THE EFFECT OF STRESS ON THE INITIAL ONSET AND RELAPSE RATE OF MULTIPLE SCLEROSIS

A Senior Honors Thesis

by

MICHELLE LYNN SNOW

Submitted to the Office of Honors Programs & Academic Scholarships
Texas A&M University
in partial fulfillment of the requirements of the

UNIVERSITY UNDERGRADUATE RESEARCH FELLOWS

April 2001

Group:

Psychology Two

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ABSTRACT

The Effect of Stress on the Initial Onset and

Relapse Rate of Multiple Sclerosis. (April 2001)

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Over 400,000 Americans have multiple sclerosis (MS) and doctors can not discover the cause of the disease or how to stop the progressive deterioration. The symptoms of MS are caused by destruction of the myelin sheath, in which the nerve pathways are disrupted and problems with movement, sensation or vision can occur. One environmental factor, stress, has been hypothesized to be a contributor to the onset of MS and one of many factors controlling the commonly occurring flare-ups of symptoms, or relapses. I have completed retrospective and progressive survey work with MS patients to evaluate the level of stress in their lives prior to the initial onset and the recurring relapses.

Two main hypotheses guided this research. First, a high percentage of MS patients perceived that stress was present in their life prior to symptom onset. Second, a high percentage of MS patients experienced relapses during or immediately following moments of stress. Members of a regional MS Society were randomly selected to participate in this study.

Each participant was sent a questionnaire to analyze stressful life events present in the year prior to symptom onset and results showed that there was a high incidence (88.6%) of stressful life events prior to symptom onset in this population.

The majority of the research was focused on the progressive study to test for a correlation between stress and the relapse rate, as seen in a change in capacity levels of certain functions commonly affected by multiple sclerosis. Each participant was sent the same questionnaire three times over a course of 18 weeks. The questionnaire consisted of five parts, asking questions in regard to social support, stressful life events, perceived stress, incapacity levels from the Kurtske scale and different ways of coping with MS.

There was no significant correlation between stress levels and incapacity levels in this population of MS patients. Most patients perceived that their stress levels, social support levels and coping techniques stayed constant over the 18-week time period, and therefore, none of these had an influence on buffering the effect of stress on the incapacity levels.

ACKNOWLEDGEMENTS

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I also want to extend my thanks to Ms. Carole Wheeler of the North Texas Chapter of the National Multiple Sclerosis Society. Thank you for putting up with my phone calls and questions at the beginning of the research. Also, I would like to thank my roommates and friends for staying up long nights and helping me fold surveys and stuff envelopes. They, unfortunately, saw the dirty work of the project and will not be able to partake in the benefits of its completion. Finally, I want to thank each participant for donating part of his or her time in helping me with my Fellows project.

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CHAPTER I

INTRODUCTION

1.1. Multiple Sclerosis

Multiple sclerosis (MS) is the common most demyelinating disease of the central nervous system affecting approximately 1/2000 of the US population. MS affects more women than men with ratios ranging from 3:2 to 2:1 and is highly prevalent in populations of European origin. MS is thought to be an autoimmune disease in which the immune system attacks myelin, the membrane that surrounds nerve fibers and enhances transmission of the electrical nerve impulses. If demyelination occurs, the nerve pathways are disrupted and problems with movement, sensation or vision can occur. Patients suffering from MS experience many different symptoms ranging from numbness in the limbs, incontinence, visual problems and even paralysis. Almost all MS patients experience periods of remission and unpredictable flare-ups (relapses). These relapses can occur spontaneously or can be triggered by an infection (Berkow, 1997). The cause of MS is unknown but epidemiological studies suggest the involvement of an infectious agent. Viral infections during childhood are currently hypothesized to be involved in the pathogenesis of MS (Paty and Ebers, 1998). Twin studies show a low concordance rate between monozygotic and dizygotic twins, indicating a high environmental factor of MS onset and progression (Paty and Ebers,

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This thesis follows the style and format of The Journal of Neuroimmunology.

1998). One environmental factor, stress, has been previously thought to have an impact on the initial onset and relapse rate of multiple sclerosis.

1.2. Statement of Problem

The purpose of this Fellows research is to test the effect of stress on the initial onset and relapse rate of multiple sclerosis. The research consists of two main goals or hypotheses. The first goal of the research is to retrospectively determine what stressful life events were present in the lives of MS patients in the 12 months prior to symptom onset. Secondly, I progressively followed the effect of stress on the exacerbation of MS symptoms, as seen in a decrease in capacity levels of certain functions commonly affected by multiple sclerosis. A randomly selected sample population from the North Texas Chapter of the National Multiple Sclerosis Society was sent questionnaires regarding both areas of focus.

1.3. Hypotheses

The hypotheses for this Fellows research project are as follows:

Hypothesis 1 - A high percentage of MS patients perceive that stress was present in their life prior to symptom onset.

Hypothesis 2 - A high percentage of MS patients experience relapses during or immediately following moments of stress.

Also, an assumption was made that everyone reacts to stress factors with a different approach. Some handle stress well while the effects easily overcome others. Each subject was analyzed for his or her ability to cope with stress.

1.4. Background Information

Stress, one environmental factor, has been previously tested as a possible contributor to MS symptoms. A review of previous literature shows contradictory and inconclusive results concerning the role of stress in MS with scientists holding differing opinions as to whether stress is a factor. However, the commonly held view that stress aggravates the disease will continue to prevail in the absence of hard data (Paty and Ebers, 1998). In a previous study 79 out of 100 MS patients reported more unwanted stress than usual in the two years prior to onset of symptoms as compared to 54 out of 100 controls (Warren et al., 1982). Warren et al. also reported that patients who recently experienced an exacerbation (relapse) scored higher in emotional disturbance and intensity of stressful events than patients in remission (Warren et al., 1982). McAlpine and Compston reported that 33.0% of MS patients in a series of theirs experienced temporary exacerbation of symptoms during or immediately following moments of stress (McAlpine and Compston, 1952). MS patients who reported significant negative or uncontrollable events were 3.7 times as likely to have an exacerbation as those free of such events (Grant et al., 1989).

Physiological effects of stress

Many researchers focus on the physiological, rather than psychological, effect of stress on multiple sclerosis. Studies have suggested that stress could produce cerebrovascular alterations which might be etiologically related to plaque formation (Jelliffe, 1921). For the total sample of MS patients in a study by Mohr, analyses revealed no strong evidence that stressful life events or psychological stress influenced the odds of experiencing new gadolinium-enhancing (Gd+) brain lesions for the total sample ($n=52$, $p>0.15$) however, conflict and disruption in routine was related to increased odds of the appearance of new Gd+ lesions 8 weeks later in the total patient sample ($OR = 1.64$; 95% CI, 1.22-2.20; $p = 0.00083$) (Mohr et al., 2000). Thus Mohr reported that the relationship between stressful life events and disease activity, whether measured as clinical exacerbations or new Gd+ lesions, is not straightforward and appears to depend on many factors including chronicity, severity, and type of stress as well as individual patient characteristics such as temperament, coping skills, level of social support, and psychopathology. Little is known about how these factors, individually or in combination, are related to clinical exacerbations and the appearance of new Gd+ lesions, and additional work in this area is warranted (Mohr et al., 2000).

A previous study by Ackerman also presented inconclusive results concerning the effect of stress on multiple sclerosis. In an examination of cytokine levels, such as interleukins and interferons, no difference was found between MS patients and controls in their subjective, autonomic, neuroendocrine and immunological responses to the stressor (Ackerman et al., 1998). In a similar study, Ackerman and colleagues administered an acute laboratory stressor to MS patients and healthy controls while monitoring immune functions known to be sensitive to psychological stress in normal controls. These measures included changes in leukocyte distribution, natural killer cell activity and lymphocyte proliferation (Ackerman et al., 1996). Resting and stress-induced alterations in total leukocyte count did not differ between MS patients and controls. However, there was a trend toward increasing NK-cell number in MS patients relative to controls. Overall, there were no substantial group or gender differences in subjective, autonomic, neuroendocrine and immunologic responses to the stressor (Ackerman et al., 1996).

The relation between stress and the common cold

Sheldon Cohen prospectively studied the relation between psychological stress and the frequency of documented clinical colds among subjects intentionally exposed to respiratory viruses. The rates of both respiratory infection ($p<0.005$) and clinical colds ($p<0.02$) increased in a dose-response manner with increases in the degree of psychological stress. The stress index was associated with host resistance and not with differential exposure to the virus (Cohen et al., 1991).

Different types of stress

It is also important to examine whether certain types of stressful life events (e.g. positive vs. negative, short term vs. chronic) have different effects on disease progression. Sibley found that marital and job-related stress was followed by clinical exacerbation; major negative life events, such as a death in the family, were not (Sibley, 1997). Major negative life events may have neutral or inhibitory effects on disease exacerbation whereas moderate stressors may be associated with increased exacerbation. This suggests that it may be important to differentiate between major and moderate life stressors when examining the relationship between stress and disease activity (Mohr et al., 2000). In contrast, research by Grant et al. has indicated that of all events, those which pose substantial long-term threats to the person directly are most likely to be associated with medical and psychiatric disorders (Grant et al., 1989). Ackerman reported that extreme stressors might even yield short-term protection against MS attacks (Ackerman et al., 1998).

Acute versus chronic stress

Stress has differential effects on the immune system depending on whether it is acute or chronic. Acute stress enhances the immune system whereas chronic stress is immunosuppressive (Dhabar and McEwen, 1997). Furthermore, stress may be accompanied by immune suppression and then be followed by immune activation (Mohr et al., 2000). This time delay in immune activation poses as a problem in detecting stress-related exacerbations. Since MS is thought to be an autoimmune disease whereby the immune system attacks the central nervous system myelin, immunosuppression induced by chronic stress would be expected to improve the symptoms of MS. In a previous study examining the effect of stress on MS patients during and after bombings associated with the Persian Gulf War patients had a decreased number of relapses than expected based on the relapse frequency during the preceding 2 years. The results suggested that a severe stressor in some way "protected" the patients for at least a limited period (Nisipeanu and Korczyn, 1993). In contrast, acute stress may exacerbate MS since it is immune enhancing which would result in immune activation and increased autoimmunity. Furthermore, having MS and knowing the prognosis and expected symptoms can also be a stressful situation for patients and could lead to a more stressful life.

