Health Utilities for Multiple Sclerosis

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What is already known about the topic?

Data on the health state utility values of Multiple Sclerosis (MS) health states have been described as sparse or of questionable methodological quality. This has led to uncertainty in assessing the effectiveness and cost-effectiveness of treatments for MS, and has hampered decision-making regarding the funding of MS interventions.

What does the paper add to existing knowledge?

The research reported here provides new, detailed, empirical MS EQ-5D and SF-6D health state utility value data, based on a UK representative sample of people with MS, by a variety of key demographic and clinical characteristics.

What insights does the paper provide for informing health care-related decision making?

This data can be used to help offer decision-makers more precise estimates of the effectiveness and cost-effectiveness of treatments for MS.

Abstract

Objectives: To estimate health state utility values (HSUVs) for Multiple Sclerosis (MS) by key demographic and clinical characteristics.

Methods: Data from a UK prospective, longitudinal, cohort study of people with MS were used for analysis. Patient-reported outcomes on the EQ-5D and the SF-36 (SF-6D) were used to estimate HSUVs by age, gender, MS type, time since diagnosis, disease severity (Expanded Disability Status Scale, EDSS), and relapse characteristics.

Results: The cohort (n=1,441) (11,778 returned questionnaires) was representative of the UK MS population. Data indicated that primary and secondary progressive MS were associated with lower HSUVs than relapsing-remitting MS, and HSUVs decreased by disease severity. This was particularly apparent for the EQ-5D, with mean estimates ranging from 0.846 to 0.025 for EDSS states 0 to 8, compared to mean SF-6D estimates ranging from 0.702 to 0.529. Experiencing a relapse in the previous six months had a significant impact on HSUVs, with mean decrements of 0.076 for the EQ-5D and 0.052 for the SF-6D.

Conclusions: These findings demonstrate the negative impact of MS on health-related quality-of-life, especially as the condition progresses, and indicate the substantial influence of varying features of relapses on HSUVs. This is the first report of SF-6D values for a UK MS population and the first time that EQ-5D data have been presented in such detail for people with MS. The representative nature of the sample means that this data can be used to offer decision-makers more precise estimates of the effectiveness and cost-effectiveness of MS treatments.

Introduction

Multiple Sclerosis (MS) is a chronic, disabling neurological disorder which can affect any system of the body. It is one of the commonest global causes of neurological disability in young and middle-aged adults (1) (2), with a worldwide prevalence of approximately 33 per 100,000 population (3). Approximately 85% of people when first diagnosed with MS are diagnosed with relapsing-remitting MS (RRMS) (4). Their disease course is characterised by episodes when they are well and episodes, known as relapses, when they experience an acute exacerbation of existing symptoms or new symptoms (5) (6). MS and the relapses experienced have a profound impact on health-related quality of life (7) (3), commensurate with congestive heart failure, chronic obstructive pulmonary disease, Type II diabetes, and having experienced an acute myocardial infarction in the previous year (8).

One of the ways in which health-related quality of life can be assessed is by considering the health state utility values (HSUVs) of different health states experienced by individuals with the condition of interest. HSUVs are used to assign a value to health states that may be experienced. These values are on a scale where one represents, or is equivalent to, full health and zero is considered equivalent to being dead. Values can also be negative, representing health states valued as worse than being dead (9).

Such HSUVs have specific relevance to health policy and health technology assessments, as they comprise the ‘quality weight’ in quality-adjusted life-years (QALYs) (9) (10). QALYs are one of the key inputs in analyses of the effectiveness and cost-effectiveness of treatments, and are one of the main outcome measures used in funding decision-making, particularly in the UK, Europe, and publically funded health care systems (11) (12) (13) (14). HSUVs can have a major impact on results obtained from health technology appraisals (15) and yet, data on the HSUVs of MS health states have been described as sparse or of questionable methodological quality (16). Systematic reviews of the cost-effectiveness of treatments for MS have highlighted particular issues with the HSUVs available for MS (17) (18) (19) (20), and a systematic review of MS HSUVs (16) identified inconsistencies and marked variability in the values reported. For example, higher HSUVs have been described for disease severity scores indicative of poorer health status (21) (22) and HSUV losses associated with

MS relapse events have been reported as ranging from 0.029 (23) to 0.8 (24) (25). This has led to uncertainty in assessing the effectiveness and cost-effectiveness of treatments for MS (26) (19), and hampered decision-making regarding the funding of MS interventions (27) (28) (29). Therefore, the aim here was to estimate HSUVs for MS using data from a prospective, longitudinal, cohort study of people with MS by demographic and clinical characteristics, including valuation by disease severity and the characteristics of relapses.

Methods

The South West Impact of Multiple Sclerosis (SWIMS) project

Data from the UK South West Impact of Multiple Sclerosis (SWIMS) project (30) were used for analysis. SWIMS is a longitudinal, prospective, cohort study of people with MS in Devon and Cornwall (South West England), with individuals followed-up six-monthly. Full details of the study methods have been reported elsewhere (30). Data are collected on demographics and clinical characteristics, and on a range of patient-reported outcome measures. SWIMS commenced recruitment in August 2004, and data from all participants who had completed initial questionnaires at October 2012 were included in this analysis.

The study was approved in the UK by the Cornwall and Plymouth and South Devon Research Ethics Committees, and written informed consent obtained from all participants.

Measures

Demographic and clinical characteristics

Participants reported their age and gender, the type of MS they had (aided by descriptions and graphical representations similar to those used by Bamer *et al.* (31) and Lublin *et al.* (32)) and the length of time since their diagnosis. Participant-reported data was supplemented, where available, with clinician-reported assessment of disease severity using the Expanded Disability Status Scale (EDSS) (33) scores, collected during routine clinic visits. These were matched with HSUV data if recorded within the same three-month window.

Participants reported relapse events for the prior six months, reporting if they had experienced a relapse, the number experienced, their length ('lasted about 48 hours', 'lasted up to 1 week', 'lasted up to 1 month', or 'lasted longer than 1 month'), whether they had been admitted to hospital as a result, and if the relapse had limited everyday activities. They were asked to give these details for up to four relapses in the six month period. (At recruitment, this information was reported for the previous 12 months).

Health state utility values

Participants completed both the EQ-5D-3L (34) (35) (36) and version 2 of the SF-36 (37) from which the SF-6D (38) can be derived. Participants completed both instruments at baseline and, thereafter, one of each measure every six months.

The EQ-5D-3L (34) (35) (36) is the most widely used generic preference-based measure for deriving HSUVs (39). It is used internationally (there are currently 141 language versions), and has become increasingly commonplace in clinical trials and economic evaluations in the UK, given that it is the measure recommended by NICE in its reference case for health technology assessment submissions (11). The EQ-5D-3L descriptive system has five dimensions, each of which can be assigned at three levels. Its dimensions are Mobility, Self-care, Usual activities, Pain/Discomfort and Anxiety/Depression. The levels relate to the severity of problems on each of the dimensions; 1

represents ‘no problems’, 2 ‘some or moderate problems, and 3 ‘extreme problems/unable’, with the exception of Mobility level 3 which is described as ‘confined to bed’. Participants’ responses to the descriptive system were assigned HSUVs based on time trade-off valuations from a representative sample of members of the UK general population (40) (41). EQ-5D-3L HSUVs range from -0.594 (equivalent to being dead) to 1 (full health).

