I, Rashmi D. Sahay, hereby submit this original work as part of the requirements for the degree of:

Master of Science

in Epidemiology (Environmental Health)

It is entitled:

Female Sexual Dysfunction in women with Multiple Sclerosis

Student Signature: ________________________________

This work and its defense approved by:

Committee Chair:

Erin Nicole Haynes, DrPH

Istvan Pirko, MD

Marepalli Rao, PhD
Female Sexual Dysfunction in Women with Multiple Sclerosis

By

Rashmi D. Sahay, MD

May 2010

A Thesis Submitted in partial fulfillment of
the requirements for the degree of

MASTER OF SCIENCE

in Environmental Health - Epidemiology

College of Medicine
Department of Environmental Health
Division of Epidemiology and Biostatistics

Thesis Committee Chair: Erin Haynes, DrPH, MS

University Of Cincinnati
Abstract:

Background: Female sexual dysfunction (FSD) is a common problem in women with Multiple Sclerosis (MS). Significance of FSD from women’s perspective in MS remains poorly understood. Aims: Evaluate level of satisfaction in relation to changes that occur in sexual functioning in women with MS and to examine relationship between overall sexual satisfaction and various factors. Methods: Data collected by anonymous, self-answered, survey questionnaire filled by subjects during clinic visits. Results: Mean age was 41.2 ±9.6 years. Mean disease duration was 8.9 ± 7.2 years. Eighty one percent had Relapsing Remitting MS. Seventy five percent were physically independent. Thirty percent had no bladder problem. Forty six percent had no bowel problem. ‘Satisfied’ response observed to all the questions pertaining to sexual functioning. Partner relationship, frequency of sexual act and feeling of desire were significant predictors of women’s overall sex life. Conclusion: Women with MS were satisfied with their overall sex life.
Dedication

I dedicate this thesis to memory of my father,

Professor Bhagwan Swaroop Darbari,

who always encouraged me to continue the path of wisdom.
Acknowledgments

Many individuals need recognition for the completion of my thesis project and studies. No words of gratitude are available to express my sincerest thanks to my esteemed thesis advisor Dr. Istvan Pirko whose expertise, guidance, suggestions and endless support helped me to complete this project. I am thankful to Dr. Erin Haynes for being my academic advisor. Her encouragement and valuable advice helped me to further pursue my research career. I am indebted to Dr. M. B. Rao for all the warmth, affection, guidance and feedback he gave to me during data analysis and helping me during my studies. My sincere thanks are due for Dr. Maria Melanson for facilitating the recruitment of research participants. I also want to thank the Staff members of Waddell Center of Multiple Sclerosis in the Department of Neurology at the University of Cincinnati who helped me in data collection. Special thanks are due to all the professors for having contributed enormously in my pursuit of knowledge.

I wish to acknowledge support of my family and friends for always believing in me. I am indebted to my mother for giving me company during lonely times and providing moral support at the time of crisis. I want to express my gratitude to my husband, Alok and my two teenagers, Aditya and Archit, for understanding me and providing me love and affection during the tense moments of my studies.

I would like to thank my thesis committee members, Dr. Haynes, Dr. Pirko and Dr. Rao for their comments and guidance. All the patients who have participated in this study are the persons behind the screen and deserve endless thanks. They shared their valuable time to advance research on a sensitive topic.
# Table of Contents

Chapter 1: Introduction  
Overview .............................................................................................................. 1  
Background ........................................................................................................ 2  
Purpose .............................................................................................................. 3  
Specific Aims ..................................................................................................... 3  

Chapter 2: Literature Review .................................................................................. 4  

Chapter 3: Material and Methods ......................................................................... 15  

Chapter 4: Results  
A. Summary Statistics ....................................................................................... 21  
B. Inferential Statistics ....................................................................................... 31  

Chapter 5: Summary and Conclusion ................................................................... 33  

References ......................................................................................................... 37  

Appendices  
A to E: Statistical outputs ................................................................................. 41  
F: Study Questionnaire ...................................................................................... 45
LIST OF TABLES AND FIGURES:

Tables:
1.0 Summary of sexual changes reported by various studies
2.1 Contingency table between sex life in general and frequency of sexual activity
2.2 Contingency table between sex life in general and partner relationship
2.3 Contingency table between sex life in general and feeling of desire
2.4 Contingency table between sex life in general and feeling of arousal
2.5 Contingency table between sex life in general and feeling of orgasm
2.6 Contingency table between sex life in general and feeling towards natural wetness
3.1 Contingency table between sex life in general and various medications
3.2 Contingency table between sex life in general and type of MS
4.0 Summary of various categories of duration of MS
5.0 Summary of various bladder symptoms
6.0 Summary of various bowel symptoms
7.1 Summary Statistics (Demographics)
7.2 Summary Statistics (Descriptors of MS)
7.3 Summary Statistics (Response to potential sexual dysfunction questions)
8.0 Results of Logistic Regression and Odds ratio

Figures:
1.0 Distribution of Age
2.0 Distribution of Disease Duration
3.0 Distribution of Type of MS
4.0 Distribution of Physical Mobility
5.0 Distribution of Bladder problems
6.0 Distribution of Bowel problems
7.0 Distribution of Prescription medications
Introduction:

Overview

Female sexual dysfunction (FSD) is a complex problem because a number of factors are involved for its causation and it is a subjective issue. There are no good reliable objective measures available to study, diagnose, and manage this problem. Research is ongoing to develop measures that can quantify pathophysiological changes that occur in sexual response cycle in order to diagnose female sexual dysfunction. Two major causes of FSD are biological and psychological. They may play a role either by itself or by interacting with each other. Biological causes include number of chronic disorders that are known to have an effect on sexual response cycle. Multiple sclerosis (MS) is one such chronic condition. MS is a disease of the central nervous system that manifests in a wide variety of ways. Symptoms secondary to involvement of autonomic nervous system causing bowel, bladder and sexual dysfunctions are commonly seen in MS patients (Hennessey et al., 1999; Demirkiran et al., 2006; Nortvedt et al., 2007).

The World Health Organization International Classifications of Diseases-10 (ICD-10) defined sexual dysfunction as “the various ways in which an individual is unable to participate in a sexual relationship as he or she would wish” (WHO: ICD-10, 1992). Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) of American Psychiatric Association defined sexual dysfunctions as “disturbances in sexual desire and psychophysiological changes that characterize the sexual response cycle and cause marked distress and interpersonal difficulty” (American Psychiatric Association: DSM-IV, 1994). Lately, Sexual Function Health Council of the American Foundation for Urologic Diseases (AFUD) developed consensus definitions and classifications on existing framework of ICD-10 and DSM-IV classifications of sexual dysfunction by including both organic and psychological component of desire, arousal, orgasm
and sexual pain disorders with special emphasis on personal distress criteria (Basson et al., 2000).

**Background:**

Multiple Sclerosis mainly affects younger and middle age-group people with females being more affected than males. Many women with MS being young and in the productive years of their life want to have family. Sexual dysfunction can occur even at early stages of MS (Tzortzis et al., 2008). Sometimes sexual dysfunction may remain unnoticed. It is therefore important to address this aspect of MS appropriately and in a timely manner. Quality of life is an important issue in women with MS due to the progressive and unpredictable nature of this disease. The stage of multiple sclerosis, physical disability, fatigue, psychosocial changes and other factors play a role in the quality of life of women with MS (Janardhan et al., 2002; Merkelbach et al., 2002; Benedict et al., 2005). Female sexual dysfunction is also one of the important issues in quality of life of these women (Nortvedt et al., 2001; Tepavcevic et al., 2008). There is an increasing interest among physicians, behavioral scientists and psychologists, to look at various aspects of female sexual dysfunction from not only medical, but cultural, relational, social and psychological point of view as wellness intervention and partner relationship have shown to be helpful in managing many chronic disorders such as MS (Stuifbergen et al., 2003; McCabe et al., 2004). The advent of effective pharmacological measures to manage male sexual dysfunction has further inspired scientists to explore new drugs promising to treat sexual dysfunction in females.
**Purpose:**

The significance of female sexual dysfunction from women’s perspective in Multiple Sclerosis remains poorly understood. Women with MS may have to accept physical and emotional compromises in their lives. Often, women are stressed because of inability to keep a balance between their personal, marital, familial and social roles. Sometimes they are reluctant to discuss sexual problems openly with their health care provider and professionals. Presence of partners or other family members during appointments also makes such issues less likely to be discussed. A subset of women with MS may face a psychologically compromised and potentially socially isolated life which may have a great impact on their overall wellbeing. Several studies have been reported on MS patients to show association between bowel, bladder, and sexual dysfunction but only a few have specifically looked at sexual dysfunction in women with MS. The purpose of this project is to study the level of stress these women are experiencing with regard to their sexual changes which may be a part of their MS. This study will help professionals in understanding the concerns of these women towards their sexual life and help manage this problem appropriately and in an individualized way.

**Specific Aims:**

The study was conducted with the following specific aims:

1. Evaluate the level of satisfaction in relation to changes that occur in sexual functioning in women with Multiple Sclerosis.

