Anxiety in Multiple Sclerosis: An Exploration of Experiences and Supports

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Summary of Thesis

Multiple Sclerosis (MS) is the most common cause of neurological disability in young adults and is associated with an unpredictable and varied disease course. Given the uncertainty associated with MS, it is unsurprising that anxiety is more prevalent in people with MS (PwMS) than in the general population. While anxiety has been associated with a number of unwanted health and quality of life outcomes, there is a paucity of research exploring the experience of anxiety in PwMS, with little consensus as to the means through which anxiety can be managed and reduced. In addition, despite Ireland having a high prevalence of MS, little is known about how anxiety is assessed and managed in PwMS in Ireland. This thesis aims to explore the experience of anxiety in PwMS and identify ways in which anxiety may be reduced. This is achieved through five interconnected studies. First, **study** 1 involved a systematic review of potentially modifiable associates of anxiety. Findings from the 39 studies included in this review highlighted a range of psychosocial and lifestyle factors associated with anxiety. Next, **study 2**, a mixed methods cross-sectional survey designed with Public and Patient Involvement (PPI), investigated associates and experiences of anxiety among 287 PwMS in the UK and Ireland, while also gathering data on the potential impacts of COVID-19 on anxiety in PwMS. Consistent with **study 1**, findings highlighted the potential role of self-efficacy, intolerance of uncertainty, social support and exercise in anxiety. In addition, challenges and anxiety-related impacts of COVID-19 for PwMS were identified. Next, **study 3** sought to gather richer qualitative data about the experiences of anxiety from interviews with nine PwMS in Ireland. Thematic analysis highlighted both the challenges in dealing with anxiety, as well as the successful strategies participants employed in managing anxiety. A strong desire for additional supports (particularly peer support) was also clear. In order to identify those with higher psychological and social support needs, **study 4** involved secondary data analysis of a large sample of 349 PwMS in Ireland. Findings highlighted some of the sociodemographic and disease-related factors which may predict psychological or social support needs. Additionally, this study explored the degree to which these needs are met through engagement with services at MS Ireland. Finally, **study 5** evaluated a structured exercise, behavioural coaching and peer support programme on anxiety which targeted several key factors highlighted in studies **1-4**, including self-efficacy, exercise, social support. Participation in this programme was associated with a reduction in anxiety. Quantitative findings suggested that this was achieved through a reduction in the physical impact of MS, while focus group findings highlighted the value of peer support. Overall, findings presented here highlight how anxiety is a common, pervasive experience for PwMS, and that needs for support to help manage this experience exist. However, there are also several existing supports for PwMS which have potential to positively impact anxiety, as well as several associates which could be targeted in the future development of interventions.

Table of Contents

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List of Tables

List of Abbreviations

ACHC	Acceptance of Chronic Health Conditions
ACT	Acceptance and Commitment Therapy
BAI	Beck Anxiety Inventory
BSI	Brief Symptom Inventory
CBT	Cognitive Behavioural Therapy
CDMS	Clinically Definite MS
CIS	Clinically Isolated Syndrome
COREQ	Consolidated Criteria for Reporting Qualitative Research
COVID-19	Coronavirus Disease 2019
DASS-21	Depression Anxiety and Stress Scale
DBT	Dialectical Behaviour Therapy
DMT	Disease Modifying Therapies
EXSE	Exercise Self-Efficacy Scale
EBV	Epstein-Barr Virus
FRaMeS	FRamework for Multiple Sclerosis Service Evaluation
FES-I	Falls Efficacy Scale International
GAD	Generalized Anxiety Disorder
GLTEQ	Godin Leisure-Time Exercise Questionnaire
HADS	Hospital Anxiety and Depression Scale
HADS-A	Hospital Anxiety and Depression Scale Anxiety Subscale
HAM-A	Hamilton Anxiety Rating Scale
IUS-12	Intolerance of Uncertainty Scale- short version
mAbs	Monoclonal antibody
MBCT	Mindfulness-Based Cognitive Therapy
MBSR	Mindfulness-Based Stress Reduction
MFIS	Modified Fatigue Impact Scale

MMAT	Mixed Methods Appraisal Tool
MRI	Magnetic Resonance Imaging
MS	Multiple Sclerosis
MSIS-29	Multiple Sclerosis Impact Scale
MSPSS	Multi-dimensional Scale of Perceived Social Support
MSSE	Multiple Sclerosis Self-Efficacy scale
OCBs	Oligoclonal Bands
PDDS	Patient Determined Disease Steps
PML	Progressive Multifocal Leukoencephalopathy
PPI	Public and Patient Involvement
PPMS	Primary progressive MS
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses
PROMIS	Patient-Reported Outcomes Measurement Information System
PwMS	People with Multiple Sclerosis
RCT	Randomized Controlled Trial
RRMS	Relapsing-remitting MS
S1P	Sphingosine 1-Phosphate Receptor
SARS	Severe Acute Respiratory Syndrome
SCT	Social Cognitive Theory
SNAP	Smoking, Nutrition, Alcohol and Physical activity
SPMS	Secondary-progressive MS
TSDX	Time Since Diagnosis
VAS	Visual Analogue Scale
WFH	Work from Home

Publications arising from this thesis

Journal articles:

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Published conference abstracts:

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Chapter 1:

General Introduction

Multiple sclerosis (MS) is the most common cause of neurological disability in young adults (Kobelt et al., 2017), affecting roughly 2.8 million people worldwide (35.9 per 100,000) (Walton et al., 2020) and over 9,000 people in Ireland (O’Connell et al., 2017). MS can lead to a number of negative health, social, economic and psychological impacts for those affected. Among these is an increased likelihood of experiencing anxiety (Patten et al., 2003; Tauil et al., 2018; Valentine et al., 2022). In this chapter, an overview of MS, its treatment and impacts are presented, followed by key research and theoretical frameworks in the area of anxiety and anxiety management. This chapter culminates with an outline of the thesis and a presentation of the aims and objectives of this research.

1.1 Characteristics of MS

MS is a chronic disease of the central nervous system in which one’s immune system (particularly T-cells) damage myelinated axons, resulting in varying degrees of damage to both the myelin sheath and the axons themselves (Høglund & Maghazachi, 2014). Incidence of MS is higher in women than men, with a reported female:male ratio of 2.7:1 in Ireland (O’Connell et al., 2017). Lesions caused by MS are linked with a plethora of symptoms, including fatigue, cognitive and emotional difficulties (including anxiety), damage to visual processes, and issues with gait, among others (McGinley et al., 2021). Other common physical symptoms of MS include issues with bladder and bowel function, pain, problems with balance and sexual dysfunction (Motl & Snook et al., 2008). Variations in symptomology however depend on severity and individual disease course (Coles, 2009). Life expectancy can be impacted by MS, with one study finding that people with MS (PwMS) had a lower mean life expectancy (75.9 years) of 7.5 years compared to the general population (83.4 years). While newer forms of treatment may increase the life expectancy of PwMS (see section 1.3), further research is needed to determine these effects (Marrie et al., 2015; Walz et al., 2022).

1.1.1 Diagnosis and presentation

Diagnosis of MS often involves the presentation of clinical symptoms, most commonly problems with vision or sensory symptoms, coupled with findings from magnetic resonance imaging (MRI), with many PwMS experiencing symptoms for some time before receiving their diagnosis (McGinley et al., 2021). Misdiagnosis with other demyelinating diseases sharing similar clinical characteristics (such as neuromyelitis optica spectrum disorder and acute disseminated encephalomyelitis) can also be common, however advances in MRI and additional testing have made progress towards addressing these issues (Brownlee et al., 2017). As a part of diagnostic testing, many PwMS will undergo a lumbar puncture, which is a procedure which involves a sample of spinal fluid being extracted by needle from an individual's lower back. Presence of oligoclonal bands (OCBs) in this sample can serve as a diagnostic aid and are included in the 2017 McDonald criteria for diagnosis (McNicholas et al., 2018). Further detail on diagnosis is discussed below in relation to different types of MS.

1.1.2 Types of MS

It is generally accepted that there are three common types of MS: relapsing remitting MS (RRMS), primary progressive MS (PPMS) and secondary progressive MS (SPMS). In addition, the term Clinically Isolated Syndrome (CIS) is used to describe individuals who have experienced their first episode of neurological symptoms consistent with a demyelinating inflammatory disease (Miller et al., 2008). Further diagnostic criteria require the clinical episode to last for more than 24 hours, and that the episode occurs independently of fever, infection, or clinical signs of encephalopathy (Miller et al., 2012). Roughly 85% of individuals diagnosed with MS will experience a disease progression that starts with a single episode fitting the diagnostic criteria for CIS (Scalfari et al., 2010). Those who experience a follow-up episode after experiencing CIS will fit the criteria for a diagnosis of clinically definite MS (CDMS). Risk factors for the development of CDMS in people with CIS include lower age at time of CIS, greater lesion load, and the presence of OCBs in the patient's cerebrospinal fluid (Kuhle et al., 2015). It is worth noting that, while cognitive impairment and disability are associated with disease duration and progressive disease course in MS, research has found significant cognitive impairment in people with CIS when matched with controls (Feuillet et al., 2007). This implies that negative impacts may be encountered even before a definitive diagnosis of MS is made.

The most common disease course experienced by PwMS is RRMS, with 85% of those diagnosed initially presenting with a relapsing-remitting disease course (McKay et al., 2015). People with RRMS experience a disease course consisting of one initial demyelinating attack (relapse) followed by a period of remission during which there is a partial or full recovery from symptoms, followed by another relapse (Coles, 2009).

Approximately 10-15% of PwMS experience a primary progressive disease course at onset (McKay et al., 2015). In contrast to RRMS, people with PPMS experience a disease course characterised by a steady worsening of symptoms from the initial presentation of the disease (Tremllett et al., 2005). Short remissions can occur with only small temporary improvement (or short plateauing of symptoms).

PPMS is associated with a later onset than RRMS (mean onset of 40 years old compared to 30 years old) and, compared to RRMS, has a higher prevalence in men (female to male ratio of 1:1 in PPMS compared to 3:1 in RRMS) (Miller & Leary, 2007). In addition to generally experiencing heightened levels of disability, people with PPMS may experience additional challenges related to quality of life with impairments to cognitive and motor function having the potential to impact on social and physical activities as well as emotional well-being (Højsgaard Chow et al., 2018; Patti et al., 2007). People with RRMS have also been shown to score better than people with progressive MS on a number of cognitive tasks (Huijbregts et al., 2004).

Over half (50-80%) of those initially diagnosed with RRMS will develop secondary progressive MS (SPMS) (Tremlett et al., 2008). SPMS is characterized by a disease course which generally begins as RRMS, but reaches a point over time where a cumulative increase in disability occurs independently of clinical relapses (Cree et al., 2021). There is a high level of variance in reported prevalence of SPMS across different studies and countries, but it is generally accepted to be the second most common form of MS, with a recent systematic review reporting prevalence of 10.9-57.8 cases per 100,000 (Inojosa et al., 2021; Khurana et al., 2018). Predicting if RRMS will develop into SPMS is a considerable challenge facing health care professionals and MS researchers (Lorscheider et al., 2016). Treatment type may play a role, with recent findings showing a decreased risk of developing SPMS in individuals initially treated with more aggressive forms of disease modifying therapies (DMTs) for MS, including natalizumab, alemtuzumab or fingolimod, when compared to those who were initially treated with less aggressive treatments such as glatiramer acetate or interferon beta (see section 1.3 for more details on treatment types) (Brown et al., 2019). Similarly, a recent longitudinal study found that improvements in disability and exposure to DMTs were significantly associated with lower risk of developing SPMS, while older age, longer disease duration, greater number of relapses in the past year and higher levels of disability were all independently associated with increased risk of SPMS development (Fambiatos et al., 2020). While it is currently estimated that between 50-80% of those diagnosed with RRMS will develop SPMS, the greater availability and use of new treatmentoptions implies that this estimate may come down in the coming years (Inojosa et al., 2021). For example, one longitudinal study with a 10-year follow-up (2004-2015) found that just 11.3% of a cohort had developed SPMS compared to the 30-50% conversion that was predicted using data from a time with lower treatment rates (Cree et al., 2016).

1.1.3 Risk factors for MS

Only 12.6% of MS cases are familial cases (where a member of the individual’s family also has an MS diagnosis), meaning that the vast majority of diagnosed patients have no known family history of the disease (Balcera & Louapre et al., 2022). For those familial cases, the degree of associated risk is partly dependent on the degree of genetic proximity (Balcera & Louapre et al., 2022). Familial cases may have unique clinical concerns and have been associated with early worsening of disability as well as increased long-term disability (Andrijauskis et al., 2019). In such cases, the heritability of MS is estimated to be around 50% based on twin studies (Balcera & Louapre et al., 2022; Boles et al., 2023, Fagnani et al., 2015), with roughly 22% of heritability explained by common genetic variants and complex interactions between genetic, epigenetic and environmental factors explaining the additional variance (Mitrovič et al., 2018). For example, interactions between certain health-related factors (e.g. smoking, adolescent obesity) and human leukocyte antigen MS risk genes are thought to significantly contribute to MS incidence (Olsson et al., 2017).

As previously mentioned, MS is roughly three times more common in women than it is in men (Rankin & Bove, 2018). Recently, there has been evidence to suggest gender differences in disease course as well. Findings suggest that women more frequently experience inflammatory disease activity, are more likely to have relapsing-remitting onset (as described in section 1.1.2) and have comparatively less brain atrophy than men, while men may experience more neurodegeneration, as well as a shorter time between diagnosis and serious disability (Magyari et al., 2022, Rankin & Bove, 2018). These findings are supported by prevalence studies reporting a greater ratio of females to males (3:1) for those with RRMS when compared with PPMS (1:1), a disease course which is associated with greater disability and neurodegeneration (Miller & Leary, 2007).

Other likely risk factors for MS include smoking, obesity (including childhood obesity), Vitamin D deficiency and infection with Epstein-Barr virus (EBV) (Ascherio, 2013; Munger et al., 2013). Recent evidence suggests that EBV can act as a trigger for MS (such that it is acquired before the onset of MS) and may also act as a driver of disease activity, however the mechanisms behind the latter effect require additional research to more accurately define its role (Soldan & Lieberman, 2023). Separately, Vitamin D deficiency has been used to explain the association between high MS prevalence and higher latitude, as those living in higher latitudes may experience lower intensity of sunlight, especially during the winter months, thus increasing the risk of vitamin D deficiency (Alharbi, 2015). In the Irish context, where vitamin D deficiency is common, latitudinal variations in MS prevalence may be associated with interactions between genetics and vitamin D deficiency (Lonergan et al., 2011; McKenna et al., 2018). Vitamin D is also used to explain the association between MS prevalence and birth month. A recent systematic review on a large sample found that there was a significantly lower incidence of MS in individuals born in October and November, and an increased incidence of MS in those born in April (Ismailova et al., 2019). It is suggested that this is due to agreater exposure to sunlight during pregnancy (and thus vitamin D) during the summer months. This is also supported by findings that vitamin D supplementation during pregnancy is associated with a lower prevalence of MS in children (Munger et al., 2016). Furthermore, one large cohort study found that women who had a high vitamin D intake had reduced likelihood of MS incidence by 40% compared to women who had no supplementation with vitamin D after accounting for latitude, smoking and obesity (Ascherio, 2013). However, there continues to be debate as to what role, if any, the supplementation of Vitamin D may play in the treatment of MS, with a recent meta-analysis reporting no significant reduction in mobility disability or annualised relapse rates after 6-24 month follow-up with vitamin D_3 treatment (Mahler et al., 2024).

1.2 Impacts of MS

While there has been an increase in MS prevalence in recent years, incidence has remained stable, suggesting that this increase in prevalence is due to reduced mortality (Rotstein et al., 2018). Additionally, diagnosis of paediatric MS is becoming increasingly common, which has been attributed to improvements in diagnostic practice as well as greater awareness among healthcare professionals (Ghai et al., 2021). As previously mentioned, a large-scale longitudinal study (n>30,000) found that life expectancy is reduced by 6 to 7 years in PwMS, mostly due to a considerable increase in mortality after 20 years of the disease (Leray et al., 2015). This study also found that death rates in this sample were higher in men and those with a progressive disease course, with over 50% of all deaths in this cohort attributable to MS. However, it is hoped that the introduction of newer line MS therapies will reduce mortality rates over the coming years.While treatments for MS have improved in recent years (see section 1.3), many PwMS continue to suffer negative impacts to their quality of life, which may arise directly from symptoms or side effects of treatments, or indirectly, from challenges associated with living with the disease. For example, a number of common MS symptoms, including fatigue, cognitive impairment and increased disability, have been shown to predict worse quality of life in PwMS (Gil-González et al., 2020). Also, while many PwMS live and manage their symptoms independently, others have a requirement for care which is often provided by friends or family members in the role of informal caregivers (Katsavos, et al., 2017; Maguire & Maguire, 2020). Having to rely on others for care can have negative implications and can indicate a level of disability which impacts on a variety of daily functions (Pike et al., 2012). Additionally, independent of these physical challenges, the experience of reduced independence can itself be a source of considerable distress for PwMS, particularly if the requirement of care extends to daily personal care activities (Cowan et al., 2020).