The internationally recognised SF-36, currently in its second version, includes 36 self-report questions regarding functional health and well-being (37). The descriptive system of the SF-6D (38) is based on 11 items from the SF-36 and comprises six dimensions; Physical functioning, Bodily pain, Vitality, Social functioning, Mental health, and Role limitation. Participants respond to questions on each of these dimensions to indicate the severity of their health state. The dimensions have between four and six response levels each. Participants’ responses were assigned HSUVs based on standard gamble valuations by a representative sample of the UK general public (38). SF-6D HSUVs range from 0.3 to 1 (full health).

Data analyses

The demographic and clinical characteristics of the SWIMS sample were described at recruitment, and were compared for representativeness with other samples of people with MS in the UK.

Mean (sd) HSUVs were calculated by participants’ age, gender, type of MS (relapsing-remitting - RRMS, primary progressive - PPMS, secondary progressive - SPMS, benign), time since diagnosis, disease severity according to the EDSS, and the number and features of relapses experienced.

Data management was conducted in Excel 2007 and STATA 12.1, and all data analyses were conducted in STATA 12.1, with data defined as panel data using the xt commands.

Results

Description of the sample and data

Data from 1,441 people with MS were available, comprising 11,778 completed SWIMS questionnaires. Respondents provided a mean (sd) of 8 (4) questionnaires, with a range from one to 17. The demographic and clinical features of participants on recruitment to SWIMS are given in Table 1.

Representativeness of the sample

Approximately 75% of those approached have taken part in the SWIMS study and response rates have been remarkably high (90% at 3.5 years follow-up (42)). The sample, at recruitment, was demographically comparable to other UK samples of people with MS (42) (43) (although the percentage of respondents reporting a diagnosis of primary progressive MS was slightly higher: 19% as compared to 15%) (43). For example, previous population surveys over the past 20 years have found mean ages of between 49.3 and 52.0 years (as compared to 50.7 years in the SWIMS sample), and male to female gender ratios ranging from 1:2.1 to 1:2.8 (as compared to 1:2.8 in the SWIMS sample) (44-50). In addition, the relapse rate in the SWIMS sample (1.1 a year) was very similar to those estimated in prospective evaluations of relapses (0.5 to 1 a year) (51). The demographic and clinical characteristics of the SWIMS participants were also comparable to those of individuals described in a recent paper documenting findings from a UK MS Register project. The 4,516 respondents had a mean (sd) age of 50.7 (11.2) years, the same as the SWIMS sample, a female: male ratio of 2.5, and were a mean (sd) of 10.9 (8.9) years since diagnosis (43).

Health state utility values (HSUVs)

6,066 fully completed EQ-5D questionnaires were available from 1,406 participants, and 5,964 SF-6D responses were provided by 1,357 participants. The mean (sd) EQ-5D value was 0.563 (0.312), and the mean (sd) SF-6D value 0.620 (0.122). HSUVs for both measures covered the full valuation range. A comparison of HSUVs for people with MS with UK norms is described in Supplement 1.

HSUVs by MS type

Table 2 presents HSUVs by type of MS. According to both the EQ-5D and the SF-6D, HSUVs were lower for those with PPMS and SPMS than for those with RRMS, implying that the former sub-types of MS have a greater impact on health-related quality of life.

HSUVs by time since diagnosis

Table 2 presents HSUVs for MS according to self-report time since diagnosis. When considering all types of MS, for both the EQ-5D and the SF-6D, values decrease from the point of diagnosis to 20 to 29 years post-diagnosis, followed by a slight increase between approximately 30 and 39 years, before a further decline thereafter. Although not so pronounced, this pattern also holds separately for individuals with RRMS. The trajectory for PPMS appears similar, but with HSUVs falling at 10 to 19 years, before improving at 20 to 29 years.

HSUVs by disease severity according to the EDSS

Table 3 presents HSUVs by EDSS scores according to MS type. These data show a broadly linear decrease in values from EDSS 0 to EDSS 8. This is particularly apparent with the SF-6D data. With the EQ-5D, there is a flattening of values at EDSS 3 and EDSS 4, and a more sharp decrease from EDSS 7 to EDSS 8. There is greater variability in EQ-5D values of those individuals with RRMS. Their values were worse than individuals with PPMS at EDSS score 3 (‘Moderate disability’), improved at

EDSS score 4 (‘Relatively severe disability’), dropped at EDSS 5 (‘Disability precludes full daily activities’), and improved at EDSS 6 (‘Assistance required to walk’). The trajectory of EQ-5D values by EDSS score was very similar for those who had PPMS and SPMS.

HSUVs in relation to relapses

Table 4 presents EQ-5D and SF-6D HSUVs for MS in the context of particular features of relapse events. These data show that experiencing a relapse in the previous six months (as compared to not experiencing a relapse) was associated with a decrement of 0.076 in EQ-5D value. The data also indicate that the number of relapses had a negative relationship with EQ-5D values. Individuals who experienced one relapse had a mean (sd) EQ-5D value of 0.570 (0.297), whilst those who experienced four relapses in the six month period had a mean (sd) EQ-5D value of 0.380 (0.377). The difference in EQ-5D values between those who had not experienced a relapse and those who had experienced four relapses was 0.23.

These data also show that experiencing a relapse in the previous six months was associated with a mean decrement of 0.052 in SF-6D values. The number of relapses had a negative relationship with SF-6D values. Individuals who experienced one relapse had a mean (sd) SF-6D value of 0.607 (0.115), whilst those who experienced four relapses in the six month period had a mean (sd) SF-6D value of 0.551 (0.115). The difference in SF-6D values between those who had not experienced a relapse and those who had experienced four relapses was 0.098. The relationship between number of relapses and health state value decrement for the SF-6D was much less pronounced than for the EQ-5D.

The relationship between the length of relapses and HSUVs indicated that relapses that lasted ‘about 48 hours’ or for ‘up to 1 week’ were associated with the lowest EQ-5D and SF-6D values. Longer relapses were generally associated with higher HSUVs.

Relapses that limited everyday activities and, in particular, relapses that resulted in a hospital admission were associated with large decrements in HSUVs, as compared to those who did not experience a relapse. For example, the difference in EQ-5D values between those who did not have a relapse and those who had four relapses with the last resulting in a hospital admission was 0.275. The equivalent figure for the SF-6D was 0.132.

Discussion

The SWIMS study provides new empirical data on the health state utility values of MS health states by the particular clinical features of the condition. These data provide insights into the impact of MS on people's lives and the health-related quality of life of people with MS, and can be used to inform effectiveness and cost-effectiveness analyses of treatments for the disease.