Viral agents

Virologists have suggested that susceptibility to microbial infectious diseases may be increased by emotional stress (Dubos, 1965; Kaplan, 1975); and/or in illnesses where the immune response is important, stress may impair cell-mediated immunity (Rogers et al., 1979). Chronic stress at the time of exposure to the putative MS causing agent would theoretically lead to immunosuppression and thus be advantageous to the pathogen allowing a persistent infection to be established.

Stress buffers

In order to accurately evaluate the effect of stress on MS it is important to also evaluate possible buffers of stress, like social support. Perceived availability of support wholly or partly protects one from the pathogenic effects of high levels of life stress (Cohen and Hoberman, 1983). In theory, participation in a more diverse social network may influence the motivation to care for oneself by promoting feelings of self-worth, responsibility, control and meaning in life (Cohen et al., 1997). The buffering hypothesis pattern suggests that both social support and positive events protect one from the pathogenic effects of high levels of life stress but are relatively unimportant for, or even harm those with low levels of stress (Cohen and Hoberman, 1983). In a study by Sheldon Cohen, life stress scores based on events that were rated by the respondent as having a negative impact were predictive of both depressive and physical symptomatology, while scores based on positive events were not related to either outcome measure (Cohen and Hoberman, 1983). In another study Cohen reported that participants with more types of social ties were less susceptible to common colds, produced less mucus, were more effective in ciliary clearance of their nasal passages and shed less virus (Cohen et al., 1997). If one assumes that the buffering qualities of social support are cognitively mediated, e.g., support operates by affecting one's interpretation of the stressor, knowledge of coping strategies or self-concept, the greater number of perceived support networks, the better the buffer (Cohen and Hoberman, 1983).

CHAPTER II

METHODOLOGY

This Fellows research project was divided into two separate parts, with each part focusing on one of the two hypotheses. The goal of the first part of the research was to determine the effect of stress on the initial onset of multiple sclerosis (MS) in a population of previously diagnosed patients. The second part of the research progressively tested the effect of stress on the relapse rate of multiple sclerosis, as seen in changes in the capacity levels of participants to perform functions commonly affected by MS.

2.1. Hypothesis One

First, I constructed a broad-based descriptive study of perceptions of 325 multiple sclerosis patients towards stress as a factor of initial onset. The 325 participants were randomly selected from the database of the North Texas Chapter of the National Multiple Sclerosis Society. This was a confidential survey where every participant received a number. All participants were over 18 years of age, of both sexes and varying ethnicities. I received approval from the Institutional Review Board for Human Subjects at Texas A&M University, as well as the support from Ms. Carole Wheeler of the North Texas Chapter of the National Multiple Sclerosis Society.

Each participant was sent a three-page questionnaire plus cover letter asking for their assistance in this research project. The first questionnaire that each participant received also included a letter from the MS Society stating their support of the research and encouraged their participation. The three-page questionnaire included 23 questions pertaining to stressful life events and 5 demographic questions.

Each participant was asked to self-evaluate their MS category as well as list their year of diagnosis, date of birth, gender and ethnicity. The questionnaire listed the three MS categories of relapse remitting, primary progressive and secondary progressive and gave a definition of each. The definitions are as follows. Relapse remitting MS is characterized by periods of relapse, exacerbation of symptoms, and remission. The patients are fairly stable with little or no deterioration. The gradual and continuing worsening of symptoms from disease onset characterize primary progressive MS. A MS patient with secondary progressive MS was originally classified as relapse remitting but then began to suffer gradual deterioration.

The 23 stressful life event questions listed possible life events, either negative or positive, that could have occurred in each participant's life in the 12 months prior to symptom onset. The retrospective survey will inquire about work situations, relationship stability, family life and other stress factors. The types of questions asked ranged from "Did you get married?" to "Were you assaulted or mugged?" or "Was there a significant change in your personal finances?" The questions asked about stressful life events that affected either the participant, members of their family or close friends. The participant evaluated how each stressful life event affected them personally, however. A majority of the questions were adapted from the Life Events Scale by Sheldon Cohen (Cohen, 1991).

For each question, the participant checked yes or no as to whether they experienced that particular event. If they answered yes, they then were asked to evaluate how each stressful life event affected them on a scale of -3 to +3. A score of -3 indicated a severely negative life event, whereas a score of +3 indicated a highly positive life event. A score of 0 indicated the participant experienced the life event but it did not affect them either positively or negatively. The final question asked the participant to list other stressful life events that were not listed previously in the questionnaire. This retrospective study was limited to only analyzing the perceptions of the subjects and not testing for causality due to the errors of subject recollection.

2.2. Hypothesis Two

The majority of this research project was focused on the progressive study, which tested the effect of stress on the relapse rate (exacerbations) of MS patients. This study was controlled, recollection bias was minimal, and a correlation between stress and relapse rate could be tested. The same MS population of 325 people was used from the first descriptive study. On the first cover letter each participant was informed of the ongoing nature of the study that would last from approximately November to February. Each participant was given the right to refuse participation. The same questionnaire was sent to the participants in November, January and February. Each questionnaire asked the participant to evaluate stressful life events in the previous month.

To completely evaluate the effect of stress on multiple sclerosis I had to evaluate other areas such as social support and perceived stress were evaluated(Figure). Each participant received a questionnaire with a total of five sections. Social support has been thought to wholly or partly protect one from the effects of high levels of life stress (Cohen and Hoberman, 1983). Therefore, each participant's level of social contacts were assessed with the Social Participation Scale which was adapted from a survey by James House (House et al., 1982). The Perceived Stress Scale, adapted from a work by Sheldon Cohen measures the impact stress has in general on a participant and determines their ability to cope with stressful life events (Cohen and Williamson, 1988). The Stressful Life Events Scale asked each participant whether they had had stressful life events in the past month in the categories of school, family, relationships, work/finances and other (Cohen et al., 1991). Participants also evaluated, on a scale of -3 to +3, how that stressful event affected them. The 16-question Incapacity Scale (Kurtzke Scale) asked participants to evaluate their functioning level on areas that are commonly affected by multiple sclerosis. For example, participants rated their function levels in climbing stairs, vision, bladder control and fatigue. Finally, the Health Management Questionnaire was a descriptive questionnaire that provided an idea of what coping methods each participant undertook.

Over an 18-week time period the participants were sent this questionnaire three times, in November, January, and February. Participants were encouraged to respond with each mailout. During this 18-week time period the changes in stress levels over time were tracked and then compared with the respondents' incapacity levels. Also, analysis was planned to see how social support and perceived stress correlates with capacity levels in this population.

CHAPTER III

RESULTS

The following sections provide the results of the evaluation of the effect of stress on the initial onset and relapse rate of multiple sclerosis. To provide the clearest description of the results obtained, the results are arranged as follows: first, demographics and descriptive data on the population that completed and returned the questionnaire on stress affecting symptom onset; and second, demographics and descriptive data on the respondents who completed all three progressive questionnaires at time one, time two, and time three. Of the data analysis of the second section, there are primary results pertaining to the hypothesis that stress effects MS exacerbations and following are secondary results pertaining to the influence of social support, and coping methods. A total of 325 MS patients received the questionnaires, but several declined participation or were ineligible so the population size dropped to 282 participants.

3.1. Hypothesis One

The following information contains the data collected from the analysis of the impact of stress on the initial onset of multiple sclerosis. A total of 74 participants, out of 282 possible, completed and returned the questionnaire that included questions relating to stressful life events prior to symptom onset and demographic questions. The following sections show the demographic data of this population and analyses of their responses to the questionnaire. Refer to Appendix A for more detailed information on the questionnaires and the scales used for evaluation.

3.1.1. Demographics

Each of the 74 participants self-evaluated their MS category as either relapse remitting, primary progressive or secondary progressive. Of the respondents, 72.6% reported they were relapse remitting, 13.7% reported they were primary progressive and 13.7% reported they were secondary progressive. Seventy seven percent were female and 23% were male. Of the respondents, 87.8% were Caucasian, 8.1% Hispanic and 4.1% Black. The ages of participants ranged from 30 to 89 years of age, with an average age of 49. Participants were also asked to list the year of their MS diagnosis. These values ranged from 1974 to 2000, with 35.6% of respondents diagnosed since 1995. The average year of onset was 1991, meaning the average participant of this population had had multiple sclerosis for at least 9 years. Figures 1 and 2 show the demographic information of this MS sample.

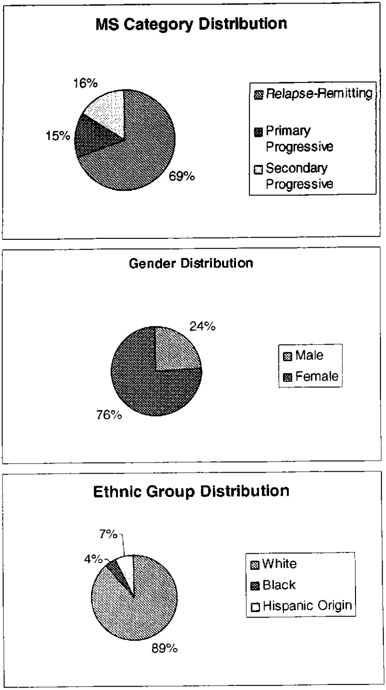

Fig. 1. Demographic results of MS category, ethnic distribution and gender distribution for hypothesis one participants (n=77).

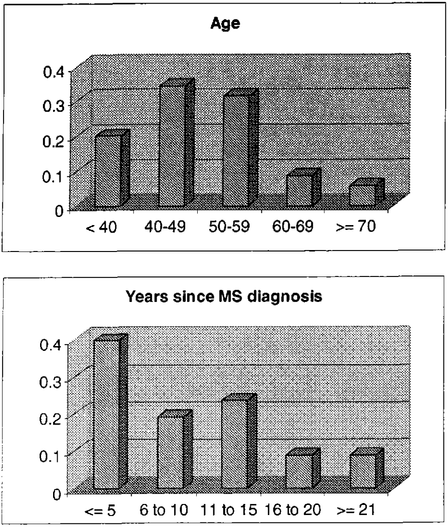

Fig. 2. Demographic information on the ages and years since diagnosis of hypothesis one participants (n=77).