In addition, changes to socioeconomic circumstance resulting from MS symptoms, such as increased rates of unemployment, may give rise to quality-of-life impacts (Gil-González et al., 2020). Unemployment itself is common in PwMS, with reported unemployment rates ranging from 32% to 80% (Strober et al., 2020), despite approximately 90% of individuals being in employment prior to diagnosis (Pompeii et al., 2005). Symptoms such as fatigue (Stober et al., 2012), mobility disability (Guerra et al., 2022; Strober et al., 2012) and bladder/bowel incontinence (Simmons et al., 2010) have all been identified as significant barriers to employment for PwMS. Furthermore, unemployment may itself impact on mental health outcomes for PwMS, including anxiety and depression, with associations between mental health outcomes and unemployment reported in both general (Bartelink, et al., 2020; Harris et al., 2010; Subramaniam et al., 2021) and MS populations (Šabanagić-Hajrić & Alajbegović, 2015).

In addition to the potential impacts of MS on employment, there are other common socioeconomic impacts related to MS. Non-medical costs (e.g., improving the accessibility of one's home) represent a considerable burden for PwMS, with one recent study finding that in the UK, 75% of these costs are self-funded by PwMS (Nicholas et al., 2020). Furthermore, PwMS with anxiety may experience higher medical costs, with one study showing that anxiety in PwMS is associated with higher prescription use and more physician visits (McKay et al., 2018). It should also be noted that Jennum et al. (2012) found the average income of employed PwMS to be significantly lower than that of healthy controls, further exasperating difficulties related to the financial burden of MS.

The psychosocial impacts of MS are varied, both in the considerable number of potential impacts on a variety of outcomes that may occur, and in their presentations from individual to individual. Common mental health conditions faced by those living with MS include depression, anxiety, adjustment disorder, bipolar disorder, psychosis, and suicidal ideation (Davis et al., 2021). There is considerable evidence to suggest that MS can impact on social relationships, for example one study highlighted that partners of PwMS may also experience increased anxiety, with the potential for challenges related to MS to impact on communication between partners (Busch & Fringer, 2022). In addition, it has been shown that cognitive impairment (a common symptom of MS) can impact on social functioning through social cognitive deficits including difficulties with facial emotional recognition (Cotter et al. 2016). While depression in PwMS has been the focus of comparatively more research than anxiety, recent research has suggested that anxiety (discussed in greater detail in section 1.4) may have a greater impact than depression in relation to outcomes such as fatigue, pain, and sleep problems (Hanna & Strober, 2020).

1.3 Treatment strategies for MS

MS can be treated through a variety of means, including disease modifying therapy (DMT), acute relapse treatment, comorbidity management, symptom control, psychological support, rehabilitative strategies and lifestyle modification (McGinley et al., 2020). Far more focus has been paid to DMTs, resulting in a lack of uniform emphasis on psychological support and rehabilitation in MS. Shared decision-making, the process of mutually exchanging information, opinions and preferences between patients and healthcare professionals to arrive at the form of treatment which may best for the PwMS, has become increasingly common. Encouragingly, shared decision making has been linked with a number of positive outcomes including improved health outcomes, improved adherence and higher patient satisfaction, and, as such, is recommended to be used in treatment decisions as part of best practice (Ben-Zacharia et al., 2018; Rieckmann et al., 2018; Ubbink et al. 2022).

1.3.1 Disease modifying therapies

DMT is used primarily with the goal of reducing short-term disability as well as the frequency at which relapses occur (Hauser & Cree, 2020). The range of available DMTs has increased considerably over the last few decades, with the introductions of DMTs with different mechanisms and administration (Henderson et al., 2023). All DMTs work by impacting immune system function, though the mechanisms under which this occurs vary based on the form of DMT (McGinley et al., 2020). Treatments have varying degrees of efficacy but can also be associated with a number of different side effects, which may impact adherence in some cases. There is currently no clear consensus as to which form of DMT has the highest level of adherence, with significant variability in adherence influenced by factors including age, gender, side-effect profile (including individual experience of side effects) and comorbid depression (Higuera et al., 2016; Longbrake et al., 2016). As such, there is considerable variability in prescribing practice with decisions to discontinue or to switch DMTs based more frequently on clinical acumen than concrete empirical recommendations (Longbrake et al., 2016). In addition to impacting tolerability, recent findings suggest that age is an important factor in the efficacy of DMT treatment, with findings suggesting reduced efficacy in individuals aged over 55 as well as an increase in associated risks (such as development of progressive multifocal leukoencephalopathy (PML)) (Prosperini et al., 2020). PML is a viral infection of the CNS which is progressive and associated with adverse cognitive, visual and gait- related symptomology, with potential for serious adverse effects for PwMS (Koralnik, 2020) Due to the potentially stressful nature of receiving an MS diagnosis, it is recommended that information on DMT therapies be provided during a follow-up interaction (rather than at the time of diagnosis) due to challenges retaining this information while experiencing high levels of stress (Johnson, 2003; Ptacek & Eberhardt,1996).

Interferon beta was the first DMT made available for treating PwMS in 1993 and, while the release of alternative DMTs have reduced its relative popularity, it remains a commonly used form of treatment (Vargas & Tyor, 2017). Interferon beta is a naturally occurring polypeptide which has anti-inflammatory effects derived from a restriction of the movement of inflammatory cells across the blood-brain barrier as well as by inhibiting T-lymphocyte proliferation, a process which can result in myelin damage (Dhib-Jalbut & Marks, 2010). Interferon-beta is commonly used in two forms, Inteferon-beta-1a, which is typically delivered subcutaneously in doses of 250 μg every other day, and Interferon beta-1b, which is typically delivered intramuscularly in doses of 30 μg every other day or subcutaneously in doses of 22 or 44 μg three times a week (Torkildsen et al., 2016). Treatment with interferon-beta has been associated with a number of positive outcomes for PwMS including improved quality of life (Rice et al., 1999), reduced annualized relapse rates (Waubant et al., 2003) and a short-term reduction in disability progression (Bermel & Rudick, 2007). Literature on the impact of interferon-b on long-term disability progression is mixed, with suggestion that this treatment lacks efficacy in this area for people with RRMS (Shirani et al., 2012). Adverse side-effects associated with interferon treatment commonly include flu-like symptoms as well as soreness of injection site and these factors can create tolerability issues for some PwMS. Generally the efficacy and relative safety of interferon treatment has made interferon a common and important first-line treatment option (Filipi & Jack, 2020; Gottberg et al., 2000). Other commonly-used injectable DMTs include glatiramer acetate which has some similar mechanisms to interferon treatment but, unlike interferon, can directly impact the central nervous system (CNS) via glatiramer acetate-specific T cells which have both anti-inflammatory and potentially neuroprotective and restorative effects (Blanchette & Neuhaus, 2008, Dhib-Jalbut, 2002).

Other DMT treatment options include oral DMTs (e.g. Sphingosine 1-Phosphate Receptor (S1P) modulators, fumarates, teriflunomide) and Monoclonal antibody (mAbs) infusions (e.g. natalizumab, ocrelizumab, ofatumumab, alemtuzumab) (McGinley et al., 2020). While oral DMTs are associated with greater risk of infection due to their immunosuppressant effects (Wijnands et al., 2018), they provide quality of life advantages for many PwMS and may be effective in delaying disease progression in newly diagnosed PwMS (Berger, 2011). S1P modulators (e.g. fingolimod, siponimod, ozanimod, and ponesimod) are generally taken once daily and function through the binding of S1P receptors to lymphocytes, ultimately reducing the number of circulating lymphocytes and restricting the migration of inflammatory cells into the CNS (McGinley & Cohen, 2021). While there is some risk of cardiac events on first administration (Comi et al., 2017; McGinley et al., 2020), these events are often manageable and rarely severe in nature, with reports on long-term treatment showing sustained efficacy, good tolerability and relatively few safety concerns (Comi et al., 2017). However, more recent evidence has suggested a significant risk of severe relapses associated with the cessation of fingolimod treatments which has in turn led to changes in clinical guidance regarding this form of treatment (Barry et al., 2019).

MAbs infusion treatments offer an alternative to other forms of DMT and feature their own set of strengths and considerations. The mechanisms driving the efficacy of mAbs treatments varies considerably based on the form of the treatment used, with anti-CD20 mABs (rituximab, ocrelizumab, ofatumumab, and ublituximab) functioning by killing the targeted cell population associated with their function (Krajnc et al., 2022). While most anti-CD20 drugs (rituximab, ocrelizumab and ublituximab) are administered intravenously, ofatumumab can be administered subcutaneously, which provides an alternative that may appeal to some PwMS, however, this is coupled with additional concerns regarding adherence (Cotchett et al., 2021). Some mAbs infusion treatments (natalizumab, rituximab, ocrelizumab, and ofatumumab, rituximab) have been shown to have superior efficacy relative to placebo, with suggestion that a more aggressive treatment approach using one of these treatments may have benefits for PwMS over the more traditional escalation approach to treatment (Simpson-Yap et al., 2021). The traditional escalation approach involves initial use of a lower risk and lower efficacy treatment for patients, with decisions to ‘escalate’ to a higher risk and higher efficacy form of DMT based on monitoring of patient symptoms and disease progression (Prosperini et al., 2020). While newer high efficacy forms of mAbs have less safety concerns than earlier forms of the treatment, mAbs are still generally reserved for patients experiencing a highly active disease course, and in Europe, are not licensed for use for the treatment of less active disease courses (Krajnc et al., 2022). Natalizumab is a commonly used form of mAbs infusion treatment which works by blocking the α4 chain of VLA-4 (α4β1) and α4β7 integrins (Skarica et al., 2011), with prospective studies indicating high levels of efficacy in the reduction of disability progression (Butzkueven et al., 2017). Unfortunately, in rare cases (about 1 in 1000) treatment with natalizumab is associated with the development of PML (Comi et al., 2017; Kartau et al., 2019). Current research suggests that anti-CD20 mABs are associated with significantly lower risk of developing PML than natalizumab, however some of these are associated with their own adverse effects (Sharma et al., 2022).

Autologous hematopoietic stem cell transplantation (AHSCT) is another treatment option that is growing in popularity to treat aggressive forms of MS. AHSCT boosts bone marrow recovery as well as “resetting” immune function to produce new autoimmune responses (Muraro et al., 2014). AHSCT is an intensive treatment process usually reserved for PwMS with highly active disease progression who have not responded to multiple other forms of DMT. AHSCT involves extracting a patient’s stem cells, administering high doses of chemotherapy to eradicate the immune system, and then reinfusing the stem cells to allow for recovery and long-term suppression of the immune system, thereby acting as an immunosuppressive therapy (Cencioni et al, 2022). A recent longitudinal study found that treatment with AHSCT resulted in less disability worsening in the majority of patients with durable improvements in disability reported in patients with RRMS (Boffa et al., 2021). Despite the efficacy of AHSCT in slowing disease progression, the risks may be higher with this form of treatment, with cardiac or respiratory failure reported in a small number of cases (2.5%) (Nicholas et al., 2021). AHSCT may be particularly valuable for use in patients with aggressive RRMS who currently have low levels of disability, with younger age and fewer prior immunotherapies also associated with better treatment outcomes (Muraro et al., 2017; Sormani et al., 2017). Unfortunately, however, this treatment is not currently available in Ireland, requiring eligible patients to travel (often to the UK) to receive it.

1.3.2 Rehabilitation and self-management in MS

Aside from DMTs, PwMS may benefit from a number of non-pharmacological interventions and support. For example, physiotherapy is an integral part of rehabilitation and symptom management for many PwMS. Physiotherapy is aimed at improving mobility and physical functionality, with significant differences in functional status reported for PwMS who take part in rehabilitation compared to those who do not (Kubsik-Gidlewska et al., 2017). Additionally, the inclusion of peer support as part of rehabilitation programmes has been recommended and may help with the psychosocial challenges presented by MS (Lahelle et al., 2018), which may include experiences of anxiety.

In dealing with their condition, PwMS also may engage in a number of self-management strategies such as dietary and lifestyle modifications. One study which explored these strategies found significant associations between healthy diet and lower disability, as well as associations between healthier lifestyle and reduced risk of severe fatigue, depression and cognitive impairment, with no investigation of potential associations between self- management strategies and anxiety reported in this study (Fitzgerald et al., 2018). In addition, self-management behaviours may themselves be a suitable target for improvement via engagement with formalised supports, with significant associations reported between coping strategies and self-management in PwMS (Plow et al., 2011; Wilski et al., 2021). However, compared to research into the efficacy of DMTs, significantly less research has evaluated such interventions.

1.3.3 Chronic disease models

The management of chronic health conditions is one of the biggest challenges facing current healthcare systems, with roughly 60% of annual deaths attributed to some form of chronic illness (Alwan et al, 2010) and considerable economic strain associated with such conditions (WHO, 2011). In comparison to the traditional medical model, management of chronic disease involves a more active role from patients in the day-to-day management of their disease as well as in decision-making related to this (Grover & Joshi, 2015). In this approach the relationship between patient and healthcare providers is crucial in supporting effective collaborative care which empowers patients to take an informed and involved role in the management of their health. This process can help to improve self-efficacy and has been associated with better patient outcomes (Katon et al., 2010).

Several models for the management of chronic illness exist, each with different areas of focus. The most researched of these is the Chronic Care Model which emphasizes the importance of evidence-based care and the patient’s role in self-management of their condition (Battersby et al, 2010). The model was a seminal proposition for care and includes a number of policy, organizational and resource based recommendations while emphasizing the patient's role in managing lifestyle factors which can influence patient outcomes (Kadu & Stolee, 2015). The central argument this model presents is that real change will only occur when clinical systems reorganize themselves to meet the specific needs of patients with chronic illness. However, the Chronic Care Model has received some criticism for being too disease focused, with suggestions that the model should become more person-centered through a goal-orientated approach to care (Grudniewicz et al., 2023)

Other models of chronic illness have been proposed to grow on the basis provided by the Chronic Care Model by introducing other considerations and points of focus. For example, the Innovative Care for Chronic Conditions model was proposed by the WHO to include additional suggestion on how policy makers can manage the political environments that contextualize their decision making as well as emphasizing the value of preventative measures (WHO, 2002). Similarly, the Improving Chronic Illness Care model builds on the Chronic Care Model by proposing means of integrating medical science in care to help facilitate the availability of prompt diagnosis and treatment for individuals with chronic illness (Care, 2010). A recent review of chronic illness models described how there is greater need for investigation of certain elements of these models including how best to support patients within their communities and how to improve health literacy between visitations, while other elements such as delivery system design and self-management support were shown to have received greater levels of attention (Grover et al. 2023).

1.3.4 The role of MS Ireland in supporting people with MS

In an Irish context, MS Ireland is a charitable organisation which plays a crucial role in the provision of information and support for PwMS (Hynes et al., 2022). Evidence suggests that state-funded health and social care services in

Ireland may not sufficiently meet the needs of PwMS (Lonergan et al., 2015), thus community-based organisations, such as MS Ireland, play a crucial role in addressing these unmet needs. To illustrate this point, a recent survey of healthcare professionals (HCPs) who work with PwMS in Ireland, found that 49% of HCPs did not provide PwMS with any information regarding psychosocial difficulties, mood or mental well-being (Hynes et al., 2022).

MS Ireland provides a range of supports for PwMS including structured exercise programmes, information sessions, peer support groups and social events, as well as supporting research in the field of MS. The majority of services provided by MS Ireland take the form of casework, whereby PwMS interact with their regional community health worker who provides support to meet the specific needs of individual PwMS. A recent evaluation of this service provision highlighted signposting, listening and the facilitation of peer support as the core mechanisms through which support is provided by community workers. This indicated generally good efficacy of MS Ireland in meeting a range of needs among PwMS (Maguire et al., 2022).

Services offered by MS Ireland may also help alleviate the experience of anxiety; however, this has remained understudied to date. As discussed later (see section 1.4.2), research suggests that PwMS may be at an increased risk of anxiety, suggesting that there is a need for support in this area. In the following sections, the concept and experience of anxiety is described in more detail, before expanding on considerations for MS-related anxiety specifically. This includes an overview of theoretical approaches for understanding and treating anxiety more generally.

