Sex differences in trauma and posttraumatic stress disorder: a quantitative review of 25 years of research. *Psychol Bull.* 2006;132(6):959-992.

7. Khorashadi A, Niemeier D, Shankar V, Mannering F. Differences in rural and urban driver-injury severities in accidents involving large-trucks: An exploratory analysis. *Accid Anal Prev.* 2005;37(5):910-921.

8. Zwerling C, Peek-Asa C, Whitten PS, Choi S-W, Sprince NL, Jones MP. Fatal motor vehicle crashes in rural and urban areas: decomposing rates into contributing factors. *Inj Prev.* 2005;11(1):24-28.

9. Cubbin C, LeClere FB, Smith GS. Socioeconomic status and the occurrence of fatal and nonfatal injury in the United States. *Am J Public Health.* 2000;90(1):70-77.

10. Gamache S, Hall JR Jr., Ahrens M, Penney G, Kirtley E. Mitigation of the rural fire problem: strategies based on original research and adaptation of existing best practices. *U.S. Fire Administration*. http://www.usfa.fema.gov/downloads/pdf/publications/MitigationRuralFireProblem.pdf. Published December 2007. Accessed July 26, 2015.

11. Link BG, Phelan J. Social conditions as fundamental causes of disease. *J Health Soc Behav.* 1995;Spec No:80-94.

12. Centers for Disease Control and Prevention (CDC). Data & statistics (WISQARS): Cost of injury

reports-2014. https://wisqars.cdc.gov:8443/costT/. Accessed January 14, 2015.

13. Bolin JN, Bellamy GR, Ferdinand AO, et al. Rural Healthy People 2020: New Decade, Same Challenges. *J Rural Health*. 2015;31(3):326-333.

14. Bolin JN, Bellamy G, Ferdinand AO, Kash BA, Helduser JW, eds. (2015). *Rural Healthy People 2020.* Vol. 1. College Station, Texas: The Texas A&M Health Science Center School of Public Health, Southwest Rural Health Research Center.

15. Gamm LD, Hutchison LL, Dabney BJ, Dorsey AM, eds. *Rural Healthy People 2010: A Companion Document to Healthy People 2010.* Volume 1. College Station, TX: The Texas A&M University System Health Science Center, School of Rural Public Health, Southwest Rural Health Research Center; 2003.

16. Southwest Rural Health Research Center, Rural Healthy People 2020 National Survey. 2015, Texas A&M Health Science Center. Unpublished data. Accessed May 18, 2015.

17. Rockett IR, Regier MD, Kapusta ND, et al. Leading causes of unintentional and intentional injury mortality: United States, 2000-2009. *Am J Public Health.* 2012;102(11):e84-e92.

18. Jennings WG, Piquero AR. Trajectories of non-intimate partner and intimate partner homicides, 1980-1999: the importance of rurality. *J Crim Justice.* 2008;36(5):435-443.

19. Campbell J, Garcia-Moreno C, Sharps P. Abuse during pregnancy in industrialized and developing countries. *Violence Against Women.* 2004;10:770-789.

20. Shuman RD Jr, McCauley J, Waltermaurer E, et al. Understanding intimate partner violence against women in the rural South. *Violence Vict.* 2008;23(3):390-405.

21. Denham AC, Frasier PY, Hooten EG, et al. Intimate partner violence among Latinas in eastern North Carolina. *Violence Against Women.* 2007;13(2):123-140.

22. Moracco KE, Hilton A, Hodges KG, Frasier PY. Knowledge and attitudes about intimate partner violence among immigrant Latinos in rural North Carolina: baseline information and implications for outreach. *Violence Against Women.* 2005;11(3):337-352.

23. Breiding MJ, Chen J, Black MC. Intimate partner violence in the United States-2010. U.S. Department of Health & Human Services, National Center for Injury Prevention and Control. https://www.ncjrs.gov/App/Publications/abstract.aspx?ID=267363. Published February 2014. Accessed July 24, 2015.

24. Martin SL, Mackie L, Kupper LL, Buescher PA, Moracco KE. Physical abuse of women before, during, and after pregnancy. *JAMA.* 2001;285(12):1581-1584.

25. Saltzman LE, Johnson CH, Gilbert BC, Goodwin MM. Physical abuse around the time of pregnancy: an examination of prevalence and risk factors in 16 states. *Matern Child Health J.* 2003;7(1):31-43.

26. Bailey BA, Daugherty RA. Intimate partner violence during pregnancy: incidence and associated health behaviors in a rural population. *Matern Child Health J.* 2007;11(5):495-503.

27. U.S. Cancer Statistics Working Group. *United States Cancer Statistics: 1999-2007 Incidence and Mortality Web-Based Report.* Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention and National Cancer Institute; 2010.

28. Gamm LD, Stone S, Pittman S. Mental health and mental disorders – a rural challenge: a literature review. In: Gamm LD, Hutchison LL, Dabney BJ, Dorsey AM, eds. *Rural Healthy People 2010: A Companion Document to Healthy People 2010.* Volume 2. College Station, TX: The Texas A&M University System Health Science Center, School of Rural Public Health, Southwest Rural Health Research Center*;* 2003:97-114.

29. Miller M, Azrael D, Barber C. Suicide mortality in the United States: the importance of attending to method in understanding population-level disparities in the burden of suicide. *Annu Rev Public Health.* April 2012;33:393-408.

30. McCarthy JF, Blow FC, Ignacio RV, IIgen MA, Austin KL, Valenstein M. Suicide among patients in the Veterans Affairs health system: rural-urban differences in rates, risks, and methods. *Am J Public Health*. 2012;102(Suppl 1):S111–S117.

31. Searles VB, Valley MA, Hedegaard H, Betz ME. Suicides in urban and rural counties in the United States, 2006-2008. *Crisis.* 2014;35(1):18-26.

32. Opoliner A, Azrael D, Barber C, Fitzmaurice G, Miller M. Explaining geographic patterns of suicide in the US: the role of firearms and antidepressants. *Inj Epidemiol*. 2014;1(1):e6.

33. Sumner SA, Layde PM, Guse CE. Firearm death rates and association with level of firearm purchase background check. *Am J Prev Med.* 2008;35(1):1-6.

34. Kaplan MS, Huguet N, McFarland BH, et al. Use of alcohol before suicide in the United States. *Ann Epidemiol*. 2014;24(8):588-592.

35. Kash BA, McMaughan D, Hutchison L, Tan D. Substance abuse trends in rural America. In: Bolin JN, Bellamy G, Ferdinand AO, Kash BA, Helduser JW, eds. *Rural Healthy People 2020*. Vol. 1. College Station, TX: Texas A&M University Health Science Center, School of Public Health, Southwest Rural Health Research Center; 2015:73-82.

36. Keyes KM, Liu XC, Cerda M. The role of race/ethnicity in alcohol-attributable injury in the United States. *Epidemiol Rev*. 2012;34:89-102.

37. Bohnert AS, Fudalej S, Ilgen MA. Increasing poisoning mortality rates in the United States, 1999–2006. *Public Health Rep*. 2010;125(4):542-547.

38. Paulozzi LJ, Xi Y. Recent changes in drug poisoning mortality in the United States by urban–rural status and by drug type. *Pharmacoepidemiol Drug Saf.* 2008;17(10):997-1005.

39. Rossen LM, Khan D, Warner M. Hot spots in mortality from drug poisoning in the United States, 2007–2009. *Health Place*. March 2014;26:14-20.

40. Welki AM, Zlatoper TJ. The impact of highway safety regulation enforcement activities on motor vehicle fatalities. *Transport Res E-Log.* 2007;43(2):208-217.

41. Peura C, Kilch JA, Clark DE. Evaluating adverse rural crash outcomes using the NHTSA State Data System [published online ahead of print June 24, 2015]. *Accid Anal Prev*. 2015;82:257-262.

42. Travis LL, Clark DE, Haskins AE, Kilch JA. Mortality in rural locations after severe injuries from motor vehicle crashes. *J Safety Res.* 2012;43(5-6):375-380.

43. Dudgeon A, Evanson TA. Intimate partner violence in rural U.S. areas: what every nurse should know. *Am J Nurs.* 2014;114(5):26-35; quiz 36, 48.

44. Logan TK, Shannon L, Walker R. Protective orders in rural and urban areas: a multiple perspective study. *Violence Against Women.* 2005;11(7):876-911.

45. Branas CC, Nance ML, Elliott MR, Richmond TS, Schwab CW. Urban–rural shifts in intentional firearm death: different causes, same results. *Am J Public Health.* 2004;94(10):1750-1755.

46. Denney JT, He M. The social side of accidental death. *Soc Sci Res.* 2014;43:92-107.

47. Hosking J, Ameratunga S, Morton S, Blank D. A life course approach to injury prevention: a "lens and telescope" conceptual model. *BMC Public Health.* September 8 2011;11:695.

48. Archer J. Cross-cultural differences in physical aggression between partners: a social-role analysis. *Pers Soc Psychol Rev*. 2006;10(2):133-153.

49. Moghadam VM. Patriarchy in transition: women and the changing family in the Middle East. *J Comp Fam Stud.* 2004;35:137-162.

50. Adler C. Unheard and unseen. Rural women and domestic violence. *J Nurse Midwifery.* 1996;41(6):463-466.

51. Few AL. The voices of Black and White rural battered women in domestic violence shelters. *Fam Relat.* 2005;54(4):488-500.

52. Johnson M, Elliott BA. Domestic violence among family practice patients in midsized and rural communities. *J Fam Pract.* 1997;44(4):391-400.

53. Lanier C, Maume MO. Intimate partner violence and social isolation across the rural/urban divide. *Violence Against Women.* 2009;15(11):1311-1330.

54. Struthers CB, Bokemeier JL. Myths and realities of raising children and creating family life in a rural county. *J Fam Issues.* 2000;21(1):17-46.

55. Websdale N. Rural woman abuse: the voices of Kentucky women. *Violence Against Women.* 1995;1(4):309-338.

56. Jawa RS, Young DH, Stothert JC, et al. Farm machinery injuries: the 15-year experience at an urban joint trauma center system in a rural state. *J Agromedicine.* 2013;18(2):98-106.