2. Examine the relationship between overall sexual satisfaction and several factors such as women’s age, duration of disease, physical mobility, bladder problems, bowel problems and various aspects of sexual functioning.
Literature Review:

Multiple sclerosis (MS) is a chronic progressive disease of the central nervous system with a purported autoimmune etiology with well recognized neurodegenerative features. Chronic inflammation of central nervous system leads to formation of plaques of demyelination causing disruption in nerve conduction in the brain and spinal cord white matter. Multiple Sclerosis mainly affects young and middle age women more than men. For unclear reasons, the risk of developing MS is increasing at a higher rate in females than males (Noonan et al., 2002; Wallin et al., 2004). Female to male ratio of MS has recently been reported to be in the range of 1.33 to 3.96 (Orton et al., 2006). Most people exhibit their first symptom of MS around 20 to 40 years of age (Kunz and Finkel, 1987). Symptoms of MS occur due to difficulty in communicating messages between brain, spinal cord and other body parts. Wide variety of clinical presentations can be seen depending on the site of the MS lesion such as fatigue, muscle spasticity and stiffness, pain, vertigo, cognitive changes, loss of bowel and bladder control, sexual dysfunction and others.

The prevalence of female sexual dysfunction is higher in women with MS when compared to the general population. In a case-control study conducted on MS patients by Zorzon et al. one or more sexual changes were present in 62.9% women with MS in comparison to 11.2% healthy women and 47.8% women with chronic diseases such as rheumatoid arthritis, systemic lupus erythematosis, psoriatic arthritis and ankylosing arthritis (Zorzon et al., 1999). It was also reported that sexual disorder was present in higher percentage in MS patients (73.1%) in comparison to chronic disease controls (39.2%) and healthy controls (12.8%) for both gender (Zorzon et al., 1999). Norvedt et al. also showed increased prevalence of sexual dysfunction in
MS. In their study 35% patients had some sexual problem, 29% had major sexual problems and 36% did not have any sexual problem (Norvedt et al., 2001).

Sexual dysfunction is one of the common symptoms seen in all forms of MS (Zorzon et al., 1999; Demirkiran et al., 2006). Zorzon et al. conducted face to face interview of 70 women and 38 men with confirmed diagnosis of MS and showed presence of sexual dysfunction in 65% patients with relapsing-remitting MS, 88% with primary-progressive MS and 100% with secondary-progressive MS (Zorzon et al., 1999). Similarly, in a study by Demirkiran et al. in which 51 patients with MS were interviewed face to face, primary sexual dysfunction was detected in 77.1% cases of remitting-relapsing MS, 77.8% cases of secondary-progressive MS and 100% cases of primary-progressive MS. In another study in 63 newly diagnosed women with MS, presence of sexual dysfunction was 92% in relapsing-remitting MS and 7.9% in primary-progressive MS (Tzortzis et al., 2008).

Among various changes occurring in sexual functioning in MS patients, loss of libido had been noticed as the most frequent sexual problem by a number of studies. Given below in Table 1.0 is the distribution of various sexual changes reported by some studies.

**Table 1.0: Summary of sexual changes reported by various studies**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Libido/Desire</td>
<td>28.1</td>
<td>32</td>
<td>43.8</td>
<td>42.9</td>
<td>80.5</td>
<td>74.4</td>
</tr>
<tr>
<td>Arousal</td>
<td>18.8</td>
<td>19</td>
<td>NA</td>
<td>32.6</td>
<td>77.5</td>
<td>NA</td>
</tr>
<tr>
<td>Orgasm</td>
<td>12.5</td>
<td>16</td>
<td>37.5</td>
<td>45.1</td>
<td>77.5</td>
<td>15.4</td>
</tr>
<tr>
<td>Lubrication</td>
<td>NA</td>
<td>NA</td>
<td>39.1</td>
<td>34.8</td>
<td>73.2</td>
<td>38.5</td>
</tr>
<tr>
<td>Loss of genital sensation</td>
<td>NA</td>
<td>25</td>
<td>39.1</td>
<td>36.2</td>
<td>68.3</td>
<td>26.9</td>
</tr>
<tr>
<td>Sexual Pain</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>17.9</td>
<td>NA</td>
<td>NA</td>
</tr>
</tbody>
</table>

NA= not available; all numbers represent percentages
One study done on MS patients had shown that people with MS differ from general population with respect to sexual dysfunction, sexual satisfaction and relationship satisfaction (McCabe, 2002). In this study McCabe used the Index of Sexual Satisfaction measure (ISS: Hudson, 1992) to assess sexual satisfaction, modified version of the Kansas Marital Satisfaction (KMS) scale to measure relationship satisfaction and the Nature of the Sexual Problem Subscale of the Sexual Dysfunction Scale (SDS: McCabe, 1994) to measure sexual dysfunction. He demonstrated statistically significant results for difficulty in masturbating (p<0.05) and lack of sensation and numbness during sexual activity (p<0.001) between the MS group and the general population. No significant difference in the frequency of sexual dysfunctions in females such as painful intercourse, failure to have an orgasm, poor vaginal lubrication, intercourse impossible, lack of sexual interest and difficulty becoming aroused was observed. He found coping strategies related to focusing on the positive and problem-focused coping, and health-related quality of life related to cognitive functioning as significant predictor of sexual dysfunction in females. For sexual satisfaction in females, adoption of detachment as a coping strategy and poor level of cognitive functioning were the significant predictors. For relationship satisfaction in females, health related quality of life related to sleep and rest and also cognitive functioning were the significant predictors (McCabe, 2002). In another study McCabe and McDonald evaluated the level of relationship satisfaction and sexual satisfaction between MS patients and their partners (McCabe and McDonald, 2007). They studied six variables- physical support, emotional support, intimacy, respect, understanding and relationship to assess relationship satisfaction. There was a statistically significant difference between people with MS and their partners on these six relationship variables (p<0.01). Results indicated that the partners of people with MS felt that MS had a more negative impact on the physical and emotional support in the relationship when
compared to participants with MS. For sexual satisfaction variables studied were; affection, variety of sexual activities, frequency of sex, intimacy, sexual satisfaction in general and partner’s perceived sexual satisfaction. No significant difference (p = .62) was observed between people with MS and their partners on these variables related to sexual satisfaction (McCabe and McDonald, 2007). In this same study by examining the correlations between physical, relationship and sex variables for people with MS, McCabe and McDonald reported that the more support, intimacy, respect and understanding the persons with MS experienced, the more satisfied they were with the relationship. They also reported that individuals with MS who were less satisfied with their relationship were also less sexually satisfied (McCabe and McDonald, 2007).

Mixed and scanty results are available showing association between sexual dysfunction and various factors related to MS. Relationship between sexual dysfunction and disability due to MS had shown inconsistent results. Hulter and Lundberg studied women with MS with a mean disease duration of 16.5 years and Expanded Disability Status Scale (EDSS) score of 1 to 9 (median 6.5). They found that women with lower scores in EDSS reported more significant negative sexual changes as regards to lubrication (p<0.01) and disappearance of clitoral erections (p<0.05) (Hulter and Lundberg, 1995). Zivadinov et al. found significant positive correlation between sexual dysfunction and low Functional Independence Measure (FIM) while positive but weak correlation between sexual dysfunction and higher EDSS (Zivadinov et al., 1999). Demirkiran et al. and Tepavcevic et al. showed significant positive correlation between sexual dysfunction and EDSS (Demirkiran et al., 2006; Tepavcevic et al., 2008). In study by Tzortzis et al. sexual dysfunction was observed in newly diagnosed women with MS despite the fact that they were ambulatory and without any major neurological impairment (Tzortzis et al., 2008). In
a 2 year follow up study by Zorzon et al. percentage of sexual changes at the start of study as compared to end of 2 year follow up were as follows; anorgasmia- 37.1 to 37.5%, decreased vaginal lubrication- 35.7 to 39.1% and reduced libido- 31.4 to 43.8%. No change in EDSS was found at the end of 2 years but still patients showed changes in their sexual functioning (Zorzon et al., 2001). In a study done by Christopherson et al. the risk of developing sexual problems in MS increased with the progress of disease without much change in physical disability (Christopherson et al., 2006). The relationship between level of disability due to multiple sclerosis and sexual dysfunction thus remains uncertain.

Mixed results have also been shown between presence of sexual dysfunction and duration of MS. Tzortzis et al. reported sexual dysfunction in women with MS with the mean time since the first symptom of MS to be 2.7 years with a considerable variation (0.2–7 years) (Tzortzis et al., 2008). In a cross-sectional study of patients with Relapsing Remitting form of MS with mean duration of disease 4.1 ± 2.7 years, 50.5% females reported at least one sexual dysfunction (Barak et al., 1996). A population based survey conducted by Hennessey et al. on MS patients reported that 52% women showed deterioration in sexual activity since developing MS. In this study the duration of these alterations in sexual activity was 8.7 years (Hennessey et al., 1999). The median duration of disease in a study done by Hutler et al. on women with MS was 16.5 years with various sexual disturbances; 36.2% having reduced lubrication, 38.3% having reduced orgasm and 59.6% having reduced desire (Hutler et al., 1995). Tepavcevic et al. showed the presence of at least one symptom of sexual dysfunction in 85% women with MS with a mean duration of disease 9.1± 6.7 years (Tepavcevic et al., 2008).