3.1.2. Primary Results

The questionnaire listed 23 stressful life events and asked each participant to check whether they experienced those events in the 12 months prior to symptom onset. If they did experience an event, they were then asked to evaluate each event on a scale of -3 to +3 where -3 represented a severely negative event and +3 represented a highly positive event. From this information, the total number of stressful life events that each person experienced was calculated.

The range of stressful life events was from 0 to 14 events per person (Figure 3). The average number of stressful life events per person for this population was 4.57 events. A significant number of MS patients (88.6%) experienced at least one stressful life event in the year prior to symptom onset. The stressful life events that occurred at the highest frequency included serious problems, disappointments or successes at work of MS patients or their spouse/partner (50%), behavior problems in a member of their

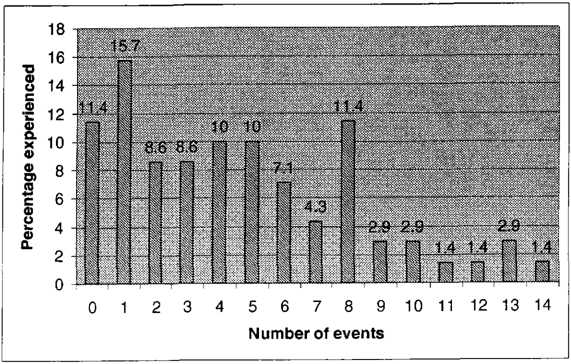

Fig. 3. The average number of stressful life events per person.

family (46.6%), events other than the ones listed on the survey (38.4%), loss or change of jobs or involuntary unemployment of MS patients or their spouse/partner (37.8%), significant change in their personal finances (35.1%), or a move (32%). For these six events, the average rating of the participants ranged from -0.4348 to -1.97, on a scale of -3 to +3. All six of these events were mild to moderate negative life events, with none being severe (<-2.00). Table 1 provides detailed information on all 23 stressful life events including the number who reported a "yes" answer and the averages of the ratings.

Table 1

Number of participants who reported a "yes" answer for each stressful life event and the average rating of each event for 77 participants.

Stressful life event	n	Mean	Std. Deviation
moved	23	-0.4348	2.1495
broken engagement/relationship	8	-2.1250	2.1002
married	5	1.0000	1.8708
death	16	-1.8750	1.8212
separation/divorce	5	-2.2000	1.3038
break up with a close friend	4	-2.5000	0.5774
worsening of an important relationship	22	-2.1364	1.4241
birth of child/adoption	7	-0.2857	2.5635
accident	11	-1.7273	1.7939
hospitilization	18	-1.8333	1.8550
pregnancy	6	-1.5000	1.8708
miscarriage/stillbirth	0	0.0000	0.0000
loss/change in jobs	25	-1.4000	1.8028
business/investment loss	7	-2.4286	0.7868
problems or successes at work	37	-1.0000	2.0412
success or failure in a course	10	1.0000	2.4495
change in personal finances	23	-0.6957	2.1413
burglary	9	-2.0000	0.7071
assualt/mugging	3	-3.0000	0.0000
behaviour of family member	31	-1.9677	1.3288
appearance in court	4	-2.7500	0.5000
loss of pet	15	-2.0667	0.8837
other events	23	-1.5217	2.0861

Total Average Score	70	4.5714	3.6379

3.2. Hypothesis Two

The following sections contain information regarding the second part of the analysis concerning the effect of stress on the exacerbations of multiple sclerosis. The data was collected at three time periods: time one (T1), time two (T2) and time three (T3). These three time points occurred over an 18-week time period with approximately one-month separations. The following information includes a section on demographics of the sample population, primary results concerning the effect of stress on the exacerbation of multiple sclerosis symptoms and secondary results to the study. Refer to Appendix A for more detailed information on the questionnaires and the scales used for evaluation.

3.2.1. Response Rate

A total of 325 MS patients were randomly selected from the database of the North Texas Chapter of the National Multiple Sclerosis Chapter. Several selected participants chose to decline participation or where ineligible for participation and the population size dropped to 282. Of those eligible, 87 participants completed and returned the first questionnaire of the progressive study. Only 70 participants followed up with the second questionnaire in the progressive study. Finally, 64 participants completed and returned the third questionnaire. A total of 44 MS patients completed and returned all three questionnaires. The rest of the respondents failed to follow-up with a survey, or did not send in the baseline survey (T1) but returned the second or third survey. During the analysis, the numbers dropped slightly because any missing data from a particular section would immediately remove that person from that particular analysis.

In order to gain the ability to generalize the results to our entire population, we sent a non-respondent survey to 10% of the non-respondents. They were sent a questionnaire with the most important questions of each section plus demographic information, totaling 16 questions. Eighteen non-respondent surveys were mailed and 6 surveys were returned due an undeliverable address. When the questionnaires were mailed, they were sent through bulk mail due to the large amount. The bulk mail system did not return the undeliverable mail to the sender, however, and notification of faulty addresses was never received. The mail-outs for the non-respondent survey were sent through regular mail. Since 33% of the non-respondent surveys were returned due to faulty addresses, it was generalized that approximately 33% of the total non-respondents had faulty addresses.

One major limitation arose during the course of the survey. Many of the randomly selected participants were on the MS Society mailing list but did not have multiple sclerosis. Instead they joined the mailing list for an affected family member, donations, or information on the disease. A total of 43 participants (13%) returned unanswered questionnaires stating that they were not diagnosed with multiple sclerosis. They were therefore removed from the population.

3.2.2. Demographics

A total of 44 MS patients completed all three questionnaires of the progressive survey. Of these respondents, 75% classified themselves as relapse remitting, 4.9% chronic progressive and 19.5% secondary progressive. Respondent diagnosis occurred between the years of 1974 and 2000. Half of the respondents (50%) were diagnosed prior to 1990 and 26.8% were diagnosed within the last two years. The male to female ratio was 1:3 in the respondent population. There was still a high majority of Caucasian participants (90%) compared to 7.3% Hispanic origin and 2.4% Black. The average age of the 44 respondents was 50 years old. Figure 4 reflects the demographic information of this population in better detail.

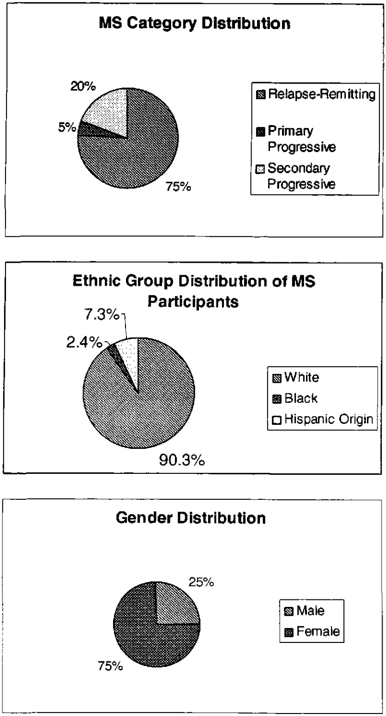

Fig. 4. Demographic information on the population in hypothesis two (n=44).

4.2.3. Primary Results

Once all the data was collected, a score was computed for each respondent's stress level, incapacity level, social support level, health management level, and perceived stress level at time 1 (T1), time 2 (T2) and time 3T(T3). A more detailed explanation follows as to how each score was computed.

The stressful life events scale of each questionnaire contained five different subsections: school, family, relationships, work/finances and other stressful life events. An average of the scores for each of these stress subsections was calculated per participant. The total stress level score was calculated by averaging the scores of the five sections. The average stress level for each participant could possibly range from -3 to +3 where -3 represented all severely negative stressful life events and +3 indicated a very high stressful life event average.

The average stress score for the first time period (T1) was -0.2961 (s.d. 0.3600, n=36). The average stress score for the second time period (T2) was -0.2125 (s.d. 0.2567, n=38) and at the third time period (T3) was -0.2272 (s.d. 0.2274, n=40). Refer to Figure 5 for more detailed information. At each time period, participants were mildly stressed and their stress levels actually decreased slightly as time progressed.

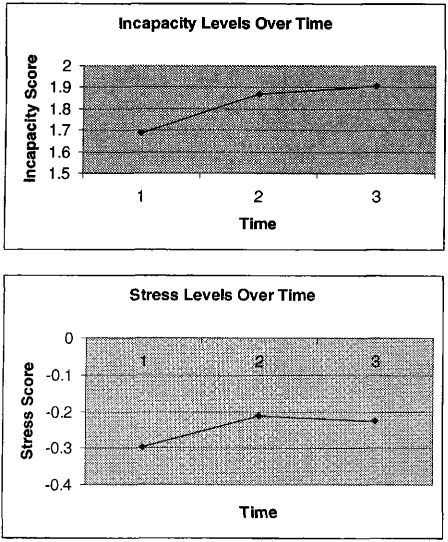

Fig. 5. Graphical depiction of the change in incapacity levels and stress levels over time.

An incapacity score from the Kurtzke scale was also calculated for each time point. The participants rated their ability to perform sixteen functions on a scale of 1 to 5 where 1 represented normal functioning and 5 represented total dependence on human aid or assistive devices. Each participant received a score of the average of his or her self-evaluated capacity levels for each time point.

At T1, the average incapacity score was 1.6857 (s.d. 0.5789, n=35). This score changed at T2 to 1.8701 (s.d. 0.5921, n=38). At T3, there was another change from the initial score to 1.9046 (s.d. 0.6451, n=38). Refer to Figure 5 for more detailed information. This data tells us that the participants were, on average, needy of assistive devices to perform a few of their functions and that this need went up over time.

A General Linear Model (GLM) test was used to analyze the relationship between stress levels, incapacity levels and time. The GLM test tested the relationship between T1, T2, and T3 and had a repeated measure design because of the three time periods. A test of within-subjects contrasts showed that there was significant linear relationship between the incapacity levels at T1, T2 and T3 (p=0.001). The same test showed that there was a significant linear relationship between stress levels at T1, T2, and T3 (p=0.001).