57. National Safety Council. *Injury Facts, 2010 Edition.* Itasca, IL: National Safety Council; 2010.

58. Hendricks KJ, Layne LA, Goldcamp EM, Myers JR. Injuries to youth living on U.S. farms in 2001 with comparisons to 1998. *J Agromedicine.* 2005;10(4):19-26.

59. McCurdy SA, Kwan JA. Agricultural injury risk among rural California public high school students: prospective results. *Am J Ind Med.* 2012;55(7):631-642.

60. Larson-Bright M, Gerberich SG, Alexander BH, et al. Work practices and childhood agricultural injury. *Inj Prev.* 2007;13(6):409-415.

61. Nance ML, Carr BG, Kallan MJ, Branas CC, Wiebe DJ. Variation in pediatric and adolescent firearm mortality rates in rural and urban US counties. *Pediatrics.* 2010;125(6):1112-1118.

62. Smallfield S, Anderson AJ. Addressing agricultural issues in health care education: an occupational therapy curriculum program description. *J Rural Health.* 2008;24(4):369-374.

63. Cowden JD, Smith S, Pyle S, Dowd MD. Connected kids at Head Start: taking office-based violence prevention to the community. *Pediatrics.* 2009;124(4):1094-1099.

64. Bhandari S, Bullock LF, Anderson KM, Danis FS, Sharps PW. Pregnancy and intimate partner violence: how do rural, low-income women cope? *Health Care Women Int.* 2011;32(9):833-854.

65. Coker AL, Smith PH, Whitaker DJ, Le B, Crawford TN, Flerx VC. Effect of an in-clinic IPV advocate intervention to increase help seeking, reduce violence, and improve well-being. *Violence Against Women.* 2012;18(1):118-131.

66. Grace LG, Starck M, Potenza J, Kenney PA, Sheetz AH. Commercial sexual exploitation of children and the school nurse. *J Sch Nurs.* 2012;28(6):410-417.

Suggested Chapter Citation:

McMaughan D, Lin S. Injury and Violence Prevention in Rural America. In: Bolin JN, Bellamy G, Ferdinand AO, et al. eds. *Rural Healthy People 2020.* Vol. 2. College Station, TX: Texas A&M University Health Science Center, School of Public Health, Southwest Rural Health Research Center; 2015:87-94.

SOCIAL DETERMINANTS OF HEALTH: IMPLICATIONS FOR RURAL AMERICA

By Alva O. Ferdinand, DrPH, JD

SCOPE OF THE PROBLEM

- Certain factors, such as employment status, neighborhood quality, food security, educational attainment, and exposure to violence, have been shown to have bearings on individual and community health.
- Residents of rural communities often face challenges in obtaining quality housing and food.
- Improvements in unemployment rates have lagged in rural areas relative to urban areas, thus contributing to disparities in socioeconomic status.
- Upwards of seven million rural households spend more than 30 percent of their monthly income on housing costs, thus rendering their housing "unaffordable."
- Low rates of high educational attainment are prevalent in some rural regions and have been shown to be correlated with poverty and poor health status.
- Exposure to violence is a growing concern in rural communities, with implications for neighborhood quality, stress, and educational commitment and attainment, among other factors.

Greater appreciation for and focus on the social determinants of health have evolved over the last decade, both in the United States[1-3] and worldwide.[4] Generally, social determinants of health refer to "the complex, integrated, and overlapping social structures and economic systems that are responsible for most health inequities."[5] Stated alternatively, social determinants of health "represent nonmedical factors that affect both the average and distribution of health within populations, including distal determinants (political, legal, institutional, and cultural factors) and proximal determinants (socioeconomic status, physical environment, family and social networks, and demographics)."[6] The social determinants of health encompass the circumstances in which people are born, live, work, and age, and the systems in place to treat ill persons.[7] Thus, social determinants of health involve local, state, and federal policies, programs, and institutions, as well as private sectors and community factors.[8]

Though the United States has experienced significant reductions in the prevalence of certain health outcomes over the last decade, much of these improvements were as a result of increased medical research, advances in treatment protocols, and prevention efforts.[1] While these improvements should have been correlated with considerable reductions in disease burden among all socioeconomic groups in the U.S., certain groups of people continue to bear most of the burden. Socioeconomically disadvantaged groups often face suboptimal living and work conditions that impact health and perpetuate health disparities. As such, many scholars, agencies, policymakers, clinical, and public health practitioners alike have recognized the need to address health in a more comprehensive manner that includes an examination of where population groups live, work, learn, engage in recreational activities, and access health care.

The national dialogue about the determinants of health and health disparities has centered on critical differences in access to quality health care among various regional, ethnic, racial, and socioeconomic groups.[9] Yet, many other factors that are not directly related to accessing quality health care play pivotal roles in health outcomes. Some of these factors include, but are not limited to:

- Availability of resources to obtain and maintain daily needs (e.g. housing and nutritious food
- Access to educational and economic opportunities

- Quality of education and job training
- Availability of community resources that support recreational and leisure-time activities
- Transportation options
- Social support
- Protection from crime, violence, and social disorder
- Socioeconomic conditions (e.g. concentrated poverty and accompanying stressful conditions)
- Residential segregation
- Language and literacy
- Culture
- Access to emerging technologies (e.g. cell phones, the internet, social media, etc.)[10]

Social determinants' roles in health have been noted throughout the history of public health in the U.S. For example, public health strategies to control infectious diseases in the U.S. entailed ensuring access to and availability of clean water and nutritious food, improved waste disposal, and adequate housing.[6] Moreover, public health strategies aimed at addressing accidental injuries have entailed laws that regulate risk factors associated with occupational and traffic-related injuries.[6] Additionally, public health interventions aimed at reducing the burden of chronic diseases in the U.S. have included prevention programs and policies that reduce risk by containing exposure to second-hand smoke, reducing dietary fat and salt, and adhering to preventive screening protocols.[6]

HEALTHY PEOPLE 2020 GOALS AND OBJECTIVES

The goal of Healthy People 2020's social determinants of health objectives is to "create social and physical environments that promote good health for all." [10] This goal is one of just four overarching goals for the current decade.[8] The U.S. Department of Health and Human Services (DHHS) has noted that every person should have the wherewithal to achieve the highest attainable level of health, regardless of differences in rural/urban residence, race, ethnicity, religion, socioeconomic status, physical and mental disability or any other distinctions that have been associated with marginalization in society.[8]

In justifying the focus on social determinants of health, the DHHS provided three rationales. The first rationale is that health is not fully achieved by just controlling disease.[8] Achieving health also involves "assuring the conditions in which people can be healthy." The second rationale is that achieving health equity is critical to population health. Reducing inequalities in the social and physical environments can significantly facilitate the improvement of health behaviors.[8] The third rational is that population health has significant bearing on prosperity and security at the national level. Scholars have estimated that approximately $260 billion of labor time is lost because of the burden of disease each year.[11]

The Healthy People 2020 objectives that are aimed at addressing social determinants of health are captured under five main headings: (1) economic stability, (2) education, (3) health and health care, (4) neighborhood and built environment, and (5) social and community context. Because a focus on the social determinants of health was not included in previous iterations of Healthy People, some of the objectives for this decade serve to capture baseline measures. Some of the specific objectives include:

Economic Stability

- **SDOH-3** Proportion of persons living in poverty
- **SDOH-4** Proportion of households that experience housing cost burdens
- **NWS-12** Eliminate very low food security among children
- **NWS-13** Reduce household food insecurity and in doing so, reduce hunger

Education

- **SDOH-2** Proportion of high school completers who were enrolled in college the October immediately after completing high school
- **AH-5.1** Increase the proportion of students who graduate with a regular diploma four years after starting 9th grade
- **DH-20** Increase the proportion of children

with disabilities, birth through age two years, who receive early intervention services in home or community-based settings

- **EMC-2.3** Increase the proportion of parents who read to their young child

Neighborhood and Built Environment

- **AH-11.1** Reduce the rate of minor and young adult perpetration of violent crimes
- **IVP-29** Reduce homicides
- **IVP-33** Reduce physical assaults
- **IVP-42** Reduce children's exposure to violence

Social and Community Context

- **AH-3.1** Increase the proportion of adolescents who have an adult in their lives with whom they can talk about serious problems
- **DH-17** Increase the proportion of adults with disabilities who report sufficient social and emotional support

RURAL HEALTHY PEOPLE 2020 SURVEY OUTCOMES

A national survey was conducted in 2011-2012 to determine how rural stakeholders ranked the Healthy People 2020 objectives in light of their importance for rural-dwelling Americans.[12] The overall percentage of rural stakeholders who identified "Social Determinants of Health" as a top ten priority health issue was 21.3 percent (n=1214), making it the 19th highest priority for rural Americans. Findings were similar across the four United States Census Bureau regions, ranging from 20.6 to 22.8 percent. In this nationwide survey, respondents identified several sub-objectives important to social determinants of health for rural areas (in rank order), poverty/income, education, race/ethnicity, healthy lifestyle, housing, and employment (Southwest Rural Health Research Center, 2015, unpublished data).