Strong association has been found between sexual dysfunction and reduced quality of life in patients with MS by many researchers (Nortvedt et al., 2001; Janardhan and Bakshi, 2002;
McCabe et al., 2002b; Tepavcevic et al., 2008). Norvedt et al. reported reduced quality of life in MS patients in the presence of both sexual and bladder dysfunction by studying 194 MS patients using SF-36 Health Survey. In this study MS patients with sexual dysfunction scored low on all eight domains: physical functioning, role physical, bodily pain, general health, vitality, social functioning, role emotional and mental health (Norvedt et al., 2001). Another study using MSQOL-54 Instrument as the quantitative measure of QOL showed lower scores on fatigue, depression and physical disability (Janardhan and Bakshi, 2002). McCabe and McKern examined both objective and subjective aspect of quality of life by comparing 381 MS patients with 291 individuals from general population without any chronic disease using the World Health Organization Quality of Life-100 scale (WHOQOL-100; the World Health Organization Quality of Life Group, 1994). They found reduced quality of life in MS patients in comparison to general population in all domains for both objective and subjective dimensions of QOL (McCabe et al., 2002b). Tepavcevic et al. specifically designed a study to look at quality of life of MS patients in relation to sexual changes. In this study it was found that scores of 13 out of 14 subscales of MSQoL-54 (Multiple Sclerosis Quality of Life) and Szasz Sexual Functioning Scale both were significantly lower except for the pain scale (Tepavcevic et al., 2008).

Many researchers feel that female sexual dysfunction in MS is an underestimated problem (Zorzon et al., 1999; Rosen et al., 2003; Demirkiran et al., 2006). Zorzon et al. found that only 5.7% females compared to 10.5% males with MS discussed their sexual problems with physicians (Zorzon et al., 1999). Another study done on general population in the United States also reported that only 16.1% women compared to 21.9% men discussed their sexual problems with their physician (Laumann et al., 2009). Thus it is very likely that despite having problems with sexual functioning, women do not want to talk and disclose such personal issues with their
healthcare provider. In general population of the United States, Laumann et al. also found that higher number of women (38.1%) than men (36.3%) felt that sexual disturbance is not a serious matter to be discussed with their physician (Laumann et al., 2009). They also showed that higher number of women (79.7%) in comparison to men (75.7%) does not seek help for their problem of sexual dysfunction from health professionals. In this study 28.2% women and 25.4% men thought that sexual changes are due to normal aging and were therefore not worried about it (Laumann et al., 2009). This may also be the reason why problem of sexual dysfunction is more commonly observed in males than females. McCabe et al. showed that 53.5% of MS patients were either not at all concerned or were very little concerned about their sexual problems (McCabe et al., 1996). In their another study McCabe et al. showed that as the period of MS disease prolongs patients develop a positive coping strategies (McCabe et al., 2003). That may be the likely reason for MS patients to be less concerned about sexual dysfunction. Zorzon et al. showed that 62.9% women with MS, 47.8% women with chronic disease and 11.2% healthy woman reported sexual changes which were lower than the percentages reported by men with MS (92.1%) and healthy males (15.4%). For men with chronic diseases the percentage was 21.9% (Zorzon et al., 1999). Similarly, more men (82%) then women (52%) with MS reported deterioration in sexual activity since developing MS in a population based study conducted by Hennessey et al. (Hennessey et al., 1999).

Women from certain cultures are often reluctant to discuss sexual matters openly (Ahmed and Bhugara, 2004). Laumann et al. by doing a cluster analysis of general population world-wide demonstrated significant differences in the percentage scores between men and women for all aspects of sexual wellbeing in all clusters except for physical and emotional satisfaction in cluster 3 (East Asian countries) (Laumann et al., 2006).
Socioeconomic conditions have also shown to affect sexual issues. Zivadinov et al. showed a significant correlation between presence of sexual dysfunction with lower education and unemployment in female patients with MS (Zivadinov et al., 1999). Demirkiran et al. also found that less educated MS patients reported more problems of sexual dysfunction (Demirkiran et al., 2006). In another study educated women with a college degree showed less distress about sexual dysfunction as compared to lower level of education (Bancroft et al., 2003).

Studies have examined approach of health professionals towards history taking of sexual problems. Pauls et al. in their study on international group of physicians and health professionals with interest in the field of urogynecology and reconstructive pelvic surgery reported various barriers to screen for FSD. It was found that 78% of professionals cited lack of enough time to screen patients and 28% were uncertain about the therapeutic options (Pauls et al., 2005). Haboubi and Lincoln studied the views of professionals in both acute and rehabilitation settings concerning the discussion of sexual issues with patients. They found that doctors in comparison to nurses, males versus females and respondents from medical ward in comparison to surgical or rehabilitation settings were more likely to initiate discussion about sexual issues from their patients (Haboubi and Lincoln, 2003). In a study done on physicians from multispecialty practice, statistically more male physicians than female physicians reported discomfort when questioning female patients about sexual function (Burd et al., 2006). Thus there may be a possibility that some professionals may not be inquiring sexual problems from female patients in a way that is needed. Since it is physician’s responsibility to take initiative in asking questions from their patients about health related sexual issues therefore there is a need to train physicians and other health professionals as to how to deal with such sensitive and personalized issues in a
dignified way. For this health care takers should have some knowledge about their patient’s culture and background.

The pathophysiological mechanisms behind female sexual dysfunction are still under investigation. Altered genital blood flow was originally thought to be mainly responsible for changes in sexual functioning but now neural, hormonal and psychological origin of female sexual dysfunction has also been proposed (Berman and Bassuk, 2002). Foley and Iverson by developing a hypothetical model classified sexual dysfunction in multiple sclerosis into primary, secondary and tertiary dysfunction (Foley and Iverson, 1992). According to them primary sexual dysfunction was result of involvement of neural pathways which directly affects sexual responses leading to loss of genital sensations, problems of desire, arousal, orgasm and lubrication. Sexual arousal starts from central nervous system which then sends messages to sexual organs by nerve conduction through the spinal cord. Thus damage to these neural pathways from degenerative disease can have a direct effect on sexual response cycle (Schober and Pfaff, 2007). Close association shown between bladder dysfunction and sexual dysfunction in MS patients supports the neural mechanism (Zivadinov et al., 1999; Nortvedt et al., 2001; Demirkiran et al., 2006). Secondary sexual dysfunction is due to presence of other symptoms such as fatigue, spasticity, bowel and bladder problems, restricted mobility, cognitive disturbances, pain and numbness that can have an effect on sexual functioning in MS patients. Association has been shown between sexual dysfunction and many of these secondary factors such as physical disability, fatigue and cognitive problems by studying quality of life of MS patients (Benedict et al., 2005). Tertiary sexual dysfunction is due to psychological, emotional, social and cultural causes which are related to MS disease. Presence of depression, performance anxiety, changes in self-image and body image, mood disturbances etc. are commonly seen in
MS patients. Demirikan et al. showed involvement of psychological and emotional component with sexual dysfunction in patients with MS (Demirikan et al., 2006).

According to World Health Organization International Classifications of Diseases-10 (ICD-10) specific categories of sexual dysfunction includes lack or loss of sexual desire (F52.0), sexual aversion disorder (F52.1), failure of genital response (F52.2), orgasmic dysfunction (F52.3), nonorganic vaginismus (F52.5), nonorganic dyspareunia (F52.6) and excessive sexual drive (F52.7). According to Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) of the American Psychiatric Association, female sexual dysfunction was limited to psychiatric disorders in women which include hypoactive sexual desire (302.71), sexual aversion (302.79), female arousal disorder (302.72), female orgasmic disorder (302.73), dyspareunia (302.76) and vaginismus (306.51). The American Foundation for Urologic Disease has published 1999 Consensus Classification System after modifying ICD-10 and DSM-IV classification of female sexual dysfunction into four broad categories based on clinical observation only; without any involvement of its etiology or pathophysiology with the intention that physicians and researchers can study this complex problem in a clinical and meaningful way so as to manage them accordingly. FSD is thus classified as; (1) Sexual desire/interest disorders; (2) Sexual arousal disorder; (3) Orgasmic and ejaculatory disorders; and (4) Sexual pain disorders. In addition, the personal distress criteria for most of these diagnostic categories was considered essential element of the new diagnostic system (Basson et al., 2000).