Separate analyses were performed upon each of the subsections (school, family, relationships, work/finances, and other) of the stressful life events scale in comparison to the incapacity level. Of the five categories, only the "other" category had a significant change between the time intervals (p=0.05). The other categories remained fairly

Table 2
Analysis of the reported means of the subsections of the stress questionnaire

Category	Mean	Std. Deviation
School 1	-0.2755	0.8032
School 2	-0.5408	0.5552
School 3	-0.4066	0.5179
Family 1	-0.2454	0.4061
Family 2	-0.1612	0.2811
Family 3	-0.1154	0.2530
Relationship 1	-0.2049	0.3999
Relationship 2	-0.0972	0.2278
Relationship 3	-0.1184	0.2135
Work 1	-0.3710	0.5815
Work 2	-0.3313	0.4486
Work 3	-0.3083	0.3983
Other 1	-0.3487	0.3865
Other 2	-0.2641	0.4158
Other 3	-0.3300	0.3236

constant over the 18-week period. Refer to Table 2 for detailed information on these analyses.

Also, there was no significant correlation between any of the five categories with respect to the incapacity score. Over the 18-week time period, the incapacity levels increased significantly ($p<0.05$) while the stress levels decreased significantly ($p<0.05$). This information does not support the initial hypothesis that an increase in stress will cause exacerbation, or worsening, of symptoms. Therefore it was beneficial to perform secondary analyses to examine why the data does not support the initial hypothesis.

4.2.4. Secondary Results

The following information provides the results of the analyses of the secondary part of the research on the effect of stress on MS exacerbations. Analysis includes results on the perceived stress scale, social participation scale and the health management questionnaire. All data was taken from the 44 MS participants who completed and returned the questionnaires at all three time points.

Perceived stress results

Each participant answered 10 questions regarding their perceived stress levels, and their ability to cope with the everyday problems found in life. They rated each question on a scale of 0 (Never) to 4 (Very often). The average score for each time period was 1.6628 (s.d. 0.1135, n=43) for T1, 1.6000 (s.d. 0.7155, n=41) for T2, and

1.6512 (s.d. 0.6333, n=43) for T3. Therefore, on average, participants perceived stress in their life almost never to sometimes, during all three time periods. Four of the ten questions determined the respondent's ability to cope and were reverse coded. Of those questions, for all three time points, the average response was 1.50, but when reverse coded equaled an average of 2.5. This means that respondents sometimes to fairly often felt like they had control of their lives. There was no significant change in perceived stress levels between the three time periods ($p<0.05$).

Social participation results

All 44 respondents answered a social participation questionnaire at each time period. The questionnaire was divided into two separate categories, people interactions and independent social involvements. The first section analyzed the amount of time each participant spent in contact with other people like friends, family, church members or coworkers. The second half asked the person to describe their contacts with society through television, radio, newspaper, etc. The first section asked participants to rate each event on a scale of 1 (not at all during the past month) to 5 (almost every day during the past month). The second section had 7 possible answer choices ranging from 1 (not at all) to 7 (more than 5 hours per day).

The first section on personal contacts was divided into two sections: personal activities and spectator activities. Personal activities include visiting with friends or family or going to work. Examples of spectator activities were going to church, going to a movie or attending a class. The answers for each section were averaged and each participant received a score for personal activities, spectator activities and independent social involvements. The average personal activity score was 3.2833 (s.d. 0.9384, n=40) for T1, 2.9756 (s.d. 0.876, n=41) for T2 and 3.0388 (s.d. 0.8613, n=43) for T3. Overall, the respondents had personal activity contacts an average of once a week during the month. The average spectator activity score was 1.6634 (s.d. 0.6347, n=41) for T1, 1.6537 (s.d. 0.6372, n=41) for T2 and 1.7095 (s.d. 0.6570, n=42) for T3. Overall, the respondents participated in spectator activities an average of once to twice a month.

Finally, the independent social involvement scores were 3.0762 (s.d. 0.6970, n=42) for T1, 3.0000 (s.d. 0.6761, n=43) for T2 and 2.9091 (s.d. 0.5906, n=44) for T3. This data shows that respondents participated in these independent social involvements an average of one to two hours a day. A GLM repeated measures test was performed and there was no significant linear relationship between personal activities, spectator activities or independent social activities with respect to time one, two, or three. Scores for all three variables stayed relatively constant over the 18-week time period. Refer to Table 3 for detailed information on the social support results.

Table 3
Social network questionnaire means

Time 1	Social Network	N	Mean	Standard Deviation
	personal events	40	3.2833	0.9384
	spectator events	41	1.6634	0.6347
	independent events	42	3.0762	0.6970
Time 2	personal events	41	2.9756	0.8768
	spectator events	41	1.6537	0.6372
	independent events	43	3.0000	0.6761
Time 3	personal events	43	3.0388	0.8613
	spectator events	42	1.7095	0.6570
	independent events	44	2.9091	0.5906

Health management results

Finally, each participant answered the health management questionnaire, which asked them to answer whether they participated in a coping activity particular for multiple sclerosis and then to evaluate their feelings of the activity. They rated each activity on a scale of -3 to +3 where -3 represented a highly negative experience and +3 represented a highly positive experience.

At T1, the average number of coping activities per person was 4.0698 (s.d. 1.9444, n=43). At T2, participants used 3.9286 (s.d. 1.7305, n=42) coping activities and at time three 3.6667 (s.d. 1.6626, n=42). A GLM repeated measures test of within-subject contrasts showed that there was no significant linear relationship between the number of coping activities over the three time periods. Table 4 provides more detailed information about health management methods over time.

Table 4
Ratings of health practices

Time	Health Practice	% Yes*	Average Rating	Average # of Health Practices/Person
Time 1	exercise	80	1.6286	4.0698
	yoga	13.6	0.1667	
	healthy diet	72.7	1.2667	
	prescription medication	76.7	1.9355	
	alternative medication	32.6	1.8571	
	therapy	23.3	0.5000	
	spiritual exercise	50	2.1364	
	meditate or quiet time	63.6	2.0000	
Time 2	exercise	74.4	1.4839	3.9286
	yoga	11.6	1.0000	
	healthy diet	74.4	1.3750	
	prescription medication	81.4	1.8235	
	alternative medication	28.6	1.5000	
	therapy	14	1.5714	
	spiritual exercise	51.2	2.1364	
	meditate or quiet time	60.5	2.0000	
Time 3	exercise	66.7	1.5556	3.6667
	yoga	4.8	0.6667	
	healthy diet	69	1.2500	
	prescription medication	83.3	1.4000	
	alternative medication	31	1.6667	
	therapy	7.1	2.6667	
	spiritual exercise	45.2	2.3750	
	meditate or quiet time	59.5	1.7826	

* N=44

CHAPTER IV

CONCLUSIONS

4.1. Hypothesis One Conclusions

The principle goal of this section of the research was to determine if a high percentage of MS patients experienced stressful life events prior to symptom onset. The following conclusions are based upon data from 77 MS participants who completed and returned the questionnaire evaluating stressful life events prior to symptom onset. Also, demographic data was obtained and analyzed to test for the ability to generalize to the entire MS population. Refer to Appendix A for more detailed information on the questionnaires and the scales used for the evaluation.

4.1.1. Demographic Conclusions

Of the respondents, 72.6% reported they were relapse remitting, 13.7% reported they were primary progressive and 13.7% reported they were secondary progressive. The national average of MS participants is between 60 and 80% relapse remitting and the remaining percent in the progressive stages. Therefore, the multiple sclerosis category percentages adhere to the expected national averages.

Of the respondents, 77% were female and 23% were male. Nationally, MS occurs twice as often in women as in men. The female to male ratio in this population is higher than the national average. This occurrence could be explained by the fact that the participants were randomly selected from the National MS Society, which is a form of support group, and women may be more likely to attend support groups than men.

Of the respondents, 87.8% were Caucasian, 8.1% Hispanic and 4.1% Black. Multiple sclerosis has a high prevalence in Caucasian people of northern European origin and is extremely rare among Asians and Africans. The ages of participants ranged from 30 years old to 89 years old, with an average of 49 years old. MS is usually diagnosed between the ages of 15 and 40, with a peak incidence in people in their 20s and 30s. The population in this study is slightly older than the expected MS population.

Participants also listed the year of their MS diagnosis. These values ranged from 1974 to 2000, with 35.6% of respondents diagnosed since 1995. The average year of onset was 1991, meaning the average participant of this population had had multiple sclerosis for at least 9 years. Some patients experience symptoms years before they were actually diagnosed and may have had MS longer than the time stated. Even though there were a high percentage (35.6%) of MS patients who were recently diagnosed, many have had multiple sclerosis for several years. Therefore, the population still has a wide spread of varying disease courses and progression.

For the most part, the averages of this particular population of MS participants corresponded to the national averages with regard to age, disease category and year of diagnosis. The sex ratio was skewed slightly for the reasons explained above. Therefore, we should be able to generalize the data found in this population to the MS population as a whole.

4.1.2. Primary Conclusions

A significant number of MS patients (88.6%) experienced at least one stressful life event in the year prior to symptom onset. This supports the hypothesis that stress does impact the initial onset of symptoms. The average number of life events experienced prior to symptom onset was 4.57. In the 12 months prior to the onset of symptoms, the MS population of this research experienced a significant number of stressful life events, whether negative or positive. This also supports the previous findings that high stress levels are present prior to symptom onset.

Previous research has indicated that of all events, those which pose substantial long-term threat to the person directly are most likely to be associated with medical and psychiatric disorders (Grant et al., 1989). Of the top six stressful life events prior to symptom onset, five were long-term stressful life events associated with the MS patient or their spouse/partner. Those five long-term stressful life events were serious problems, disappointments or successes at work of MS patients or their spouse/partner, behavior problems in a member of their family, events other than the ones listed on the survey, loss or change of jobs or involuntary unemployment of MS patients or their spouse/partner, or a significant a change in their personal finances. The other event, moving, was not as long-term as compared to the others.

Sibley found that marital and job-related stress was followed by clinical exacerbation, major negative life events, such as a death in the family, were not (Sibley, 1997). Three of the top six stressful life events found in this study pertain to work and/or finances and none pertain to highly negative life events, like accidents or death.