Health state utility values are presented for both the EQ-5D and the SF-6D, with the two measures showing a similar pattern of values associated with MS by age, gender, disease severity and clinical characteristics. However, there were some clear differences in the values provided by the two measures. There was an obvious linear decline in EQ-5D and SF-6D values by increasing disability, according to the EDSS. Based on previous reports which suggest a minimally important difference of between 0.03 (52) (53) and 0.075 (54) on the EQ-5D, the change in HSUV at each point change on the EDSS for 'all diagnoses' would be considered of clinical relevance (apart from the change from EDSS 3 to EDSS 4). In contrast, none of the changes in SF-6D HSUVs by point change on the EDSS would be considered meaningful when a minimally important difference of 0.041 is considered (55). In addition, the relationships between EQ-5D values and features of relapses were more pronounced than the relationships between SF-6D values and relapse characteristics. Stronger relationships between clinical characteristics and EQ-5D values than between clinical characteristics and SF-6D values appears to be a general pattern when comparing EQ-5D and SF-6D data in this research and may reflect the more compressed scale of the SF-6D (0.3 to 1, as compared to -0.594 to 1 for the EQ-5D). This may imply a greater sensitivity of the EQ-5D to changes in varying clinical features of MS as compared to the SF-6D.

SF-6D data have not previously been reported for people with MS in the UK, and only two prior studies have reported SF-6D values for MS health states, in the United States (56) and Canada (57). Fisk *et al.* (57) presented data graphically, with no disaggregated detail. Noyes *et al.* (56) applied UK SF-6D values to SF-36 descriptive system data collected from people with MS in the United States and presented data by disease severity (EDSS). These values were consistently higher than those reported here (Figure 1), although this may, in part, be explained by the inclusion of people with PPMS in the current analysis but not in the Noyes *et al.* (56) data, as the SWIMS data showed lower SF-6D HSUVs for people with PPMS than for 'all diagnoses'. This appears to be the first occasion that HSUVs for PPMS have been reported separately to other forms of MS for either the SF-6D or the EQ-5D (16).

The pattern of SWIMS EQ-5D values by EDSS scores is broadly consistent with that of other UK studies (58) (22) (59) (Figure 2), although somewhat 'flatter', i.e. SWIMS participants have slightly lower EQ-5D values at less severe EDSS scores and slightly higher EQ-5D values at more severe EDSS scores. Findings from Parkin *et al.* (59) and Fogarty *et al.* (58) were based on small numbers of participants (102 and 214, respectively) as compared to the SWIMS data (1,169 EQ-5D health state descriptions given by 565 respondents). Results from Orme *et al.* (22) were based on a larger number of respondents (2,048), but the data were collected cross-sectionally via a patient association with a resulting low response rate (approximately 20%). As such, the SWIMS data may provide the least biased estimates of EQ-5D HSUVs.

An inconsistent result previously identified by Orme *et al.* (22) was replicated in the SWIMS data. In both studies, EQ-5D values were slightly higher when individuals had an EDSS score of 4 ('Relatively severe disability'), than when individuals had an EDSS score of 3 ('Moderate disability'). This finding was particularly apparent for SWIMS participants with RRMS (although this was based on a relatively small numbers of responses). In addition, this sub-group of individuals with RRMS had higher EQ-5D values at EDSS score 6 ('Assistance required to walk'), than at EDSS 5 ('Disability precludes full daily activities'). These findings may reflect complexities with how clinicians use the EDSS in practice, limitations with its psychometric properties, particular difficulties with rating the fluctuations in disability

experienced by those with RRMS, the effect of patient coping strategies at the interfaces of EDSS 3/4 and 5/6, characteristics of the EQ-5D scoring at values of approximately 0.5 to 0.6, or the result may have occurred randomly. The relationship between HSUVs and EDSS scores warrants further investigation.

This is also the first time that detailed data of this type have been presented for relapses according to their frequency, severity and length, and considering HSUVs alongside detailed information on the nature of relapses has provided new insights into the impact of differing forms of relapses on the health-related quality of life of people with MS. For example, relapses that lasted 'About 48 hours' or 'Up to 1 week' were associated with lower HSUVs than relapses that lasted 'Up to 1 month' or 'Longer than 1 month'. This may imply that shorter duration relapses are more severe in terms of their impact on health status. However, there is no clear evidence for this in the associated literature. Alternatively, this result might be a manifestation of the fact that shorter duration relapses are less likely to be treated, for example by a course of oral or intravenous steroids and, therefore, the effects linger and continue to impact on health status. But this is speculative, and the true explanation may relate to the known complexities of defining and categorising relapses.

Comparing the mean EQ-5D values of those who had experienced a relapse in the previous six months with those who had not experienced a relapse gave a relapse-associated decrement of 0.076. This was comparable with the decrement of 0.071 given by Orme *et al.* (22), but not with the figures of 0.254 and 0.468 from other UK-based studies (60) (59). The potential reasons for this become apparent when the demographic and clinical characteristics of the participants in the latter studies are considered. The Forbes *et al.* study included only 84 participants, all of whom had SPMS. The 102 participants in the Parkin *et al.* study were substantially younger than the SWIMS sample, and all had RRMS.

The data from SWIMS provides HSUVs for individuals with RRMS, PPMS and SPMS up to 30-39 years from diagnosis. This is a unique feature of the SWIMS dataset and such information has not previously been reported in this manner. The trajectory of the relationship between HSUVs and time since diagnosis may reflect some degree of adaptation to having MS (61). Individuals with MS may

view their health status as deteriorating over the first 20 to 29 years of having the disease. During this time they are likely to make adaptations to help live with the condition and develop psychological strategies for coping with the impact that it has on their lives. This process of adaptation, or 'normalisation', may then be reflected at 30 to 39 years from diagnosis by individuals perceiving their health status to be less severely affected, thus giving improved ratings on the EQ-5D and the SF-6D (SF-36). This process of adaptation may happen more quickly when the disease course is more rapid, which could explain the earlier increases in HSUVs for people with PPMS as compared to RRMS, although conclusions must be tentative as numbers providing HSUV data at 30 to 39 years from diagnosis were small for some types of MS.

The analyses reported here were limited by EDSS data not being available for all participants and not being reported concurrently with SWIMS data. Future research should aim to include EDSS assessments at the same data collection points as HSUVs. This said, problems with the EDSS, in both clinical and research practice (62), suggest that an alternative measure of disease progression in MS may be long overdue. This is supported by the inconsistent relationship between EDSS and EQ-5D values at EDSS stages 3 and 4, and EDSS stages 5 and 6, found in this research and that of Orme *et al.* (22).

This research has illuminated some of the relative merits of two of the most commonly used generic preference-based measures (9). Further research is now warranted to further investigate the psychometric functioning of the EQ-5D and the SF-6D for use in the context of MS.

The SWIMS data provide opportunities for further analyses using statistical techniques, and to develop hypotheses regarding the associations between health state utility values and the demographic and clinical features of people with MS. However, given the high quality data available, and the apparent representativeness of SWIMS participants, descriptive statistics are given in the present analyses to provide the data in a simple format for use and interpretation by others. Regression-based analyses are a recommendation for future research.

The SWIMS dataset has very high response and retention rates and appears representative of the UK population of people with MS. As such, the current findings can be generalised to other people with MS. This work has demonstrated that MS has a major impact on the health-related quality of life as compared to population norms, especially as the disease progresses into its later stages and disability levels worsen. The findings also indicate the complexity of relationships between time since diagnosis and HSUVs, and specific features of relapses experienced and EQ-5D and SF-6D values. In addition, comparing the reported findings with those from previous studies has highlighted how different HSUVs can result based on the particular characteristics of the sample and the methodological approach taken. The SWIMS study has provided HSUV data based on specific clinical and demographic characteristics of people with MS. These can now be used to offer decision-makers more precise estimates of the effectiveness and cost-effectiveness of treatments for MS.