Female sexual dysfunction being a subjective and sensitive matter is difficult to study. Usually data related to this subject is collected by either survey questionnaire, telephonic interviews or by face to face interrogation. Women sometimes feel more comfortable when asked about these personal questions in an anonymous way. New lab techniques to quantify
changes in female sexual response cycle are now under research depending on pathophysiologic mechanism responsible for female sexual dysfunction (Berman and Bassuk, 2002). Because of vascular basis behind sexual arousal disorder, various genital vascular tests are under research e.g. tissue oximetry, photoplethysmography, genital thermography, doppler ultrasonography, laser velocitometry and magnetic resonance angiography (Mulhall, 2004; Sommer et al., 2001). Use of Quantitative sensory testing (QST) to examine genital sensations in women to help in diagnosing neurogenic female sexual dysfunction has been studied (Gruenwald et al., 2007). Neurophysiological testing by somatosensory evoked potential (SSEPs) is also under investigation as a potential method to study bladder problems and sexual dysfunction (Cavalcanti et al., 2007). Thus combined use of subjective measures and newly developing sophisticated instruments seem promising in studying female sexual dysfunction.

A number of drugs are currently under testing to treat female sexual dysfunction (Berman and Bassuk, 2002). Studies are ongoing to assess the efficacy and safety of Sildenafil for female sexual dysfunction on the basis of its effectiveness in treating male erectile dysfunction (Dasgupta et al., 2004; Brown et al., 2009). However sexual counseling either by providing printed material or by direct face-to-face or telephonic support has shown to be very useful in improving some of the issues of sexual dysfunction in patients with multiple sclerosis disease (Foley et al., 2001; Christopherson et al., 2006). Zorzon et al. 1999 had reported that 70% of his MS patients felt improvement in their partner relationship after having open discussion with physician. Rehabilitation also improves symptoms of sexual dysfunction in patients with multiple sclerosis (Foley et al., 2001). There is therefore a need for a joint effort between patients, their care-takers and health care professionals in order to provide best possible
Material and methods:

One hundred and sixty women with confirmatory diagnosis of Multiple Sclerosis aged 18-80 years coming for their follow up at Waddell Center for Multiple Sclerosis at University of Cincinnati’s Department of Neurology’s MS clinic participated in this study. Participation into the study was entirely voluntary. Approval of study was granted by the University of Cincinnati Institutional Review Board (IRB). This patient population was a representative sample of about 1200 MS patients who are regularly followed in this clinic.

Women ready to participate were asked to fill an anonymous, self answered, two-part questionnaire. It was a 15 item questionnaire that was designed purposefully to collect women’s general information about their MS and their personal outlook towards various aspects of sexual response cycle. Study questionnaire is presented in the Appendix F.

Part-One of the questionnaire contained seven general questions related to demographics and descriptors of MS. The questions were on:

1) Women’s age; 2) duration of MS; 3) type of MS if known; 4) women’s walking ability; 5) bladder symptoms, if any; 6) bowel symptoms, if any and 7) medications, if any.

Part-Two of the questionnaire was meant to inquire women’s satisfactory level on all important issues related to sexual functioning. The questions pertain to:
1) Sex life in general; 2) frequency of sexual activity; 3) partner relationship; 4) desire;
5) arousal; 6) natural wetness; 7) orgasm and 8) presence or absence of pain during or after sexual activity.

In part-two of the questionnaire women’s response to seven questions (except that for sexual pain) was one of; ‘not-satisfied’, ‘satisfied’ and ‘extremely satisfied’. Response to pain was ‘yes’ or ‘no’. Being a survey an option of “do not want to answer’ was provided for each of these eight questions in part-two. To exclude women who never experienced sexual activity an option of ‘not applicable’ was also provided. This self designed, non-validated questionnaire was used because there is no standard questionnaire yet available for MS patients that can collect women’s stress level with regard to problem of female sexual dysfunction. No separate neurological, urogynecological and psychiatric evaluation was performed for this study.

If a woman answered even one question as ‘not applicable,’ ‘do not want to answer,’ or left it blank, her responses to all other questions were not included in our data analysis. Some patients did not know for sure the type of their MS and/or its exact duration and so they answered those questions with some doubt. We took their answers as fact. If the duration of MS was answered in the form of range, the upper limit of the range was taken to be the duration of their disease. In order keep uniformity, duration of disease stated in years was converted into months because some patients reported their disease duration to be less than a year.

The research design of our study was descriptive. Results were reported as summary statistics. In addition, logistic regression analysis was performed. Originally information on all categorical variables related to potential sexual dysfunction questions (except that for sexual pain) were collected in ‘ternary’ mode with;
0: Not satisfied response  
1: Satisfied response  
2: Extremely satisfied response

Contingency tables of order 3x3 were then created with one factor being ‘sex life in general’ and the other factor being any one of the ternary categorical covariates. The tables (2.1 to 2.6) are presented below with their chi-squared values and p-values;

Table 2.1 Between ‘sex life in general’ and ‘frequency of sexual activity’

<table>
<thead>
<tr>
<th>Sex life in general</th>
<th>Extremely satisfied</th>
<th>Not satisfied</th>
<th>Satisfied</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extremely satisfied</td>
<td>18</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>Not satisfied</td>
<td>0</td>
<td>26</td>
<td>8</td>
</tr>
<tr>
<td>Satisfied</td>
<td>0</td>
<td>11</td>
<td>50</td>
</tr>
</tbody>
</table>

Chi-squared = 126.407, df = 4, p-value < 2.2e-16

Table 2.2 Between ‘sex life in general’ and ‘partner relationship’

<table>
<thead>
<tr>
<th>Sex life in general</th>
<th>Extremely satisfied</th>
<th>Not satisfied</th>
<th>Satisfied</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extremely satisfied</td>
<td>19</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>Not satisfied</td>
<td>8</td>
<td>7</td>
<td>19</td>
</tr>
<tr>
<td>Satisfied</td>
<td>22</td>
<td>3</td>
<td>36</td>
</tr>
</tbody>
</table>

Chi-squared = 27.3034, df = 4, p-value = 1.726e-05
Table 2.3 Between ‘sex life in general’ and ‘feeling of desire’

<table>
<thead>
<tr>
<th>Feeling for Desire</th>
<th>Sex life in general</th>
<th>Extremely satisfied</th>
<th>Not satisfied</th>
<th>Satisfied</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extremely satisfied</td>
<td>16</td>
<td>1</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Not satisfied</td>
<td>1</td>
<td>29</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Satisfied</td>
<td>12</td>
<td>12</td>
<td>37</td>
<td></td>
</tr>
</tbody>
</table>

Chi-squared = 74.7198, df = 4, p-value = 2.284e-15

Table 2.4 Between ‘sex life in general’ and ‘feeling for arousal’

<table>
<thead>
<tr>
<th>Feeling for Arousal</th>
<th>Sex life in general</th>
<th>Extremely satisfied</th>
<th>Not satisfied</th>
<th>Satisfied</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extremely satisfied</td>
<td>13</td>
<td>0</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Not satisfied</td>
<td>0</td>
<td>23</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>Satisfied</td>
<td>13</td>
<td>12</td>
<td>36</td>
<td></td>
</tr>
</tbody>
</table>

Chi-squared = 48.6867, df = 4, p-value = 6.787e-10

Table 2.5 Between ‘sex life in general’ and ‘feeling of orgasm’

<table>
<thead>
<tr>
<th>Feeling for Orgasm</th>
<th>Sex life in general</th>
<th>Extremely satisfied</th>
<th>Not satisfied</th>
<th>Satisfied</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extremely satisfied</td>
<td>14</td>
<td>0</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>Not satisfied</td>
<td>1</td>
<td>21</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>Satisfied</td>
<td>10</td>
<td>16</td>
<td>35</td>
<td></td>
</tr>
</tbody>
</table>

Chi-squared = 43.5097, df = 4, p-value = 8.111e-09

Table 2.6 Between ‘sex life in general’ and ‘feeling towards natural wetness’

<table>
<thead>
<tr>
<th>Feeling towards Natural Wetness</th>
<th>Sex life in general</th>
<th>Extremely satisfied</th>
<th>Not satisfied</th>
<th>Satisfied</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extremely satisfied</td>
<td>13</td>
<td>3</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>Not satisfied</td>
<td>1</td>
<td>25</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>Satisfied</td>
<td>5</td>
<td>13</td>
<td>43</td>
<td></td>
</tr>
</tbody>
</table>

Chi-squared = 62.1991, df = 4, p-value = 1.000e-12
From these tables it became apparent that the chi-square test is not applicable because of presence of low frequencies in some cells. We therefore converted each ternary variable into a binary one with;

0: not satisfied response

1: satisfied or extremely satisfied responses

Physical mobility was categorized into two groups as; independent walking and no independent walking (women using cane, walker or wheelchair). Bladder and bowel problems were categorized into two groups of each as; bladder problems ‘yes’ or ‘no’ and bowel problems ‘yes’ or ‘no’. Sexual pain was already a binary response with presence or absence of pain.

Women’s response to ‘sex life in general’ was selected as the response variable (Y). The predictor variables were classified into three groups;

1. Demographics: such as women’s age.

2. Descriptors of MS: such as duration of MS, physical mobility (walking ability), bladder symptoms and bowel symptoms.

3. Response to potential sexual dysfunction questions: such as frequency of sexual activity, partner relationship, desire, arousal, orgasm, natural wetness, and sexual pain.