DISPARITIES IN RURAL AREAS

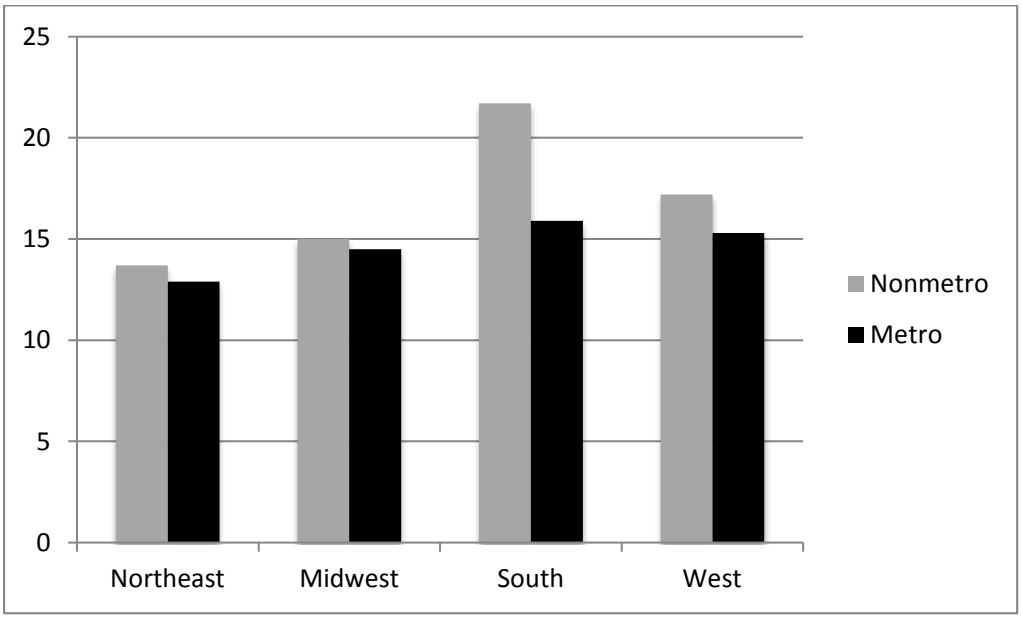
Income Disparities and Economic Stability

In the last decade, U.S. residents in all economic ranks faced significant economic burdens. More specifically, in December 2007, the U.S. experienced the most severe long-lasting recession since the Great Depression of 1929.[13] The Great Recession, as the most recent recession is commonly called, not only affected individuals in various economic classes, but also affected all areas on the U.S. Nevertheless, some areas of the country fared better than others. According to the United States Department of Agriculture (USDA) Economic Research Service, rural counties generally saw slightly higher rates of unemployment than urban areas during Great Recession.[14] Moreover, though the Great Recession ended in June 2009, employment growth in rural areas has lagged behind growth in urban areas.[14] Researchers have posited that the relationship between employment growth rates and the share of the adult population that are college graduates is one of the explanations for this trend.[14] Generally, the proportion of rural populations that is college-educated is lower than proportions in urban populations.[14] Further, lags in employment growth in rural communities have also been due to higher proportions of older individuals in rural workforces relative to urban workforces.[14]

Poverty rates are generally higher in rural counties than they are in urban counties.[15] Despite this generalization, certain regions of the U.S. have persistently experienced higher rates of poverty than others. For example, the gap between poverty rates in urban and rural areas in the U.S. South has historically been in the widest in the country (**Figure 1**).[15]

Given that approximately 43 percent of the rural population in the U.S. lives in the South, the differences in poverty rates among urban and rural areas renders significant implications for economic stability in this region. Among the most historically poverty-stricken counties in the U.S. are some that are located in Appalachia and the Mississippi Delta, as well as those that encompass Native American lands.[15] In addition to historically poverty-stricken counties in the U.S., economists at the USDA have examined the persistence of poverty over time.[15] The Economic Research Service (ERS) at the USDA has classified counties as being in persistent poverty if 20 percent or more of their populations have lived in poverty over the last 30 years.[15] Using this definition, the ERS has determined that there are currently 353 persistently poor counties in the U.S., with 301 of them located in non-metropolitan settings.[15] Furthermore, approximately 84 percent of persistently poor counties are located in the U.S. South.[15]

Figure 1: Poverty Rates by Region and Metro/Non-Metro Status, 2009 – 2013



Source: USDA Economic Research Service using data from the U.S. Census Bureau, American Community Survey.[15]

According to the U.S. Census Bureau, approximately 16 million residents of non-metropolitan areas were living in poverty in 2010.[16] This was an increase from the 11 million non-metropolitan residents that were living in poverty in 2000, and was statistically significant.[16] Rural areas saw the greatest percentage point increases in the proportion of people living in poverty-stricken areas between 2000 and 2010.[16]

The rapid growth of Latino immigrant populations in rural areas has garnered attention due to the fact that despite they play a significant role in the agricultural contributions of the U.S., they often lack the resources to meet their basic needs.[17] For example, the rate of Latino food insecure persons is nearly double that of the national rate, with factors such as language and cultural barriers, and poor quality housing playing a role in the resources needed to avoid food insecurity.[17] Acculturation and citizenship status are also factors that play a role in food insecurity among Latino populations.[17]

Several studies have highlighted the relationship between household income and health status.[18-23] Generally, researchers have noted that individuals with low-income levels experience worse outcomes, and patterns of health care utilization than higher income individuals.[24,25] These disparities in behaviors, patterns, and outcomes often span the life cycle, beginning in utero and having implications on elderly health.[25] Maternal low-income status has been found to be associated with several risk factors for adverse birth outcomes such as smoking, chronic illness, single and/or teen motherhood, urogenital tract infections, and unplanned pregnancy, among others.[25]

Housing Burdens

In 2010, there were over 30 million housing units in rural America, comprising 23 percent of the housing components in the U.S.[26] While home ownership rates in rural communities tend to be higher than national rates, ownership varies across racial and ethnic groups in these communities.[26] Minorities residing in rural settings have had substantially lower homeownership rates relative to their white non-Hispanic counterparts.[26] Nevertheless, the ownership rate of rural minorities is higher than that of non-rural minorities by approximately eight percentage points.[26] The rural African American homeownership rate declined the most among rural residents in the wake of the recent economic downturn.[26]

According to the United States Department of Housing and Urban Development (HUD), housing costs that exceed 30 percent of gross household income are unaffordable, and households that spend more than this amount on housing costs are considered "cost burdened."[27] It has been estimated that more than seven million rural households spend more than 30 percent of their monthly incomes in housing-associated costs.[26] Cost burdened individuals and households tend to move more often than their higher-income counterparts.[28] Frequent moves have several detrimental effects on children's health

outcomes, such as risk-taking and other behavioral problems.[29] Other challenges that come about as a result of frequent moving include disruptions in access to health care services, and lower rates of immunization visits.[28]

It has been noted in the literature that despite trends of out-migration from rural to urban areas, in-migration is also occurring among low-income urban individuals seeking more affordable housing opportunities, and a perceived better quality of life.[30,31] When asked about the specific factors that drew some research participants to relocate to rural areas, respondents mentioned the availability, affordability, and quality of housing as some of the compelling influences.[31] This trend of inward migration has been especially seen in non-metropolitan areas that are adjacent to metropolitan areas.[31] Other factors leading some individuals to leave urban areas were unstable housing environments, high housing costs, and low-quality, and unsafe housing and neighborhoods.[31] Nevertheless, once housing is obtained, urban individuals moving to rural areas often face challenges in securing employment.[31] More specifically, some of the barriers to obtaining gainful employment include temporary job placements, minimal levels of low-skilled employment opportunities, few childcare options amenable to shift work, perceived and actual racial disparities, as well as diminished access to public and private transportation.[31,32]

With respect to physical housing conditions, it has been estimated that over nine million housing establishments in the U.S. have moderate to severe structural deficiencies.[33] While dilapidated and structurally compromised houses have generally diminished across the United States, substandard housing continues to exist in certain subpopulations, including those located in non-metropolitan areas.[26] According to results from the American Housing Survey conducted in 2009, 1.5 million housing units in non-metropolitan areas were moderately to severely substandard.[26] This equates to 5.8 percent of rural homes that are not considered safe residential dwellings.[26] This proportion of unsafe or substandard housing is slightly above that of the national proportion.[26]

It has been noted that residence in substandard housing is associated with unwanted health outcomes.[34,35] Housing that is characterized by faulty electrical wiring and plumbing, a deteriorating foundation, broken windows, and/or compromised walls and roofing is considered to be substandard. Health outcomes that can stem from substandard housing include lead poisoning, which affects brain and nervous system development in children, and physical injury from steep staircases, inadequate safety devices on windows, malfunctioning smoke detectors and inadequate heating systems, among other things.[36] Moreover, respiratory conditions such as asthma can be exacerbated by dampness and indoor allergens in substandard housing units.[36] According to the Robert Wood Johnson Foundation Commission to Build a Healthier America, nearly 40 percent of the 6.7 million children diagnosed with asthma in the U.S experience this respiratory condition due to residential exposures.[36]

Household Food Security

Household food security is defined as, "the assured access of all people to enough food for a healthy and active life." [37] Food insecurity arises when individuals' access to adequate food is limited. It has been estimated that approximately 15 percent of U.S. households were food insecure throughout 2012, with this prevalence being unchanged since 2008. [38] According to the USDA, food insecurity was more prevalent in large cities and rural areas relative to that in suburban areas.[38] The relationship between food insecurity and increasing numbers of individuals on public assistance for food is well documented in the literature.[39,40] [41,42]

Rural America has seen significant changes in its economic foci and demographics, as well as declines in job opportunities, which have all contributed to food insecurity and the creation of "food deserts."[39] According to the USDA, food deserts are "urban neighborhoods and rural towns without ready access to fresh, healthy, and affordable food."[43] The agency has also estimated that 2.3 million individuals reside in rural, low-income areas in which the nearest supermarket is more than ten miles away.[43] Researchers have examined the reasons for increasingly disparate access to fresh, healthy, and affordable food. In their study of food availability in the rural South, Blanchard and Lyson discussed the impact that "big box general merchandisers" have had on local and regional grocers.[44] The big box general merchandisers have created hybrid superstores that combine food with a wide array of household products, thereby restructuring the way in which residents secure food, and the distribution of food retailers throughout rural America.[44]

Alabama, Arkansas, Oklahoma, and Texas have the highest percentages of counties that are classified as food deserts among the southern states.[44] Rural counties in portions of western Texas and Oklahoma have constituted the largest food desert regions in the U.S. South.[44] Significant numbers of food deserts can also be found in the Appalachian regions of West Virginia and Kentucky, the Mississippi Delta, as well as the "Black Belt,"[44] which comprises of a broad range of counties in the U.S. South characterized by a history of plantation agriculture and a high percentage of African American residents. The Black Belt can be found in 11 states (Alabama, Arkansas, Florida, Georgia, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee, Texas, and Virginia).[45] Common to food desert counties in rural areas are higher percentages of individuals that have not completed high school, lower median family incomes, greater percentages of older individuals, and higher family and individual poverty rates.[46] Despite the fact that 70 percent of Americans consume diets that should be drastically improved, low income individuals and those with less than high school educational attainment tend to consume the lowest quality diets.[47]