References

1. Hauser S. Multiple sclerosis and other demyelinating diseases. In: Isselbacher K, Braunwald E, Wilson J, eds., Harrison's Principles of Internal Medicine. New York: McGraw-Hill, 1994.
2. Noseworthy J, Lucchinetti C, Rodriguez M, et al. Medical progress: multiple sclerosis. New Englance Journal of Medicine. 2000; 343.
3. Multiple Sclerosis International Federation. Atlas of MS 2013. London: Multiple Sclerosis International Federation, 2013.
4. Zajicek J, Freeman J, Porter B. Multiple sclerosis: a practical manual. Oxford: Oxford University Press, 2007.
5. Oleen-Burkey M, Castelli-Haley J, Lage M, et al. Burden of a Multiple Sclerosis relapse. The patient's perspective. Patient. 2012; 5: 57-69.
6. Poser C, Paty D, Scheinburg L. New diagnostic criteria for multiple sclerosis: guidelines for research protocols. Annals of Neurology. 1983; 13: 227-31.
7. Benito-Leon J, Morales J, Rivera-Navarro J, et al. A review about the impact of multiple sclerosis on health-related quality of life. Disability and Rehabilitation. 2003; 25: 1291–303.
8. Miller D, Rudick R, Hutchinson M. Patient-centered outcomes. Translating clinical efficacy into benefits on health-related quality of life. Neurology. 2010; 74: S24-S35.
9. Brazier J, Ratcliffe J, Salomon J, et al. Measuring and Valuing Health Benefits for Economic Evaluation. Oxford: Oxford University Press, 2007.
10. Gold M, Siegel J, Russell L, et al. Cost-Effectiveness in Health and Medicine. Oxford: Oxford University Press, 1996.
11. National Institute for Health and Care Excellence. Guide to the methods of technology appraisal. London: National Institute for Health and Care Excellence, 2013.
12. Canadian Agency for Drugs and Technologies in Health. Guidelines for the Economic Evaluation of Helath Technologies: Canada. 3rd edition. Ottawa, Canada: Canadian Agency for Drugs and Technologies in Health, 2006.
13. Pharmaceutical Benefits Advisory Committee. Guidelines for Preparing Submissions to the Pharmaceutical Benefits Advisory Committee. Canberra, Australia: Australian Government - Department of Health and Ageing, 2008.
14. Institute for Quality and Efficiency in Health Care. Methods for Assessment of the Relation of Benefits to Costs in the German Statutory Health Care System. Cologne, Germany: Institute for Quality and Efficiency in Health Care, 2009.
15. Brazier J. Valuing health states for use in cost-effectiveness analysis. Pharmacoeconomics. 2008; 26: 769-79.
16. Naci H, Fleurence R, Birt J, et al. The impact of increasing neurological disability of mulitiple sclerosis on health utilities: a systematic review of the literature. Journal of Medical Economics. 2010; 13: 78-89.
17. Bryant J, Clegg A, Milne R. Systematic review of immunomodulatory drugs for the treatment of people with multiple sclerosis: Is there good qualitative evidence on effectiveness and cost? Journal of Neurology, Neurosurgery and Psychiatry. 2001; 70: 574-9.
18. Hoch J. Cost-effectiveness lessons from disease-modifying drugs in the treatment of multiple sclerosis. Expert Review of Pharmacoeconomics and Outcomes Research. 2004; 4: 537-47.
19. Phillips CJ, Humphreys I. Assessing cost-effectiveness in the management of multiple sclerosis. ClinicoEconomics and Outcomes Research. 2009; 1: 61-78.
20. Hawton A, Shearer J, Goodwin E, et al. Squinting through layers of fog: Assessing the cost effectiveness of treatments for multiple sclerosis. Applied Health Economics and Health Policy. 2013; 11: 331–41.
21. Henriksson F, Fredrikson S, Masterman T, et al. Costs, quality of life and disease severity in multiple sclerosis: a cross-sectional study in Sweden. European Journal of Neurology. 2001: 27-35.
22. Orme M, Kerrigan J, Tyas D, et al. The effect of disease, functional status, and relapses on the utility of people with multiple sclerosis in the UK. Value in Health. 2007; 10: 54-60.
23. Berg J, Lindgren P, Fredrikson S, et al. Costs and quality of life of multiple sclerosis in Sweden. European Journal of Health Economics. 2006; 7 Suppl 2: S75-85.
24. Kobelt G, Berg J, Lindgren P, et al. Costs and quality of life of multiple sclerosis in Switzerland. European Journal of Health Economics. 2006; 7: S86-S95.
25. Kobelt G, Berg J, Lindgren P, et al. Costs and quality of life of multiple sclerosis in the United Kingdom. European Journal of Health Economics. 2006; 7 Suppl 2: S96-104.