All variables (except women’s age and duration of disease) entered the model as binary response with;

0: not satisfied

1: satisfied

y: yes

n: no
Women’s age and duration of disease entered the model as quantitative variables. For medications that women were taking and type of their MS, contingency tables of the order 2x9 (between sex life and medications) and 2x5 (between sex life and type of MS) was also examined. Both tables (3.1 and 3.2) are presented below;

Table 3.1 Between ‘sex life in general’ and various ‘medications’

<table>
<thead>
<tr>
<th>Medications</th>
<th>Avonex (y)</th>
<th>Betaseron (y)</th>
<th>Rebif (y)</th>
<th>Copaxone (y)</th>
<th>Tysabri (y)</th>
<th>IV steroids (y)</th>
<th>Novantrone (y)</th>
<th>Others (y)</th>
<th>None (y)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NS</td>
<td>7</td>
<td>7</td>
<td>8</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>9</td>
</tr>
<tr>
<td>S</td>
<td>20</td>
<td>13</td>
<td>17</td>
<td>9</td>
<td>4</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>19</td>
</tr>
</tbody>
</table>

NS=not satisfied; S=satisfied; y=yes

Table 3.2 Between ‘sex life in general’ and ‘type of MS’

<table>
<thead>
<tr>
<th>Type of MS</th>
<th>Relapsing Remitting (y)</th>
<th>Secondary Progressive (y)</th>
<th>Primary Progressive (y)</th>
<th>Not Known (y)</th>
<th>Other (y)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex life</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NS</td>
<td>27</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>S</td>
<td>68</td>
<td>6</td>
<td>3</td>
<td>6</td>
<td>1</td>
</tr>
</tbody>
</table>

NS=not satisfied; S=satisfied; y=yes

These two contingency tables show sparse data and consequently a chi-square analysis is not feasible. Including these two covariates (medications and type of MS) in the logistic regression model will not shed light on the impact of these variables hence they were not included in the final model.
Regression results were reported in the form of coefficients, standard errors, Wald Z-statistics, p-values and Odds ratios. Adequacy of model was checked by using Hosmer and Lemeshow test for ‘goodness of fit’. All statistical tests were conducted using R-statistical package version 2.10.1. All analyses were two sided with a significance value of 0.05.

RESULTS:

A. Summary Statistics

A total of 160 women participated in this study. One hundred and eighteen (118) women completed both parts of questionnaire with a response rate of 73.8%. The mean age of women was $41.2 \pm 9.6$ years with a range between 20 to 70 years (Figure 1.0). Twenty four percent (24%) of women were at or above 50 years of age while 76% were equal to or less than 49 years of age.

Figure 1.0  Distribution of Age
The mean duration of MS was 106.8 ± 86.5 months (8.9 ± 7.2yrs) with a range between 2 to 360 months (0.17 to 30 years) (Figure 2.0)

Figure 2.0    Distribution of Disease Duration

MS when categorized into different groups, 69% women were found to have their disease for less than ten years (Table 4.0).

Table 4.0: Summary of various categories of duration of MS

<table>
<thead>
<tr>
<th>Duration of MS (Total=118)</th>
<th>N (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤ 2 years</td>
<td>25 (21.2%)</td>
</tr>
<tr>
<td>&gt; 2 to 5 years</td>
<td>24 (20.3%)</td>
</tr>
<tr>
<td>&gt; 5 to 10 years</td>
<td>32 (27.1%)</td>
</tr>
<tr>
<td>&gt; 10 to 15 years</td>
<td>14 (11.9%)</td>
</tr>
<tr>
<td>&gt; 15 to 20 years</td>
<td>14 (11.9%)</td>
</tr>
<tr>
<td>&gt; 20 years</td>
<td>9 (7.6%)</td>
</tr>
</tbody>
</table>
Relapsing-remitting form was the most common type of MS (81%) followed by secondary progressive (6%), primary progressive (4%) and other disease type (1%). Women who did not know the type of their disease were 8%. Distribution of type of MS is shown in Figure 3.0.

![Distribution of Type of MS](image)

Figure 3.0  Distribution of Type of MS

The number of women with MS who were walking independently was 75%. Those needing some type of assistance were as follows; 21% using cane, 4% using walker and only 3% were on wheelchair. Two women were using both cane and walker and one woman was using both cane and wheel chair. Figure 4.0 Shows distribution of physical mobility.
The number of bladder problems asked ranged between zero (no symptoms) to seven. Thirty five percent (35%) women stated one bladder symptom, 13% two, 12% three, 6% four and 4% had five bladder complaints. Thirty percent (30%) women did not have any bladder symptom. Only one patient was found to have six bladder symptoms. Figure 5.0 shows distribution of bladder problems.
Emptying bladder at night (34%) was the most common symptom noticed followed by urgency (31%), frequency (26%), emptying problems (26%), urinary tract infection (22%) and urinary incontinence (8%). Many women had more than one bladder symptom (Table 5.0).

Table 5.0: Summary of various bladder symptoms

<table>
<thead>
<tr>
<th>Bladder problems (Total 118)</th>
<th>N (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recurrent UTI</td>
<td>26 (22)</td>
</tr>
<tr>
<td>Emptying problems</td>
<td>31 (26.3)</td>
</tr>
<tr>
<td>Urgency</td>
<td>36 (30.5)</td>
</tr>
<tr>
<td>Frequency</td>
<td>29 (26.4)</td>
</tr>
<tr>
<td>Emptying at night</td>
<td>40 (33.9)</td>
</tr>
<tr>
<td>Incontinence</td>
<td>9 (7.6)</td>
</tr>
<tr>
<td>None</td>
<td>36 (30.5)</td>
</tr>
</tbody>
</table>

Total number of bowel problems asked ranged between zero (no symptoms) to five. Forty eight percent (48%) women stated one and 6% stated two bowel symptoms. Forty six percent (46%) women did not have any bowel symptom. Figure 6.0 shows distribution of bowel problems.
Constipation (25%) was the most common symptom noticed followed by irregular bowel habits (alternating diarrhea and constipation) in 20%, diarrhea in 10% and bowel incontinence in 5% women. Forty six percent (46%) women did not have any bowel complaint. Many women had more than one bowel complaint (Table 6.0).

Table 6.0: Summary of various bowel symptoms

<table>
<thead>
<tr>
<th>Bowel Problems (Total 118)</th>
<th>N (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constipation</td>
<td>30 (25)</td>
</tr>
<tr>
<td>Diarrhea</td>
<td>12 (10)</td>
</tr>
<tr>
<td>Irregular bowel habits</td>
<td>23 (20)</td>
</tr>
<tr>
<td>Incontinence</td>
<td>6 (5)</td>
</tr>
<tr>
<td>None</td>
<td>54 (46)</td>
</tr>
</tbody>
</table>

Distribution of prescribed medicines is shown below in Figure 7.0. Most of the women were on Avonex or Betaserone or Rebif or were not taking any medications. Twenty three percent (23%) women were on Avonex, 17% on Betaseron, 21% on Rebif, 10% on Copaxone and 3% on Tysabri. Twenty four percent (24%) women were not on any prescribed medication. One woman each was on monthly I.V steroids and some other medication. None of the women were on Novantrone.
Table 7.1 provides summary statistics of women’s age as a demographic factor.

**Table 7.1: Summary Statistics (Demographics)**

<table>
<thead>
<tr>
<th></th>
<th>Mean ± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (yrs)</td>
<td>41.15 ± 9.6</td>
</tr>
<tr>
<td>range(yrs)</td>
<td>20 – 70</td>
</tr>
</tbody>
</table>

Table 7.2 provides summary statistics of all the descriptors of MS.

**Table 7.2: Summary Statistics (Descriptors of MS)**

<table>
<thead>
<tr>
<th>Disease Descriptors (N=118)</th>
<th>Mean ± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Duration of MS (months)</td>
<td>106.8 ± 86.5</td>
</tr>
<tr>
<td>range(months)</td>
<td>2 – 360</td>
</tr>
<tr>
<td>Type of MS</td>
<td>Frequency (%)</td>
</tr>
<tr>
<td>----------------------------------</td>
<td>---------------</td>
</tr>
<tr>
<td>RR (Relapsing remitting)</td>
<td>96(81)</td>
</tr>
<tr>
<td>PP (Primary progressive)</td>
<td>5(4)</td>
</tr>
<tr>
<td>SP (Secondary progressive)</td>
<td>7(6)</td>
</tr>
<tr>
<td>Other</td>
<td>1(1)</td>
</tr>
<tr>
<td>Do not know</td>
<td>9(8)</td>
</tr>
</tbody>
</table>

**Physical mobility**

<table>
<thead>
<tr>
<th>Physical activity</th>
<th>Frequency (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Independent walking</td>
<td>88(74.6)</td>
</tr>
<tr>
<td>Needs cane</td>
<td>25(21.2)</td>
</tr>
<tr>
<td>Needs walker</td>
<td>5(4.2)</td>
</tr>
<tr>
<td>Needs wheelchair</td>
<td>3(2.5)</td>
</tr>
<tr>
<td>2 used both cane and walker</td>
<td></td>
</tr>
<tr>
<td>1 used both cane and wheelchair</td>
<td></td>
</tr>
</tbody>
</table>

**No. of bladder problems**

<table>
<thead>
<tr>
<th>No. of bladder problems</th>
<th>Frequency (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>35(29.7)</td>
</tr>
<tr>
<td>1</td>
<td>41(34.8)</td>
</tr>
<tr>
<td>2</td>
<td>15(12.7)</td>
</tr>
<tr>
<td>3</td>
<td>14(11.9)</td>
</tr>
<tr>
<td>4</td>
<td>7(5.9)</td>
</tr>
<tr>
<td>5</td>
<td>5(4.2)</td>
</tr>
<tr>
<td>6</td>
<td>1(1)</td>
</tr>
</tbody>
</table>

**No. of bowel problems**

<table>
<thead>
<tr>
<th>No. of bowel problems</th>
<th>Frequency (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>54(45.8)</td>
</tr>
<tr>
<td>1</td>
<td>57(48.3)</td>
</tr>
<tr>
<td>2</td>
<td>7(5.9)</td>
</tr>
</tbody>
</table>
Table 7.3 provides summary statistics of women’s response to various potential sexual dysfunction questions.