This information reconfirms the results found in previous research that a high percentage of MS patients experienced stressful life events prior to symptom onset. In a previous study 79 out of 100 MS patients reported more unwanted stress than usual in the two years prior to onset of symptoms as compared to 54 out of 100 controls (Warren et al., 1982). In another study, the proportion of multiple sclerosis patients who experienced marked life adversity in the year prior to onset of symptoms was significantly higher than for nonpatients in the year before interview (77% vs. 35%) (Grant et al., 1989).

Previous research has focused on the difference between chronic and acute stress affecting multiple sclerosis. Acute stress enhances the immune system whereas chronic stress is immunosuppressive (Dhabhar and McEwen, 1997). Most of the research focused on the exacerbations of already diagnosed multiple sclerosis and not onset, however. In this study, patients were not evaluated on the difference between acute and chronic stress affecting multiple sclerosis onset. Since participants were not asked the duration of each event inferences could not be made concerning the different types of stress each participant experienced.

4.1.3. Limitations

With a retrospective study there are certain limitations. First, retrospective reports are more likely to be inaccurate as time increases between the time of the report and the time of the event. Second, patient beliefs may bias reporting of past events. Third, the affective state may influence recall by facilitating access to memories of events with similar affective states. Thus, the stress resulting from an MS exacerbation may promote recall of previous stressful events (Mohr et al., 2000). Since this is a retrospective study, no conclusions concerning the causal relationship between stress and multiple sclerosis can be made.

4.1.4. Future Recommendations

Since the time since symptom onset ranged from 1 to 27 years, a high amount of recollection biases hinders the validity of the study. Therefore, it would be beneficial to work in conjunction with a physician or medical center and analyze stressful life events of MS patients who were recently diagnosed (within 1 years time). Also, a doctor or physician may be able to determine the point at which symptom onset began by reviewing the patient's medical record.

The findings of this research show that there seems to be a significant difference between different types of stressful life events and their effect on multiple sclerosis. This study showed that long-term stressful life events and marital and job-related stress had the largest prevalence prior to symptom onset. It may be beneficial to do future research in this area to look further into these particular findings or analyze differences between positive and negative stressful life events.

Finally, analysis on the difference between acute and chronic stressful life events should be done in the future. Much information points to the harmful effects of acute stress but the temporarily beneficial effects of chronic stress. Research on the impact of different forms of stressful life events on symptom onset is warranted for the future.

4.2. Hypothesis Two Conclusions

The main focus of this part of the research was to progressively follow MS patients over an 18-week time period (three collection points) and monitor the effect of stress on the exacerbation of MS symptoms. The following conclusions are based upon data collected from 44 MS patients who returned and evaluated all three questionnaires. Demographic data of this population was analyzed and conclusions follow, as well. Refer to Appendix A for more detailed information on the questionnaires and the scales used for the evaluation.

4.2.1. Demographic Conclusions

Of the 44 respondents analyzed, 75% classified themselves as relapse remitting, 4.9% chronic progressive and 19.5% secondary progressive. The number of participants with relapse remitting MS actually increased, along with the number of secondary progressive, while the number of chronic progressive participants decreased, as compared to the demographics of the population for hypothesis one. An increase in the number of relapse remitting respondents was beneficial to the study because MS patients in this category experience symptom exacerbations. Overall, this population of this section of the research adhered to the nationally expected percentages for MS category.

Respondent diagnosis occurred between the years of 1974 and 2000. Half of the respondents (50%) were diagnosed prior to 1990 and 26.8% were diagnosed within the last two years. As with the demographics of the population in hypothesis one, many participants had been diagnosed within the past few years. This could be explained by the fact that they were new in having MS and looked to the MS Society, the database, for support. Over half of the respondents have had MS for more than 10 years, which provides a large range of years since diagnosis. Therefore, we can generalize to the national population according to this data.

The male to female ratio was 1:3 in the respondent population. This same information was found within the demographics of the hypothesis one population. Nationally, the average ratio is one man to two women with multiple sclerosis. Once again, this is most likely explained by the stronger desire for women to join support groups.

There was still a high majority of Caucasian participants (90%) compared to 7.3% Hispanic origin and 2.4% Black. This ethnic bias for people of European descent is reflected nationally as well as in this particular population. Also, the average age of the 44 respondents was 50 years old. The demographics of the population show that it slightly favors women but the ratios for ethnicity, age and disease classification all adhere to the national averages.

4.2.2. Primary Conclusions

There was no significant correlation found between stressful life events and MS exacerbations. The baseline average incapacity score at time one (T1) was 1.6857 (s.d. 0.5789, n=35). The interim score at time two (T2) changed to 1.8701 (s.d. 0.5921, n=38). At the final collection point, time three (T3) there was another change from the initial score to 1.9046 (s.d. 0.6451, n=38). Over time there was a statistically significant increase (p=0.001) in the incapacity levels of the MS population used for this research. This data tells us that at baseline (T1) the participants were, on average, needy of assistive devices to perform a few of their functions and that, by the final time point (T3) 18 weeks later, the need for assistive devices had risen.

The hypothesized trend that increased stress levels would have influenced the significant increase in incapacity levels did not occur, however. At baseline (T1) the average stress score, composed of the subsections of school, family, relationships, work/finances, and other stressful events, was -0.2961 (s.d. 0.3600, n=36). The average stress score for the second time period (T2) was -0.2125 (s.d. 0.2567, n=38) and at the third time period (T3) was -0.2272 (s.d. 0.2274, n=40). This data showed that there was a statistically significant decrease (p=0.001) in the amount of average stress for the research population. The data collected showed that participants were mildly stressed during each time period and their stress levels actually decreased slightly as time progressed.

A study by Warren et al. reported that patients who recently experienced an exacerbation (decreased capacity levels) scored higher in emotional disturbance and intensity of stressful events than patients in remission (Warren et al., 1982). According to the data collected on a population of 44 multiple sclerosis patients, there was not a correlation between increased stress and decreased capacity levels. In fact, the opposite actually happened. As stress levels decreased the incapacity levels increased. Therefore, the information collected for the second part of the research did not support the initial hypothesis that a high percentage of MS patients would experience relapses during or immediately following moments of stress.

It is unknown why the number of stressful life events decreased while the incapacity levels arose. The most plausible explanation was the low number of MS patients who responded to all three questionnaires (n=44). Many participants participated during one or two time points but did not participate during all three, and were therefore excluded. Also, since all members selected for the study were involved in the MS Society they most likely had a desire to improve their health and well-being, including decreasing stressful life events in their life.

None of the subcategories (school, family, relationships, work/finances and other) of the stressful life events scale had a correlation with the incapacity levels either. Of these groups the average stressful life events score was mild. The highest score for any of the categories was -0.4190 for the T3 score of the school section. Refer to Table ? for detailed information on these subcategories. Since the total stress score was relatively mild, it was expected that these scores be relatively mild as well.

Only the "other" category had a significant change (p=0.05) between the T1 and T2 time periods. The other categories remained fairly constant over the 18-week period with no significant change between T1, T2 and T3. Also, every category had a statistically non-significant decrease between the baseline time (T1) and the final collection time (T3). When comparing each category over the course of time to the incapacity levels over the course of time, there was no significant correlation between any of the categories and incapacity levels of MS.

4.2.3. Secondary Conclusions

The following information provides results of the analyses performed on the secondary parts of the progressive questionnaire. The conclusions were based upon the responses of 44 MS patients over a period of 18 weeks (three collection times). These include conclusions on social support data, perceived stress data and health management data. The demographic data for the primary results applies to this population as well, as it is the same population of people.

Perceived stress conclusions

The perceived stress levels of each participant were measured at baseline (T1), an interim time point (T2), and at the final data collection time point (T3). At T1 the average perceived stress level was 1.6628 (s.d. 0.1135, n=43), 1.6000 (s.d. 0.7155, n=41) for T2, and 1.6512 (s.d. 0.6333, n=43) for T3. There was no significant change in perceived stress levels between the three time periods ($p<0.05$). We can conclude that participants perceived stress in their life almost never to sometimes, during all three time periods. This did not change as their reported stress levels decreased. Even though they experienced changes in the actual number of stressful life events experienced, participants, on average, did not report being affected by these changes when reporting their perceived stress.

Four of the ten questions were reverse coded to determine the respondent's ability to cope with stressful situations brought about by life. Of those questions, for all three time points, the average response was 1.50, but when reverse coded equaled an average of 2.5. This means that respondents sometimes to fairly often felt like they had control of their lives. This reported moderate control of participants' lives also did not change as stress levels decreased over the three time periods.

Due to the fact that participants remained constant in their report of low levels of perceived stress and moderate levels of control, it was concluded that this particular population had developed means of coping with the ever-changing stressful events in their life. This means of coping would possibly diminish the effect of stress on the exacerbation of multiple sclerosis.

Social support conclusions

The conclusions that follow are taken from the data of the 44 respondents who answered a social participation questionnaire at each of the three time periods. Analysis included the frequency of personal contacts, such as visiting with friends or family, and spectator event contacts, such as going to a movie or concert, that occurred during the past month. Also, data was collected on the frequency of independent social involvements, such as watching television or listening to the radio, that occurred on a daily basis.

The average personal activity score was 3.2833 (s.d. 0.9384, n=40) for T1, 2.9756 (s.d. 0.876, n=41) for T2 and 3.0388 (s.d. 0.8613, n=43) for T3. Overall, the respondents had personal activity contacts an average of once a week during the month. There was no control for this particular analysis so comparisons were made only between the changes in participant scores from baseline to the final data collection. There was not a significant change in the personal activity score between T1, T2 and T3. Therefore, this population maintained a constant level of personal contacts throughout the 18-week time period.

The average spectator activity score was 1.6634 (s.d. 0.6347, n=41) for T1, 1.6537 (s.d. 0.6372, n=41) for T2 and 1.7095 (s.d. 0.6570, n=42) for T3. Overall, the respondents participated in spectator activities an average of once to twice a month. The number of spectator activities was almost half of the number of personal contacts per participant but this was to be expected. Attending a function, instead of participating, is not as socially fulfilling and would probably provide less of the support and networking as personal contacts. The number of spectator activities, like the personal contacts, did not change over time as this population maintained a constant level of contacts.