26. Chilcott J, McCabe C, Tappenden P, et al. Modelling the cost effectiveness of interferon beta and glatiramer acetate in the management of multiple sclerosis. British Medical Journal. 2003; 326: 522-25.
27. National Institute for Clinical Excellence. Beta interferon and glatarimer acetate for the treatment of multiple sclerosis. Guidance No. 32. 2002.
28. National Institute for Health and Clinical Excellence. Natalizumab for the treatment of adults with highly active relapsing-remitting multiple sclerosis. Guidance No. TA127. 2007.
29. National Institute for Health and Clinical Excellence. Fingolimod for the treatment of highly active relapsing-remitting multiple sclerosis. TA254. 2012.
30. Zajicek J, Ingram W, Vickery J, et al. Patient-orientated longitudinal study of multiple sclerosis in south west England (The South West Impact of Multiple Sclerosis Project, SWIMS) 1: protocol and baseline characteristics of cohort. BMC Neurology. 2010; 10: 88.
31. Bamer A, Cetin K, Amtmann D, et al. Comparing a self report questionnaire with physician assessment for determining multiple sclerosis clinical disease course: a validation study. Multiple Sclerosis. 2007; 13: 1033-37.
32. Lublin F, Reingold S, National Multiple Sclerosis Society (USA) Advisory Committee on Clinical Trials of New Agents in Multiple Sclerosis. Defining the clinical course of multiple sclerosis: results of an international survey. Neurology. 1996; 46: 907-11.
33. Kurtzke J. Rating neurologic impairment in multiple sclerosis: an expanded disability status scale (EDSS). Neurology. 1983; 33: 1444-52.
34. EuroQoL Group. EuroQoL - a new facility for the measurement of health-related quality-of-life. Health Policy. 1990; 16: 199-208.
35. EuroQol Group. EQ-5D user guide. Rotterdam, Netherlands: The EuroQol Group, 1996.
36. Brooks R, EuroQol Group. EuroQol: the current state of play. Health Policy. 1996; 37: 53-72.
37. Ware J, Sherbourne C. The MOS 36 item short-form health survey (SF-36). I. Conceptual framework and item selection. Medical Care. 1992; 30: 473-83.
38. Brazier J, Roberts J, Deverill M. The estimation of a preference-based single index measure for health from the SF-36. Journal of Health Economics. 2002; 21: 271-92.
39. Morris S, Devlin N, Parkin D, et al. Economic Analysis in Health Care. Second Edition. Chicester: Wiley, 2012.
40. Measurement and Valuation of Health Group. The measurement and valuation of health: Final report on the modelling of valuation tariffs. York: Centre for Health Economics, University of York, 1995.
41. Dolan P. Modeling Valuations for EuroQol Health States. Medical Care. 1997; 35: 1095-108.
42. Zajicek J, Ingram W, Vickery J, et al. Patient-orientated longitudinal study of multiple sclerosis in south west England (The South West Impact of Multiple Sclerosis Project, SWIMS 1: protocol and baseline characteristics of cohort. BMC Neurology. 2010; 10: 88.
43. Jones KH, Ford DV, Jones PA, et al. How People with Multiple Sclerosis Rate Their Quality of Life: An EQ-5D Survey via the UK MS Register. PLoS ONE. 2013; 8.
44. Fox C, Bensa S, Bray I, et al. The epidemiology of multiple sclerosis in Devon: a comparison of new and old classification criteria. Journal of Neurology, Neurosurgery and Psychiatry. 2004; 75: 56-60.
45. Robertson N, Deans J, Fraser M, et al. Multiple sclerosis in the North Cambridgeshire districts of East Anglia. Journal of Neurology, Neurosurgery and Psychiatry. 1995; 59: 71-76.
46. Ford H, Gerry E, Airey C, et al. The prevalence of multiple sclerosis in the Leeds Health Authority. Journal of Neurology, Neurosurgery and Psychiatry. 1998; 64: 605-10.
47. Forbes RB, Wilson S, Swingler RJ. The prevalence of multiple sclerosis in Tayside, Scotland: do latitudinal gradients really exist? Journal of Neurology. 1999; 246: 1033-40.
48. McDonnell G, Hawkins S. An epidemiologic study of multiple sclerosis in Northern Ireland. Neurology. 1998; 50: 423-28.
49. Forbes RB, Swingler RJ, Hawkins S, et al. An epidemiological study of multiple sclerosis in Northern Ireland. Neurology. 1999; 52: 214-18.
50. Ford D, Jones K, Middleton R, et al. The feasibility of collecting information from people with Multiple Sclerosis for the UK MS Register via a web portal: characterising a cohort of people with MS. BMC Medical Informatics & Decision Making. 2012; 12: 73.
51. Confavreux C, Compston A. The natural history of multiple sclerosis. McAlpine's Multiple Sclerosis. Philadelphia: Churchill Livingstone Elsevier, 2006.
52. Drummond M. Introducing economic and quality of life measurements into clinical studies. Annals of Medicine. 2001; 33: 344–49.

53. Marra C, Woolcott J, Kopec J, et al. A comparison of generic, indirect utility measures (the HUI2, HUI3, SF-6D, and the EQ-5D) and disease-specific instruments (the RAQoL and the HAQ) in rheumatoid arthritis. Social Science and Medicine. 2005; 60: 1571–82.
54. Brazier J, Roberts J, Tsuchiya A, et al. A comparison of the EQ-5D and SF-6D across seven patient group. Health Economics. 2004; 13: 873-74.
55. Walters S, Brazier J. Comparison of the minimally important difference for two health state utility measures: EQ-5D and SF-6D. Quality of Life Research. 2005: 1523–32.
56. Noyes K, Bajorska A, Chappel A, et al. Cost-effectiveness of disease-modifying therapy for multiple sclerosis: A population-based study. Neurology. 2011; 77: 355-63.
57. Fisk JD, Brown MG, Sketris IS, et al. A comparison of health utility measures for the evaluation of multiple sclerosis treatments. Journal of Neurology, Neurosurgery and Psychiatry. 2005; 76: 58-63.
58. Fogarty E, Walsh C, Adams R, et al. Relating health-related Quality of Life to disability progression in multiple sclerosis, using the 5-level EQ-5D. Multiple Sclerosis. 2013; 19: 1190-6.
59. Parkin D, Jacoby A, McNamee P, et al. Treatment of multiple sclerosis with interferon beta: An appraisal of cost-effectiveness and quality of life. Journal of Neurology Neurosurgery and Psychiatry. 2000; 68: 144-49.
60. Forbes RB, Lees A, Waugh N, et al. Population based cost utility study of interferon beta-1b in secondary progressive multiple sclerosis. British Medical Journal. 1999; 319: 1529-33.
61. Prosser L, Kuntz K, Bar-Or A, et al. Patient and community preferences for treatment ans health states in multiple sclerosis. Multiple Sclerosis. 2003; 9: 311-19.
62. Whitaker J, McFarland H, Rudge P, et al. Outcomes assessment in multiple sclerosis clinical trials: a critical analysis. Multiple Sclerosis. 1995; 37-47: 37-47.

Table 1: Demographic and clinical characteristics of SWIMS participants at recruitment

Characteristic	
Gender (n=1,408): n (%)	
Male	368 (26.1%)
Female	1,040 (73.9%)
Age (n=1,400): mean (sd)	50.7 (11.7)
[range] years	[18.2 to 83.3]
Type of MS (n=1,363): n (%)	
Relapsing-Remitting	572 (42.0%)
Primary Progressive	264 (19.4%)
Secondary Progressive	231 (17.0%)
Benign	45 (3.3%)
Combination or not known*	251 (18.4%)
Time since diagnosis (n=1,347): mean (sd)	9.6 (10.0)
[range]	[1 month to 53.5 years]
EDSS score (n=289): mean (sd)	4.3 (2.3)
[range]	[0 to 9]
Experienced a relapse(s) in the previous 12 months (n=1,367): n (%)	
Yes**	732 (53.6%)
No	455 (33.3%)
Don't know	180 (13.2%)
Number of relapses in the previous 12 months (n=1,367): mean (sd)	1.1 (1.2)
n (%)	
0**	638 (46.7%)
1	382 (27.9%)
2	196 (14.3%)
3	87 (6.4%)
4	64 (4.7%)

* This category refers to instances where a respondent either ticked more than one type of MS ('benign', 'relapsing-remitting', 'primary progressive', 'secondary progressive') or ticked that they did not know which type they had.

** 3 people reported that they had experienced a relapse in the previous 12 months, but in answer to an additional question reported that that had had zero relapses in this time frame.