**Table 7.3: Summary Statistics (Response to potential sexual dysfunction questions)**

<table>
<thead>
<tr>
<th>Sexual Issues examined (Total 118)</th>
<th>Frequency (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Sex life in general</td>
<td></td>
</tr>
<tr>
<td>Not satisfied</td>
<td>34(29)</td>
</tr>
<tr>
<td>Satisfied</td>
<td>61(52)</td>
</tr>
<tr>
<td>Extremely satisfied</td>
<td>23(19)</td>
</tr>
<tr>
<td>2. Frequency of sexual act</td>
<td></td>
</tr>
<tr>
<td>Not satisfied</td>
<td>37(31)</td>
</tr>
<tr>
<td>Satisfied</td>
<td>63(53)</td>
</tr>
<tr>
<td>Extremely satisfied</td>
<td>18(15)</td>
</tr>
<tr>
<td>3. Partner relationship</td>
<td></td>
</tr>
<tr>
<td>Not satisfied</td>
<td>10(8)</td>
</tr>
<tr>
<td>Satisfied</td>
<td>59(50)</td>
</tr>
<tr>
<td></td>
<td>Extremely satisfied</td>
</tr>
<tr>
<td>----------------------</td>
<td>---------------------</td>
</tr>
<tr>
<td><strong>4. Desire</strong></td>
<td></td>
</tr>
<tr>
<td>Not satisfied</td>
<td>42(36)</td>
</tr>
<tr>
<td>Satisfied</td>
<td>47(40)</td>
</tr>
<tr>
<td>Extremely satisfied</td>
<td>29(25)</td>
</tr>
<tr>
<td><strong>5. Arousal</strong></td>
<td></td>
</tr>
<tr>
<td>Not satisfied</td>
<td>35(30)</td>
</tr>
<tr>
<td>Satisfied</td>
<td>57(48)</td>
</tr>
<tr>
<td>Extremely satisfied</td>
<td>26(22)</td>
</tr>
<tr>
<td><strong>6. Orgasm</strong></td>
<td></td>
</tr>
<tr>
<td>Not satisfied</td>
<td>37(31)</td>
</tr>
<tr>
<td>Satisfied</td>
<td>56(48)</td>
</tr>
<tr>
<td>Extremely satisfied</td>
<td>25(21)</td>
</tr>
<tr>
<td><strong>7. Natural wetness</strong></td>
<td></td>
</tr>
<tr>
<td>Not satisfied</td>
<td>41(35)</td>
</tr>
<tr>
<td>Satisfied</td>
<td>58(49)</td>
</tr>
<tr>
<td>Extremely satisfied</td>
<td>19(16)</td>
</tr>
<tr>
<td><strong>8. Pain</strong></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>28(24)</td>
</tr>
<tr>
<td>No</td>
<td>90(76)</td>
</tr>
</tbody>
</table>
B. Inferential statistics:

Regression Model:

Theoretically, the logistic regression model is given by:

\[ \ln \frac{P(Y=1)}{P(Y=0)} = \beta_0 + \beta_1 \text{age} + \beta_2 \text{disease duration} + \beta_3 \text{independent walking} + \beta_4 \text{bladder problems} + \beta_5 \text{bowel problems} + \beta_6 \text{partner-relationship} + \beta_7 \text{frequency sexual act} + \beta_8 \text{desire} + \beta_9 \text{arousal} + \beta_{10} \text{natural wetness} + \beta_{11} \text{orgasm} + \beta_{12} \text{sexual pain} \]

There were 13 parameters in the model. Study data was used to estimate parameters of the model.

The estimated model is given by:

\[ \ln \frac{P(Y=1)}{P(Y=0)} = (-11.45) + 0.03 \text{age} + (-0.004) \text{disease duration} + 0.97 \text{independent walking} + 2.11 \text{bladder problems} + (-1.35) \text{bowel problems} + 4.55 \text{partner-relationship} + 2.41 \text{frequency sexual act} + 3.65 \text{desire} + 1.48 \text{arousal} + 0.80 \text{natural wetness} + 1.78 \text{orgasm} + 1.53 \text{sexual pain} \]

Given below in Table 8.0 are the estimated values of all the parameters of the model along with their standard errors (SE), Z-Statistics, p-values and odds ratios.
**Table 8.0 Results of Logistic Regression and Odds ratio**

<table>
<thead>
<tr>
<th>Model Parameters</th>
<th>Coef</th>
<th>SE</th>
<th>Wald Z</th>
<th>p-value</th>
<th>OR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept (β₀)</td>
<td>-11.45</td>
<td>3.77</td>
<td>-3.04</td>
<td>0.002</td>
<td></td>
</tr>
<tr>
<td><strong>Demographics</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>0.03</td>
<td>0.05</td>
<td>0.63</td>
<td>0.53</td>
<td>0.00</td>
</tr>
<tr>
<td><strong>Descriptors of MS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disease-duration</td>
<td>-0.004</td>
<td>0.006</td>
<td>-0.61</td>
<td>0.54</td>
<td>1.00</td>
</tr>
<tr>
<td>Independent walking (y)</td>
<td>0.97</td>
<td>1.11</td>
<td>0.87</td>
<td>0.38</td>
<td>2.63</td>
</tr>
<tr>
<td>Bladder problems(y)</td>
<td>2.11</td>
<td>1.34</td>
<td>1.58</td>
<td>0.12</td>
<td>8.25</td>
</tr>
<tr>
<td>Bowel problems(y)</td>
<td>-1.35</td>
<td>1.01</td>
<td>-1.35</td>
<td>0.18</td>
<td>0.26</td>
</tr>
<tr>
<td><strong>Response to potential sexual dysfunction qs.</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Partner relationship(1)</td>
<td>4.55</td>
<td>1.58</td>
<td>2.88</td>
<td>0.004**</td>
<td>94.79</td>
</tr>
<tr>
<td>Frequency of sexual act (1)</td>
<td>2.41</td>
<td>0.87</td>
<td>2.78</td>
<td>0.005**</td>
<td>11.10</td>
</tr>
<tr>
<td>Feeling of natural wetness (1)</td>
<td>0.80</td>
<td>9.11</td>
<td>0.88</td>
<td>0.38</td>
<td>2.22</td>
</tr>
<tr>
<td>Feeling of desire (1)</td>
<td>3.65</td>
<td>1.11</td>
<td>3.30</td>
<td>0.001**</td>
<td>38.48</td>
</tr>
<tr>
<td>Feeling of arousal (1)</td>
<td>1.48</td>
<td>1.00</td>
<td>1.47</td>
<td>0.14</td>
<td>4.37</td>
</tr>
<tr>
<td>Feeling of orgasm (1)</td>
<td>1.78</td>
<td>1.05</td>
<td>1.69</td>
<td>0.09</td>
<td>5.91</td>
</tr>
<tr>
<td>Sexual pain (y)</td>
<td>1.53</td>
<td>1.03</td>
<td>1.48</td>
<td>0.14</td>
<td>4.62</td>
</tr>
</tbody>
</table>

**Significant results, Coef=coefficient, SE=standard error, OR=odds ratio**  
1=satisfied response, y=yes, qs= questions

**Result of Hosmer and Lemeshow test for ‘goodness of fit’:**

H₀: The response probability has a logistic regression model pattern.

With p>0.37 we do not reject null hypothesis.
Summary and Conclusion:

Diagnosis of Female Sexual dysfunction (FSD) as per new consensus classification requires presence of women’s personal distress towards changes in their sexual response cycle in addition to organic and psychological factors. This study was designed to evaluate the level of satisfaction women with MS are experiencing with regard to changes in their sexual functioning related to their disease process. Associations between overall sexual satisfaction and various factors were examined and significant predictors of overall sex life in women with MS were determined.