Educational Attainment

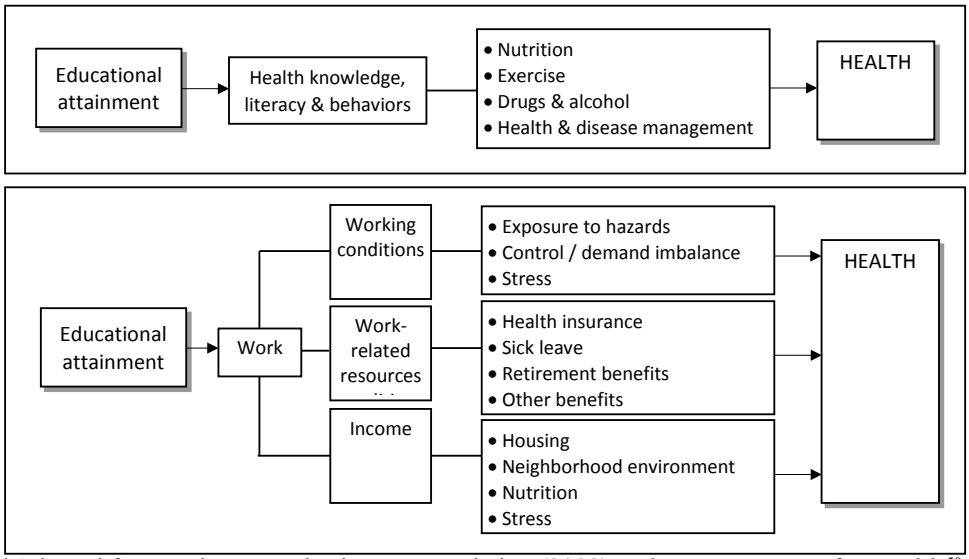
Educational attainment has been shown to be an important social determinant of health, having bearings on food security and home ownership status, among other things.[20,32,48,49] Researchers have identified several pathways through which educational attainment impact individual and collective health status (**Figure 2**).

Generally, educational attainment is instrumental in developing human capital in a given geographical region. Rural counties are often characterized by low rates of high educational attainment.[49] Previous research has shown that rural residents with lower levels of educational attainment (e.g. less than high school) were more likely to rate their health as "poor."[20] Despite significant improvements in educational attainment levels in the U.S. generally over the last several decades, these improvements have not been experienced in all regions.[51] Areas such as the Research Triangle in North Carolina and the Silicon Valley in California have seen increased numbers of highly educated residents, whereas large pockets of educational deprivation continue to exist in the rural U.S. South.[51] Persistent gaps in educational attainment have also been seen between rural Appalachian communities and the U.S.[52] Adding to lags in educational attainment in certain rural areas is the exponential growth of minority populations, particularly Hispanic groups with lower levels of high school and college educational attainment.[52] "Brain-drain", which is a term commonly used to refer to the phenomenon of well-educated residents moving to other locations,[51] has also occurred in rural areas, and regions such as the Midwestern states, and areas comprising of the Great Lakes.[51,53]

Educational attainment has been shown to be correlated with poverty, as education strongly impacts one's income level.[54] Previous research has shown that the odds of living in poverty are between 1.2 and 2.3 times higher for people residing in rural areas relative to residents of urban areas.[55] One explanation that has been discussed in the literature is that individuals might choose to live in rural communities because of the high proportion of entry-level positions and low living costs in those areas.[54] A high percentage of the jobs in rural areas comprise of low-skill positions.[54] This has implications for sustained limited capital in rural areas.

In their study of the relationship between educational attainment and risk of death, Probst and colleagues found that more than 50

Figure 2. Influence of Education on Health



*Adapted from Robert Wood Johnson Foundation (2009). *Education Matters for Health.*[50]

percent of rural Hispanics and blacks had less than a high school education, with most of them residing in the U.S. West and South.[56] Educational attainment was found to be one of the important factors in increased death risk among rural minorities.[56] Additionally, educational attainment levels less than college was found to be associated with premature death.[56]

Neighborhood Quality and Conditions

Neighborhood quality has been widely discussed in both the peer-reviewed and non-peer reviewed literature as playing a significant role in individual and collective health status.[57-62] Neighborhood conditions have been shown to be correlated with risk factors for certain chronic and respiratory conditions, birth outcomes, mortality, disability, as well as violence-related injuries, mental health problems, and general health status.[63,64]

While rural neighborhoods have traditionally been perceived as less prone to the incidence of criminal activity and violence, recent research has demonstrated that these activities are becoming increasingly problematic in these areas.[65,66] In their examination of exposure to violence among teenagers, Mink and colleagues found that rural teens were, in certain instances, more likely than non-rural teens to be exposed to violence.[66] For example, rural teens were more likely than non-rural teens to carry a weapon during the past thirty days.[66] Researchers have also found that contrary to what is commonly believed, rural residence does not have a protective effect with respect to exposure to violence.[65,66] Moreover, research exploring the relationship between violent and criminal behaviors among African American youth showed that exposure to violence was associated with educational commitment, risk proneness, and overall self-esteem.[65] Domestic and intimate partner violence is also a major concern in rural America. A thorough discussion of these issues can be found in the previous chapter titled, "Injury and Violence Prevention in Rural America."

Previous research has investigated environmental hazards in rural areas.[60,64,67] Residential malodors in rural areas are often the result of nearby solid waste landfills, waste-water treatment plants, and industrialized animal and chemical operations.[60] It has been noted in the literature that sustained malodors arising from livestock production facilities pose considerable hardships for human health and general quality of life in rural areas.[64,67,68]

In addition to malodors, rural residents are also often exposed to pesticides and other chemicals due to farming. Pesticide and other farming-related chemical exposures have been shown to be associated with increased morbidity and mortality among individuals residing in close proximity to agricultural fields treated with such chemicals.[69] Pesticide exposure has been associated with reduced motor and neurological functions, lung cancer, and other chronic respiratory conditions.[69] Moreover, these chemical exposures have been also found to be associated with reproductive and developmental abnormalities among neighboring residents.[69] In their study of patterns of agricultural pesticide exposure, Griffith and colleagues found that rural counties in the U.S. South with higher proportions of low-income, minority populations spent approximately eight times more money on pesticides than counties with lower proportions of minorities.[69] This finding indicates that minorities in the South may be bearing substantial health burdens with respect to farming-related chemical exposures and their associated health outcomes.

Social Support and Community Context

Social support refers to the availability of several stress resistance resources that contribute to positive outcomes.[70] Previous research has shown that having people in one's life to provide emotional, tangible, and informational support can have important and impactful implications for overall wellbeing during stressful times.[70,71] When these resources are not available, negative outcomes, such as depression and non-adherence to medication routines can occur.[70] In a study of rural women living with HIV, Vyavaharkar and colleagues found that satisfaction with social support was one of the best positive predictors for adherence to HIV medications.[70]

In addition to adherence with medication routines, social support also has implications for how individuals perceive their neighborhoods. In a study examining the perceptions of rural and urban youth relative to feelings of safety and neighborhood organization, researchers found that African American youth who had higher levels of social support and capital tended to view their neighborhoods as safe and sufficiently organized to lead productive and healthy lives.[72] Social support is also an important factor for immigrants that relocate to rural areas. Research that has investigated the role of social support for individuals emigrating from Mexico to rural America has shown that social

capital is critical to movement and adaptation to new residential and occupational settings.[73]

PROPOSED SOLUTIONS OR INTERVENTIONS

Improvements in the conditions in which people are born, live, work, and seek health care require the joint efforts of health care and public health professionals, community leaders, researchers, business enterprises, and policymakers. Given the complex and deep-seated relationships between social and physical environments and health status, multiple approaches are needed. It has been noted in the peer-reviewed literature that specific programmatic examples aimed at improving the social determinants of health are lacking.[74] Nevertheless, various organizations have been implementing programs and strategies aimed at addressing individual social determinants of health.

The Rural School and Community Trust, for example, has been working to address the issue of educational adequacy in rural communities.[75] Generally, educational adequacy refers to the level of funding required for schools to provide education at high standards, with the underlying premise that every child should receive high-quality education and support services that equips him or her with the knowledge and skills required to reach their full potential.[75] The Rural School and Community Trust, a non-profit organization, has suggested several strategies for improving educational outcomes in rural settings. Some of these suggestions include, but are not limited to, greater investments in educational resources for rural schools relative to non-rural schools, small-scale schooling, salary adjustments that would entice highly qualified teachers to live, work and become long-term residents of rural communities, and improved parent and community involvement in rural educational experiences and governance.[75] Improvements in rural educational efforts can serve to have important implications for bettered job and income trajectories among rural residents.

In regard to food insecurity in rural regions, many actors such as non-profit organizations, faith-based organizations, low-income residents, and other consumers have engaged in enhancing food systems and access. Community gardens, farmers' markets, culinary and agricultural programs, and the promotion of local and culturally appropriate foods have been avenues for improvements in food security and community development in rural settings.[76] Other strategies have included the conducting of food assessments, which fosters comprehensive awareness around the issue of food security and inclusion of low-income residents in evaluating their food systems and being actively involved in improvement efforts.[76] The creation of food policy councils at the local level has also been suggested as a mechanism for promoting collaborations among various food and agriculture stakeholders. These councils have served to educate the general public, policymakers and siloed organizations about current food security needs and opportunities for coordination and collaboration.[76] The aforementioned programs and initiatives can serve to effectively address the issue of household food insecurity among rural populations.

Recognizing the need for improved housing conditions among some rural residents, the USDA has continued to make single family housing repair loans and grants available to low-income, rural homeowners.[77] Additionally, the USDA has continued to designate housing loans and grants specifically for farm laborers.[78] Further, the USDA has designed and implemented rural business developmental grants, which is geared toward the expansion and/or development of small and emerging private rural businesses.[79] If tapped into, these programs have the ability to positively affect the proportion of rural households that experience housing costs burdens and reside in substandard housing conditions.

COMMUNITY MODELS KNOWN TO WORK

Over the last decade, several advisory and work groups, as well as task forces have been actively launching novel programs aimed at improving the conditions in which residents in rural communities are born, live, work, and receive health care. The following are examples of community models that have been effective in improving some various determinants of health in rural America.

Chronic Users System of Care (CUSOC), based in Mendocino County, California, was started in 2011 as a case management program to provide services to persons and families affected by co-occurring substance abuse and chronic health conditions.[80] The majority of CUSOC clients were frequent utilizers of emergency departments. Partnerships with healthcare providers, law enforcement, and drug treatment facilities allowed this 501c3 to identify individuals in need of services and their barriers to recovery. The greatest barrier among the first 100 clients served was housing. In 2013, CUSOC was adopted by the Mendocino County AIDS/Viral Hepatitis Network[81] under a new name – Recovery Oriented System of

Care. Once identified, clients have access to a variety of services including referrals, medical monitoring, assessments, treatment services, and housing and financial assistance.