1.4 Anxiety

1.4.1 Defining anxiety

The term “anxiety” is generally used to describe feelings of unease or worry about potentially negative future events (Barlow, 2004). While a range of anxiety disorders exist (see section 1.4.3), it must be noted that not all experiences of anxiety are inherently problematic. Often, anxiety is a natural and adaptive emotion which promotes survival by helping individuals to identify and avoid potentially perilous situations and outcomes (Crocq, 2022). It is not always clear at which point this natural adaptive experience becomes problematic, with a level of subjectivity involved in determining the point at which anxiety becomes maladaptive (for example, by inhibiting everyday functioning). Furthermore, the experience of anxiety itself exists on a spectrum, with individuals varying in the extent to which they experience anxiety at differing levels of severity.

Anxiety is often associated with the concept of “worry”. Worry and rumination are forms of repetitive negative thinking, a concept which is transdiagnostic in nature (McEvoy et al., 2013). Worry is a core feature of several anxiety disorders and mood disorder including generalized anxiety disorder (GAD) (Gana et al., 2001) which is described in more detail in section 1.4.3. Worry, like anxiety, is a common experience, but the worry associated with anxiety disorders such as GAD often presents as a chronic, severe and uncontrollable experience for those affected (American Psychiatric Association, 2013).

In order to help classify anxiety, in part to help with the provision of support, diagnostic criteria (a set of signs, symptoms and tests) are used to identify if an individual's experience of anxiety aligns with that of a clinical disorder.

Classification of anxiety disorders by the Diagnostic and Statistical Manual of Mental Disorders (DSM) helped to standardise diagnostic and research practices, with later additions (including the latest version DSM-5-TR) (APA, 2022) acknowledging anxiety disorders as separate from psychoneurotic disorders and deserving of their own classification (Kupfer, 2022). Standardisation of practice under the DSM system provides some considerable benefits, including helping individuals with anxiety disorders to get treatment and support from their insurance providers (Rachman & Rachman, 2013). However, one of the major criticisms of the DSM is the way in which it pathologises the experience of anxiety.

In situations where a clinical diagnosis of anxiety may not be feasible, such as when conducting cross-sectional research, tools such as the Hospital Depression and Anxiety Scale (HADS) can be used to denote clinically significant levels of anxiety (Snaith, 2003). Here, researchers may interpret scores above a clinical cut-off to be indicative of an anxiety disorder, however scores can also give insight into the level of anxiety experienced among individuals. For example, this tool has been used in the context of MS (Jerković et al., 2023; Marrie et al., 2018) and other chronic illnesses (Annunziata et al., 2020; Covic et al., 2012,) to document variations in the experience of anxiety.

Conceptually, anxiety is associated with an unpleasant and persistent state of heightened vigilance which may be unpredictable or uncontrollable in nature and for which the cause may be unclear (Tuma & Maser, 2019). Fear is a closely related and highly correlated construct, however distinctions between fear and anxiety can also be drawn. Fear is often associated with an emergency response to a perceived threat or dangerous situation for which the cause is usually known (as is the case with phobias) which is usually reduced when the situation is altered to remove the source of threat (Rachman & Rachman, 2013). Anxiety and fear can be distinguished by their verbal-subjective and somato-visceral symptoms as well as by their associated overt motor acts. Specifically, anxiety generally includes symptoms of avoidance, worry and muscle tension, whereas fear has been associated with responses of escape, threat and autonomic responses including trembling and sweating (Caske et al., 2011). It should be noted however that escape and autonomic responses can occur as part of some anxious responses, highlighting the overlap between these concepts.

It should be noted that, despite the effort to distinguish between the somato-visceral responses in anxiety and fear, strong autonomic responses are also commonly reported by individuals with anxiety disorders (Hoehn-Saric et al., 2004). However, while evidence consistently suggests that muscle tension is associated with anxious responses, there can be a difference between subjective somatic responses and actual physiological states. For instance, individuals with anxiety disorders show greater sensitivity but less accuracy when reporting physiological change than healthy controls (Hoehn-Saric et al., 2004). The directionality of the relationship between somatic response and psychological state is complex, involving a combination of bottom-up and top-down processes by which individuals with anxiety disorders can incur autonomic responses to anxious psychological states, but equally are more likely to interpret change in physiological state as threatening than healthy controls (Mallorquí-Bagué et al., 2016).

1.4.2 Prevalence of anxiety

Anxiety disorders are the most prevalent form of mental health disorder, with some studies reporting that over a third of individuals develop an anxiety disorder at some point in their lifetime (Bandelow & Michaelis, 2022). However, it should be noted that there is a great variance in reported prevalence rates, as differences in measures, methodology or diagnostic criteria can have a significant impact on outcomes reported (Lépine, 2002). Even when using the same measures, there can be variance in thresholds for what is considered clinically significant anxiety. As an example of this variance in prevalence, a systematic review of 87 studies attempting to assess global prevalence rates found that past year prevalence of anxiety disorders ranged from 2.4% to 29.8%, with significantly higher prevalence rates reported in Euro/Anglo cultures than in African cultures (Baxter et al., 2013). It should be noted that the difference in prevalence rates across cultures may be partially explained by cultural differences in the social acceptability of anxiety as well as how frequently anxiety itself is conceptualized as such within a given culture. Similarly, a separate review estimating lifetime prevalence of anxiety disorders reported a 16.6% prevalence, much lower than what some samples have reported (Somers et al., 2006). Adding to the difficulty in accurately judging anxiety prevalence, evidence suggests less than half of individuals with anxiety disorders seek help for their disorder, with some studies estimating that as low as 30% of individuals with anxiety seek help (Leon et al., 1995; Roness et al., 2005). Similarly, evidence suggests that GAD, the most common form of anxiety disorder, is largely under-diagnosed and under-treated, with those who do receive a diagnosis most commonly experiencing symptoms for 5-10 years prior to this diagnosis (Wittchen, 2002).

While there is evidence in the general population for variability in the prevalence of anxiety according to region of residence (Marques et al., 2011), there is significantly less research on how this association presents in MS populations. A recent meta-analysis found a 49% prevalence of anxiety in PwMS in European studies, which was higher than the prevalence rates of 34% and 26% in the US and Oceania respectively (Peres et al., 2022). Separately, a meta-analysis conducted by

Boeschoten et al. (2017) reported significantly higher anxiety in PwMS in Europe than in other regions. While some studies have failed to show a higher prevalence of anxiety in PwMS, several studies have found statistically significant evidence for higher prevalence of anxiety in PwMS compared to general populations (Patten et al., 2003; Tauil et al., 2018; Valentine et al., 2022). The potential reasons for the increased prevalence of anxiety among PwMS are explored in later sections.

1.4.3 Types of anxiety disorder

It should be noted that comorbidity across anxiety disorders is very high, such that the majority of individuals who experience an anxiety disorder will fit the diagnostic criteria for multiple types of anxiety disorder (Reich et al., 1996). Due to the high level of comorbidity between anxiety disorders, anxious symptomatology is often measured generally, with several of the most commonly used measures not distinguishing between types of anxious symptomatology (e.g. HADS-A, State-Trait Anxiety Inventory (STAI)) (Spielberger et al., 1971; Zigmond & Snaith, 1983). Finally, it should be noted that until recently, obsessive compulsive disorder (OCD) would have been included as one of the most common types of anxiety disorder, however, under the DSM-V, OCD is no longer categorized as an anxiety disorder (APA, 2013). This remains a topic of debate, with some recommendations that OCD be reclassified under anxiety disorders with other obsessive compulsive spectrum disorders also added under this category. Given the level of comorbidity between anxiety disorders, as well as the current debate regarding OCD, some researchers have challenged the concept of psychiatric classification and diagnosis as it relates to anxiety (Park & Kim, 2020). However, other research has highlighted differences between OCD and other anxiety disorders (Stein et al., 2010; Robbins et al., 2019). Despite this recent change of classification, prevalence rates of OCD in PwMS are reported as high as 31% in some cohorts (Khatri et al., 2021), with meta- analytic reports suggesting a lifetime prevalence of 1.3% in general populations (Fawcett et al., 2020), suggesting the persisting need to address this common comorbidity. While the physiological and psychosocial reasons for links between OCD and MS are not fully understood, some evidence suggests that brain white-matter abnormalities (Fontenelle et al., 2009), autoimmunity (Hoekstra & Minderaa, 2005), and disruption of functional cortical-cortical and/or cortical-subcortical connections (Douzenis et al., 2009) might play a role in this.

Generalized anxiety disorder (GAD) is an anxiety disorder characterized by extended periods (at least 6 months or more) of excessive worry, persistent feelings of irritation or restlessness and somatic symptoms which can include muscle tension and fatigue (Wittchen, 2002). GAD is associated with significant economic burden due to reduced work productivity and cost from increased use of primary health care, as well as significant impairment even when it occurs without comorbid depression or other mental disorders (Wittchen, 2002). Unsurprisingly then, people with GAD have been shown to experience significantly lower quality of life than healthy controls (Barrera et al., 2009). GAD is the most common type of anxiety disorder, with one review reporting prevalence rates of up to 3.7%, however it should be noted that this varied greatly across countries and cultures (Marques et al., 2011). Prevalence of GAD is thought to be significantly higher in MS populations, with a recent multi-centre study reporting a prevalence rate of 26.1% (Alswat et al., 2023).

Panic disorder (PD) is characterized by experiencing panic attacks which can be recurrent and are often followed by periods of fear that another panic attack will occur (Asmundson et al., 2014). Panic attacks can be thought of as the most acute experience of anxiety and, while they are not dangerous in and of themselves, can lead to severely unpleasant experiences where the person experiencing the panic attack perceives themselves to be under severe threat e.g. fear of dying (Perrotta, 2019). Individuals experiencing a panic attack will experience a short period of fear and discomfort coupled with a combination of some somatic symptoms (e.g. sweating, accelerated heart rate, nausea, chest pain) (Park & Kim, 2020). Individuals with PD may change their behaviours to avoid situations in which a panic attack may occur which in turn may have considerable implications for quality of life (Candilis et al., 1999). Twelve-month prevalence rates for panic disorder have been reported as high as 2.6% in the USA but are considerably lower in some other countries with predominantly Caucasian countries showing consistently higher prevalence rates (Marques et al., 2011). One study investigating correlates of PD found associations between PD and frequent alcohol consumption, with reduced prevalence of PD found in those of older age (Olaya et al., 2018). Limited large-scale research exists tracking prevalence rates of PD in PwMS, however in studies involving smaller samples, prevalence rates of 3.3% (de Cerqueira et al., 2015), 7.8% (Błachut et al., 2020), and 10% have been reported (Korostil & Feinstein, 2007).

Social anxiety disorder (SAD) (also known as social phobia) is characterized by a fear of the possibility of social scrutiny and is often associated with avoidance of social or performance-based situations (Stein & Stein, 2008). The psychosocial impairment associated with SAD is considerable, with 90% reporting impairment (such as reduced work productivity, socio-economic status or quality of life) and one third of individuals with SAD reporting severe impairment in one of these areas (Leichsenring & Leweke, 2017). Twelve-month prevalence rates are up to 2.8% in the USA, 2.3% in Europe but are significantly lower in many non-European countries, with less than 1% Twelve-month prevalence in China, South Korea, Japan and Nigeria (Marques et al., 2011). However, the lifetime prevalence rate for SAD is estimated to be 12.1% (Kessler et al., 2005). A history of psychiatric disorders in one's family is a major risk factor for SAD, with separation from parents and childhood sexual abuse also significant risk factors (Bandelow et al., 2004). Furthermore, it should be noted that individuals with SAD often report substance abuse issues, such that 48% of individuals with a lifetime diagnosis of SAD also meet the criteria for diagnosis of an alcohol use disorder (Grant et al., 2005). The relationship between SAD and substance abuse is unique even among anxiety disorders, with one regression analysis finding that other anxiety disorders did not predict alcohol or cannabis dependence after controlling for relevant variables, compared to SAD which emerged as a unique predictor of both (Buckner et al., 2008). It is suggested that many people with SAD and PD who exhibit frequent alcohol consumption or cannabis dependence may use alcohol or cannabis as a form of self-medication. Two studies which investigated prevalence rates of SAD in PwMS found rates of 29.8% and 30.6% respectively (Poder et al., 2007, 2009) with a more recent study reporting rates of 26.9% (Khatri et al., 2021), with these rates indicative of potentially higher prevalence rates of SAD in PwMS, compared to general populations.

1.4.4 Risk factors for anxiety

Being female is consistently associated with a higher risk of anxiety disorders. It is estimated that women are 1.5-2 times more likely to develop an anxiety disorder in their lifetime, with a particularly increased risk of GAD, PTSD and PD. Research also suggests that a greater heritability of risk-associated genetic factors, an increase in negative affectivity during the developmental period associated with gender role socialisation, and greater levels of rumination and emotion focused coping all contribute to gender differences in anxiety prevalence

(McLean et al., 2009). However, while women with MS are more likely to experience anxiety than men, there has been suggestion that women are more adept at maintaining a good quality of life while experiencing anxiety than men (Bove & Chitnis, 2014).

An individual’s response to anxiety symptoms is important in determining their outcomes. For example, it has been shown that in those with high anxiety sensitivity, lower acceptance of experiencing emotional distress is associated with higher levels of worry and anxious arousal (Kashdan et al., 2008). Similarly, research on intolerance of uncertainty (IU) has highlighted the importance of individual response (Boelen et al., 2009; Duglas et al., 2004). IU has been shown to partially mediate the relationship between another well-established risk factor, neuroticism, and anxiety symptoms (McEvoy & Mahoney, 2012). Neuroticism here refers to the Big Five personality trait (Ormel et al., 2013), which indicates a stable tendency towards self-doubt, anxiety, depression and other forms of negative emotion. Specifically, anxiety from anticipation of future uncertainty (prospective anxiety) has been shown to mediate the relationship between neuroticism and GAD, while inaction due to future uncertainty (inhibitory anxiety) mediates the relationship between neuroticism and PD and social anxiety (McEvoy & Mahoney, 2012). This may be an important factor to consider in the context of MS, which is associated with considerable uncertainty. IU is explored in more detail in section 1.5.3.

Several factors related to self-perception have also been associated with variance in anxious symptomology. For example, there is a plethora of research associating high anxiety with low self-esteem, with a large meta-analysis of longitudinal studies suggesting that this effect occurs bidirectionally, such that anxiety predicts self-esteem and self-esteem predicts anxiety (Sowislo & Orth 2013).

Given the popularity of mindfulness-based interventions in the treatment of anxiety, it is important to note here that self-esteem partially mediates the relationship between anxiety and mindfulness (Bajaj et al., 2016). Additionally, having a combination of low self-esteem and high anxiety has been associated with risk averse behaviour in relationships which can have significant impacts on interpersonal outcomes (Wray et al., 2005). Negative impact of risk-adverse behaviours (e.g., not participating in social events, not leaving one's home etc.) on these relationships can be particularly damaging given associations between anxiety and social factors.

Social factors which may impact anxiety include the qualitative (e.g. social support) and quantitative (e.g. number of friends) aspects of one's social network and marital status (Vink et al., 2008). Social support can be defined as a measure of the perception or experience of being cared for or about, as part of a mutually supportive relationship or social network (Taylor, 2011). Good levels of social support have been linked with reduced anxiety across a number of populations, including at different age brackets (e.g. adolescence (Rakin et al., 2018; Sirin et al., 2013), and in older adults (Alipour et al., 2009)), and in populations with chronic health conditions (DiNicola et al., 2013). The stress-buffering model (Aneshensel & Stone, 1982) provides one theoretical explanation for this association, such that perceived social support has a protective role against anxiety by reducing the frequency with which situations are deemed threatening, while also increasing the perception of resources available.

Contemporary research has found support for this hypothesis across multiple populations (Gellert et al., 2018; Jairam & Kahl Jr., 2012; Raffaelli et al., 2013) with some suggestions that the stress-buffering effects of social support vary, potentially based on factors including early experiences, personality and social behaviour

(Ditzen & Heinrichs, 2014), with some populations potentially experiencing lower buffering effects (Moskowitz et al., 2013).

In addition to sociodemographic, psychological and social factors, several health-related lifestyle factors have been linked with anxiety. For example, negative health behaviours such as smoking (Fluharty et al., 2016) and a low-quality "Western" diet (characterized by processed foods and refined sugars) are associated with increased anxiety (Aucoin et al., 2021; Jacka et al., 2010). Gut microbiota are thought to be one of the driving factors in the association between diet and anxiety, with the gut-brain axis potentially influencing stress-response and anxiety (Luna & Foster, 2015). Additionally, exercise has been shown to have strong associations with anxiety, with a lot of support for the efficacy of exercise-based interventions in the treatment of anxiety (Jayakody & Hosker, 2014). While many of these exercise interventions are promising in their potential for anxiety reduction, lack of exercise or sedentary behaviour may be associated with increased risk of anxiety (Teychenne et al., 2015). As PwMS are 2.3 times less likely to have sufficient levels of physical activity than healthy controls, this may put them at an increased risk of anxiety (Motl et al., 2015).