Table 2: HSUVs by MS type and time since diagnosis

MS type *Time since diagnosis*	*EQ-5D*		*SF-6D*	
	n responses [n participants]	Mean (sd) EQ-5D value	n responses [n participants]	Mean (sd) SF-6D value
Relapsing-remitting:				
0 to 9 years	745 [420]	0.685 (0.248)	671 [354]	0.661 (0.129)
10 to 19 years	377 [165]	0.666 (0.230)	221 [124]	0.659 (0.116)
20 to 29 years	121 [73]	0.580 (0.292)	98 [57]	0.621 (0.116)
30 to 39 years	38 [20]	0.586 (0.242)	28 [16]	0.639 (0.107)
All	1,331 [633]	0.668 (0.251)	1,048 [529]	0.657 (0.125)
Primary progressive:				
0 to 9 years	281 [166]	0.492 (0.294)	235 [129]	0.584 (0.113)
10 to 19 years	215 [103]	0.400 (0.360)	136 [77]	0.574 (0.100)
20 to 29 years	84 [45]	0.413 (0.348)	70 [37]	0.589 (0.108)
30 to 39 years	13 [10]	0.378 (0.305)	24 [12]	0.600 (0.134)
All	617 [301]	0.444 (0.330)	476 [238]	0.582 (0.109)
Secondary progressive:				
0 to 9 years	178 [105]	0.450 (0.295)	140 [82]	0.573 (0.110)
10 to 19 years	247 [119]	0.473 (0.290)	179 [98]	0.564 (0.096)
20 to 29 years	101 [61]	0.429 (0.348)	104 [56]	0.560 (0.088)
30 to 39 years	62 [33]	0.407 (0.346)	27 [21]	0.553 (0.096)
All	631 [301]	0.450 (0.308)	490 [251]	0.565 (0.097)
Benign:				
0 to 9 years	64 [39]	0.875 (0.191)	46 [32]	0.755 (0.121)
10 to 19 years	26 [18]	0.815 (0.269)	18 [13]	0.740 (0.132)
20 to 29 years	16 [11]	0.777 (0.250)	11 [6]	0.700 (0.068)
30 to 39 years	-	-	-	-
All	115 [69]	0.845 (0.227)	99 [59]	0.746 (0.117)
All diagnoses:				
0 to 9 years	2,848 [842]	0.613 (0.290)	2,798 [788]	0.635 (0.128)
10 to 19 years	1,797 [499]	0.533 (0.315)	1,763 [478]	0.610 (0.111)
20 to 29 years	784 [230]	0.472 (0.332)	764 [223]	0.593 (0.111)
30 to 39 years	297 [96]	0.531 (0.331)	305 [95]	0.614 (0.118)
40 to 49 years	92 [28]	0.451 (0.343)	94 [30]	0.586 (0.096)
All	6,066 [1,406]	0.566 (0.312)	5,964 [1,357]	0.620 (0.122)

- Less than 10 observations, hence not reported.

Table 3: Mean (sd) EQ-5D and SF-6D health state values by EDSS scores and disease type

MS type	n responses [n participants]	Mean (sd) EQ-5D value	n responses [n participants]	Mean (sd) SF-6D value
Relapsing-remitting:				
EDSS 0	21 [18]	0.897 (0.132)	21 [20]	0.701 (0.131)
EDSS 1	40 [36]	0.763 (0.186)	23 [23]	0.716 (0.144)
EDSS 2	64 [57]	0.719 (0.229)	46 [45]	0.677 (0.112)
EDSS 3	30 [27]	0.523 (0.317)	17 [17]	0.602 (0.131)
EDSS 4	25 [22]	0.596 (0.274)	-	-
EDSS 5	19 [18]	0.438 (0.359)	11 [10]	0.692 (0.135)
EDSS 6	61 [49]	0.502 (0.275)	28 [28]	0.591 (0.085)
All	270 [194]	0.623 (0.294)	157 [133]	0.657 (0.128)
Primary progressive:				
EDSS 3	10 [9]	0.595 (0.251)	-	-
EDSS 4	-	-	-	-
EDSS 5	10 [10]	0.525 (0.259)	-	-
EDSS 6	42 [36]	0.500 (0.254)	32 [26]	0.553 (0.092)
EDSS 7	18 [15]	0.365 (0.281)	-	-
EDSS 8	17 [16]	-0.067 (0.198)	-	-
EDSS 9	-	-	-	-
All	107 [90]	0.393 (0.349)	64 [53]	0.580 (0.104)
Secondary progressive:				
EDSS 6	81 [58]	0.481 (0.269)	50 [37]	0.569 (0.094)
EDSS 7	12 [11]	0.397 (0.317)	11 [10]	0.517 (0.127)
EDSS 8	16 [14]	0.021 (0.387)	-	-
EDSS 9	-	-	-	-
All	125 [92]	0.421 (0.334)	79 [61]	0.570 (0.100)
All diagnoses*:				
EDSS 0	48 [35]	0.846 (0.182)	46 [35]	0.702(0.124)
EDSS 1	78 [60]	0.762 (0.220)	56 [49]	0.691 (0.132)
EDSS 2	135 [109]	0.711 (0.221)	119 [105]	0.669 (0.121)
EDSS 3	91 [79]	0.608 (0.281)	94 [72]	0.646 (0.117)
EDSS 4	86 [65]	0.609 (0.256)	70 [55]	0.635 (0.096)
EDSS 5	86 [67]	0.531 (0.286)	73 [55]	0.610 (0.104)
EDSS 6	494 [258]	0.496 (0.269)	425 [234]	0.581 (0.090)
EDSS 7	76 [55]	0.392 (0.278)	73 [57]	0.554 (0.103)
EDSS 8	69 [44]	0.025 (0.314)	62 [41]	0.529 (0.111)
EDSS 9	-	-	-	-
All	1,169 [565]	0.535 (0.317)	1,026 [529]	0.609 (0.115)

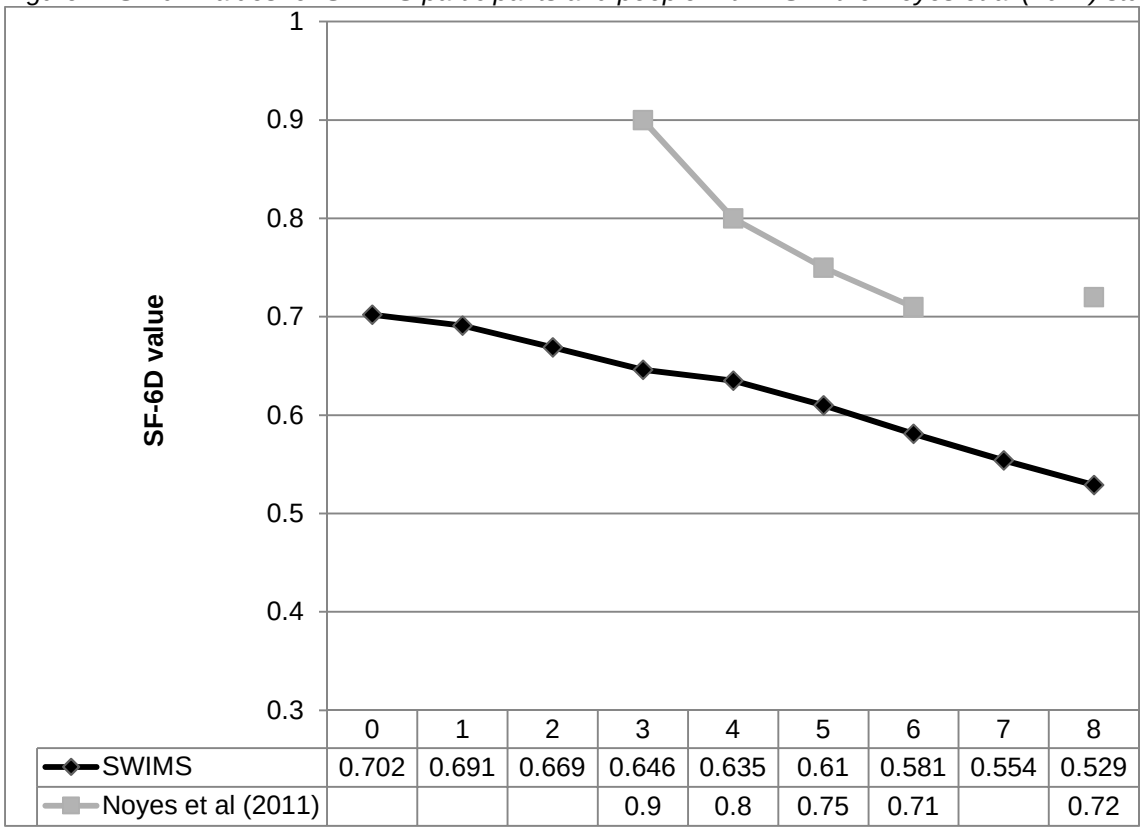
* 'All diagnoses' include responses where participants did not report their MS type.
- Less than 10 observations, hence not reported.