Youth Emergency Services (YES), Inc. Housing and Independent Living Program[82,83] is based in Gillette, Wyoming. The program, known as Y.E.S. House, serves five to 21-year-old youth and adolescents who need assistance for foster care, crisis housing, advocacy, rehabilitation, education, and counseling. Originally funded by a Community Services Block Grant, the goal of the program is to provide young people, many of whom are low-income and/or troubled youth, with the tools to become stable and self-sufficient.

Women to Women Online Support Network is an evidence-based program for women who live in rural or isolated areas and suffer from a chronic condition.[84] The program provides support, largely through internet-based interventions, educational programs, and support groups. From 1997 to 2010, the original project was delivered in eight northwestern states, by the Montana State University College of Nursing, to women living more than 25 miles away from a city. Presented in three different phases, reproducibility has always been stressed. A plethora of literature exists to report the effectiveness of the program on: improvements in self-esteem,[85] reductions in psychological distress, such as depression,[86] and improvements in self-efficacy.[87]

Pathways Community Hub,[88,89] administered by Northeast Oregon Network (NEON) in three rural Oregon counties, uses a community health worker model to help patients navigate health and social services. The community health workers help identify community members most in need of services, make an assessment, and select the evidence-based pathway best suited for that individual. Participating providers, who have contracts with NEON, pay the community health workers. When a "pathway" has been successfully completed, an invoice is generated and NEON pays the providers, who in turn pay the community health workers.) Options for pathways include: medical or social services referrals, medical homes, tobacco cessation, insurance coverage and more. A data tracking system is used for both the invoicing and outcomes monitoring. The program was implemented in 2014 with funds from a Federal Office of Rural Health Policy Network Development grant.

CONCLUSION

The recognition that various economic, environmental, personal and other social factors are instrumental in influencing individual and population health has been more pronounced and accepted over the last decade. This is evidenced by the fact that while social determinants of health have been labeled as one of the leading health indicators for Healthy People 2020, it was not one of the indicators for Healthy People 2010. Given the relative novelty associated with appreciation for the role of social determinants in population health, efforts are underway to determine baseline measures for several of these determinants as a precursor for subsequent Healthy People benchmarks and progress monitoring.

Rural residents have not been exempt from the challenges in which urban and suburban residents face with respect to the conditions in which they live, work, socialize, and access health care. In fact, some of the challenges may be more pronounced in rural communities due to disparities in poverty rates (**Figure 1**) and food security. Moreover, environmental exposures related to agriculture and substandard housing conditions in rural communities have been associated with chronic respiratory and injury-related diseases, among others. As this recognition of the influence of social determinants of health continues to strengthen, future research should examine the impact that various programmatic and policy initiatives are having on improving the living and working conditions that play a role in individual and population health. Further, given the complex nature of the relationship between social factors and health policymakers, public health professionals, researchers, businesses, and community groups should continue to collaborate in designing and implementing interventions aimed at addressing disparities in home, school, workplace, and neighborhood environments in rural settings.

REFERENCES

1. Centers for Disease Control and Prevention (CDC). *Establishing a Holistic Framework to Reduce Inequities in HIV, Viral Hepatitis, STDs, and Tuberculosis in the United States*. Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention; 2010.

2. U.S Department of Health and Human Services. Learn about the NPA: social determinants. National Partnership for Action to End Health Disparities (NPA). http://minorityhealth.hhs.gov/npa/templates/

browse.aspx?lvl=1&lvlid=11#sd. Updated April 4, 2011. Accessed August 19, 2014.

3. Centers for Disease Control and Prevention (CDC). Social determinants of health. http://www.cdc.gov/socialdeterminants/. Accessed August 19, 2014.

4. World Health Organization. Social determinants of health. http://www.who.int/social_determinants/B_132_14-en.pdf?ua=1. Published November 23, 2012. Accessed August 19, 2014.

5. Centers for Disease Control and Prevention (CDC). Social determinants of health: definitions. http://www.cdc.gov/socialdeterminants/Definitions.html. Updated March 21, 2014. Accessed August 19, 2014.

6. Shi L, Johnson JA. *Novick & Morrow's Public Health Administration: Principles for Population-Based Management.* 3rd ed. Burlington, MA: Jones & Bartlett Learning; 2014.

7. Walker RJ, Smalls BL, Campbell JA, Strom Williams JL, Egede LE. Impact of social determinants of health on outcomes for type 2 diabetes: a systematic review. *Endocrine.* 2014;47(1):29-48.

8. U.S. Department of Health and Human Services. Healthy People 2020: an opportunity to address social determinants of health in the United States. http://www.healthypeople.gov/2010/hp2020/advisory/societaldeterminantshealth.htm. Published July 26, 2010. Accessed August 19, 2014.

9. Satcher D, Higginbotham EJ. The public health approach to eliminating disparities in health. *Am J Public Health.* 2008;98(9 Suppl):S8-S11.

10. U.S. Department of Health and Human Services. Healthy People 2020: social determinants of health. HealthyPeople.gov. https://www.healthypeople.gov/2020/topics-objectives/topic/social-determinants-health. Accessed August 19, 2014.

11. Davis K, Collins SR, Doty MM, Ho A, Holmgren AL. Health and productivity among U.S. workers. http://www.commonwealthfund.org/usr_doc/856_Davis_hlt_productivity_USworkers.pdf. Published August 2005. Accessed August 21, 2014.

12. Bolin JN, Bellamy GR, Ferdinand AO, et al. Rural Healthy People 2020: new decade, same challenges. *J Rural Health.* 2015;31(3):326-333.

13. Collyns C. The crisis through the lens of history. *Finance and Development.* 2008;45(4):18-20.

14. Hertz T, Kusmin L, Marré A, Parker T. Rural employment in recession and recovery. United States Department of Agriculture Economic Research Service. http://www.ers.usda.gov/amber-waves/2014-october/rural-employment-in-recession-and-recovery.aspx#.VbpK4_nxUQo. Published October 6, 2014. Accessed June 15, 2015.

15. United States Department of Agriculture Economic Research Service. Rural poverty & well-being: geography of poverty. http://www.ers.usda.gov/topics/rural-economy-population/rural-poverty-well-being/geography-of-poverty.aspx. Updated May 18, 2015. Accessed June 15, 2015.

16. Bishaw A. Changes in areas with concentrated poverty: 2000 to 2010. http://www.census.gov/content/dam/Census/library/publications/2014/acs/acs-27.pdf. Published June 2014. Accessed June 26, 2015.

17. Sano Y, Garasky S, Greder K, Cook C, Browder D. Understanding food insecurity among Latino immigrant families in rural America. *J Fam Econ Issues.* 2011;32:111-123.

18. Hartley D. Rural health disparities, population health, and rural culture. *Am J Public Health.* 2004;94(10):1675-1678.

19. Eberhardt MS, Pamuk ER. The importance of place of residence: examining health in rural and nonrural areas. *Am J Public Health.* 2004;94(10):1682-1686.

20. Bethea TN, Lopez RP, Cozier YC, White LF, McClean MD. The relationship between rural status, individual characteristics, and self-rated health in the Behavioral Risk Factor Surveillance System. *J Rural Health.* 2012;28(4):327-338.

21. Braveman PA, Egerter SA, Mockenhaupt RE. Broadening the focus: the need to address the social determinants of health. *Am J Prev Med.* 2011;40(1 Suppl 1):S4-S18.

22. Brody GH, Yu T, Chen E, Miller GE, Kogan SM, Beach SR. Is resilience only skin deep? Rural African Americans' socioeconomic status-related risk and competence in preadolescence and psychological adjustment and allostatic load at age 19. *Psychol Sci.* 2013;24(7):1285-1293.

23. Brown RA, Adler NE, Worthman CM, Copeland WE, Costello EJ, Angold A. Cultural and community determinants of subjective social status among Cherokee and White youth. *Ethn Health.* 2008;13(4):289-303.

24. Dubay LC, Lebrun LA. Health, behavior, and health care disparities: disentangling the effects of income and race in the United States. *Int J Health Serv.* 2012;42(4):607-625.

25. Fiscella K, Williams DR. Health disparities based on socioeconomic inequities: implications for urban health care. *Acad Med.* 2004;79(12):1139-1147.

26. Housing Assistance Council. Housing in rural America. http://www.ruralhome.org/storage/documents/ts2010/ts-report/ts10_rural_housing.pdf. Published October 2010. Accessed June 26, 2015.

27. U.S. Department of Housing and Urban Development. Affordable housing. http://portal.hud.gov/hudportal/HUD?src=/program_offices/comm_planning/affordablehousing/. Accessed June 26, 2015.

28. Cohen R, Wardrip K. Should I stay or should I go? Exploring the effects of housing instability and mobility on children. http://www.nhc.org/media/files/HsgInstablityandMobility.pdf. Published February 2011. Accessed June 26, 2015.

29. Jelleyman T, Spencer N. Residential mobility in childhood and health outcomes: a systematic review. *J Epidemiol Community Health.* 2008;62(7):584-592.

30. Foulkes M, Newbold K. Poverty catchments: migration, residential mobility, and population turnover in impoverished rural Illinois communities. *Rural Sociol.* 2008;73(3):440-462.

31. Clark SL. In search of housing: urban families in rural contexts. *Rural Sociol.* 2012;77(1):110-134.

32. Bentzinger AL, Cook CC. On the path to homeownership: low-income owners and renters in rural communities. *Housing and Society.* 2012;39(1):77-98.

33. U.S. Department of Housing and Urban Development. HUD, HGTV, DIY Network, and Rebuilding Together join to fight unsafe housing conditions. http://portal.hud.gov/hudportal/HUD?src=/press/press_releases_media_advisories/2013/HUDNo.13-174. Published November 20, 2013. Accessed June 30, 2015.

34. Gentry AL, Grzywacz JG, Quandt SA, Davis SW, Arcury TA. Housing quality among North Carolina farmworker families. *J Agric Saf Health.* 2007;13(3):323-337.