1.5 Theoretical models of anxiety

A variety of theoretical models have been proposed to explain anxiety, for example the Contrast Avoidance Model (CAM), Intolerance of Uncertainty Model (IUM), Emotional Dysregulation Model (EDM), state versus trait anxiety and the Metacognitive Model (MCM). While these models do not account for the specific MS-related considerations of anxiety in PwMS, understanding the relationship between anxiety and concepts proposed by these models may help to better understand the experience of anxiety in PwMS.

1.5.1 Trait vs. state anxiety

Aside from the classification of different types of anxiety disorders, an individual’s level of anxiety is frequently conceptualised in two dimensions: state and trait anxiety. Trait anxiety describes a general predisposition towards experiencing an anxious response which is conceptually consistent over time, while state anxiety refers to a transient experience of perceived feelings of dread, tension and apprehension (Endler & Kocovski, 2001). While these concepts were originally proposed to be unidimensional (e.g. Spielberger, 1983), there is now considerable debate surrounding the potential multi-dimensional nature of state and trait anxiety, as well as the specificity with which the State Trait Anxiety Inventory (STAI) (Spielberger, 2019) measures these proposed concepts (Balsamo et al., 2013). Despite neuroscientific evidence showing distinct neural mappings for state and trait anxiety (Saviola et al., 2020), it is now commonly argued that the STAI measures distinct concepts of negative affect, rather than anxiety specifically (Bados et al., 2010; Balsamo et al., 2013). Despite this, the STAI remains a commonly used measure for anxiety, with state and trait anxiety remaining a common way of conceptualising anxiety.

1.5.2 The Contrast Avoidance Model

One popular theoretical model of anxiety, the Contrast Avoidance Model, asserts that individuals with GAD have increased sensitivity to negative shifts in emotion and use worry to create and sustain negative emotion to avoid these emotional shifts (Behar et al., 2009). In this model (as is the case with the IUM and the EDM of anxiety discussed below) worry acts to reduce sympathetic nervous system responses (Rashtbari & Saed, 2020). One of the primary criticisms of this model is based on a combined neurobiological and evolution-theoretical perspective which asserts that the stress response associated with worry is not generated but is the default response in neutral situations such that this response is only inhibited by the perception of safety (Brosschot et al., 2016).

1.5.3 Intolerance of Uncertainty Model

Another theoretical approach to understanding anxiety is the Intolerance of Uncertainty Model (Bottesi et al., 2016). IU is a concept that describes an individual's capacity to endure the negative response associated with ‘uncertain’ situations or situations in which individuals are without salient, key or complete information (Carleton, 2016). In the general population, IU is described as an innate predisposition, which is inhibited the perception of learned safety conditions. Given the high degree of uncertainty associated with MS and its disease course, IU may be a particularly important consideration when exploring psychological well-being in PwMS (Rahimi et al., 2023). While intolerance of uncertainty is considered an innate feature, the severity of this intolerant response varies for different individuals, with research showing a strong association between IU and worry (Dugas et al., 2001). Similar to worry, IU is a transdiagnostic concept associated the incidence and maintenance of anxiety and mood disorders (Carleton et al., 2012).

In the intolerance of uncertainty model (IUM), which shares some conceptual overlap with the CAM, IU is said to contribute to anxiety through three distinct pathways, positive beliefs about worry, cognitive avoidance (coping strategies which include thought suppression and distraction, with the goal of escaping or avoiding undesirable thoughts or situations) and negative problem orientation (NPO), with suggestion that this contribution may also occur through negative emotional orientation (Llera & Newman, 2023; Oullet et al., 2019). As previously described, worry in this model also can be used by individuals for protective reasons, with this behaviour becoming reinforced if feared events do not occur, which might often be the case (Dugas et al., 2004). Cognitive avoidance here reinforces anxiety by preventing desensitization through insufficient exposure to threat-related stimuli, with a recent systematic review finding that cognitive avoidance was the emotional regulatory strategy most associated with intolerance of uncertainty (Sahib et al., 2023). Negative problem orientation, like IU, is itself a well-established transdiagnostic construct which entails viewing problems as threatening and is often associated with low self-efficacy (Llera & Newman, 2023). NPO can be considered a facet of IU, where IU is a negative response to uncertainty and NPO is a negative response to the uncertainty created by problems (Clarke et al., 2017).

1.5.4 The Metacognitive Model

Separately, the metacognitive model (MCM) of anxiety (Clarke & Wells, 1995) asserts that metacognitions (thoughts or perceptions of our own cognitive processes) play a central role in generalized anxiety. In this model both positive and negative beliefs about worry can contribute to generalized anxiety, with negative beliefs about worry (e.g. that worry is uncontrollable or harmful) having a particularly significant impact on the experience of anxiety (Belloch et al., 2007). It is suggested that these negative beliefs about worrying, or meta-worrying, are associated with behaviours such as the excessive seeking of reassurance as well as the avoidance of situations that may trigger worry. It is suggested that these behaviours can further reinforce an individual’s beliefs about worry (Wells, 2010). Additionally, according to the MCM, individuals with clinically significant levels of worry may engage in thought control behaviours, such as thought suppression (a deliberate attempt to not think about negative thoughts), which are often ineffective and can also further reinforce negative beliefs about the uncontrollability of worrying (Gwilliam et al., 2004).

Meta-analytic research of Metacognitive therapy, a form of treatment therapy based on the MCM, shows efficacy in treating anxiety and depression disorders, with suggestion that this efficacy may even surpass the efficacy of Cognitive Behavioural Therapy (CBT) (Normann et al., 2014).

Recent research involving the MCM continues to find that the central concepts of the model significantly predict the variance in anxiety symptoms (Nordahl et al., 2023) with suggestion that MCM based interventions could have good efficacy and feasibility for improving psychological outcomes in samples with chronic health conditions. A recent systematic review of meta-cognitive beliefs also found that metacognition was linked to anxiety, depression and quality of life in participants with chronic health conditions (Lenzo et al., 2020).

1.5.5 The Emotional Dysregulation Model

The Emotional Dysregulation Model (EDM) of generalized anxiety assumes that emotion consists of 4 central components (Mennin et al., 2000). The first component asserts that those with generalized anxiety have a lower threshold for stimuli to trigger an emotional response and furthermore, such individuals experience both positive, and to a greater extent, negative emotional states more intensely and may also be more likely to express these emotions (particularly negative emotions) (Behar et al., 2009). This assertion of greater emotional expression overlaps with recent review findings where emotional suppression was the emotional regulatory strategy least associated with IU (Sahib et al., 2023). Additionally, the EDM asserts that affected individuals have greater relative difficulty in identifying discrete emotions and using this information for their benefit as well as having negative reactivity and perception of emotional states (fear of emotion) (Turk et al., 2005). Finally, the EDM suggests that individuals with GAD employ more maladaptive emotional regulation strategies (e.g. thought suppression, denial) such that these strategies may result in a worse emotional state than existed before the regulatory strategies were employed (Hoffman et al., 2012). In this model, emotional regulation can occur at several points in time during the process of generating an emotion and can take the form of several affective styles (e.g. concealing, adjusting, and tolerating) such that the adaptiveness of the response is dependent on the demands of the given situation. The EDM asserts that strong psychological functioning is determined by the flexibility with which these regulatory strategies are employed (Hoffman et al., 2012).

Empirical evidence suggests that, while negative perceptions of worry (the central concept of MCM) are the strongest predictor of GAD, fear of depression and separately, fear of anxiety (concepts more central to the EDM) significantly predict GAD symptoms in men and women respectively, suggesting that the EDM can significantly contribute to our understanding of anxiety (Deleurme et al., 2022).

While it is currently unclear how these models (particularly those based on GAD) translate to anxiety in PwMS, some evidence from MS populations such as efficacy of MCM mindfulness in supporting emotional dysregulation, anxiety and affective health (Duraney et al., 2022, Nazaribadie et al., 2021) suggests an importance of understanding these models and the potential efficacy of supports based on this understanding.

1.6 Anxiety interventions

Anxiety disorders are generally recognised as being underdiagnosed and undertreated in primary care (Bandelow & Michaelis, 2022). In addition, there is considerable variability in defining remission for anxiety disorders, which can lead to difficulty in comparing efficacy of differing forms of treatment (Springer et al., 2018). One large-scale European study on the treatment of mental health disorders found that only 20.3% of individuals with anxiety disorder contacted health care services and that 23.2% of those who did subsequently received no treatment (Alonso & Lépine, 2007).

Anxiety can be treated through psychotherapy, pharmacology, or through a combination of both (Bandelow et al., 2022). Results of a recent meta-analysis found a medium to large effect size for the impact of psychotherapy-based treatments on GAD, with younger age associated with larger effect sizes (Carl et al., 2020).

1.6.1 Cognitive Behavioural Therapy

CBT has been shown through meta-analysis to be particularly effective in the treatment of GAD, with treatment of SAD resulting in comparatively lower remission rates (Springer et al., 2018). CBT is used to describe therapies based on the principles of rationalism (the idea that one' thoughts and beliefs have personal impact) and empiricism (encouraging clients to test their beliefs and behaviours) with a particular emphasis on prioritising the present moment and fostering a collaborative relationship between client and therapist (Dryden & Branch, 2011). In practice, CBT involves the monitoring of thoughts, behaviours and emotional responses and the challenging of thoughts, behaviours or responses which manifest as unhelpful or maladaptive. The principles and methods of CBT have been shown to have efficacy in treatment of a variety of disorders and symptomology (Hayes & Hofmann, 2018). Incidences of relapse in CBT are considered low (14%) and may not vary based on diagnosis according to recent meta-analytic findings (Levy 2021).

Another recent meta- analysis investigating the efficacy and acceptability of internet-based CBT in routine clinical practice found both a good level of effect on anxiety symptomology, as well as a relatively good level of acceptability, with a deterioration rate of 2.9% across included studies (Etzelmueller et al., 2020). In addition, there is review evidence to suggest that coupling CBT treatment with exercise interventions may have additional efficacy (Frederiksen et al., 2021). CBT may also have potentially long-term efficacy in the treatment of fatigue in PwMS (Heinzlef et al., 2022). One RCT (Pahlavanzadeh et al., 2017) showed the efficacy of group-based CBT for reducing anxiety in PwMS with moderate to mild levels of anxiety; however, it is unclear if any adaptations were made specifically for PwMS in this study. Further research should focus on identifying any adaptations that could help with the efficacy and tolerability of CBT for PwMS.

1.6.2 Acceptance and Commitment Therapy

Another approach which has been used in support of PwMS is Acceptance and Commitment Therapy (ACT), which may have particular efficacy in situations where individuals experience issues with avoidance or control (Coto-Lesmes et al., 2020). The primary therapeutic goal of ACT is to help promote psychological flexibility or, more specifically, with the persistence or cessation of behaviours in the pursuit of goals, particularly in instances where this process may involve a level of discomfort (Hayes et al., 2011). ACT is an active process which encourages individuals to engage in the present moment and to act in line with their personal values particularly when facing individual adversity (Forman et al., 2012). Through this process, ACT encourages individuals away from patterns of avoidant behaviour towards acceptance, focusing less on changing the content or form of negative thoughts but instead focusing on reducing the impact of these thoughts on behaviour (Wilson et al., 2020). ACT has also shown to be effective in both group and online settings (Kelson et al., 2019).

Theoretically, ACT could help PwMS manage the uncertainty associated with living with a chronic health condition. Research involving the use of ACT in MS populations is promising, with evidence that ACT may have efficacy for management of fatigue and pain (Davoodi et al., 2019) with mixed findings in the areas of anxiety and quality of life (Pakenham et al., 2018; Sheppard et al., 2010; Thompson et al., 2022). ACT also may have value in supporting carers of PwMS, however there is considerable need for additional research in this area (Potter et al., 2021).

1.6.3 Dialectical Behaviour Therapy

Dialectical Behaviour Therapy (DBT) is another form of third-wave cognitive behavioural therapy, designed specifically for individuals with high suicidality where additional emphasis is put on emotional regulation strategies with unique mindfulness-based approaches aimed at increasing acceptance (Malivoire, 2020). By focusing on acceptance and change strategies, DBT may help PwMS adjust to a chronic diagnosis and manage the common experience of anxiety and depression with potential utility for PwMS who experience higher levels of anxiety and depression (Blair et al., 2017). Initial pilot-study evidence suggests efficacy of DBT in reducing anxious symptomology in PwMS (Botanov & Hughes, 2023; Hughes et al. 2022). While research suggests that DBT and ACT may have efficacy for use in MS populations, further research is needed to confirm this efficacy as well as to identify any MS-specific adaptations that should be made (Zarotti et al., 2023).

1.6.4 Mindfulness-Based Cognitive Therapy

Mindfulness-based cognitive therapy (MBCT) originated by combining key features and activities of MBSR (Mindfulness-Based Stress Reduction) with components of CBT such as additional cognitive exercises (Tickell et al., 2020). MBSR was originally designed to address chronic pain, with evidence to suggest the potential for MBSR to help reduce stress, anxiety and depression in PwMS (Simpson et al., 2017). MBCT and MBSR differ from CBT in that the goal is to create awareness of one’s thought processes rather than changing the content of one’s thoughts (Ehde et al., 2019). MBCT and MBSR involves a focus on mindfulness as a core skill and involve formal meditation which distinguishes these therapies from the practices of ACT or DBT (Lao et al., 2016). Existing evidence on the use of MBCT interventions for PwMS suggest potential efficacy for improving psychological well-being (Navidi Moghadam et al., 2017) and fatigue (Chalah et al., 2018).

1.6.5 Exercise interventions

While associations between anxiety and exercise in PwMS have been established (Axelrad, 2020), exercise interventions for PwMS have shown mixed results in the reduction of anxiety, with more consistent efficacy reported in reducing fatigue and in the improvement of quality of life (Afkar et al., 2017; Gascoyne et al., 2020; Shohani et al., 2020). It should be noted that anxiety was not the target variable of many of the studies which did not report an effect. While there is potential for exercise interventions to positively impact on anxious symptomology, the mechanisms driving these improvements have not yet been sufficiently explored. Additionally, it should be noted that promotion of physical activity in PwMS should be done with care. While exercise behaviours can provide PwMS a sense of control over symptoms, poor adherence to prescribed exercise can create feelings of guilt and worry that disease progression would be the ‘fault’ of the PwMS (Adamson et al., 2018).

1.6.6 Social Cognitive Theory based interventions

Evidence suggests that the application of programmes based on the principles of Social Cognitive Theory (SCT) may have particular value in PwMS where long term adherence to exercise and positive physical activity behaviours is an important outcome (Garrett et al., 2013). SCT is based on the principles of self-efficacy, goal setting and outcome expectations, where maintenance of behaviour (not just the initiation of behaviour) is a point of focus (Uszynski et al., 2018). With a growing body of research suggesting associations between core principles of SCT and physical activity in PwMS (Baird et al., 2021; Silveira et al., 2020; Suh et al., 2014), and evidence that interventions in this area may have efficacy for the promotion of physical activity in PwMS (Motl et al., 2011; Pilutti et al., 2014), the potential for these programmes to help with the reduction of anxiety should be further explored.

1.6.7 Peer support interventions

Peer support interventions have also been shown to be effective at reducing anxious symptomology in some populations (Field et al., 2013; Tan et al., 2023; Zhang et al., 2022). However, it should be noted that attendance/membership of support groups may be less impactful than subjective self-identification with a support group when comparing associations with mental health outcomes (including anxiety) (Wakefield et al., 2013). These findings emphasize the importance of attempting to foster this self- identification as a core part of peer support interventions. Connected-health peer support interventions, which may be of particular value for some individuals due to their enhanced accessibility, have also shown to have promising efficacy for anxiety reduction, as well as in supporting areas related to quality of life, cognitive function and physical MS symptomology (Kever et al, 2022; Leavitt et al., 2020; McArthur et al., 2023; Van Geel et al., 2020). These interventions generally had good feasibility, with satisfactory levels of reported completion and adherence rates. Feasibility studies on use of connected-health peer support interventions with MS caregivers also appears promising, with suggested efficacy in reducing anxiety and caregiver burden (Khazaeili et al., 2019).

1.7 Rationale for thesis

Despite some attempts to manage anxiety in MS in clinical settings, there has been little research designed to explore the experience of anxiety in PwMS in detail. In particular, there is a need for a more focused analysis of the modifiable factors that may predict anxiety in this population so that appropriate targets for intervention may be identified. In addition, more recently, the COVID-19 pandemic may have impacted the experience of anxiety in PwMS. Understanding how changes brought about during the pandemic (including changes in the provision of supports) impacted the management of anxiety for PwMS living in Ireland merits investigation. Finally, while MS Ireland offers support for PwMS, little research has explored the extent to which these supports can help reduce anxiety in PwMS.