Table 4: HSUVs by features of relapses experienced in previous six months

	EQ-5D		SF-6D	
	n responses [n participants]	Mean (sd) EQ-5D value	n responses [n participants]	Mean (sd) SF-6D value
No relapse in past 6 months	2,872 [989]	0.610 (0.303)	2,902 [978]	0.649 (0.124)
≥1 relapse in past 6 months	2,131 [952]	0.534 (0.316)	1,990 [880]	0.597 (0.115)
Relapse frequency:				
1 relapse	1,281 [720]	0.570 (0.297)	1,242 [700]	0.607 (0.115)
2 relapses	531 [391]	0.504 (0.316)	486 [325]	0.588 (0.110)
3 relapses	177 [146]	0.469 (0.352)	149 [127]	0.571 (0.117)
4 relapses	125 [103]	0.380 (0.377)	102 [83]	0.551 (0.115)
No. of relapses not reported	17 [16]	-	1 [11]	-
Relapse duration:				
1st relapse				
Lasted about 48 hours	125 [100]	0.558 (0.322)	128 [128]	0.597 (0.115)
Lasted up to 1 week	363 [255]	0.544 (0.304)	324 [234]	0.608 (0.114)
Lasted up to 1 month	400 [308]	0.606 (0.278)	413 [289]	0.610 (0.114)
Lasted longer than 1 month	439 [328]	0.589 (0.300)	390 [288]	0.618 (0.118)
2nd relapse				
Lasted about 48 hours	78 [68]	0.457 (0.347)	70 [53]	0.598 (0.104)
Lasted up to 1 week	158 [116]	0.497 (0.315)	152 [115]	0.589 (0.113)
Lasted up to 1 month	120 [109]	0.558 (0.266)	110 [92]	0.598 (0.116)
Lasted longer than 1 month	97 [85]	0.610 (0.274)	85 [75]	0.611 (0.113)
3rd relapse				
Lasted about 48 hours	32 [26]	0.440 (0.345)	28 [24]	0.579 (0.128)
Lasted up to 1 week	50 [42]	0.537 (0.299)	48 [40]	0.567 (0.118)
Lasted up to 1 month	32 [30]	0.619 (0.256)	22 [20]	0.607 (0.108)
Lasted longer than 1 month	25 [24]	0.428 (0.375)	16 [16]	0.575 (0.145)
4th relapse				
Lasted about 48 hours	16 [13]	0.448 (0.395)	16 [15]	0.580 (0.146)
Lasted up to 1 week	10 [10]	0.396 (0.399)	13 [13]	0.586 (0.109)
Lasted up to 1 month	-	-	-	-
Lasted longer than 1 month	44 [40]	0.382 (0.403)	29 [26]	0.529 (0.114)
Relapse severity:				
1st relapse				
Limited everyday activities	1,731 [820]	0.510 (0.312)	1,605 [770]	0.582 (0.106)
Hospital admission	184 [158]	0.484 (0.326)	166 [142]	0.573 (0.118)
2nd relapse				
Limited everyday activities	610 [390]	0.474 (0.321)	536 [332]	0.561 (0.098)
Hospital admission	41 [40]	0.453 (0.359)	33 [31]	0.568 (0.125)
3rd relapse				
Limited everyday activities	195 [151]	0.439 (0.341)	162 [127]	0.541 (0.100)
Hospital admission	15 [15]	0.335 (0.329)	14 [14]	0.517 (0.083)
4th relapse				
Limited everyday activities	69 [64]	0.380 (0.378)	55 [47]	0.508 (0.082)
Hospital admission	-	-	-	-

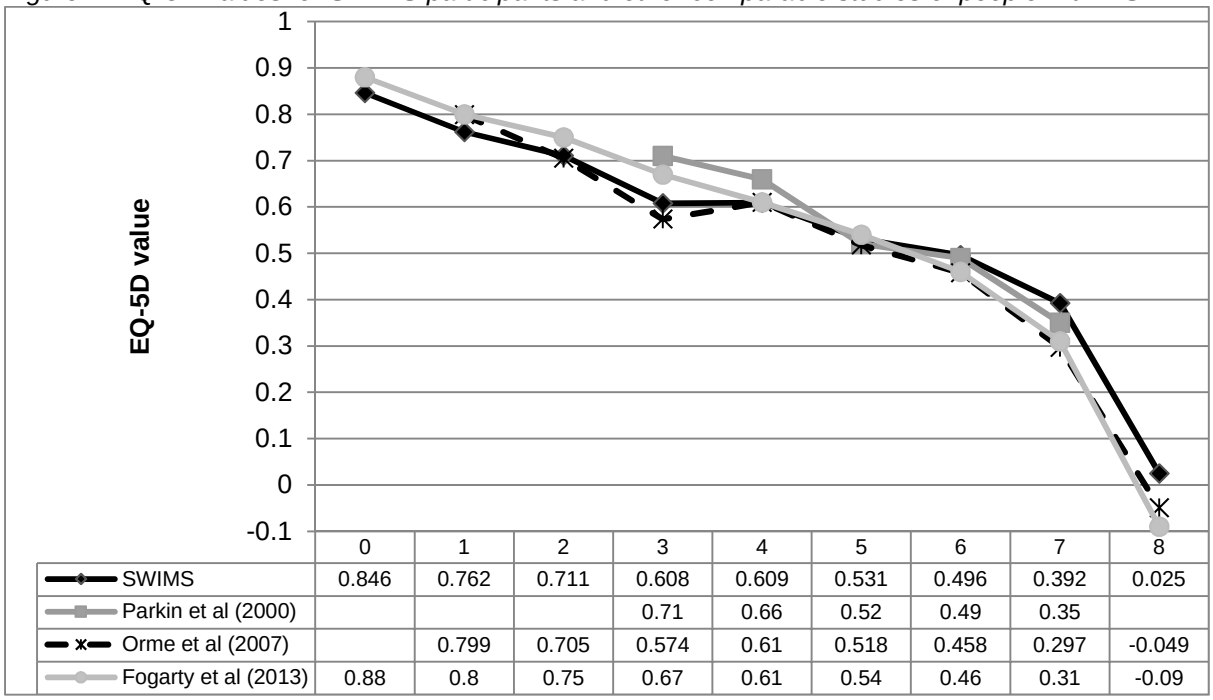
- Less than 10 observations, hence not reported.