35. Oneal GA, Eide P, Hamilton R, Butterfield P, Vandermause R. Rural families' process of re-forming environmental health risk messages. *J Nurs Scholarsh.* 2015;47(4):354-362.

36. Robert Wood Johnson Foundation. Improving the health of all Americans through safe and healthy housing. http://www.commissiononhealth.org/PDF/e434bb61-64d3-4267-9dca-705b9d80ddaa/HousingFactSheetJun09.pdf. Accessed June 26, 2015.

37. Bartfeld J, Dunifon R. State-level predictors of food insecurity and hunger among households with children. http://naldc.nal.usda.gov/download/32791/PDF. Published October 2005. Accessed June 15, 2015.

38. Coleman-Jensen A, Nord M, Singh A. Household food security in the United States in 2012. http://www.ers.usda.gov/media/1183204/err-155-report-summary.pdf. Published September 2013. Accessed June 16, 2015.

39. Whitley S. Changing times in rural America: food assistance and food insecurity in food deserts. *J Fam Soc Work.* 2013;16(1):36-52.

40. Kohn MJ, Bell JF, Grow HM, Chan G. Food insecurity, food assistance and weight status in US youth: new evidence from NHANES 2007-08. *Pediatr Obes.* 2014;9(2):155-166.

41. Metallinos-Katsaras E, Gorman KS, Wilde P, Kallio J. A longitudinal study of WIC participation on household food insecurity. *Matern Child Health J.* 2011;15(5):627-633.

42. Nord M. How much does the Supplemental Nutrition Assistance Program alleviate food insecurity? Evidence from recent programme leavers. *Public Health Nutr.* 2012;15(5):811-817.

43. United States Department of Agriculture: Agricultural Marketing Service. Creating access to healthy, affordable food: food deserts. http://apps.ams.usda.gov/fooddeserts/fooddeserts.aspx. Accessed June 25, 2015.

44. Blanchard T, Lyson T. Food availabilty & food deserts in the nonmetropolitan south. http://srdc.

msstate.edu/publications/other/foodassist/2006_04_blanchard.pdf. Published April 2006. Accessed June 25, 2015.

45. University of Georgia Initiative on Poverty and the Economy. Interactive poverty statistics. . http://www.poverty.uga.edu/stats/. Accessed June 26, 2015.

46. Morton LW, Blanchard TC. Starved for access: life in rural America's food deserts. *Rural Realities.* 2007;1(4):1-10.

47. Morton LW, Bitto EA, Oakland MJ, Sand M. Accessing food resources: rural and urban patterns of giving and getting food. *Agric Human Values.* 2008;25(1):107-119.

48. Kim D, Kawachi I. A multilevel analysis of key forms of community- and individual-level social capital as predictors of self-rated health in the United States. *J Urban Health.* 2006;83(5):813-826.

49. Monnat SM, Beeler Pickett C. Rural/urban differences in self-rated health: examining the roles of county size and metropolitan adjacency. *Health Place.* 2011;17(1):311-319.

50. Robert Wood Johnson Foundation. Education matters for health. http://www.commissiononhealth.org/PDF/c270deb3-ba42-4fbd-baeb-2cd65956f00e/Issue Brief 6 Sept 09 - Education and Health.pdf. Published September 2009. Accessed June 30, 2015.

51. Waldorf BS. Is human capital accumulation a self-propelling process? Comparing educational attainment levels of movers and stayers. *Ann Regional Sci.* 2009;43(2):323-344.

52. Shaw TC, DeYoung AJ, Rademacher EW. Educational attainment in Appalachia: growing with the nation, but challenges remain. *Journal of Appalachian Studies.* 2004;10(3):307-329.

53. Whisler R, Waldorf B, Mulligan G, Plane D. Quality-of-life and the migration of the college-educated: a life-course approach. *Growth Change.* 2008;39(1):58-94.

54. Fisher M. Why is U.S. poverty higher in nonmetropolitan than in metropolitan areas? *Growth Change.* 2007;38(1):56-76.

55. Weber B, Jensen L, Miller K, Mosley J, Fisher M. A critical review of rural poverty literature: is there truly a rural effect? *Int Regional Sci Rev.* 2005;28(4):381-414.

56. Probst JC, Bellinger JD, Walsemann KM, Hardin J, Glover SH. Higher risk of death in rural blacks and whites than urbanites is related to lower incomes, education, and health coverage. *Health Aff (Millwood).* 2011;30(10):1872-1879.

57. Braveman P, Gottlieb L. The social determinants of health: it's time to consider the causes of the causes. *Public Health Rep.* 2014;129(Suppl 2):19-31.

58. Marmot M, Bell R. Fair society, healthy lives. *Public Health.* 2012;126 Suppl 1:S4-S10.

59. Braveman P, Egerter S, Williams DR. The social determinants of health: coming of age. *Annu Rev Public Health.* 2011;32:381-398.

60. Wing S, Horton RA, Marshall SW, et al. Air pollution and odor in communities near industrial swine operations. *Environ Health Perspect.* 2008;116(10):1362-1368.

61. Lavizzo-Mourey R, Williams DR. Strong medicine for a healthier America: introduction. *Am J Prev Med.* 2011;40(1 Suppl 1):S1-S3.

62. Robert Wood Johnson Foundation. Where we live matters for our health: neighborhoods and health. http://www.commissiononhealth.org/PDF/888f4a18-eb90-45be-a2f8-159e84a55a4c/Issue Brief 3 Sept 08 - Neighborhoods and Health.pdf. Published September 2008. Accessed June 30, 2015.

63. Reschovsky JD, Staiti AB. Access and quality: does rural America lag behind? *Health Aff (Millwood).* 2005;24(4):1128-1139.

64. Merchant JA, Naleway AL, Svendsen ER, et al. Asthma and farm exposures in a cohort of rural Iowa children. *Environ Health Perspect.* 2005;113(3):350-356.

65. Trejos-Castillo E, Vazsonyi AT, Jenkins D. Violent and criminal behaviors in rural and non-rural African American youth: a risk-protective factor approach. *Southern Rural Sociology.* 2008;23(2):108-130.

66. Mink MD, Moore CG, Johnson A, Probst JC, Martin A. Violence and rural teens: teen violence, drug use, and school-based prevention services in rural America. http://rhr.sph.sc.edu/report/(4-5) Violence and Rural Teens.pdf. Published March 2005. Accessed July 30, 2015.

67. Tyndall J, Colletti J. Mitigating swine odor with strategically designed shelterbelt systems: a review. *Agroforest Syst.* 2007;69:45-65.

68. Blanes-Vidal V, Nadimi ES, Ellermann T, Andersen HV, Lofstrom P. Perceived annoyance from environmental odors and association with atmospheric ammonia levels in non-urban residential communities: a cross-sectional study. *Environ Health.* April 18 2012;11:27.

69. Griffith M, Tajik M, Wing S. Patterns of agricultural pesticide use in relation to socioeconomic characteristics of the population in the rural U.S. South. *Int J Health Serv.* 2007;37(2):259-277.

70. Vyavaharkar M, Moneyham L, Tavakoli A, et al. Social support, coping, and medication adherence among HIV-positive women with depression living in rural areas of the southeastern United States. *AIDS Patient Care STDS.* 2007;21(9):667-680.

71. Kaufman AV, Kosberg JI, Leeper JD, Tang M. Social support, caregiver burden, and life satisfaction in a sample of rural African American and White caregivers of older persons with dementia. *J Gerontol Soc Work.* 2010;53(3):251-269.

72. Brevard J, Maxwell M, Hood K, Belgrave F. Feeling safe: intergenerational connections and neighborhood disorganization among urban and rural African American youth. *J Community Psychol.* 2013;41(8):992-1004.

73. Flores-Yeffal NY, Aysa-Lastra M. Place of origin, types of ties, and support networks in Mexico-U.S. migration. *Rural Sociol.* 2011;76(4):481-510.

74. Baker EA, Barnidge E, Langston M, Schootman M, Motton F, Rose F. Leadership and job readiness: addressing social determinants of health among rural African American men. *Int J Men's Health.* 2013;12(3):245-259.

75. Malhoit GC. Providing rural students with a high quality education: the rural perspective on the concept of educational adequacy. http://www.ruraledu.org/user_uploads/file/Providing_Rural_Students.pdf. Published July 2005. Accessed July 19, 2015.

76. United States Department of Agriculture. Access to affordable and nutritious food: measuring and understanding food deserts and their consequences. http://www.ers.usda.gov/media/242675/ap036_1_.pdf. Published June 2009. Accessed July 19, 2015.

77. United States Department of Agriculture: Rural Development. Single family housing repair loans & grants. http://www.rd.usda.gov/programs-services/single-family-housing-repair-loans-grants. Accessed July 30, 2015.

78. United States Department of Agriculture. Farm labor housing loans and grants. Catalog of Federal Domestic Assistance. https://www.cfda.gov/index?s=program&mode=form&tab=core&id=692091d9dab40292b38c3925d965b0d3. Accessed July 19, 2015.

79. United States Department of Agriculture: Rural Development. Rural business development grants. http://www.rd.usda.gov/programs-services/rural-business-development-grants. Accessed July 19, 2015.

80. U.S. Department of Health and Human Services. Chronic Users System of Care (CUSOC). Rural Assistance Center. https://www.raconline.org/success/project-examples/783. Published January 20, 2015. Accessed June 25, 2015.

81. Mendocino County AIDS/Viral Hepatitis Network. Chronic Users System of Care (CUSOC) Case Management Program. http://www.newmcavhn.org/CUSOC_top.html. Accessed June 25, 2015.

82. U.S. Department of Health and Human Services. Youth Emergency Services, Inc. Housing and Independent Living Program. Rural Assistance Center. https://www.raconline.org/success/project-examples/610. Published September 8, 2009. Updated June 5, 2015. Accessed June 25, 2015.

83. Youth Emergency Services Inc. http://www.youthemergencyservices.org/ Accessed June 25, 2015.

84. U.S. Department of Health and Human Services. Women to Women online support network. Rural Assistance Center. https://www.raconline.org/success/project-examples/394. Published April 9, 2007. Updated June 1, 2015. Accessed June 25, 2015.

85. Hill W, Weinert C, Cudney S. Influence of a computer intervention on the psychological status of chronically ill rural women: preliminary results. *Nurs Res.* 2006;55(1):34-42.