The final section of this chapter presents an overview of the aims and objectives of this thesis. Prior to this, the concept of Patient and Public Involvement (PPI), a fundamental component of this research, is introduced.

1.7.1 Patient and Public Involvement (PPI)

PPI research is research conducted in partnership with those who the research is designed to assist. PPI research involves working with individuals and researchers from the population of interest in as many stages of the research process as possible, from the design and target of the research to the interpretation and dissemination of results. When properly implemented, PPI is thought to have a number of potential benefits, including improving the integrity and value of research through increased relevancy to participants and improving the dissemination of findings beyond academic audiences (Tomlinson et al., 2018). Additionally, use of PPI research has been reported as potentially beneficial for doctoral researchers' well-being (Tomlinson et al., 2019). PPI research also has potential to ethically reduce potential power imbalances between researchers and participants, with relevancy for research involving vulnerable groups (Madden & Speed, 2017). However, while PPI is becoming increasingly valued in research, one recent review of the use of PPI research with MS populations highlighted both the benefits but also the relevant paucity of PPI reported in clinical trials involving MS research, with recommendations made to address this issue (Gray et al., 2023).

A strength of this thesis is that it is PPI-led, given that the research supervisor is a person living with MS. Furthermore, in line with the recommendations above, a PPI panel was established early on in the project, with members consulted to help co-design and review preliminary findings of the research. PPI-input was also crucial in helping to identify the aims of the thesis, described below.

1.8 Aims and objectives of thesis

This thesis aims to explore the experience of anxiety in PwMS and identify ways in which anxiety may be reduced. This is achieved through the following objectives:

- Objective 1: To establish the modifiable associates of anxiety in MS.
- Objective 2: To assess the impact of the COVID-19 pandemic on anxiety in

PwMS living in the UK and Ireland.

- Objective 3: To explore the challenges associated with living with anxiety, as well as the strategies used by PwMS to manage their anxiety.
- Objective 4: To identify which PwMS are most in need of psychological support.
- Objective 5: To evaluate the efficacy of a structured exercise, behavioural coaching and peer support programme offered by MS Ireland in relation to anxiety.

These objectives are addressed through a series of five interconnected studies which employ a variety of methodological approaches, as outlined in section 1.8.1.

1.8.1 Overview of thesis structure

The following chapters present the research conducted as part of this thesis.

Firstly, Chapter 2 addresses objective 1 by presenting a systematic review of 39 studies linking potentially modifiable psychological, social and lifestyle factors to anxiety in PwMS (**study 1**; Fahy & Maguire, 2022). Next, Chapter 3 presents a mixed methods survey of 287 PwMS living in the UK and Ireland (**study 2**; Fahy & Maguire, 2023a). In addition to further addressing objective 1 by investigating associations with anxiety and modifiable associates identified through the systematic review, **study 2** also addresses objective 2 by assessing the impact of the COVID-19 pandemic on PwMS.

Chapter 4 describes **study 3** which, through 9 semi-structured interviews with PwMS living in Ireland, gathered richer qualitative descriptions of the experience of anxiety in PwMS, as well as identifying strategies used by PwMS in the management of anxious symptomology, thereby addressing objective 3. Additionally, **study 3** gathered data surrounding the type of supports which may help with reducing anxiety in PwMS.

Chapter 5 presents **study 4** which, through secondary analysis of data from 349 PwMS, examined the demographic and disease-related predictors of psychological and social support needs in PwMS, thereby addressing objective 4. This study also explored the experience of services offered by MS Ireland.

The final empirical chapter, Chapter 6, describes **study 5** which presents an analysis of a structured exercise programme offered by MS Ireland termed the MoveSmart programme. This involved pre and post-intervention data from 284 PwMS and sought to evaluate the mechanisms and efficacy of the programme in relation to anxiety as well as describing the experiences of PwMS with the programme, thereby addressing objective 5.

Finally, Chapter 7 presents a focused discussion and evaluation of the studies conducted, including consideration of the implications of the findings for the management of anxiety in MS.

Chapter 2:

Study 1: Potentially modifiable associates of anxiety in people with multiple sclerosis: A systematic review

This chapter is adapted from the publication: Fahy, A., & Maguire, R. (2022). Potentially modifiable associates of anxiety in people with multiple sclerosis: a systematic review. *Disability and Rehabilitation, 44(*26), 8201-8212.

Abstract

Purpose: A high percentage of people with multiple sclerosis (PwMS) experience anxiety, which can negatively impact quality of life. Despite this, anxiety in PwMS remains under researched. This review aims to identify associates of anxiety in PwMS that are amenable to change, with a view to informing the development of interventions in the area. **Materials and method:** The following databases were searched for studies investigating anxiety in PwMS from 2015-2021: PsycINFO, PubMed, EMBASE, Web of Science. The search consisted of keywords relating to MS and fear, anxiety or worry. Once screening was complete by two reviewers, a narrative synthesis was used to analyse the data, with the MMAT used for quality appraisal. **Results:** Of the 3117 unique abstracts screened, 39 studies met the criteria for inclusion. Evidence was found linking anxiety in PwMS to several modifiable factors broadly categorized as either psychological, social or lifestyle factors. Perceptions of self and one's ability to cope/adjust to MS emerged as important psychological factors. Physical activity and social support from friends were also linked with improved anxiety outcomes. **Conclusion:** Anxiety in PwMS is linked to a number of modifiable factors. Findings may help inform the development of rehabilitation interventions to decrease anxiety in MS.

2.1 Introduction

As highlighted in Chapter 1, MS is neurodegenerative disease characterized by inflammation of the spinal-cord and brain, demyelination, and axonal damage (Thompson et al., 2018). MS is the most common disabling neurological disease in young people, with many PwMS experiencing symptoms of chronic pain, fatigue and cognitive impairment (Dua et al., 2008; Rahn, et al., 2012). MS has an unpredictable disease course, most commonly manifesting as a series of relapses (characterized by an emergence or worsening of symptoms) and remissions (characterized by 'recovery' where there are no new active disease symptoms) (Thompson et al., 2018), although many PwMS (10-15%) (Miller et al., 2007) experience more progressive forms of the disease which may involve a gradual worsening of symptoms. This unpredictability may create specific MS-related concerns in relation to worry, fear and anxiety in PwMS (Thornton et al., 2006). Reflecting this and as outlined in Chapter 1, mood-disorder comorbidity in MS is common, with a review estimating that 30.5% of PwMS show clinically significant levels of depression, while an estimated 22.1% show clinically significant levels of anxiety, with both rates significantly exceeding prevalence rates seen in the general population (Boeschoten, et al., 2017).

Despite this high prevalence and the existence of evidence to show the impacts of anxiety on quality of life for PwMS, anxiety remains under- researched in this population (Alsaadi et al., 2017; Hviid et al., 2011). A recent systematic review investigating both pharmacological and psychological treatment options which target anxiety in PwMS found only one control study which targeted anxiety specific to a population with MS (Fiest et al., 2016). Additionally, the focus of this study was limited to injection anxiety (which may be a dated dimension of anxiety as injectable therapies for MS have become much less common than other treatment options in recent years), with no significant improvement effects found (Mohr et al., 2005).

The specific need for psychological interventions for mood disorders in PwMS has previously been highlighted and is supported by evidence suggesting their potential effectiveness and relative lack of tolerability concerns for PwMS when compared with currently-used pharmacological methods (Fiest et al., 2016). Additionally, lesion studies have found that, unlike depression, anxiety does not appear to be linked with physical abnormalities detectable by MRI and, thus, it is suggested that anxiety is more likely to result from psychosocial pressures (Morrow, 2018; Zorzon et al., 2001). This clear dearth in treatment options stems, in part, from a lack of research in the field of anxiety in PwMS in general. Given this, more research is needed to fully understand the associates of anxiety in order to properly inform the development of interventions in this area (Bruce & Arnett, 2009). To date, only one previous systematic review has specifically investigated factors relating to anxiety in PwMS (Butler et al., 2016), with no reviews to date focusing specifically on the modifiable associates of MS. The lack of attention given to the importance of anxiety in PwMS seems to be reflected in practical settings, with evidence suggesting there are a large number of patients with clinically significant levels of anxiety who are going untreated (Orr et al., 2018).

In order to address shortcomings in previous literature and the first objective of this thesis, **study 1** describes a systematic review of recent literature investigating potentially modifiable associates of anxiety in PwMS. In addition to helping inform the development of targeted interventions by focusing solely on modifiable factors, it is hoped that this research will provide much needed assistance to clinicians in the identification of individuals with MS who carry a high risk of anxiety comorbidity

(Boeschoten, et al., 2018). The importance of accurate and early anxiety diagnosis is supported by evidence suggesting how the lack of a diagnosis is linked with increased likelihood of problematic health behaviours in PwMS, including alcohol and substance abuse and smoking (Marrie et al., 2015). Theoretically, by assisting with the identification of at-risk individuals, this type of research may lead to earlier and more accurate diagnoses.

2.2 Methods

2.2.1 Search strategy

The review was conducted in accordance with Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines and was preregistered at The Open Science Framework (osf.io) (Fahy & Maguire, 2020). The following databases were searched for studies investigating anxiety in PwMS: PsycINFO, PubMed, EMBASE, and Web of Science. Through collaboration with a professional librarian a search strategy was formed. The search consisted of the keywords 'multiple sclerosis' AND 'anxiety' (anx* OR 'fear' OR 'worry') and was adapted for use with each database. Supplementary searches were not conducted as part of this review. The search was restricted to studies published in English between January 2015 and July 2021.Specifically, searches of databases were initially conducted in January 2020 and updated in July 2021 to allow for the inclusion of more up-to-date research in the area, including those studies which focused on anxiety in the context of the COVID-19 pandemic. Findings of the updated search have been pooled with the initial search findings and are reported together here. The limited timeframe was decided on due to the volume of studies anticipated in relation to anxiety (due to the broad search strategy), as well an acknowledgement of how the treatment and management of MS has changed significantly in recent years, which may have implications for the types of anxiety that PwMS may experience now compared to in previous years. For instance, the wider range of treatment options available has meant that there has been less reliance on injectable therapies, with a shift towards oral or infusion therapies (Marrie et al., 2015). Many older studies in this population focused specifically on injection anxiety in PwMS (Mohr et al., 2002) which may be less commonly experienced today (Bigaut et al., 2021; Feist et al., 2016; Mohr et al., 2005; Mohr et al., 2002; Mohr et al., 2001).

2.2.2 Inclusion and exclusion criteria

Included studies must have collected primary data from adults with MS. Papers with mixed samples were only included if the sample was at some point split for analysis of the MS subgroup. In these cases, only findings specifically relating to analysis of the exclusively MS subgroup were reported. If a study with a mixed sample only analysed MS populations in conjunction with a mix of other neurological conditions, the study was excluded. Included studies must also have used a measure of anxiety (validated or non-validated measures), worry or fear, which was analysed in relation to at least one other modifiable factor. Factors were classed as modifiable if they were considered to be reasonably amenable to change in a clinical context, and were not considered a common symptom of MS which would already be considered as part of routine MS treatment. Characteristics relating to participants' socio-demographic or economic status were considered as unmodifiable for the purpose of this study and were therefore excluded. Similarly, studies which only explored anxiety in relation to overlapping constructs such as depression and stress were not included. This decision was made based on the large pool of existing evidence already inextricably linking anxiety to these factors. Validation/feasibility studies, posters and conference papers and studies with small samples (n<30) were also excluded. All other forms of study design were considered for this review.

2.2.3 Selection process

First, all studies were uploaded to Rayyan.org which is an online application designed for systematic review screening (Ouzzani, et al., 2016). All study duplicates identified were removed by AF. Next, abstracts were independently screened by AF and RM, with a high level of agreement between reviewers. Following abstract screening, all remaining full-texts were obtained and independently screened against the exclusion criteria. Any disagreements through the process were resolved through conversation.

2.2.4 Data extraction and analysis

During the screening phase, relevant data was extracted and put in tabular format independently by AF. This process was checked by RM with any disagreements resolved through discussion. Data extracted included study design, sample characteristics, such as age, gender and type of MS, country in which the study was completed, a summary of relevant findings, and a list of any relevant measures used. Data was analysed using the process of narrative synthesis (Lisy & Porritt, 2016). Specifically, reflexive thematic analysis based on the principles of Braun and Clarke (2006; 2019), was used to construct an evidence synthesis, which can be used to compare quantitative findings from studies with a variety of designs (Popay et al., 2006). The principles of reflexive thematic analysis involve acknowledging the researcher’s positionality and constructing themes based on the available data without applying pre-existing theoretical framework. The process of creating this synthesis involves the juxtaposition of study findings as well as the analysis of common findings across studies. Specifically, this process involves an initial phase of data immersion, whereby researchers familiarize themselves with the data, before initial codes and themes are created. Narrative summaries of the quantitative findings were coded to identify themes and subthemes. These themes are then further refined through discussion until the point of data saturation whereby no further themes can be identified. Through discussions among the two reviewers, a decision was made to classify identified modifiable factors under the broad categories of lifestyle, psychological and social factors. This decision was made to better classify areas which may be targeted by interventions. Lifestyle factors were considered to be patterns of behaviour which individuals have autonomy over. Social factors were categorized as factors which related to the frequency, nature and quality of interactions between the individual and others. Finally, psychological factors were categorized as mental states or processes, including attitudes, perceptions and cognitive processes.

2.2.5 Quality assessment

The Mixed Methods Appraisal Tool (MMAT) was used to assess the quality of all included studies (Hong et al., 2018). The MMAT is a tool suitable for critical appraisal of a multitude of designs of empirical study, including cross-sectional, randomized controlled trials (RCT) and cohort designs, making it a suitable choice for this review. As well as being widely employed in a number of recent systematic reviews, the MMAT has been used frequently in reviews involving PwMS (Ow et al., 2021; Power et al., 2021; Quinn et al., 2021). In addition, the MMAT has been shown to have a strong reliability, with an intra-class correlation of 0.8 suggesting agreement between individual reviewers (Pace et al., 2012). Following two screening questions, the tool is used to assess studies according to a series of five criteria which vary depending on the design of the study to be evaluated (Hong et al., 2018). Studies were scored based on their ability to satisfy these criteria, with studies satisfying three of the five criteria classified as ‘medium’ quality studies. Studies that satisfied less or more criteria than this were classified as ‘low’ or ‘high’ quality studies respectively. To ensure that recommendations for rehabilitation professionals can be based on the best available evidence, a decision was taken to exclude low quality studies from the analysis. This process was completed in tandem with the extraction of the outcome data.

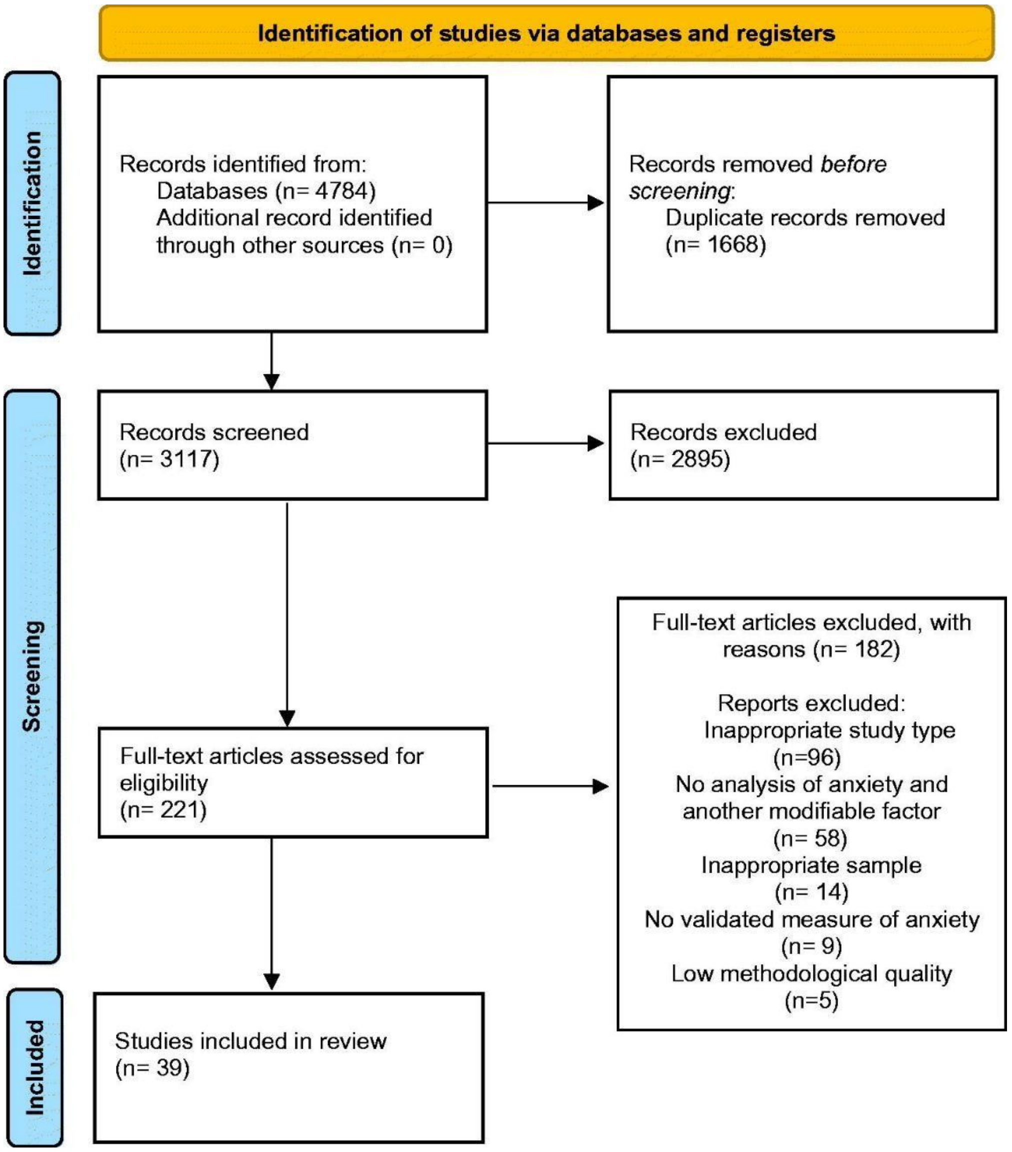
2.3 Results

2.3.1 Overview

The initial search of online databases resulted in 4784 studies. After duplicate removal, 3116 unique entries remained. The abstracts of these studies were then screened against the exclusion criteria, which resulted in 221 studies moving to the full-text screening stage. 182 of these studies were excluded, with the most common reason for exclusion being an inappropriate study type. Five studies were excluded due to low methodological quality following the quality appraisal process. This resulted in a final tally of 39 studies to be included in the narrative synthesis (see Figure 2.1).