One hundred and sixty women with MS from an out-patient MS clinic participated in this study by filling an anonymous survey. Information about their MS in general and their response to various questions on potential sexual dysfunction was collected. Only 118 women provided full data (no missing observations) for statistical analysis. The mean age of women in the study was 41.2 ± 9.6 years. Seventy six percent (76%) women were less than fifty (50) years of age. The mean duration of MS was 8.9 ± 7.2 years. Sixty seven percent (67%) women had their MS for less than ten (10) years. Eighty one percent (81%) women had Relapsing-remitting MS. Eight percent (8%) women did not know their specific MS subtype. Seventy five percent (75%) women were walking independently and 21% were using cane. Thirty percent (30%) of women had no bladder problems. About 35% stated presence of only one bladder symptom. Similarly, 46% women had no bowel problems while 48% women stated only one bowel symptom. Twenty three percent (23%) women were taking Interferon beta-1a (Brand name-Avonex). Twenty two percent (22%) were on Interferon beta-1a (Brand name-Rebif) and equal numbers of women (22%) were not taking any medication. Only 17% were on Betaserone and 10% were on Copaxone. None of the patient was on Novantrone.
Our findings for women’s response to various potential sexual dysfunction questions show that- for ‘sex life in general’ 52% women showed satisfaction when compared to 29% showing no-satisfaction and 19% showing extreme-satisfaction. For ‘frequency of sexual activity’ 53% women showed satisfaction while 31% were not-satisfied and only 15% were extremely satisfied. For ‘partner relationship’ 50% women showed satisfaction and 42% showed extreme satisfaction in comparison to only 8% women stating not-satisfied response towards partner relationship. For ‘feeling of desire’ 40% women showed satisfaction, 36% showed no-satisfaction and 25% showed extreme-satisfaction. For ‘feeling of arousal’ 48% of women showed satisfied, 30% showed not-satisfied and 22% showed extremely satisfied response. For ‘feeling towards orgasm’ 47% were satisfied, 31% were not-satisfied and 22% were extremely-satisfied. For ‘feeling towards natural wetness during sexual activity’ 49% stated being satisfied, 35% not-satisfied and only 16% were extremely-satisfied. Seventy six percent (76%) women stated absence of pain during sexual activity when compared to 24% stating presence of pain. These findings thus point that overall these women with MS appear quite satisfied with the possible changes occurring in their sexual functioning related to their disease process.

We have segregated the predictors of women’s overall sex life into demographics, descriptors of MS, and responses to potential sexual dysfunction questions. Based on demographics, women’s age was not a significant (p=0.53) predictor of overall sex life. Among the descriptors of MS none of the four factors [duration of MS (p=0.54), independent walking (p=0.38), presence of bladder problems (p=0.12) and bowel problems (0.18)] were found to be significant for women’s overall sex life in MS. A close association had been shown earlier between sexual dysfunction and bladder and or bowel problems (Hennessey et al., 1999; Demirkiran et al., 2006; Nortvedt et al., 2007). As stated above, we only saw a non-significant
trend in our study population. This is likely due to the fact that our study population in general was relatively healthy, without severe disabilities and with a relatively low proportion of Secondary Progressive or Primary Progressive MS cases that in general represent a more disabiling condition.

Among various responses to potential sexual dysfunction questions only three factors emerged as significant predictors of women’s overall sex life in MS. These were women’s satisfactory response towards; partner relationship (p= 0.004), frequency of sexual activity (p=0.005) and feeling of desire (p=0.001). Other factors such as response to feeling of arousal (p=0.14), feeling of orgasm (p=0.09), feeling towards natural wetness (p=0.38) and presence of sexual pain (p=0.14) did not turn out as significant predictors of women’s sex life in MS.

The partner relationship showing significant satisfactory response (p= 0.004) towards overall sex life with an odds ratio (OR) of 94.8 indicates that women with MS are not much distressed towards their sexual life if they have a good partner relationship. This finding is in accordance to McCabe’s study results where greater partner support to MS patients was associated with higher relationship satisfaction (McCabe and Marita, 2007). In our study we did not ask questions related to psychosocial factors such as women’s marital status which would have been an additional asset in interpreting these results. Being in marital relationship has shown as an important factor in coping with MS (Harisson et al., 2004).

The response towards feeling of desire showing significant satisfactory results (p=0.001) with an OR of 38.5 suggests that women with MS for some reason change their personal outlook towards their sexual life. It may be the chronic nature of MS which makes them emotionally strong to cope with their disease by way of coping strategies as suggested by McCabe (McCabe, 2002).
Significant satisfactory response observed towards frequency of sexual activity (p=0.005) with an OR of 11.1 points that women with MS adapt themselves according to the circumstances. Sexual adjustment has been shown in MS patients due to the positive coping strategies (McCabe, 2002). Also, there may be a possibility that women with MS may be practicing various other alternative ways to achieve sexual satisfaction.

Results of our study indicate that women with MS are not distressed about their overall sex life. The likely reason being that majority of them are young, physically independent, had relapsing-remitting form of MS for shorter time period and they did not indicate major sexual problems. The shorter duration of MS found in our study is in support of previous findings that sexual problems can occur even at early stages of MS (Tzortzis et al., 2008). Our results are statistical interpretation of a probabilistic model and therefore care should be taken while interpreting these findings.

The strength of our study is that this is one of the few studies done on MS patients determining the stress level in relation to female sexual dysfunction. The study provided some important information about the level of comfort these women are experiencing towards the changes in their sexual functioning from their own perspective. This study also provides some useful information about factors that can have an influence on women’s sex life.

Our study is not without limitations. The participation into our study was entirely voluntary therefore there may be a chance that only those women who were not much concerned about this aspect of MS participated in this study leading to selection bias. Being a cohort study no control group was used. No separate physical, neurological or urogynecological examination was performed. No data was collected for psychosocial factors which may have an influence on sex life. The questionnaire used was a self developed and was a non-validated questionnaire.
There is a need to study women’s level of stress in context of changes in sexual functioning in more detail by including all various factors that can have an influence on their sex life before any final conclusion is made. Also, there is a need to develop a standardized questionnaire related to female sexual dysfunction which should have physical, psychosocial and stress component so that uniform interpretation can be done. This study can be helpful as a preliminary step in developing such questionnaire.

References:


McCabe MP, McKern S (b) Quality of Life and Multiple Sclerosis: Comparison Between People With Multiple Sclerosis and People From the General Population Journal of Clinical Psychology in Medical Settings, Vol. 9, No. 4, December 2002


McCabe, Marita P. Perceptions of Relationship and Sexual Satisfaction among People with Multiple Sclerosis and their Partners. Sexuality and disability 2007; 25 (4):179


Rosen RC. Female sexual dysfunction: industry creation or under recognized problem. BJU Int 2003; 92:3–4.

Schober JM, Pfaff D. The neurophysiology of sexual arousal Best Pract Res Clin Endocrinol Metab. 2007 Sep; 21(3):445-61


Appendices:

A. Statistical Output for summary statistics:

```r
> summary(finaldata)
Age dis.dur.mths RR SP PP other
Min. :20.00 Min. : 2.0 n:23 n:110 n:113 n:117
1st Qu.:34.00 1st Qu.: 36.0 y:96 y: 7 y: 5 y: 1
Median :40.50 Median : 81.0
Mean   :41.15       Mean   :106.8
3rd Qu.:48.00       3rd Qu.:156.0
Max.   :70.00 Max.   :360.0

DNK indep cane walker whch UTI emty urg freq emtyngt
y: 9 y:88 y:25 y: 5 y: 3 y:26 y:31 y:36 y:29 y:40

incont (bl) None(bl) constp dia incont(bowl) irreg None(bowl) Avonex Betaseron Rebif
y: 9 y:36 y:30 y: 12 y: 6 y:23 y:54 y:27 y:20 y:25

Copaxone Tysabri Novantrone IV.steroids none othres sxlife freqsxact
y: 12 y: 4 y: 1 y:28 y: 1 ns :34 ns :37
s :59 s :47 s :57 s :58 s :56

partrel desire arousal wet org pain
exst:49 exst:29 exst:26 exst:19 exst:25 n:90
ns :10 ns :42 ns :35 ns :41 ns :37 y: 28
s :59 s :47 s :57 s :58 s :56
```

> sd(Age)
[1] 9.611805
> sd (dis.dur.mths)
[1] 86.51897
B. Statistical Output- 3x3 contingency tables:

1. table (sxlife, freqsxact)
   freqsxact
   sxlife  exst  ns  s
   exst   18   0   5
   ns     0   26   8
   s      0   11  50

   chisq.test(table(sxlife, freqsxact))
   Pearson's Chi-squared test
   data:  table(sxlife, freqsxact)
   X-squared = 126.407, df = 4, p-value < 2.2e-16
   Warning message:
   In chisq.test(table(sxlife, freqsxact)) :
   Chi-squared approximation may be incorrect

2. table (sxlife, partrel)
   partrel
   sxlife  exst  ns  s
   exst   19   0   4
   ns     8   7  19
   s     22   3  36

   chisq.test(table(sxlife, partrel))
   Pearson's Chi-squared test
   data:  table(sxlife, partrel)
   X-squared = 27.3034, df = 4, p-value = 1.726e-05
   Warning message:
   In chisq.test(table(sxlife, partrel)) :
   Chi-squared approximation may be incorrect