Figure 1: SF-6D values for SWIMS participants and people with MS in the Noyes et al (2011) study



	0	1	2	3	4	5	6	7	8
SWIMS	0.702	0.691	0.669	0.646	0.635	0.61	0.581	0.554	0.529
Noyes et al (2011)				0.9	0.8	0.75	0.71		0.72

Figure 2: EQ-5D values for SWIMS participants and other comparable studies of people with MS



	0	1	2	3	4	5	6	7	8
SWIMS	0.846	0.762	0.711	0.608	0.609	0.531	0.496	0.392	0.025
Parkin et al (2000)				0.71	0.66	0.52	0.49	0.35	
Orme et al (2007)		0.799	0.705	0.574	0.61	0.518	0.458	0.297	-0.049
Fogarty et al (2013)	0.88	0.8	0.75	0.67	0.61	0.54	0.46	0.31	-0.09

Supplement 1

Tables 1A and 2A present health state utility values for MS by age and gender, alongside comparative data from representative samples of the UK general population (1) (2) (3). These data demonstrate the negative impact of MS on people's health-related quality of life as measured by both the EQ-5D and the SF-6D. For example, Table 1A reports a difference of 0.3 in EQ-5D HSUVs between those with MS and the general population and Table 2A reports such a difference of 0.17 in SF-6D health state values.

Table 1A: EQ-5D HSUVs for people with MS by age and gender, compared to a representative sample of UK population

	All		Male		Female	
Age (years)	UK population mean (sd) n*	People with MS mean (sd) n responses	UK population mean (sd) n*	People with MS mean (sd) n responses	UK population mean (sd) n*	People with MS mean (sd) n responses
All ages	0.86 (0.23) 3,392	0.56 (0.31) 6,066	0.86 (0.24) 1,467	0.54 (0.32) 1,407	0.85 (0.22) 1,925	0.57 (0.31) 4,656
< 25	0.94 (0.12) 304	0.71 (0.29) 77	0.94 (0.12) 128	-	0.94 (0.12) 176	0.69 (0.30) 69
25 to 34	0.93 (0.15) 753	0.68 (0.30) 472	0.93 (0.16) 330	0.68 (0.30) 84	0.93 (0.15) 423	0.68 (0.30) 388
35 to 44	0.91 (0.16) 561	0.63 (0.29) 1,385	0.91 (0.17) 256	0.58 (0.31) 304	0.91 (0.15) 305	0.64 (0.28) 1,081
45 to 54	0.85 (0.25) 488	0.55 (0.31) 1,771	0.84 (0.27) 221	0.50 (0.32) 438	0.85 (0.23) 267	0.56 (0.30) 1,333
55 to 64	0.80 (0.26) 484	0.51 (0.32) 1,725	0.78 (0.28) 196	0.50 (0.33) 427	0.81 (0.26) 288	0.51 (0.32) 1,298
65 to 74	0.78 (0.26) 488	0.50 (0.29) 545	0.78 (0.28) 228	0.54 (0.28) 118	0.78 (0.25) 260	0.49 (0.29) 427
75+	0.73 (0.27) 314	0.38 (0.36) 62	0.78 (0.25) 108	0.51 (0.31) 16	0.71 (0.27) 206	0.34 (0.36) 46

- Less than 10 observations, hence not reported.
*Source: Kind, Hardman (1), Table A.

Table 2A: SF-6D HSUVs for people with MS by age and gender, compared to a representative sample of UK population

	All		Male		Female	
Age (years)	UK population mean (sd)* n*	People with MS mean (sd) n responses	UK population mean (sd)* n*	People with MS mean (sd)* n responses	UK population mean (sd)* n*	People with MS mean (sd) n responses
All ages	0.79 (0.15) 22,166	0.62 (0.12) 5,964	0.81 (0.15) 9,664	0.61 (0.12) 1,392	0.79 (0.11) 12,502	0.62 (0.12) 4,565
20 to 24	0.82 (0.14) 1,441	0.73 (0.15) 25	0.83 (0.18) 628	-	0.80 (0.12) 813	0.69 (0.15) 19
25 to 29	0.82 (0.13) 1,729	0.71 (0.14) 84	0.83 (0.13) 754	0.72 (0.13) 11	0.81 (0.11) 975	0.70 (0.14) 73
30 to 34	0.81 (0.13) 1,795	0.67 (0.15) 216	0.83 (0.11) 783	0.66 (0.17) 30	0.80 (0.13) 1,013	0.67 (0.14) 186
35 to 39	0.81 (0.14) 2,061	0.65 (0.13) 396	0.83 (0.17) 899	0.63 (0.13) 91	0.80 (0.14) 1,163	0.66 (0.13) 305
40 to 44	0.81 (0.14) 2,172	0.64 (0.13) 701	0.82 (0.14) 947	0.62 (0.11) 146	0.79 (0.14) 1,225	0.65 (0.13) 555
45 to 49	0.79 (0.14) 1,995	0.63 (0.12) 876	0.81 (0.15) 870	0.61 (0.11) 193	0.78 (0.14) 1,125	0.63 (0.12) 683
50 to 54	0.79 (0.15) 1,818	0.62 (0.12) 888	0.79 (0.16) 792	0.60 (0.11) 217	0.79 (0.15) 1,025	0.62 (0.13) 671
55 to 59	0.78 (0.17) 1,707	0.61 (0.11) 878	0.80 (0.15) 744	0.60 (0.11) 207	0.76 (0.16) 963	0.61 (0.11) 671
60 to 64	0.78 (0.15) 1,795	0.60 (0.11) 861	0.78 (0.16) 783	0.59 (0.10) 214	0.77 (0.16) 1,013	0.61 (0.11) 647
65 to 69	0.78 (0.14) 1,441	0.60 (0.11) 622	0.80 (0.15) 628	0.60 (0.11) 178	0.76 (0.16) 813	0.60 (0.11) 444
70 to 74	0.76 (0.16) 1,153	0.58 (0.10) 258	0.77 (0.15) 503	0.58 (0.11) 55	0.75 (0.16) 650	0.58 (0.10) 203
75 to 79	0.73 (0.16) 687	0.60 (0.12) 90	0.76 (0.16) 300	0.57 (0.10) 20	0.71 (0.15) 388	0.61 (0.12) 70
80 to 84	0.70 (0.15) 576	0.57 (0.11) 21	0.74 (0.15) 251	-	0.68 (0.14) 325	0.57 (0.11) 14
85+	0.66 (0.14) 377	0.59 (0.09) 40	0.70 (0.16) 164	0.59 (0.09) 14	0.64 (0.13) 213	0.56 (0.08) 19

- Less than 10 observations, hence not reported.
* Estimated from data given by van der Berg (3), p.1510.

References

1. Kind P, Hardman G, Macran S. UK Population Norms for EQ-5D. York: Centre for Health Economics, University of York, 1999.

2. Kind P, Dolan P, Gudex C, et al. Variations in population health status: results from a United Kingdom national questionnaire survey. British Medical Journal. 1998; 316: 736-41.

3. van der Berg B. SF-6D population norms. Health Economics. 2012; 21: 1508-12.