Figure 2.1

PRISMA Flow Chart



2.3.2 Study characteristics

Table 2.1 displays summary data along with ratings of study quality. All included studies used a quantitative design, with cross-sectional designs (n=23) being the most common, followed by randomized controlled trials (n=9), and quantitative non-randomized studies (n=7). Included studies were conducted in 15 different countries, with the USA being the most common (n=8) followed by Iran (n=6). The sample sizes of included studies ranged from 36 to 2,399, with a total of 10,779 PwMS included in all studies. With the exception of one study (Taspinar et al., 2015), all study samples had a majority female population, which is in line with MS population norms. All studies reported only binary gender. The mean age of included study samples ranged from 24.2 to 58.3 years of age. Relapsing-remitting multiple sclerosis (RRMS) was the most common form of MS in all studies that provided this information, with a range of 61.9% to 100% of the sample. Descriptions of MS type were unavailable for 9 studies.

2.3.3 Measures of anxiety/fear

20 of the 39 studies included used the Hospital Anxiety and Depression Scale (HADS) (Zigmond & Snaith, 1983) as their measure of anxiety, with the State Trait Anxiety Index (STAI) (Spielberger et al., 1983) (n=9) and the Hamilton Anxiety Rating Scale (HAM-A) (Hamilton, 1959) (n=4) used in some studies. The Depression Anxiety and Stress Scale (DASS-21) (Lovibond & Lovibond, 1995) (n=2) and the Patient-Reported Outcomes Measurement Information System (PROMIS) Anxiety subscale (Pilkonis et al., 2011) (n=2) were used in two studies each. The Beck Anxiety Inventory (BAI) (Beck et al., 1988), the Brief Symptom Inventory (BSI) (Derogatis & Spencer, 1993) and the Generalized Anxiety Disorder Assessment (GAD-7) (Spitzer et al., 2006) were used to assess anxiety in individual studies. Other measures included the Falls Efficacy Scale International (FES-I) (Yardley et al., 2005) (n=2) to assess fear of falling, a single item visual analogue scale measure (VAS) (Giordano et al., 2018) (n=1) to assess fear of wheelchair dependency, and the fear of relapse scale to assess fear of MS relapse (Khatibi et al., 2020).

2.3.4 Quality assessment

Following the exclusion of low-quality studies (n=5) the remaining 39 studies showed evidence of methodological quality in at least three of the five areas that the MMAT appraises. It should be noted, however, that some of the quantitative descriptive studies failed to provide evidence to substantiate the representativeness of their sample. Furthermore, more than half of these studies failed to address the risk of nonresponse bias. Sampling strategies, statistical methods and the measurements used in the included quantitative descriptive studies were of a good standard.

Table 2.1

Sample demographics and quality appraisal data

Authors	Design	Country	Sample size (% female)	Age (M)	Type of MS	Measure of Anxiety	Modifiable Associate(s)	Quality Appraisal
Alschuler et al. 2021	Cross-sectional	USA	419 (81.3%)	55.8	RRMS=64.8% PPMS=10.2% SPMS=16.5% Unknown=7.5% CIS=1%	PROMIS anxiety	Mindfulness (Five Facet Mindfulness Questionnaire-15), Tolerance of uncertainty (IUS short-form), Resilience (LOT-R), Optimism	High
Altınkaynak Yılmaz & Ozdelikara (2021)	Cross-sectional	Turkey	123 (65.9%)	N/A	RRMS=86.2% PPMS=1.6% SPMS=12.2%	HAM-A	Social Support (MSPSS)	High
Anagnostouli et al. 2019	Cross-sectional	Greece	128 (75%)	44	RRMS=93%	DASS	Behavioural stress management (Dass-21)	High
Bogart 2015	Cross-sectional	USA	106 (45%)	58.3	N/A	HADS	Disability identity (8-item Disability Personal Identity Scale)	Medium
Carnero Contentti et al. 2021	Cross-sectional	Argentina	281 (70%)	40.8	RRMS=76.2% PPMS=6.4% SPMS=6.7% Unaware=10.7%	HADS	Cannabis use (self-report)	High
Casey et al. 2018	RCT analysis	Ireland	59 (84.6%)	41.98	RRMS=83.1% SPMS=1.5% PPMS=1.5% Benign=6.2% Unknown=7.7%	HADS	Self-efficacy (EXSE)	Medium
Comber al. 2017	Cross-sectional	Ireland	140 (69%)	38.1	N/A	FoF, single-item	Falls self-efficacy (16-item FES)	Medium
Coote et al. 2017	RCT	Ireland	65 (87.9%)	43.3	RRMS=86.3% Unknown= 7.6% Benign= 6.1% SPMS= 1.5% PPMS=1.5%	HADS	Exercise (EXSE, EGS, MOESS)	High

De la Torre et al. 2020	RCT	Spain	60 (73.3%)	44.3	RRMS=100%	STAI	Mindfulness (intervention)	High
Fleming et al. 2021	RCT	Ireland	80 (86.3%)	46.7	N/A	HADS and STAI	Pilates exercise (intervention)	High
Gacoyne et al. 2019	Cross-sectional	Australia	1500 (79.5%)	56	RRMS=61.9 PPMS=8.7% SPMS=15% PRMS=2% Unknown=12.5%	HADS	Lifestyle factors	High
Giordano et al. 2018	Cross-sectional	International	2399 (82.2%)	38.6	RRMS= 95% Unknown=5%	VAS (fear of wheelchair dependency)	Risk Knowledge (RIKNO 2.0, MSKQ)	Medium
Grech et al. 2016	Cross-sectional	Australia	107 (77.6%)	48.8	RRMS=77.6% SPMS=22.4%	40-item STAI	Coping (60-item COPE inventory)	Medium
Güner et al. 2020	Cross-sectional	Turkey	63 (68.3%)	31	RRMS=100%	HAM-A	Automatic thoughts (ATQ), Dysfunctional attitudes (DAS)	Medium
Hanna & Strober et al. 2020	Longitudinal	USA	183 (90%)	44.1	RRMS=95% PPMS=2.7% SPMS=2.2% Progressive relapsing= 0.5%	STAI	Social support (MSSS), Substance use (COPE)	High
Hasanpour-Dehkordi et al. 2018	RCT	Iran	60 (N/A)	30	N/A	STAI	Yoga (intervention)	High
Henry et al. 2019	Cross-sectional	France	112 (69%)	44.9	RRMS=64% PPMS=36%	HADS	Perceived social support (MSPSS)	High
Jongen et al. 2017	Prospective	The Netherlands	36 (69.4%)	N/A	RRMS=66.66% progressive=33.33%	HADS	Self-efficacy (MSESS)	Medium
Jongen et al. 2019	RCT	The Netherlands	158 (88.7%)	40	RRMS=100%	HADS	Self-efficacy (MSESS)	Medium
Kalron et al. 2018	Cross-sectional	Israel	190 (56%)	40.8	RRMS=86% Progressive=14%	Fear of falling (FES-I)	Physical activity level (GLTEQ)	High

Keikhaei et al. 2018	RCT	Iran	60 (60.6%)	N/A	RRMS=90.1% PSMS=9.1%	STAI	Motor-balance exercise (intervention)	Medium
McKay et al. 2016	Prospective	Canada	949 (75.2%)	48.6	RRMS=72.4% SPMS=20.3% PPMS= 6.3% CIS=0.5% Unknown= 0.4%	HADS	Smoking (single-item measure), alcohol (CAGE)	High
Mioduszewski et al, 2018	Cross-sectional	Canada	52 (75%)	47	RRMS=69% SPMS=19% PPSMS=7% Unknown=2%	GAD-7	Mindfulness	Medium
Orr et al. 2018	Cross-sectional	Canada	251 (81.3%)	50.9	RRMS=72.1% PPMS=9.2% SPMS=18.7%	HADS	Perceived need for mental health care (single item measure)	High
Oz & Oz 2020	RCT	Turkey	40 (75.5%)	41.5	N/A	BSI	Psychoeducation (intervention)	High
Pagnini et al. 2019	Longitudinal	Italy	156 (64.1%)	42.8	N/A	HADS	Mindfulness (LMS, FFMQ)	High
Pham et al. 2018	Cross-sectional	Canada	244 (73%)	49.5	RRMS= 66.4% SPMS=20.9% PPMS= 9.4%	HADS	Lifestyle (single-item measures)	Medium
Prakash et al. 2019	Cross-sectional	USA	198 (85%)	45.1	RRMS=91% PRMS=5% SPMS=4%	HADS	Emotional regulation (CERA)	Medium
Ramezani et al. 2021	Cross-sectional	Iran	410 (79.5%)	38.6	N/A	HADS	Smoking (N/A)	Medium
Ratajska et al. 2020	Longitudinal	USA	789 (71.6%)	46.5	RRMS=81% PPMS=19%	STAI	Social support (MSSS)	Medium
Sbragia et al. 2021	Cross-sectional	Italy	106 (69.8%)	43.1	RRMS=65.1% PPMS=16% SPMS=18.9%	HADS	Resilience (CD-RISC 25)	High
Seddighi-Khavidak et al. 2020	RCT	Iran	30 (66.7%)	45.8	RRMS=93.3% PMS=6.7%	FES-1	Lavender oil use (intervention)	Medium
Shaygannejad et al. 2021	Cross-sectional	Iran	165 (82%)	35.3	RRMS=100%	Fear of relapse scale	Social support (MSPSS)	High

Sparling et al. 2017	Cross-sectional	International	508 (81.5%)	N/A	RRMS=71.5% Secondary/progressive=28.5%	DASS	Social participation (4-item social participation questionnaire)	Medium
Taspinar et al. 2019	Randomized prospective controlled study	Turkey	36 (48%)	33.5	N/A	HADS	Exercise (intervention)	High
Uccelli et al. 2016	Cross-sectional	Itay	198 (75%)	24.2	N/A	HADS	Self-efficacy (GSES), self-esteem (RSS)	High
Valvano et al. 2016	Longitudinal	USA	128 (85%)	45.5	RRMS= 75% Unexplained=25%	HADS	Stigma (MS-Related Stigma Scale)	Medium
Van Damme et al. 2016	Cross-sectional	Belgium	117 (64.1%)	41	RRMS=77% SPMS=18% PPMS=5%	HADS	Acceptance (ICQ), Goal adjustment/pursuit (TEN/FLEX)	Medium
Yael et al. 2019	Cross-sectional	USA	98 (N/A)	50.8	RRMS=87.5% PPMS=9.2% Other=3.3%	STAI	Money management	High

2.3.5 Narrative synthesis

Due to the heterogeneity of the potential associates of anxiety being investigated in the studies reviewed, as well as the heterogeneity in outcome measures, a meta-analysis was not a suitable way of analyzing results. Thus, a process of narrative synthesis (Lisy & Porritt, 2016) was deemed to be the best way to interpret findings of this review.

Results were explored under the following headings based on the nature of the associate investigated; Psychological factors, Social factors and Lifestyle factors (see Table 2.2 for summary).

Table 2.2

Classification of Potential Associate Categories

Category	Associate	Studies with an effect	Studies with no effect
Psychological factors: Perception of Self	Self-efficacy	Uccelli et al. 2016, Casey, Uszynski et al. 2018, Jongen et al. 2019, Jongen et al. 2016	Jongen et al. 2019, Jongen et al. 2016
	Falls-efficacy/control	Comber et al. 2017	
	Self Esteem	Uccelli et al. 2016	
	Stigma	Valvano et al. 2016	Valvano et al. 2016
	Disability Identity/Perceived need for care	Bogart et al. 2015 (DI), Orr et al. 2019 (PNFC)	
	Cognitive fusion	Valvano et al. 2016	
	Money Management	Yael et al. 2019	
	Lavendar Oil Use	Seddighi-Khavidak et al. 2020	
Psychological factors: Ability to Cope/Adjust	Mindfulness	Mioduszewski et al. 2018, Pagnini et al. 2019, De la Torre 2020	
	Acceptance/Coping	Grech et al. 2016, Van Damme et al. 2016, Oz & Oz 2020	
	Risk Knowledge	Giordano et al. 2018	
	Emotional Regulation Strategy	Prakash et al. 2019	
	Goals	Van Damme et al. 2016 (adjustment),	
	Resilience	Sbragia et al. 2021, Alschuler et al. 2021	
	Stress-management	Anagnostouli et al. 2019, Oz & Oz 2020	
	Intolerance of Uncertainty	Alschuler et al. 2021	
	Dysfunctional Attitudes	Güner et al. 2020	
Lifestyle factors	Physical activity	Casey, Uszynski et al. 2018, Hasanpour-Dehkordi et al. 2016, Coote et al. 2017, Karlon et al. 2018, Taspinar et al. 2015, Keikhaei et al. 2018, Fleming et al. 2021	Coote et al. 2017, Gascoyne et al. 2019,

	Associate	Studies with an effect	Studies with no effect
	Substance Use/Alcohol Consumption	McKay et al. 2016 (smoking/alcohol), Gascoyne et al. 2019 (smoking)	Gascoyne et al. 2019 (alcohol), Pham et al. 2018 (smoking/alcohol), Carnero Contentti et al. 2021 (cannabis), Ramezani et al. 2021 (smoking), Hanna & Strober 2020 (substance use)
	Money Management	Yael et al. 2019	
	Lavendar Oil Use	Seddighi-Khavidak et al. 2020	
Social factors	Social Support	Henry et al. 2019, Shaygannejad et al. 2021, Altınkaynak Yılmaz & Ozdelikara 2021, Ratajska et al. 2020, Hanna & Strober 2020	
	Social Participation	Sparling et al. 2017	

2.3.6 Psychological factors

A total of 20 studies investigated anxiety in relation to some psychological associate. The majority of these associates related to either (1) participants' ability to adjust and/or regulate their responses to change or difficulty, or (2) participants' perception of themselves.