Finally, the independent social involvement scores were 3.0762 (s.d. 0.6970, n=42) for T1, 3.0000 (s.d. 0.6761, n=43) for T2 and 2.9091 (s.d. 0.5906, n=44) for T3. This data shows that respondents participated in these independent social involvements an average of one to two hours a day. Once again, there was no significant change in the number of independent social involvements between T1, T2 and T3.

Since neither the personal contacts, spectator activities, or independent social involvements changed over time it was assumed that social networking does not affect the change in incapacity levels of this particular population. Perceived availability of support wholly or partly protects one from the pathogenic effects of high levels of life stress (Cohen and Hoberman, 1983). If these patients perceive that they have a wide range of social networks, this can buffer the negative effects of stress. In this population, the stress levels went down, instead of up. Therefore, we can not make any conclusions concerning the buffering hypothesis of social support on this particular population of 44 MS participants.

Health management conclusions

Finally, conclusions can be made involving the data from the 44 participants who answered the health management questionnaire. Data was collected on whether they participated in a coping activity particular for multiple sclerosis and then their evaluations of the activity. At T1, the average number of coping activities per person was 4.0698 (s.d. 1.9444, n=43). At T2, participants used 3.9286 (s.d. 1.7305, n=42) coping activities and at time three 3.6667 (s.d. 1.6626, n=42). As with social support and perceived stress there was no significant linear relationship between the number of coping activities over the three time periods.

Participants were using an average of about 4 coping strategies out of 8 possible coping strategies. This 50% involvement rate reconfirms the previously stated assumption that involvement in the MS Society promotes a general desire to maintain health and well-being. This desire would be fulfilled in participation in these coping strategies such as exercise, meditation or therapy. There was no conclusive evidence to show that these coping strategies had an influence on the incapacity levels of the participants.

4.2.4. Limitations

The study had many limitations, leading to poor results. First, the validity of the MS sample was affected because of the high number (13%) of non-MS patients selected for the study and for the high number (33%) of non-respondent surveys with a faulty address. The longitudinal design of the study meant that participants had to participate at each time point to provide useful data. There was no requirement for participation, nor was there compensation, which meant people were less likely to respond.

Also, the data was collected over a relatively short time period of 18 weeks. It is not known exactly how long after a stressful life event that an exacerbation may be seen. Perhaps a longer time period would have shown more accurate results on how stress affected the incapacity levels. The chosen time period between data collection, approximately one month, was appropriate for the study.

4.2.5. Future Recommendations

Further research in this area is warranted. Perhaps testing the difference between acute and chronic stress and the effect on the exacerbations. Previous research has shown that chronic stress leads to immunosuppression while acute stress may leads to immune activation and possible exacerbations. A study by Nisipeanu et al. showed that observers of the Persian Gulf War bombings actually had fewer exacerbations during or after the bombings than before (Nisipeanu and Korczyn, 1993). There is not a lot of evidence to support or reject the different effects of acute or chronic stress on multiple sclerosis and more research will be beneficial to understanding MS.

The first analysis performed on the effect of stress on the initial onset of MS showed that there was a different effect depending on the type of stress. For example, work related stressors had more prevalence prior to onset than did severe life events such as a death in the family. This second part of the research showed no correlation between different types of stress such as school, family, relationships, work/finances or other stressful life events. Perhaps due to limited subject participation and time the differences between these types of stressful life events were not visible in this study but would be visible in a more long-term study.

A longer testing time period is recommended. The limited time frame of this study could have possibly led to less accurate results. Also, research should be performed on subjects selected from a more diverse population, like a hospital or doctors office. A doctor or medical professional could monitor their health and more accurately identify the exacerbations. This research relied on each participant's ability to self-evaluate his or her incapacity level.

Finally, involvement in a society such as the MS Society usually comes with a desire to improve your health and well-being. This desire may lead to a conscience effort to decrease stressful life events in your life. Those that chose to participate probably want to improve their health and learn more about multiple sclerosis than those who declined. Selection of a more diverse population would help eliminate this bias toward participants desiring to lower their stressful life events through different means of coping.

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APPENDIX A

QUESTIONNAIRES AND SCALES USED TO TEST THE EFFECT OF STRESS ON MULTIPLE SCLEROSIS

Cover Letter

Hello!

I am asking for your help to research the effect of stress on patients with multiple sclerosis, about which there is little information available. Your name was provided to me by Carole Wheeler of the North Central Texas Chapter Multiple Sclerosis Society. As a daughter of an MS patient, I have a particular interest in factors that cause and affect the disease, especially stress. I chose to join the Undergraduate Research Fellows Program at Texas A&M University and to direct my research efforts toward the impact stress has on the initial onset and on the relapse of the disease.

The study will consist of 325 people from Tarrant County who all have multiple sclerosis and are members of the MS Society. This is a confidential study in which each participant is assigned a number and will not be asked their name or other identifying information on the questionnaire. My research professors and I will be the only people with access to the names. I will evaluate stressful life events present one year prior to disease onset and will measure stressful events, perceived stress, social support and symptom levels according to the Kurtske scale. You will receive a follow-up survey in the middle of January and in the middle of February. A stamped self-addressed envelope will be provided with each questionnaire. If a question makes you feel uncomfortable, you have the option of not answering that question and will still be included in the survey. If for some reason you do not want to participate in the survey, please return the questionnaire and so indicate.

Some questions in the survey deal with sensitive issues, such as personal capabilities and stressful events that are present in your life. If you ever feel uncomfortable by a question or topic, or have concerns about an issue dealing with stress or multiple sclerosis, please call Carole Sue Wheeler, Program Development Manager for the Tarrant County Multiple Sclerosis Society (e-mail: carole.wheeler@nctms.org) or Shannon Barnard LSW, Program Specialist (e-mail: shannon.barnard@nctms.org). The telephone for both is (817) 877-1222.

Please understand that this research study has been reviewed and approved by the Institutional Review Board – Human Subjects in Research, Texas A&M University. For research-related problems or questions regarding subjects' rights, you can contact the Institutional Review Board through Dr. Richard E. Miller, IRB Coordinator, Office Of Vice President for Research and Associate Provost for Graduate Studies at (979) 845-8585 (email: rich-miller@tamu.edu).

Thank you for your willingness to participate in the study. Your answers to the questions in this study will help us to better understand how stressful situations impact the progression of multiple sclerosis. That information will then be shared with the MS Society and stress management professionals. A summary of the research findings will be sent to you at the end of the study.

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Social Participation Scale

For the next set of questions, please use one of the following answers.

1. *Not at all during the past month.*
2. *Once or twice during the past month.*
3. *Once a week during the past month.*
4. *A few times each week during the past month.*
5. *Almost every day during the past month.*

A. In the past month how often did you:

	--- Frequency ---				
1. visit with friends, neighbors?	1	2	3	4	5
2. visit with relatives?	1	2	3	4	5
3. go to the movies, sports events, concerts, etc?	1	2	3	4	5
4. go to fairs, museums, exhibits, etc.?	1	2	3	4	5
5. attend meetings?	1	2	3	4	5
6. go to church?	1	2	3	4	5
7. go to classes or lectures?	1	2	3	4	5
8. go to work (paid or volunteer)?	1	2	3	4	5

For the next set of questions, please use one of the following answers.

1. *not at all*
2. *less than 60 minutes a day*
3. *one to two hours a day*
4. *two to three hours a day*
5. *three to four hours a day*
6. *four to five hours a day*
7. *more than 5 hours a day*

B. In the past month how often did you:

	--- Length of time ---						
1. watch television (total time)?	1	2	3	4	5	6	7
2. listen to the radio (total time)?	1	2	3	4	5	6	7
3. listen to the news on radio or television?	1	2	3	4	5	6	7
4. read newspapers?	1	2	3	4	5	6	7
5. read magazines or books?	1	2	3	4	5	6	7

Stressful Life Events Scale

School

Does you, your spouse/partner or your child attend school at this moment?
Yes [ ]   No [ ] ---> Please go to the section on **Family**.

If yes, please rate how the following events have affected **YOU**, even if they happened to another family member.

A more negative rating indicates a more stressful event and a more positive rating indicates a more positive event. If the event has not occurred in your life or did not affect you, choose 0 for not applicable.

--- Rating of Event ---

	Negatively			**N/A**		**Positively**	
1. Having a challenging class.	-3	-2	-1	0	+1	+2	+3
2. Receiving a grade lower than expected in a class.	-3	-2	-1	0	+1	+2	+3
3. Applying and/or interviewing for an academic program.	-3	-2	-1	0	+1	+2	+3
4. Assignments, tests and/or deadlines.	-3	-2	-1	0	+1	+2	+3
5. Not getting into an academic program.	-3	-2	-1	0	+1	+2	+3
6. Conflicts with a professor or teacher.	-3	-2	-1	0	+1	+2	+3
7. If a school event has stressed you that we have not listed, please list it here. SchoolEvent:_______________	-3	-2	-1	0	+1	+2	+3

Family

The following questions deal with positive and/or negative stressful events associated with your family life. Please rate how each event has affected **YOU** over the past MONTH

> *A more negative rating indicates a more stressful event and a more positive rating indicates a more positive event. If the event has not occurred in your life or did not affect you, choose 0 for not applicable.*

				--- Rating of Event ---				
		Negatively			**N/A**			**Positively**
1.	Having a change in marital status (ex. single to married, married to divorced).	-3	-2	-1	0	+1	+2	+3
2.	Change in the relationship between you and a family member.	-3	-2	-1	0	+1	+2	+3
3.	Dealing with a family member who has behavior problems.	-3	-2	-1	0	+1	+2	+3
4.	Pregnancy of you or your spouse/partner or adoption of a child.	-3	-2	-1	0	+1	+2	+3
5.	You or your spouse/partner experiencing a miscarriage.	-3	-2	-1	0	+1	+2	+3
6.	Caring for a child.	-3	-2	-1	0	+1	+2	+3
7.	Caring for a chronically ill person (other than yourself).	-3	-2	-1	0	+1	+2	+3
8.	A family member moves out of the house.	-3	-2	-1	0	+1	+2	+3
9.	Death of a close family member.	-3	-2	-1	0	+1	+2	+3
10.	Accident (emergency medical treatment) and/or hospitalization of a family member.	-3	-2	-1	0	+1	+2	+3
11.	Planning or organizing a special occasion (ex. Christmas, birthday party, wedding).	-3	-2	-1	0	+1	+2	+3
12.	Moving.	-3	-2	-1	0	+1	+2	+3
13.	If a family event has stressed you that we have not listed, please list it here. FamilyEvent:____________	-3	-2	-1	0	+1	+2	+3

Relationships

The following questions deal with positive and/or negative stressful events associated with relationships outside your family. Please rate how each event has affected **YOU** over the past MONTH.