3. table (sxlife, desire)
   desire
   sxlife  exst  ns  s
   exst   16   1   6
   ns     1   29   4
   s     12  12  37

   chisq.test(table(sxlife, desire))
   Pearson's Chi-squared test
   data:  table(sxlife, desire)
   X-squared = 74.7198, df = 4, p-value = 2.284e-15

4. table (sxlife, arousal)
   arousal
   sxlife  exst  ns  s
### Statistical Model Output - regression analysis:

```r
> library(Design)

> logi.model <-

> lrm(sxlife ~ Age + dis.dur.mths + indep + blad.prob + bowl.prob + partrel + freqsxact + desire + arousal + wet + org + pain)
```

```r
ext  13  0  10
ns  0  23  11
s   13  12  36

chisq.test(table(sxlife, arousal))
Pearson's Chi-squared test
data:  table(sxlife, arousal)
X-squared = 48.6867, df = 4, p-value = 6.787e-10

5. table (sxlife, org)

<table>
<thead>
<tr>
<th>sxlife</th>
<th>exst</th>
<th>ns</th>
<th>s</th>
</tr>
</thead>
<tbody>
<tr>
<td>exst</td>
<td>14</td>
<td>0</td>
<td>9</td>
</tr>
<tr>
<td>ns</td>
<td>1</td>
<td>21</td>
<td>12</td>
</tr>
<tr>
<td>s</td>
<td>10</td>
<td>16</td>
<td>35</td>
</tr>
</tbody>
</table>

chisq.test(table(sxlife, org))
Pearson's Chi-squared test
data:  table(sxlife, org)
X-squared = 43.5097, df = 4, p-value = 8.111e-09
Warning message:
In chisq.test(table(sxlife, org)) :
  Chi-squared approximation may be incorrect

6. table (sxlife, wet)

<table>
<thead>
<tr>
<th>sxlife</th>
<th>exst</th>
<th>ns</th>
<th>s</th>
</tr>
</thead>
<tbody>
<tr>
<td>exst</td>
<td>13</td>
<td>3</td>
<td>7</td>
</tr>
<tr>
<td>ns</td>
<td>1</td>
<td>25</td>
<td>8</td>
</tr>
<tr>
<td>s</td>
<td>5</td>
<td>13</td>
<td>43</td>
</tr>
</tbody>
</table>

chisq.test(table(sxlife, wet))
Pearson's Chi-squared test
data:  table(sxlife, wet)
X-squared = 62.1991, df = 4, p-value = 1.000e-12
Warning message:
In chisq.test(table(sxlife, wet)) :
  Chi-squared approximation may be incorrect
Logistic Regression Model

```
lrm(formula = sxlife ~ Age + dis.dur.mths + indep + blad.prob +
    bowl.prob + partrel + freqsxact + desire + arousal + wet +
    org + pain)
```

Frequencies of Responses

```
0  1
34  84
```

<table>
<thead>
<tr>
<th>Obs</th>
<th>Max Deriv</th>
<th>Model L.R.</th>
<th>d.f.</th>
<th>P</th>
<th>C</th>
<th>Dxy</th>
</tr>
</thead>
<tbody>
<tr>
<td>118</td>
<td>2e-08</td>
<td>94.1</td>
<td>12</td>
<td>0</td>
<td>0.97</td>
<td>0.941</td>
</tr>
</tbody>
</table>

Gamma  Tau-a   R2   Brier
0.941   0.389   0.786  0.064

<table>
<thead>
<tr>
<th>Coef</th>
<th>S.E.</th>
<th>Wald Z</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interception</td>
<td>-11.452384</td>
<td>3.768201</td>
<td>-3.04</td>
</tr>
<tr>
<td>Age</td>
<td>0.034105</td>
<td>0.054096</td>
<td>0.63</td>
</tr>
<tr>
<td>dis.dur.mths</td>
<td>-0.003587</td>
<td>0.005845</td>
<td>-0.61</td>
</tr>
<tr>
<td>indep=y</td>
<td>0.966963</td>
<td>1.108468</td>
<td>0.87</td>
</tr>
<tr>
<td>blad.prob=y</td>
<td>2.110305</td>
<td>1.339411</td>
<td>1.58</td>
</tr>
<tr>
<td>bowl.prob=y</td>
<td>-1.353657</td>
<td>1.004133</td>
<td>-1.35</td>
</tr>
<tr>
<td>partrel=1</td>
<td>4.551613</td>
<td>1.579760</td>
<td>2.88</td>
</tr>
<tr>
<td>freqsxact=1</td>
<td>2.406790</td>
<td>0.866805</td>
<td>2.78</td>
</tr>
<tr>
<td>desire=1</td>
<td>3.650256</td>
<td>1.105218</td>
<td>3.30</td>
</tr>
<tr>
<td>arousal=1</td>
<td>1.475088</td>
<td>1.000553</td>
<td>1.47</td>
</tr>
<tr>
<td>wet=1</td>
<td>0.797687</td>
<td>0.911181</td>
<td>0.88</td>
</tr>
<tr>
<td>org=1</td>
<td>1.776227</td>
<td>1.052766</td>
<td>1.69</td>
</tr>
<tr>
<td>pain=y</td>
<td>1.529317</td>
<td>1.034350</td>
<td>1.48</td>
</tr>
</tbody>
</table>

D. Statistical Model Output- odds ratio:

```
> oddsratios.lrm <- exp(1)^logi.model$coefficients
> oddsratios.lrm
```

<table>
<thead>
<tr>
<th>Coef</th>
<th>S.E.</th>
<th>Wald Z</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>Age</td>
<td>dis.dur.mths</td>
<td>indep=y</td>
</tr>
</tbody>
</table>
E. Statistical Model Output- ‘goodness of fit’ test:

```
> residuals.lrm(logi.model,type=c("gof"))

             Sum of squared errors Expected value|H0          SD          Z           P
 7.5029693                7.1080762      0.4428383      0.8917320   0.3725366
```

F. Questionnaire: Sexual Dysfunction in women with Multiple Sclerosis

Below you will find a few questions related to your diagnosis of MS and potential sexual dysfunction you may have experienced. You may elect not to answer all of the questions, and your participation is entirely voluntary. We appreciate your time and efforts in helping us understand this important aspect of MS.

Part A:

1. What is your current age: ………………………..years.

2. For how long you had Multiple Sclerosis: ……………………..years

3. If you know, what form of MS do you have:
   a. Relapsing-remitting
   b. Secondary progressive
   c. Primary progressive
   d. Other
   e. Do not know

4. When you walk longer distances/outside of your home, the following applies. Circle one of them.
   a. You are able to do that independently.
   b. You need a cane.
c. You need a walker.
d. You need a wheelchair or a motorized scooter.

5. Do you have any of the following bladder problems: Circle what is applicable:
   a. Recurrent infections (UTI-s).
   b. Emptying problems (you don't feel fully empty, and you have to go back in less than half an hour to empty again).
   c. Urgency (need to rush to the bathroom).
   d. Increased frequency (need to go very often).
   e. Getting up at night to empty your bladder, almost every night.
   f. Incontinence (full loss of bladder control).
   g. None of the above

6. Do you have any of the following bowel problems: Circle what is applicable.
   a. Constipation (less than one bowel movement per day).
   b. Diarrhea (loose stools).
   c. Incontinence.
   d. Irregular bowel habits (diarrhea intermixed with periods of constipation).
   e. None of the above

7. Are you on any of the following disease modifying agents: Circle that is applicable.
   (1) Avonex.
   (2) Betaseron.
   (3) Rebif.
   (4) Copaxone.
   (5) Tysabri.
   (6) Novantrone.
   (7) monthly IV steroids.
   (8) none of the above.
   (9) other/s.
Part B.
Below you will find questions about potential sexual dysfunction. Please circle the appropriate answers.

1. In general, how much satisfied are you with your sexual life?
   Not Satisfied    Satisfied    Extremely Satisfied    NA    Do not want to answer

2. How do you feel about the frequency of your sexual activity?
   Not Satisfied    Satisfied    Extremely Satisfied    NA    Do not want to answer

3. How do you feel about your relationship with your partner?
   Not Satisfied    Satisfied    Extremely Satisfied    NA    Do not want to answer

4. How do you rate your desire/interest to have sexual activity?
   Not Satisfied    Satisfied    Extremely Satisfied    NA    Do not want to answer

5. How do you rate your arousal level (feeling or maintaining sexual excitement) during sexual activity?
   Not Satisfied    Satisfied    Extremely Satisfied    NA    Do not want to answer

6. How do you rate your natural wetness (lubrication) during sexual activity?
   Not Satisfied    Satisfied    Extremely Satisfied    NA    Do not want to answer

7. How will you rate your orgasm (pleasurable feeling) during sexual activity?
   Not Satisfied    Satisfied    Extremely Satisfied    NA    Do not want to answer

8. Do you experience pain during or after sexual activity?
   YES       NO    Do not want to answer