2.3.6.1 Ability to adjust/cope with MS

Thirteen studies dealt with some dimension of participants' ability to adapt to, or address, different circumstances relating to their disease. Overall, these 13 studies indicate that anxiety is associated with coping strategies. For example, two studies found significant independent associations between high resilience and lower anxiety (Alschuler et al., 2021; Sbragia et al., 2021). Similarly, Van Damme et al., (2016) explored how participants' approach to goals related to their anxiety, finding that tenacious goal pursuit (the adjustment of life circumstances to help goal achievement), flexible goal pursuit (the adjustment of life goals based on constraining life circumstance) and acceptance significantly predicted lower anxiety. Grech et al., (2016) found higher use of acceptance and behavioral disengagement coping to mediate the relationship between low executive functioning and higher anxiety. The inverse was true of higher use of adaptive coping, which mediated the relationship between high executive function and lower trait anxiety. Prakash et al. (2019) similarly found a significant positive association between anxiety and maladaptive emotional regulation strategy. Here, maladaptive emotional regulation strategy refers to a pattern of attempts to exert control over one's own emotional state which results in negative affective and goal-related outcomes. It is worth noting that, despite these findings, the relationship between adaptive strategy use and anxiety was not significant. Oz & Oz (2020) administered a psychoeducation intervention which successfully increased the use of problem- focused coping in participants, where participant anxiety also decreased following the intervention. Anagnostouli et al., (2019) found participants had significantly lower levels of anxiety following a cognitive-behavioural stress management programme. Meanwhile, three studies (De la Torre et al., 2020; Mioduszewski et al., 2018; Pagnini et al., 2019) found a statistically significant inverse association between mindfulness and anxiety, suggesting that this is another potential coping strategy that may benefit PwMS. In addition, De La Torre et al. (2020) found that after a mindfulness intervention, the largest significant impact out of all factors assessed was on anxiety. In another study highlighting the importance of adjustment, Güner et al. (2020) found a significant correlation between anxiety and automatic thoughts and dysfunctional attitudes. Here, dysfunctional attitudes and automatic thoughts (both general and disease-related) were conceptualized as obstacles in the adaption process in individuals with MS. Finally, Alschuler et al. (2021) found that intolerance of uncertainty (and not optimism) was significantly and independently associated with anxiety in PwMS..

2.3.6.2 Perception of self

Eight studies investigated how participants' self-perceptions related to anxiety. This included four studies which investigated the relationship between anxiety and self-efficacy, with an additional study investigating falls self-efficacy. While most of these studies suggest self-efficacy as a potential mechanism for reducing anxiety, some mixed findings are evident. Jongen et al. (2016; 2019) investigated the effects on anxiety of treatment programmes which aimed to improve self-efficacy in PwMS. While significantly lower anxiety was found in participants with RRMS 12 months after treatment compared to at baseline, no such effect was found for participants with progressive MS (Jongen et al., 2016). Following another intervention to increase self-efficacy, participants had reduced anxiety symptoms one month after treatment, but not at three- and six-month follow-ups (Jongen et al., 2019). A further study found a significant negative correlation between both anxiety and self-efficacy and anxiety and self-esteem in a sample of young adults with MS (Uccelli et al., 2016). In contrast, Casey, Uszynski et al. (2018) found no significant correlation between anxiety and self-efficacy. In the one study which investigated falls-self-efficacy, it was found that fear of falling significantly predicted the variance in falls self-efficacy (Comber et al., 2017).

Four additional studies investigated other facets of participants' perception of themselves and their illness in general. Bogart et al. (2015) found that stronger disability identity (which involves affirming one's status as a member of a group that experiences disability) was a unique predictor of lower anxiety. Orr et al. (2018) found that anxiety symptoms, but not a clinical diagnosis of anxiety, was significantly associated with a perceived need for mental health care. Valvano et al. (2016) found a significant correlation between stigma and anxiety, with stigma indirectly affecting anxiety through "cognitive fusion". Cognitive fusion here refers to a common experience in which an individual has difficulty distinguishing between their thoughts and their experiences. However, direct effects of stigma on anxiety were found to be non-significant. Giordano et al. (2018) was the only study to investigate associates relating to fear for wheelchair dependency. This study found a significant negative association between fear for wheelchair dependency and risk knowledge. Given the diversity of measures used here, we cannot be confident of the precise role of illness and self-perceptions on anxiety.

2.3.7 Lifestyle factors

A total of 14 studies investigated the association between some modifiable lifestyle factor and anxiety. The most commonly investigated lifestyle associate here was physical activity, investigated in eight studies. Seven of these eight studies found significant results linking exercise to improved anxiety outcomes. For example, Taspinar et al. (2015) found significant improvements in anxiety symptoms in an MS population following an eight-week calisthenic exercise programme. Similarly, Hasanpour-Dehkordi et al. (2016) found that participants had significantly lower anxiety symptomology compared to controls following a twelve-week yoga intervention. Additionally, Fleming et al. (2021) conducted a home-based Pilates intervention specifically aimed at reducing anxiety in PwMS which was successful in doing so. Both studies investigating the relationship between fear of falling and lifestyle factors found significant results. Notably, Kalron et al. (2018) found that insufficiently active individuals had a significantly increased fear of falling, with further analysis showing that fear of falling significantly predicted the variance in physical activity. Seddighi-Khavidak et al. (2020) found that lavender oil use during balance exercises was associated with significantly lower fear of falling (potentially due to calming effect of lavender oil use) than when the exercises were completed without lavender oil. Keikhaei et al. (2018) found significantly lower state and trait anxiety in an MS population following a motor- balance exercise intervention, adding to the evidence linking physical activity with improvements in anxiety. Coote et al. (2017) compared the effects of coupling an exercise programme with two types of education programme, one focused on attention control and another based on Social Cognitive Theory (SCT). SCT outlines the relationship between an individual’s behaviour and observation of other people’s behaviours, personal characteristics and an individual’s environment. Specifically, this study included self-efficacy, outcome expectations, goal-setting, barriers and benefits as principle components of the SCT education intervention. Significant improvements in anxiety were found at three and six-month follow-ups for the SCT group. However, no significant effects on anxiety were found in the attention control group. In contrast to many of the findings outlined above, Gascoyne et al. (2019) found no association between physical activity as measured by a SNAP (smoking, nutrition, alcohol and physical activity) model and prevalence or severity of anxiety symptoms.

A few studies, including Gascoyne et al. (2019), investigated the relationship between anxiety and smoking or alcohol consumption. Gascoyne et al. (2019) found a significant association between smoking status, but not alcohol consumption, and anxiety severity. Pham et al. (2018) found a significant relationship between anxiety and smoking (using crude and adjusted odds ratios). However, when confounders were adjusted for, no significant relationship was found. Pham et al. (2018) also found no significant association between alcohol consumption and anxiety. In contrast to these findings, McKay et al. (2016) conducted a prospective study which found a significant association between anxiety at baseline and both alcohol dependence and smoking. It should be noted however that, despite this association at baseline, alcohol dependence had no significant effect on the participants’ odds of developing anxiety symptoms, at either the one- or two-year follow-ups. Carnero Contentti et al. (2021) found no association between cannabis use and anxiety. Similarly, Ramezani et al. (2021) found no association between smoking and anxiety in PwMS., Hanna & Stober (2020) found no association between substance abuse and anxiety. Finally, in the only study to investigate money management skills, it was found that individuals with efficient money management skills had lower state anxiety than inefficient individuals (Yael et al., 2019).

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2.3.8 Social factors

Six studies investigated social factors relating to anxiety. For example, Henry et al. (2019) found a negative correlation between anxiety and social support from friends. This relationship was confirmed as significant by a path analysis. Additionally, there was a significant negative correlation found between anxiety and social support from family and from significant others. However, these relationships did not stand up to more statistically robust analysis. Ratajska et al. (2020) found that higher social support was significantly associated with lower state and trait anxiety and found evidence to suggest that this association remains stable over time. Hanna and Strober (2020) and Altınkaynak Yılmaz & Ozdelikara (2022) also found statistically significant negative associations between anxiety and social support. While Sparling et al. (2017) looked at social participation, rather than social support, the study's findings add to the evidence that there may be an association between friendships and reduced anxiety symptomology. The study found that participants who interacted with friends in-person at least once per week were less anxious than those with less frequent friend interactions. Importantly, no such effect was found for participants who had regular interactions with friends in an online setting. Finally, Shaygannejad et al. (2021) found a significant correlation between fear of disease relapse in people with RRMS and social support.

2.4 Discussion

Study 1 aimed to establish the extent to which recent research has investigated modifiable associates of anxiety in MS. While some findings of this review were mixed, results suggest that a range of lifestyle, social and psychological factors may play a role in the experience of anxiety in people with MS. These findings offer some insight into how psychological wellbeing might be improved in this group, paving the way for targeted interventions in the area.

The modifiable factors most frequently investigated in relation to anxiety in MS were psychological factors, categorized broadly as those relating to (1) an individual's self-perceptions, and (2) their ability to cope with MS. Self-efficacy was the most researched construct relating to self-perceptions here (Casey, Uszynski et al., 2018; Jongen et al., 2019; Jongen et al., 2016; Uccelli et al., 2016), with this body of evidence suggesting that, overall, there is an inverse relationship between self-efficacy and anxiety in PwMS. These results suggest that self-management interventions which aim to increase self-efficacy in PwMS may have the potential to help reduce anxiety. Our findings are unsurprising given that associations between self-efficacy and anxiety have been well-established in general populations (Mills et al., 2006; Tahmassian et al., 2011). One explanation for this comes from SCT, which proposes that higher self-efficacy helps individuals to feel more in control over potential threats, and thus, helps them to avoid apprehensive thought processes associated with anxiety (Bandura, 1988). The results from our systematic review suggest that this might be of particular importance in reducing anxiety in younger populations and those with RRMS, however further research is necessary to investigate the effect of age on this relationship. It is also less clear as to the effects self-efficacy has on those with progressive MS, implying that any interventions designed to target anxiety should be tailored according to an individual’s disease status.

This review also shows how anxiety in MS is associated with an individual’s ability to cope with, and adjust to, their disease. While there was some variance in the specific concepts examined in the studies reviewed, there is evidence to suggest that developing interventions around these concepts of adjustment could have, and have had, beneficial effects on anxiety for PwMS. Notably, results unanimously suggest that higher levels of acceptance, as well as related concepts such as disability identity were associated with lower levels of anxiety (Grech et al., 2016; Oz & Oz, 2020; Van Damme et al., 2016). Similarly, three studies showed robust evidence of an association between mindfulness and improved anxiety outcomes (De la Torre, 2020; Mioduszewski et al., 2018; Pagnini et al., 2019). Given existing evidence supporting the efficacy of mindfulness interventions generally (Jayewardene et al., 2017), as well as their efficacy when delivered online to an MS population (Bogosian et al., 2015), the utility of these interventions is promising, particularly for PwMS wishing to improve anxiety symptoms while maintaining social distance. In addition, there was substantial evidence linking anxiety outcomes to a range of regulatory strategies, including stress-management, psychosocial adjustment, tenacious goal pursuit, and flexible goal pursuit (Jongen et al., 2016; Van Damme et al., 2016). Conversely, coping and regulatory strategies such as problem-focused coping, dysfunctional attitudes, and maladaptive emotional regulation, were associated with higher levels of anxiety (Prakash et al., 2019; Van Damme et al., 2016). Given these clear links between coping strategies and anxiety outcomes, it may be pertinent for MS service providers to assess the current coping strategies that PwMS depend on, as well as considering how best to foster more adaptive coping strategies associated with improved anxiety outcomes in MS.

Another notable finding from **study 1** was the robust evidence supporting associations between physical activity and anxiety (Casey, Uszynski et al., 2018; Fleming et al., 2021; Hasanpour-Dehkordi et al., 2018; Kalron et al., 2018; Taspinar et al., 2015). This finding was unsurprising given the wealth of evidence from both general and MS populations highlighting beneficial effects of physical activity (Conn et al., 2010; Latimer-Cheung et al., 2013). Learmouth and Motl (2016), who found links between improved quality of life and increased physical activity in PwMS, suggest that these benefits can at least be partially explained by improved self-efficacy, which, as we have shown, has also been linked to improved anxiety outcomes. The wealth of evidence tying physical activity to improved physical symptoms in PwMS means it is already recommended and prioritized in clinical practice and rehabilitation (Dalgas et al., 2009; Halabchi et al., 2017), however, our findings serve to emphasize the importance of physical activity for the treatment of anxiety comorbidities, further strengthening the case for developing targeted exercise programmes for PwMS.

Surprisingly, despite a wealth of evidence linking smoking and alcohol consumption to adverse outcomes for PwMS (Paz-Ballesteros et al., 2017; Wang et al., 2015) there were inconclusive results regarding the relationship of these behaviours with anxiety in our review (Gascoyne et al., 2019; McKay et al., 2016; Pham et al., 2018; Ramezani et al., 2021). One explanation for this may be offered by Pham et al. (2018), who found that depression partially or fully mediated the relationship between smoking and anxiety (Gascoyne et al., 2019; McKay et al., 2016; Pham et al., 2018; Ramezani et al., 2021). Similarly, investigation of links between cannabis consumption, as well as substance use found no significant links between these behaviours and anxiety outcomes (Contentti et al., 2021; Hanna & Strober, 2020). While the review findings mirror those from some studies conducted on general populations (Haynes et al., 2005), results of these individual studies do not provide enough evidence to make generalized conclusions, suggesting further research is warranted in this area.

There is more evidence to support the role of social support in reducing anxiety in MS. Of the six studies investigating social factors in our review, all of these highlighted the importance of social interactions and support in improved anxiety symptomology (Altınkaynak Yılmaz et al., 2021; Hanna & Strober, 2020; Henry et al., 2019; Ratajska et al., 2020; Shaygannejad et al., 2021; Sparling et al., 2017). The context of these social interactions may be crucial however, with Sparling et al. (2017) finding how weekly interactions with friends in-person was linked with better anxiety outcomes, while no such link was found between anxiety and online interactions. This finding could be expected, given the emerging evidence linking higher social media use with higher levels of anxiety (Baltacı et al., 2019; Vannucci et al., 2017). There is however a distinction between social media use and direct online contact. More research is required, however, to identify the specific aspects of social networks that could be improved to better address the social and emotional needs of PwMS in the context of the COVID-19 pandemic and beyond. Interestingly, in those studies that investigated different sources of social support (i.e., support from friends, family and/or significant others), social support from friends was consistently linked to better anxiety outcomes, while evidence linking anxiety and support from family and significant others was less conclusive (Altınkaynak Yılmaz et al., 2021; Henry et al., 2019; Shaygannejad et al., 2021). Overall, these findings suggest that the relationship between anxiety and social factors is significant and further research is warranted to evaluate methods of improving social support in PwMS.

2.4.1 Limitations of this review

Almost all included studies relied solely on self-reported measures of anxiety or fear. While self-reported measures are useful from a feasibility standpoint and as such are used commonly, they can also be subject to several biases, including social desirability bias, which can impact results. Additionally, studies which investigated social support in relation to anxiety used self-reported measures, which is particularly concerning as individuals with high anxiety can be prone to distorted perspectives as to the amount or quality of the social support they receive (Bruce & Arnett, 2009). Furthermore, most studies used a cross-sectional design, which makes it difficult to assess the directionality of the relationships explored. Through the quality appraisal process, it became evident that many studies could not provide clear evidence as to the representativeness of their sample (for example, some studies did not report the sociodemographic and MS-related characteristics of their sample), however, by excluding studies of low quality, we can be more confident in the strength of the review findings. Further limitations are that studies not available in English were not included in this review. In addition, only peer-reviewed journal articles were included, with unpublished studies and any form of 'grey literature' meeting exclusion criteria. Unfortunately, this makes included articles more likely to have some level of publication bias as unpublished material is more likely to include findings of non-significant relationships.

2.4.2 Conclusion

The findings of **study 1** highlight links between anxiety in MS and a number of diverse factors, all of which are amenable to change. Specifically, we show how anxiety in PwMS is linked to a variety of psychological, social and lifestyle factors.

Key concepts linked with better anxiety outcomes include a positive perception of self, an ability to adapt to the challenges of MS, adequate social support (particularly from friends) and an active lifestyle. These results have a number of potential implications for those working in MS rehabilitation, as well as for PwMS themselves. We argue that further research is needed to develop interventions which can target these modifiable factors in order to reduce the experience of anxiety in those with MS. Specifically, we suggest that group-based self-management interventions may have utility in reducing anxiety in PwMS by addressing the main associates of anxiety identified in this review; namely, self-efficacy, coping skills, physical activity and social support.

However, while the findings of this review highlight the relationship between anxiety and a number of modifiable associates, there is need for greater exploration of these factors in PwMS in order to help to inform the development of much needed supports. Furthermore, while the focus on modifiable factors in **study 1** is valuable for informing these supports, the exploration of associations between anxiety and sociodemographic factors may assists with the identification of PwMS who may be at increased risk of experiencing anxiety. Additionally, it is unclear how the context of the COVID-19 pandemic may have affected the experience of anxiety in PwMS, as well as the associations described here. To address these issues, and objective 2 of this thesis, Chapter 3 describes **study 2** which describes a cross-sectional, mixed-methods study of a large sample of PwMs living in Ireland and the UK.

Chapter 3:

Study 2: Anxiety in people with multiple sclerosis during the COVID-19 pandemic: A mixed-methods survey.

This chapter has been adapted from the publication: Fahy, A., & Maguire, R. (2023). Anxiety in people with multiple sclerosis during the COVID-19 pandemic: A mixed-methods survey. *Rehabilitation Psychology*.

Abstract

Background: During the COVID-19 pandemic, anxiety increased for many PwMS, however little is known about the factors which influenced this. Building on the results of **study 1**, this study aimed to identify psychosocial modifiable associates of anxiety in PwMS during the COVID-19 pandemic, while also exploring pandemic experiences of PwMS living in Ireland and the UK.