A more negative rating indicates a more stressful event and a more positive rating indicates a more positive event. If the event has not occurred in your life or did not affect you, choose 0 for not applicable.

--- Rating of Event ---

	Negatively			**N/A**			**Positively**
1. Change in the relationship between you and a close friend.	-3	-2	-1	0	+1	+2	+3
2. Death of a close friend.	-3	-2	-1	0	+1	+2	+3
3. Death, runaway, or give-away of a close pet.	-3	-2	-1	0	+1	+2	+3
4. Moving away of a close friend.	-3	-2	-1	0	+1	+2	+3
5. Being in a new situation that requires you to make friends.	-3	-2	-1	0	+1	+2	+3
6. Stressful life event of a close friend (ex. death, divorce, pregnancy).	-3	-2	-1	0	+1	+2	+3
7. Accident (emergency medical treatment) and/or hospitalization of a close friend.	-3	-2	-1	0	+1	+2	+3
8. If a relationship event has stressed you that we have not listed, please list it here. Relationship Event:_____________	-3	-2	-1	0	+1	+2	+3

Work/Finances

The following questions deal with positive and/or negative stressful events associated with your work or your spouse/partner's work and your financial situation. Please rate how each event has affected **YOU** over the past MONTH.

A more negative rating indicates a more stressful event and a more positive rating indicates a more positive event. If the event has not occurred in your life or did not affect you, choose 0 for not applicable.

		--- Rating of Event ---						
		Negatively			**N/A**		**Positively**	
1.	Changing jobs.	-3	-2	-1	0	+1	+2	+3
2.	Change in salary.	-3	-2	-1	0	+1	+2	+3
3.	Unemployment.	-3	-2	-1	0	+1	+2	+3
4.	Change of job title or responsibilities.	-3	-2	-1	0	+1	+2	+3
5.	Relationship problems with a boss or co-workers.	-3	-2	-1	0	+1	+2	+3
6.	Unrealistic expectations at work.	-3	-2	-1	0	+1	+2	+3
7.	Responsibilities of a managerial/leadership position.	-3	-2	-1	0	+1	+2	+3
8.	Financing a major purchase (car, house, education, etc.)	-3	-2	-1	0	+1	+2	+3
9.	Business or investment loss.	-3	-2	-1	0	+1	+2	+3
10.	Tight budget.	-3	-2	-1	0	+1	+2	+3
11.	Taking out loans.	-3	-2	-1	0	+1	+2	+3
12.	Paying bills.	-3	-2	-1	0	+1	+2	+3
13.	Paying for unexpected expenses (ex. car repairs, broken A/C, broken dishwasher).	-3	-2	-1	0	+1	+2	+3
14.	If a work or financial even has stressed you that we have not listed, please list it here. Event:________________________	-3	-2	-1	0	+1	+2	+3

Other Events

Below is a list of some of the many daily stressful events or events that may occur at random. Please rate how each event has affected **YOU** over the past month.

> *A more negative rating indicates a more stressful event and a more positive rating indicates a more positive event. If the event has not occurred in your life or did not affect you, choose 0 for not applicable.*

--- Rating of Event ---

	Negatively			N/A			Positively
1. Traffic/Lines	-3	-2	-1	0	+1	+2	+3
2. Fears	-3	-2	-1	0	+1	+2	+3
3. Cooking/Cleaning	-3	-2	-1	0	+1	+2	+3
4. Worrying	-3	-2	-1	0	+1	+2	+3
5. Malfunctioning appliances or machines.	-3	-2	-1	0	+1	+2	+3
6. Burglarization of your house or that of a close relative/friend.	-3	-2	-1	0	+1	+2	+3
7. You, your spouse, immediate family member or close friend was assaulted or mugged.	-3	-2	-1	0	+1	+2	+3
8. You or your spouse appeared in court.	-3	-2	-1	0	+1	+2	+3
9. Natural disasters (ex. fire, flood, snow storm).	-3	-2	-1	0	+1	+2	+3
10. Traveling.	-3	-2	-1	0	+1	+2	+3

Perceived Stress Scale

The questions in this scale ask you about your *feelings and thoughts during the* ***last month.*** Please select one of the following answers for each question.

0. Never
1. Almost Never
2. Sometimes
3. Fairly often
4. Very often

In the last month, how often did you . . .

1. become upset because of something that happened unexpectedly? 0 1 2 3 4
2. feel that you were unable to control the important things in your life? 0 1 2 3 4
3. feel nervous and "stressed"? 0 1 2 3 4
4. feel confident about your ability to handle your personal problems? 0 1 2 3 4
5. feel that things were going your way? 0 1 2 3 4
6. find that you could not cope with all the things that you had to do? 0 1 2 3 4
7. feel that you controlled irritations in your life? 0 1 2 3 4
8. feel that you were on top of things? 0 1 2 3 4
9. become angered because of things that were outside of your control? 0 1 2 3 4
10. feel difficulties were piling up so high that you could not overcome them? 0 1 2 3 4

Incapacity Scale

Please circle the number that normally describes your ability to perform the following functions during the **past 30 days.**

1. Stair climbing – Ability to ascend and descend a flight of stairs about 12 steps.

1 = normal.
2 = some difficulty, but performed without aid.
3 = need for canes, braces, prostheses, or dependent upon banister to perform.
4 = need human assistance to perform.
5 = unable to perform; includes mechanical lift.

2. Ambulation – Ability to walk on level ground or indoors some 50 m without rest.

1 = normal.
2 = some difficulty but performed without aid.
3 = need for canes, braces, and/or prostheses to perform.
4 = need for human assistance or use of manual wheelchair which patient enters, leaves and maneuvers without aid.
5 = unable to perform; includes perambulation in a wheelchair and motorized wheelchair.

3. Chair/bed transfer – Ability to enter and leave regular chair and/or bed; includes wheelchair transfer as indicated.

1 = normal.
2 = some difficulty but performed without aid.
3 = need for adaptive or assistive devices such as trapeze, sling, bars, lift, sliding board to perform.
4 = requires human aid to perform.
5 = must be lifted/moved almost completely by another person.

4. Toilet transfer – Ability to seat self and arise from fixed toilet, and maintain position thereon.

1 = normal.
2 = some difficulty but performed without aid.
3 = need for adaptive or assistive devices such as bars, and/or trapeze to accomplish.
4 = requires human aid to accomplish transfer or positioning.
5 = must be lifted/moved/held almost completely by another person.

5. Bowel function.

1 = normal.
2 = bowel retention not requiring more than occasional enemas or suppositories, self-administered.
3 = bowel retention requiring regular enemas and/or suppositories, self-administered, in order to

induce evacuation; cleanses self.
4 = bowel retention requiring enemas and/or suppositories administered by another; needs assistance in cleansing; occasional incontinence; presence of colostomy tended by self.
5 = frequent soiling due either to incontinence or to a poorly-maintained ostomy device, or an ostomy which patient cannot maintain without assistance.

6. Bladder function.

1 = normal.
2 = occasional hesitancy/urgency.
3 = frequent hesitancy/urgency/retention. Use of indwelling or external catheter applied and maintained by self.
4 = occasional incontinence; use of indwelling or external catheter applied and maintained by others; ileostomy or suprapubic cystostomy maintained by self.
5 = frequent incontinence; ostomy device which patient cannot maintain without assistance.

7. Bathing.

1 = normal.
2 = some difficulty with washing and drying self though performed without aid whether in tub or shower or by sponge-bathing, which ever is usual for the patient.
3 = need for assistive devices (trapezes, slings, lifts, shower or tub bars) in order to bathe self, need to bathe self outside tub/shower if that is the usual method.
4 = need for human assistance in bathing parts of body or in entry/exit/positioning in tub or shower.
5 = bathing performed by others (aside from face and hands).

8. Dressing.

1 = normal.
2 = some difficulty clothing self completely in standard garments, but accomplished by self.
3 = specially adapted clothing (special closures, elastic-laced shoes, front-closing garments) or devices (long shoe-horns, zipper extenders) required to dress self.
4 = need for human aid to accomplish; performs considerable portion him/herself.
5 = need for almost complete assistance; unable to dress self.

9. Grooming – Care of teeth/dentures, and hair; shaving or application of cosmetics.

1 = normal.
2 = some difficulty but all tasks performed without aid.
3 = need for adaptive devices (electric razors or toothbrushes, special combs or brushes, arm rests or slings) but performed without aid.
4 = need for human aid to perform some of the tasks.
5 = almost all tasks performed by another person.

10. Feeding – Ingestion, mastication, swallowing of solids and liquids, and manipulation of the appropriate utensils.

1 = normal.
2 = some difficulty but performed without aid.
3 = need for adaptive devices (special feeding utensils, straws) or special preparation (portions pre-cut or minced, bread buttered) to feed self.
4 = need for human aid in delivery of food; dysphagia preventing solid diet; esophagostomy or gastrostomy maintained and utilized by self; tube-feeding performed by self.
5 = unable to feed self or to manage ostomies.

11. Vision.

1 = normal.
2 = lenses required or mildly corrected visual acuity deficit (better than about 20/50 both eyes); able to read standard newspaper print.
3 = corrected acuity about 20/50 (6/15) or worse in the better eye; magnifying lenses or larger print necessary for reading; one eye grade 4 and the other grade 1 or 2.
4 = corrected acuity about 20/100 (6/30) or worse in the better eye; essentially unable to read; one eye grade 5 and the other grade 3.
5 = legal blindness; corrected acuity 20/200 or worse in both eyes.