86. Winters CA, Cudney S, Sullivan T. Expressions of depression in rural women with chronic illness. *Rural Remote Health.* 2010;10(4):1533.

87. Weinert C, Cudney S, Hill WG. Rural women, technology, and self-management of chronic illness. *Can J Nurs Res.* 2008;40(3):114-134.

88. U.S. Department of Health and Human Services. NEON Pathways Community Hub. Rural Assistance Center. https://www.raconline.org/success/project-examples/796. Published May 11, 2015. Accessed June 25, 2015.

89. National Cooperative of Health Networks Association. Featured project: NEON Pathways Community Hub. http://www.nchn.org/blog-post/featured-project-neon-pathways-community-hub.html. Published November 19, 2014. Accessed June 25, 2015.

Suggested Chapter Citation:

Ferdinand AO. Social Determinants of Health: Implications for Rural America. In: Bolin JN, Bellamy G, Ferdinand AO, et al. eds. *Rural Healthy People 2020.* Vol. 2. College Station, TX: The Texas A&M University Health Science Center, School of Public Health, Southwest Rural Health Research Center; 2015:95-107.

RURAL HEALTH INFORMATION TECHNOLOGY CHALLENGES

By Susan H. Fenton, PhD, and Billy U. Philips, PhD, MPH

SCOPE OF THE PROBLEM

- Health care providers that fail to implement and use electronic health records consistent with federal regulations will face financial penalties which may threaten their survival.[1]
- Rural health care providers, already facing financial challenges, find it difficult to invest sufficient resources in health information technology.[2]
- Rural organizations are less likely to find information technology staff for the successful implementation and maintenance of health information technology.[3]
- More than half of rural locations report internet speeds of less than ten mbps,[2] which is considered suboptimal for information technology processing of electronic health records and insurance reimbursement.

Since 2008 the adoption of a basic electronic health record system (EHR) by non-federal acute care hospitals has increased from 9.4 percent to 59.4 percent throughout the nation.[4] Nationally, physician office use of a basic EHR system increased from 10.5 percent in 2006 to 48.1 percent in 2013.[5] These significant increases are a direct result of the Meaningful Use incentive program included in the Health Information Technology for Economic and Clinical Health (HITECH) of 2009,[1] part of the Affordable Care Act.

Prior to and since the implementation of HITECH, there have been many studies examining the impact of health information technology on health care delivery in the United States. The federal government's push for implementation of health information technology had ambitious goals, including significantly improving the quality of the care delivered[6-10] and contributing to substantial changes in the way health care services are reimbursed.[11,12] Significant lessons have been learned about the impact of health information technology on patient safety. Perhaps most importantly, providers discovered that implementing health information technology can have unintended consequences and even introduce new errors.[8,10,13-22] Because of this, the findings related to patient outcomes have been mixed.[3,23-25] However, as the industry gains more experience with health information technology, the data are beginning to indicate consistent improvement. A recent empirical study conducted by Lin, Lin, and Chen explicitly examined the impact of meaningful use upon the quality of care.[26] Not only did they detect a positive impact of meaningful use overall, they found that improvement in quality of care measures was higher for rural health care organizations than urban organizations.[26] This may be due to the fact that the opportunities for improvement in rural organizations were more significant than urban healthcare organizations.

HEALTHY PEOPLE 2020 GOALS AND OBJECTIVES

Healthy People 2020 establishes goals and objectives for the nation's health over the current decade. Health information technology, along with health communication, is a leading health indicator with an overall goal to "use health communication strategies and health information technology to improve population health outcomes and health care quality, and to achieve health equity." [27] Two of the Healthy People 2020 goals for health information technology are addressed in this review, with rural and urban comparisons.

- **HIT-1** Increase the proportion of medical practices that use a basic EHR system

  Baseline: 27.9 percent of medical practices reported using a basic EHR in 2010.[5]

  Target: 70 percent

  Target-Setting Method: 150 percent improvement

Data Source: National Ambulatory Medical Care Survey – Electronic Health Records Survey (NAMCS-EHR)

- **HIT-2** Increase the proportion of providers who are meaningful users of health information technology

  Baseline: 50+ percent had the capability to meet each of 12 Meaningful Use Core objectives.[28]

  Target: 75+ percent

  Target-Setting Method: 50 percent improvement

  Data Source: Office of the National Coordinator for Health Information Technology, Office of Economic Analysis, Evaluation and Modeling

RURAL HEALTHY PEOPLE 2020 SURVEY OUTCOMES

In a nationwide survey of rural stakeholders, health communication and health information technology were ranked as the 20th most frequently cited health priority for people living in rural areas of the United States.[29] Interestingly, the rankings were not the same across all of the U.S. Census Bureau and Department of Health and Human Services regions. For example, the topic was tied for 16th in the Northeast and West regions.

When completing the survey for specific sub-objectives for health communication and health information technology, many more of the respondents ranked health information technology-related sub-objectives as most important. According to **Table 1**, more than 27.4 percent of the respondents felt that health information technology infrastructure and support was most important, with EHR/EMR and health information exchange ranked second and third most important respectively (SRHRC, unpublished data).[30]

The ranking of infrastructure and support as most important is concerning, when considered within the context of the rural toolkit for grants and funding as Most Useful or Useful by 76.5 percent of the respondents. This is a vital resource, for, as described by Gabriel and McCullough in their studies, rural providers find it difficult to access the resources that would help them to implement the necessary

Table 1. Health communication and health information technology sub-objectives.

Sub-objectives	Frequency	Percent
Infrastructure/Support	40	27.4
EHR/EMR	22	15.07
Health information exchange	18	12.33
Education	17	11.64
Telehealth/telemedicine	15	10.27
Health information technology (HIT)	11	7.53
Patient-to-provider communication	4	2.74
Patient access	3	2.05
Protected health information (PHI)	3	2.05
Patient safety/security	3	2.05
Database of prescription drug use	1	0.68
Personal accountability	1	0.68
	146	**99.97**

Source:[29,30]

infrastructure to successfully implement EHRs or health information technology.[2,31]

PREVALENCE AND DISPARITIES IN RURAL AREAS

The most current data on adoption and meaningful use by hospital organizational characteristics reveal that smaller and rural hospitals have significantly lower rates of adoption of EHR systems.[32] Although these smaller and/or rural hospitals have seen a larger percentage increase in EHR adoption between 2010 and 2012 as shown in **Table 2**, they still lag significantly behind the larger and urban hospitals. The rural-urban gap grew from 5.7 percent in 2008 to 7.2 percent in 2010 to 14.2 percent in 2012. So, even though the percentage increase was greater for rural hospitals, the digital divide continued to grow. By default, this means that smaller and rural hospitals will have lower rates of meaningful use of EHRs. Thus, they will be less likely to enjoy federal financial incentives for using health information technology, while at the same time be more likely to have their Medicare reimbursements cut or reduced in FY 2015.

In an examination of regional extension center (REC) enrolled primary care practice (PCP) adoption and meaningful use of EHRs, Samuel found rurality, health professional shortage area (HPSA) status, minority concentration, broadband capacity, and distance to nearest major teaching hospital to all have an impact (**Table 3**).[33]

Table 2. Relative change in adoption of electronic health record systems, 2008-2012.

	Percent of hospitals that have at least a basic EHR*			**Percent change**
Characteristic	**2008**	**2010**	**2012**	**2010 to 2012**
Size				
Small	6.1	10.7	38.3	257.1
Medium	9.8	17.8	46.5	161.1
Large	18.5	25.7	61.9	140.8
Region				
Northeast	10.0	16.1	44.4	176.2
Midwest	8.3	16.5	49.2	197.8
South	8.7	12.4	38.7	212.6
West	8.9	18.0	46.2	157.1
Profit Status				
For profit	6.5	7.8	29.8	282.1
Private nonprofit	9.9	17.6	49.6	181.3
Public	7.5	13.7	39.0	185.0
Location				
Rural	4.6	9.8	33.5	240.6
Urban	10.3	17.0	47.7	180.1

Adapted from DesRoches, 2012, Table 2.[29]
*Hospitals with either a basic or a comprehesive system.

Table 3. Unadjusted county-level electronic health record adoption and meaningful use rates among regional extension center-enrolled primary care practices.

	County-level EHR adoption rate (%)	County-level meaningful use rate (%)
Metropolitan Status		
Urban	89.9	60.5
Rural	85.9	50.3
HPSA Status		
Non-HPSA	89.0	58.5
Whole-county HPSA	85.6	46.0
Minority Concentration		
Q1 9 Q1 (<6.0%)	86.7	54.7
Q2 (6.0–14.2%)	86.8	54.3
Q3 (14.3–32.6%)	88.0	55.9
Q4 (32.7–98.8%)	88.2	51.9
Technological Infrastructure: Broadband capacity per 1000 households		
≤200	88.5	50.0
>200 to ≤400	86.7	51.8
>400 to ≤600	87.2	54.2
>600	88.4	58.4
Distance to nearest teaching hospital		
≤30 miles	90.6	60.6
31–60 miles	89.7	59.4
61–90 miles	86.6	54.2
>90 miles	83.9	45.1

Adapted from Samuel, 2014, Table 2.[30]

BARRIERS

As indicated in **Table 3**, rural health care providers face obstacles when implementing EHRs and health information technology. One significant barrier can be uncertainty regarding the financial incentives or subsidies available for implementing EHRs,[2,31] as was also revealed in the Rural Healthy People 2020 survey. A second barrier that appears to have remained consistent from pre-HITECH to the present is a lack of staff and health care professionals in rural areas with sufficient experience in health information technology implementation and use.[2,3] It is also possible that there are other less intrinsically tangible barriers such as lack of adequate leadership[34] and the difficulties associated with effective change management.[35]

KNOWN CAUSES OF THE PROBLEM

Causes of the lagging implementation of health information technology in rural health care delivery settings are as complex as the overall implementation of health information technology in general. Probably the largest cause can be traced back to the fact that rural health care providers are rarely teaching or research institutions. They not only lack the grant or other funding that comes with a strong research program, they also lack the benefit of research

data and experts to analyze the data. Most health information technology research has come from large, teaching health systems with significant resources not available to small, rural organizations.

Additionally, practice patterns are different in rural areas, resulting in the failure of some rural providers to qualify for the meaningful use incentives. For example, rural health clinics are most often reimbursed under Medicare Part A, instead of Medicare Part B as required by HITECH.[1] Other meaningful use qualification challenges are faced by family practitioners or others who may treat a substantial number of Medicaid patients, but not enough to meet the threshold to qualify for the higher Medicaid incentives and longer implementation timeline.[36]

PROPOSED SOLUTIONS OR INTERVENTIONS

In many rural areas, the Health Information Regional Extension Centers (RECs) are fulfilling their objectives of assisting providers in implementing EHRs and health information technology.[36] However, rural providers lag behind urban provider adoption, while federal support for the RECs is ending. Many are trying out new models to become sustainable. Some level of continued support from the federal and state governments is needed to help close the rural-urban digital gap identified in 2012. Revising the meaningful use incentive program based on rural versus urban practice patterns and allowing rural health clinics to qualify as eligible providers would increase the number of providers which could then receive financial assistance. Although all might not *meaningfully* use EHRs, some certainly would, thus increasing the likelihood of adoption of clinical health information technology in rural clinical practices and hospitals.

COMMUNITY MODELS KNOWN TO WORK

The model that works best in rural health care delivery is essentially the same model that works in urban health care delivery. Health care providers must first implement health information technology in the form of EHRs that meet the nationally promulgated standards. While this step is an important one in improving the quality of care delivered, it is only the first step. The full benefits are only realized once rural health care providers are connected via health information exchange technology as described by two case studies in the U.S. Department of Health and Human Services Rural Assistance Center.[37] Rural organizations in the vastly different states of Illinois (Sarah Bush Lincoln Health Center) and the state of Louisiana (Louisiana Rural Health Information Exchange) found that EHR implementation and information sharing was beneficial, but costly.[37] For maximum benefit, the organizations with EHRs need to be connected so they can share information to deliver better patient care.

SUMMARY AND CONCLUSIONS

The use of EHRs and health information technology was reported to be in the top 20 priorities according to the Rural Healthy People 2020 survey. While studies document a significant increase (240.6 percent) by rural providers and hospitals in the adoption and use of health information technology from 2010 to 2012,[32] the overall gap between urban and rural providers continues to grow. Providers want and need support to identify grant and other funding support. As a corollary, it is recommended that policy-makers consider revising or even extending the EHR meaningful use incentive program to provide additional focused support in the rural setting. The continued improvement of health care quality rests on the ability of providers to have access to and effectively utilize the full range of patient data. This access and utilization rests on the implementation of EHRs and health information technology in all care settings.

REFERENCES

1. Health Information Technology for Economic and Clinical Health (HITECH) Act. http://www.healthit.gov/sites/default/files/hitech_act_excerpt_from_arra_with_index.pdf. Enacted February 17, 2009.

2. Gabriel MH, Jones EB, Samy L, King J. Progress and challenges: implementation and use of health information technology among critical-access hospitals. *Health Aff (Millwood).* 2014;33(7):1262-1270.

3. Bahensky JA, Jaana M, Ward MM. Health care information technology in rural America: electronic medical record adoption status in meeting the national agenda. *J Rural Health.* 2008;24(2):101-105.

4. Charles D, Gabriel M, Furukawa MF. *Adoption of Electronic Health Record Systems among U.S. Non-federal Acute Care Hospitals: 2008-2013. ONC Data Brief, no. 16*. Washington, DC: Office of the National Coordinator for Health Information Technology; 2014.

5. Hsiao CJ, Hing E. Use and characteristics of electronic health record systems among office-based physician practices: United States, 2001-2013. *NCHS Data Brief.* 2014;(143):1-8.

6. Amarasingham R, Plantinga L, Diener-West M, Gaskin DJ, Powe NR. Clinical information technologies and inpatient outcomes: a multiple hospital study. *Arch Intern Med.* 2009;169(2):108-114.

7. Appari A, Carian EK, Johnson ME, Anthony DL. Medication administration quality and health information technology: a national study of US hospitals. *J Am Med Inform Assoc.* 2012;19(3):360-367.

8. Kilbridge PM, Classen DC. The informatics opportunities at the intersection of patient safety and clinical informatics. *J Am Med Inform Assoc.* 2008;15(4):397-407.

9. McCullough JS, Casey M, Moscovice I, Prasad S. The effect of health information technology on quality in U.S. hospitals. *Health Aff (Millwood).* 2010;29(4):647-654.

10. Joint Commission on Accreditation of Healthcare Organizations, USA. Safely implementing health information and converging technologies. *Sentinel Event Alert.* 2008(42):1-4.

11. Bates DW, Bitton A. The future of health information technology in the patient-centered medical home. *Health Aff (Millwood).* 2010;29(4):614-621.

12. Bell K. A Health Information Technology Framework For The Accountable Care Environment. Health Affairs Blog. http://healthaffairs.org/blog/2013/06/06/a-health-information-technology-framework-for-the-accountable-care-environment/. Published June 6, 2013. Accessed June 30, 2015.

13. Ash JS, Berg M, Coiera E. Some unintended consequences of information technology in health care: the nature of patient care information system-related errors. *J Am Med Inform Assoc.* 2004;11(2):104-112.

14. Ash JS, Sittig DF, Dykstra RH, Guappone K, Carpenter JD, Seshadri V. Categorizing the unintended sociotechnical consequences of computerized provider order entry. *Int J Med Inform.* 2007;76 Suppl 1:S21-S27.

15. Damberg CL, Ridgely MS, Shaw R, et al. Adopting information technology to drive improvements in patient safety: lessons from the Agency for Healthcare Research and Quality health information technology grantees. *Health Serv Res.* 2009;44(2 Pt 2):684-700.

16. DeVore SD, Figlioli K. Lessons premier hospitals learned about implementing electronic health records. *Health Aff (Millwood).* 2010;29(4):664-667.

17. Singh H, Mani S, Espadas D, Petersen N, Franklin V, Petersen LA. Prescription errors and outcomes related to inconsistent information transmitted through computerized order entry: a prospective study. *Arch Intern Med.* 2009;169(10):982-989.

18. Harrison MI, Koppel R, Bar-Lev S. Unintended consequences of information technologies in health care--an interactive sociotechnical analysis. *J Am Med Inform Assoc.* 2007;14(5):542-549.

19. Horsky J, Kuperman GJ, Patel VL. Comprehensive analysis of a medication dosing error related to CPOE. *J Am Med Inform Assoc.* 2005;12(4):377-382.

20. Koppel R, Metlay JP, Cohen A, et al. Role of computerized physician order entry systems in facilitating medication errors. *JAMA.* 2005;293(10):1197-1203.

21. Metzger J, Welebob E, Bates DW, Lipsitz S, Classen DC. Mixed results in the safety performance of computerized physician order entry. *Health Aff (Millwood).* 2010;29(4):655-663.

22. Middleton B, Bloomrosen M, Dente MA, et al. Enhancing patient safety and quality of care by improving the usability of electronic health record systems: recommendations from AMIA. *J Am Med Inform Assoc.* 2013;20(e1):e2-e8.

23. Messer LC, Parnell H, Huffaker R, Wooldredge R, Wilkin A. The development of a health information exchange to enhance care and improve patient outcomes among HIV+ individuals in rural North Carolina. *Int J Med Inform.* 2012;81(10):e46-e55.

24. Weir CR, Staggers N, Laukert T. Reviewing the impact of computerized provider order entry on clinical outcomes: The quality of systematic reviews. *Int J Med Inform.* 2012;81(4):219-231.

25. Benavides-Vaello S, Strode A, Sheeran BC. Using technology in the delivery of mental health and substance abuse treatment in rural communities: a review. *J Behav Health Serv Res.* 2013;40(1):111-120.

26. Lin YK, Lin M, Chen H. Beyond Adoption: Does Meaningful Use of EHR Improve Quality of Care? Social Science Research Network. Published May 30, 2014. Accessed June 30, 2015.

27. U.S. Department of Health and Human Services. Healthy People 2020: Health communication and health information technology. HealthyPeople.gov. http://www.healthypeople.gov/2020/topics-objectives/topic/health-communication-and-health-information-technology. Updated August 13, 2015. Accessed August 13, 2015.

28. King J, Patel V, Furukawa MF. *Physician Adoption of Electronic Health Record Technology to Meet Meaningful Use Objectives: 2009-2012*. ONC Data Brief, No. 7. Washington, D.C.: Office of the National Coordinator for Health Information Technology; 2012.

29. Bolin JN, Bellamy GR, Ferdinand AO, et al. Rural Healthy People 2020: new decade, same challenges. *J Rural Health*. 2015;31(3):326-333.

30. Southwest Rural Health Research Center, Rural Healthy People 2020 National Survey. 2015, Texas A&M Health Science Center. Unpublished data. Accessed June 11,2015.

31. McCullough J, Casey M, Moscovice I, Burlew M. Meaningful use of health information technology by rural hospitals. *J Rural Health.* 2011;27(3):329-337.

32. DesRoches CM, Worzala C, Joshi MS, Kralovec PD, Jha AK. Small, nonteaching, and rural hospitals continue to be slow in adopting electronic health record systems. *Health Aff (Millwood)*. 2012;31(5):1092-1099.

33. Samuel CA. Area-level factors associated with electronic health record adoption and meaningful use in the Regional Extension Center Program. *J Am Med Inform Assoc.* 2014;21(6):976-983.

34. Bebow GL. The CEO's role in small and rural hospitals' EMR implementation. *Front Health Serv Manage.* 2011;28(1):31-34.

35. Lorenzi NM, Riley RT. Managing change: an overview. *J Am Med Inform Assoc.* 2000;7(2):116-124.

36. Casey MM, Moscovice I, McCullough J. Rural primary care practices and meaningful use of electronic health records: the role of Regional Extension Centers. *J Rural Health.* 2014;30(3):244-251.

37. U.S. Department of Health and Human Services. Rural Project Examples: Health Information Technology. Rural Assistance Center. http://www.raconline.org/success/project-examples/topics/health-information-technology. Published 2014. Accessed July 18, 2014.

Suggested Chapter Citation:

Fenton SH, Philips BU. Rural Health Information Technology Challenges. In: Bolin JN, Bellamy G, Ferdinand AO, et al. eds. *Rural Healthy People 2020*. Vol. 1. College Station, TX: Texas A&M University Health Science Center, School of Public Health, Southwest Rural Health Research Center; 2015:109-115.