12. Speech and hearing – Verbal output and input for interpersonal communication purposes.

1 = normal; no subjective hearing loss; articulation and language appropriate to the culture.
2 = impaired hearing or articulation, not interfering with communication.
3 = deafness sufficient to require hearing aid and/or dysarthria interfering with communication.
4 = severe deafness compensated for by sign language or lip reading facility and/or severe dysarthria compensated for by sign language or self-written communication.
5 = severe deafness and/or dysarthria without effective compensation.

13. Physical problems – Presence of general medical and/or neurologic and/or orthopedic disorders. This would include MS.

1 = no significant disorder present.
2 = disorder(s) not requiring active care; may be on maintenance medication; monitoring not required more often than every three months.
3 = disorder(s) requiring occasional monitoring by physician or nurse, more often than every three months but less often than weekly.
4 = disorder(s) requiring regular attention (at least weekly) by physician or nurse.
5 = disorder(s) requiring essentially daily attention by physician or nurse; usually in hospital.

14. Societal role – Primarily refers to patient's ordinary occupation, including housewife or student as applicable, as it may be modified by impairment or disability.

1 = no impairment.
2 = performs usual role and tasks despite some difficulty with their performance.

3 = impairments require modification of usual role and tasks in nature, frequency or duration.
4 = impairments preclude usual role and tasks; unemployable outside sheltered workshop or very unique skills; generally dependent on assistance (public, private or family) to maintain situation in usual household.
5 = requires long-term institutional care or its equivalent if maintained at home by intensive nursing, whether societal or family.

15. Fatigability – This is a sense of overwhelming weakness or lassitude which dramatically alters baseline motor and coordination (occasionally visual or sensory) functions. It may be transient or persistent for hours or even days, and occurs at varying frequency; a very common complaint in MS.

1 = no fatigability
2 = fatigability present but does not notably interfere with baseline physical function.
3 = fatigability causing intermittent and generally mild transient impairment of baseline physical function.
4 = fatigability causing intermittent transient loss of frequently moderate impairment of baseline physical function.
5 = fatigability which generally prevents prolonged or sustained physical function.

16. Psychic (mood and mentation) function.

1 = normal.
2 = mild mood or behavior disturbance not interfering with usual function.
3 = moderate mood or behavior disturbance (e.g., depression, anxiety) and/or mild mentation impairment with some interference with usual functions.
4 = severe mood or behavior disturbance (depression, euphoria, anxiety) and/or moderate mentation impairment and/or mild active psychotic reaction.
5 = severe mentation impairment or psychosis. (Note "mentation impairment" includes mental retardation as well as "organic brain syndrome" or "dementia").

Health Management Questionnaire

Many people with multiple sclerosis utilize a variety of techniques to help improve the course of the disease. Below is a list of a few common techniques thought to help MS. If you do use one of the techniques, check **yes** and rate the experience.

Negatively						**Positively**
-3	-2	-1	0	+1	+2	+3

--- Rate the Experience ---

1. Do you exercise?
   No [ ]   Yes [ ] --->   -3 -2 -1 0 +1 +2 +3
2. Do you practice yoga?
   No [ ]   Yes [ ] --->   -3 -2 -1 0 +1 +2 +3
3. Do you follow a healthy diet?
   No [ ]   Yes [ ] --->   -3 -2 -1 0 +1 +2 +3
4. Do you take prescription medication?
   No [ ]   Yes [ ] --->   -3 -2 -1 0 +1 +2 +3
5. Do you take alternative medication?
   No [ ]   Yes [ ] --->   -3 -2 -1 0 +1 +2 +3
6. Do you receive therapy (physical, occupational, other)?
   No [ ]   Yes [ ] --->   -3 -2 -1 0 +1 +2 +3
7. Do you have a spiritual exercise routine?
   No [ ]   Yes [ ] --->   -3 -2 -1 0 +1 +2 +3
8. Do you meditate or have a quiet time?
   No [ ]   Yes [ ] --->   -3 -2 -1 0 +1 +2 +3

Stressful Life Events Prior to Symptom Onset Scale

Multiple sclerosis can often take as long as a few years to diagnose. Many times, MS patients experience symptoms long before the actual diagnosis. The following questions deal with positive or negative stressful events prior to the onset of symptoms. Please answer the questions according to the stressful events that occurred in the **12 months prior to onset of symptoms**, which may have occurred earlier than diagnosis. If an event did occur, check **yes** and **rate the experience**.

Negatively **Positively**
-3 -2 -1 0 +1 +2 +3

In the 12 months prior to the onset of MS symptoms rate the following questions.

1. Had you moved?
   No [ ] Yes [ ] ---> -3 -2 -1 0 +1 +2 +3
2. Had you broken off an engagement to be married or ended an intimate relationship?
   No [ ] Yes [ ] ---> -3 -2 -1 0 +1 +2 +3
3. Did you get married?
   No [ ] Yes [ ] ---> -3 -2 -1 0 +1 +2 +3
4. Did someone you were close to pass away?
   No [ ] Yes [ ] ---> -3 -2 -1 0 +1 +2 +3
5. Were you separated or divorced?
   No [ ] Yes [ ] ---> -3 -2 -1 0 +1 +2 +3
6. Did you break up with a close friend?
   No [ ] Yes [ ] ---> -3 -2 -1 0 +1 +2 +3
7. Did you have any important relationship, for example, with your spouse, a close friend, your boss, or a family member become significantly worse (this should not include the relationship referred to in the item 6 above)?
   No [ ] Yes [ ] ---> -3 -2 -1 0 +1 +2 +3
8. Did you have a child or adopt a child?
   No [ ] Yes [ ] ---> -3 -2 -1 0 +1 +2 +3
9. Did you, a very close friend, or a close family member have an accident that required emergency medical treatment?
   No [ ] Yes [ ] ---> -3 -2 -1 0 +1 +2 +3

10. Had you, a very close friend, or a close family member been hospitalized for a serious (life threatening) illness?
No [ ]   Yes [ ] ---> -3 -2 -1 0 +1 +2 +3

11. Had you or your spouse/partner been pregnant?
No [ ]   Yes [ ] ---> -3 -2 -1 0 +1 +2 +3

12. Did you or your spouse/partner have a miscarriage or stillbirth?
No [ ]   Yes [ ] ---> -3 -2 -1 0 +1 +2 +3

13. Did you or your spouse/partner lose or change jobs or be involuntarily unemployed?
No [ ]   Yes [ ] ---> -3 -2 -1 0 +1 +2 +3

14. Did you or your spouse/partner suffer a significant business or investment loss or have a business you owned fail?
No [ ]   Yes [ ] ---> -3 -2 -1 0 +1 +2 +3

15. Did you or your spouse/partner have any serious problems, disappointments **or** successes at work?
No [ ]   Yes [ ] ---> -3 -2 -1 0 +1 +2 +3

16. Did you or your spouse/partner have significant success **or** failure in an educational course (university, training program, etc.)?
No [ ]   Yes [ ] ---> -3 -2 -1 0 +1 +2 +3

17. Had there been a significant change in your personal finances?
No [ ]   Yes [ ] ---> -3 -2 -1 0 +1 +2 +3

18. Had your house been broken into and/or burglarized?
No [ ]   Yes [ ] ---> -3 -2 -1 0 +1 +2 +3

19. Had you or your spouse/partner or other member of your immediate family been assaulted or mugged?
No [ ]   Yes [ ] ---> -3 -2 -1 0 +1 +2 +3

20. Had the behaviour of any member of your family been a significant problem for you?
No [ ]   Yes [ ] ---> -3 -2 -1 0 +1 +2 +3

21. Did you or your spouse/partner have to appear in court as either a defendant, a witness to a criminal case, or as party to a suit?
No [ ]   Yes [ ] ---> -3 -2 -1 0 +1 +2 +3

22. Did you have a pet (animal) to whom you were attached die, or get lost, or did you have to give it away?
No [ ] Yes [ ] ---> -3 -2 -1 0 +1 +2 +3

23. Other than the events we have already asked about, had any other significant things happened to you or to a very close friend or close family member that made that period significantly different from a typical year?
No [ ] Yes [ ] ---> -3 -2 -1 0 +1 +2 +3

Significant Event: ______________________________

To help us better understand your answers, we would appreciate knowing about you.

What category of MS do you classify yourself as? (Check one)

[ ] **Relapse remitting** – Characterized by periods of relapse and remission; patients are fairly stable with little or no deterioration.

[ ] **Primary progressive** – Characterized by gradual and continuing worsening of symptoms from onset.

[ ] **Secondary progressive** – An MS patient who was classified as relapse remitting but now begins to suffer gradual deterioration

Year diagnosed with Multiple Sclerosis? _______

Date of Birth? _________

Gender? M F

Please check the ethnicity that best describes you?
[ ] White
[ ] Hispanic origin
[ ] Black
[ ] American Indian/ Eskimo/ Aleut
[ ] Asian/ Pacific Islander

VITA

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Michelle Lynn Snow is currently attending Texas A&M University and pursuing a bachelor's degree in Genetics and a minor in Spanish. She has maintained a 4.00 throughout her time at Texas A&M and plans to graduate in the spring of 2002. Ms. Snow will also attend the University of Salamanca, Spain during the summer of 2001 to pursue her coursework in Spanish.

Ms. Snow was a University Undergraduate Research Fellow during the academic year of 2000-2001 and was a member of the Psychology 2 group. As part of the research, Ms. Snow won first prize in the Undergraduate Poster Presentation for Social Sciences Group 2 during Student Research Week.

Ms. Snow also has obtained several other honors during her collegiate career. She is a President's Endowed Scholarship Recipient at Texas A&M University, as well as a Fort Worth Junior Women's League Scholarship Recipient. She was part of the TAMU Honors Program, as well as the Engineering Scholars Program her freshman year.

Michelle Lynn Snow also maintains a high level of activities on and off campus. She is the Senator for the Texas A&M Genetics Society, and also a member of Aggie Sisters for Christ. She was Service Co-Chair for Phi Eta Sigma Honor Society and is also a member of Gamma Sigma Delta Agricultural Honor Society. Finally, Ms. Snow volunteers at Hope Crisis Pregnancy Center as a crisis counselor.