Method: A cross-sectional survey of 287 PwMS, designed with public and patient involvement included a number of validated measures and open-text questions. Hierarchical regression analysis investigated relationships between anxiety and (1) sociodemographic and (2) psychosocial modifiable factors, while reflective thematic analysis was applied to open-ended responses. **Results**: Self-efficacy, intolerance of uncertainty, social support, and exercise habits significantly predicted anxiety, with 58% of participants reporting increased anxiety during the pandemic. Themes identified from open-text responses related to personal health concerns, social concerns, and responsibilities/external burdens during the pandemic. **Conclusion:** Findings highlight the prevalence of anxiety experienced by PwMS during the pandemic, as well as a number of associates which could be applied to targeted interventions to reduce anxiety in this population.

3.1 Introduction

As detailed in Chapter 1**,** anxiety in PwMS has been linked with a number of negative psychological and physical outcomes, such as chronic pain and fatigue (Kalia & O'Connor, 2005, Wood et al., 2013). There is some discourse as to the exact prevalence of anxiety among PwMS, but it is generally accepted as being more common in this group than in the general population, with a meta-analysis suggesting a prevalence rate of 34% (Boeschoten et al., 2017). There are clear specific MS-related concerns surrounding anxiety, or worry about unpredictable future events, in MS, which most commonly follows a relapsing-remitting disease course defined by an unpredictable worsening, plateauing and improvement of symptoms (Pugliatti et al., 2006). Additionally, evidence from lesion studies suggests that, unlike depression, anxiety is not linked with physical abnormalities detectable by MRI and thus is likely to be the result of psychosocial factors (Morrow et al., 2018; Zorzon et al., 2001). This suggests that anxiety may be a good target for psychosocial intervention.

Given its known association with depression and other health outcomes, strategies for anxiety reduction may result in a variety of positive outcomes for PwMS (Morrow et al., 2018). Despite this, there is dearth of research into both the predictors and potential means of alleviating anxiety in PwMS (Feist, 2016). As outlined in **study 1** (Fahy & Maguire, 2022)**,** while there has been some evidence of the feasibility of reducing anxiety in PwMS by applying interventions which focus on factors such as physical activity, self-efficacy and mindfulness (which have been linked with improvements in anxiety across a number of populations and chronic conditions), there remains a need for the development of interventions designed to target anxiety while accounting for the experience of uncertainty and unpredictability inherent to the experience of MS.

Throughout the COVID-19 pandemic, there was concern that certain mental health outcomes including anxiety may have been impacted in the general population (Hyland et al., 2020). While more recent findings on this effect in general populations are mixed (Hyland et al. 2021), this period may have had particular impact on PwMS who may exhibit increased fears regarding COVID-19 specifically. In addition to potential impacts on anxiety, there have been reports of increased prevalence of depression and worsening of MS symptoms (sleep problems, fatigue) during the COVID-19 pandemic (Motolese et al., 2020). While some studies have shown that PwMS are not at an increased risk of COVID-19, once factors such as obesity and smoking are controlled for (Bsteh et al., 2021; Louapre et al., 2021), other research has shown how those taking certain immunosuppressant DMTs are at risk of worse outcomes (Barzegat et al., 2021; Jeantin et al., 2024). Furthermore, registry data from the UK suggests that PwMS may be more likely to suffer from long COVID (Garjani et al., 2021). At the time of data collection (January-April 2021) in Ireland and the UK there was significant social restrictions in place (Ryan et al. 2023) with some PwMS receiving advice to ‘cocoon’ (isolate oneself in the home) with considerable criticisms since aimed at how this advice was communicated (Gallagher, 2022). Many participants may have received their first COVID-19 vaccines in both the UK and Ireland during our data collection phase, with the first vaccines administered in each country just before data collection and a wider roll out occurring during data collection (Ryan et al. 2023). Many PwMS may have also experienced reduced access to healthcare services during this period in both Ireland and the UK.

However, in spite of potential physical health risks for certain individuals with MS, psychological distress in PwMS during the pandemic has been associated with psychological coping strategies, rather than MS disease-related variables or COVID- 19 risk factors (Alschuler et al., 2021). While the directionality of these relationships is unclear, these findings highlight the importance of psychological functioning during the pandemic in PwMS. In addition, as shown in **study 1**, it is likely that there are a number of other modifiable factors that influence the experience of anxiety in MS, but these have not been fully explored in the context of COVID-19.

In an attempt to inform the development of much needed interventions, **study 2** focuses on the investigation of modifiable associates of anxiety in MS, where a modifiable associate is defined as one that is reasonably amenable to change in a clinical context and not a prevalent symptom of MS, after controlling for a range of sociodemographic and health factors. The secondary aim of this study is to assess the perceived impact of COVID-19 on anxiety in PwMS as well as investigating the experiences of PwMS during the pandemic.

3.2 Methods

3.2.1 Design and sample

This study involved a mixed methods cross-sectional design, with survey development informed by the systematic review of modifiable factors in anxiety in MS presented in **study 1** (Fahy & Maguire, 2022) and PPI from a sample of 8 people with MS. Evidence suggests that 'lay knowledge' provided by PPI contributors adds valuable context as well as aiding the identification of variables which should be chosen for analysis (Hannigan, 2018).

Prior to the development of the survey used in this study, a meeting was organised between the researchers involved in survey design and the PPI panel. This PPI panel meeting was conducted in September 2020 over Microsoft Teams. This panel was comprised of 8 people who differed in gender, age and years diagnosed with MS. The panel was organised in collaboration with MS Ireland with the goal of discussing the feasibility of the proposed study design and receiving input from those involved. As part of this discussion, each person with MS gave accounts of their own experience with anxiety and MS as well as their opinions on the proposed methodology. This discussion was summarized and presented back to the group via email. At this point the PPI panel had the opportunity to judge if this account was an accurate representation of the meeting and whether they would like to provide any additional feedback.

All variables assessed in the final survey were chosen with consideration of the input from the PPI panel. In particular, the concept of feeling in control was seen as important in relation to anxiety, along with the value of social support and lifestyle behaviours such as exercise. Furthermore, reacting to the unpredictability of future events (intolerance of uncertainty) was highlighted as an important factor by several participants in the PPI panel. In addition, while it was not featured as a significant factor in study 1, optimism was chosen to be included in this survey based on PPI input. Finally, self-efficacy, acceptance of MS and the importance of anxiety reducing behaviours were all discussed by the panel.

A mixed-methods design was chosen in order to allow for both the quantitative investigation of associations between anxiety and potential associates as well as the qualitative exploration of the experiences of PwMS during the COVID-19 pandemic, with the cross-sectional design chosen as the most feasible means of addressing these aims, particularly within the context of the COVID-19 pandemic.

In order to be eligible to participate, respondents had to be diagnosed with MS, aged over 18, be fluent English speakers, with no previous diagnosis of anxiety. Ethical approval was granted from Maynooth University Social Research Subcommittee in December 2020. The survey was published online using Qualtrics software (Qualtrics, Provo, UT, Version April 2021). Power calculations conducted using G*Power software (Faul et al., 2009) indicated that a sample of 199 participants was suitable for this analysis. Recruitment took place between January-April 2021 following promotion of the survey in collaboration with MS Ireland and among a private Facebook group for PwMS in the UK and Ireland (see Appendix A). Participants who used the link to the Qualtrics survey were first presented with an information sheet (Appendix B) describing the study procedure and aims as well as their rights regarding consent. If participants granted consent, they were then directed to the survey itself which generally took participants between 10-25 minutes to complete.

3.2.2 Measures

3.2.2.1 Sociodemographic factors

Participants were asked to provide basic demographic and disease-related information including age, gender, employment status, living status, marital/relationship status, country of residence, time since diagnosis and MS type (RRMS, PPMS, SPMS, or unknown/other).

3.2.2.2 Anxiety

The anxiety subscale of the Hospital Anxiety and Depression Scale (HADS-A) was used as a measure of anxiety given its previous validation in MS populations (Honarmand & Feinstein 2009). The HADS-A includes 7 items (e.g., “I can sit at ease and feel relaxed") answered using a 4-point Likert scale (definitely, usually, not often, not at all). Total HADS-A scores range from 0 (no symptoms) to 21 (most severe symptoms). A score of >8 indicates general anxiety disorder with a sensitivity of 88.5% and specificity of 80.7% (Honarmand & Feinstein, 2009). HADS-A had good reliability in our sample (Cronbach’s Alpha=0.89).

Participants were also asked to rate their agreement with a single-item measure (‘My feelings of anxiety have increased as a result of the COVID-19 pandemic’) on a 5-point scale ranging from 1 (strongly disagree) to 5 (strongly agree). Using an open-text response, participants were asked ‘If you would like to, please comment on how your levels of anxiety have been impacted by the COVID-19 pandemic’.

The remainder of the questionnaire included measures hypothesized to have relationships with anxiety from the findings of **study 1** and with input from the PPI panel.

3.2.2.3 Exercise habits

The Godin Leisure-Time Exercise Questionnaire (GLTEQ) (Godin, 2011) was used to measure exercise habits. Here, participants indicate how many times they engage in sessions of mild/light, moderate and strenuous exercise in a typical week (where sessions are periods of activity exceeding 15 minutes). Scores are calculated by multiplying the number of mild/light, moderate and strenuous exercise sessions by 3, 5 and 9 respectively and summing these. The GLTEQ is a validated tool for assessing exercise habits in PwMS and an appropriate tool for assessing the correlates and outcomes of physical activity (Sikes et al., 2019).

3.2.2.4 Social support

Perceived social support was measured using the Multi-dimensional Scale of Perceived Social Support (MSPSS, Zimet et al., 1988). The MSPSS includes three subscales - family, friends, and significant other. Each source is evaluated by the sum of four items, with answers scored between 1 (strongly disagree) and 7 (strongly agree). Total scores range from 4-28, with higher scores indicating higher perceived social support. The scale has been used frequently in MS populations with good reliability and high internal consistency (Cronbach’s Alpha > 0.9) (Hyarat & Al-Gamal, 2018). The Cronbach’s alpha in the current sample was 0.93.

3.2.2.5 MS control

Perceived control of MS was measured using the control subscale of the Multiple Sclerosis Self-Efficacy scale (MSSE) (Rigby et al., 2003). This contains 9 items, each answered on an integer scale from 10-100, with total scores ranging from 90-900. Each item asks participants to rate their certainty in relation to some facet of their ability to control their MS symptoms (e.g. “How certain are you that you can control your fatigue?”). The MSSE control subscale has a high level of internal consistency as well as good reliability (Schwartz et al., 1996), with a Cronbach's alpha in our sample of 0.94.

3.2.2.6 Acceptance of MS

Acceptance of MS was measured using the Acceptance of Chronic Health Conditions Scale (ACHC) (Stuifbergen et al., 2008). This contains 14 items relating to different facets of MS acceptance (e.g., "I've come to terms with my MS"), with participants rating their agreement on a five-point Likert scale. Total scores range from 14-70 where higher scores reflect a greater level of acceptance. The ACHC has been tested in MS populations and shown good reliability and internal consistency (Cronbach's Alpha= 0.82) (Stuifbergen et al., 2008). Cronbach's alpha in our sample was 0.87.

3.2.2.7 Intolerance of uncertainty

Intolerance of uncertainty was measured using the short version of the intolerance of uncertainty scale (IUS-12) (Carleton et al., 2007). The IUS-12 contains two subscales- the inhibitory anxiety subscale and the prospective anxiety subscale, which each relate to a different facet of intolerance of uncertainty. Prospective anxiety is measured by seven items assessing an individual's preference for predictability and their propensity to act towards improving this perceived predictability. Inhibitory anxiety is measured by five items which assess the individual's reaction to uncertainty as well as their propensity to avoid uncertain situations. All answers are logged on a 5-point Likert scale ranging from 1 (not at all characteristics of me) to 5 (entirely characteristic of me). Total scores (ranging from 12-60) can also be calculated by combining the scores from the individual subscales. It has been suggested that the IUS-12 be used for exploration of intolerance of uncertainty in PwMS (Alschuler & Beier, 2015). Cronbach's alpha in our sample was 0.92.

3.2.2.8 Optimism

In order to assess levels of optimism, participants were asked to rate their agreement with a single-item measure ("I am optimistic about my future"), taken from the European Quality of Life Survey (Eurofound, 2017). Response were rated on a 5-point Likert Scale, ranging from strongly agree to strongly disagree.

A final open text item at the end of the survey asked participants to provide additional comments relating to any aspect of the survey or their personal experience.

3.2.3 Data analysis

Descriptive statistics were first calculated, including means, ranges and standard deviations for continuous variables, and frequencies/percentages for categorical variables. Spearman's rho

correlations assessed associations between the dependent variable (HADS-A) and the independent variables. Correlational analyses showed no multicollinearity, with the assumptions of linearity and homoscedasticity also met. A hierarchical multiple regression model was constructed to assess the relationship between HADS-A scores and (1) sociodemographic factors (gender, age, time since diagnosis, MS type, employment status, living status, country of residence, relationship status), and (2) potentially modifiable psychosocial factors (GLTEQ, IUS-12, ACHC, MSSE control, MSPSS, optimism).

Analysis of the open-text responses was conducted according to the principles of reflexive thematic analysis (Braun & Clarke, 2006; 2019). In an effort to acknowledge the positionality of researchers it should be noted that the primary researcher comes from a perspective of a 'male doctoral researcher with no experience of MS diagnosis, individually or in their immediate family', while the research supervisor is a person living with MS, and has links with MS Ireland, and therefore has the potential to identify with the participants in the study. This began with the process of data immersion, reading and re-reading responses followed by preliminary coding. These codes were then combined to form some basic themes which were reviewed, combined, and refined to form stronger over-arching themes. These themes were then revised again to ensure data saturation, the point at

which no other themes or codes were identifiable by the reviewers. Findings of the analysis were finally compiled and reported.

Qualitative and quantitative findings were integrated through narrative using a contiguous approach (Fetters et al., 2013). A contiguous approach was chosen given its utility for research where the quantitative (factors associated with anxiety) and qualitative approaches (experience of PwMS with anxiety during the COVID-19 pandemic) have slightly different focuses and is common in research where qualitative research aims to provide contextual information that expands upon quantitative findings. This process involves reporting quantitative (section 3.4.1) and quantitative findings (3.4.2) in separate sections within a singular report (Yaqoob & Barolia, 2023).

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3.3 Results

3.3.1 Descriptive statistics

Descriptive statistics are displayed in Tables 3.1 and 3.2. A total of 287 participants responded to the survey. The sample was predominantly female (91.3%) ranging in age from 19-86 years. The majority were living with others (91.7%), married (75.3%), with almost all living in the UK (61.7%) or Ireland (36.6%). An almost equal amount were not currently working (39%) or in full-time employment (37.3%), with the remainder working part-time (23.4%). The majority had been diagnosed with RRMS (82.2%), in line with the expected MS prevalence (Ghasemi et al., 2017).

The mean HADS-A score was 10.4, with 72.2% scoring above the clinical cut-off (>8) (Hansson et al., 2009). Specifically, 27.8% of participants reported non-clinical levels of anxiety, while 19.5% reported mild levels, 33.2% reported moderate levels and 19.5% reported severe levels of clinically significant anxiety. 57.7% percent of participants reported that their levels of anxiety had increased as a result of the COVID-19 pandemic (25.9% = no change, 16.4% = decreased anxiety). Perceived social support varied, with the mean score of 52.92 indicating generally high levels of social support. Levels of MSSE control and MS acceptance also varied. There were wide variations in the reported GLTEQ scores, indicating a wide variability in exercise habits, with some implausibly high scores indicating potential difficulties with participants' engagement with the measure. As such, these outliers (more than two standard deviations from the mean) were excluded from analysis. Similarly, there was a high percentage of missingness (18.8%) of GLTEQ data, which was largely a result of participants logging their responses as general descriptions of their exercise habits, as opposed to a numerical indication of the number of 15-minute sessions of exercise they complete, as the measure requires. There was also a high percentage of missingness (14.6%) of MSSE data, however the reasons for this are less clear.

Table 3.1

Sample demographics

Variable	N	(%)
Gender		
Male	25	(8.7%)
Female	262	(91.3%)
Missing	-	-
MS type		
Relapsing Remitting MS	236	(82.2%)
Primary Progressive MS	12	(4.2%)
Secondary Progressive MS	26	(9.1%)
Other	4	(1.4%)
Unknown	9	(3.4%)
Missing	-	-
Employment status		
Full-time employed	107	(37.3%)
Part-time employed	67	(23.4
Not currently working	112	(39%)
Missing	1	(0.3%)
Living Status		
Living alone	23	(8%)
Living with others (no dependants)	115	(40.1%)
Living with others (including dependants)	148	(51.6%)
Missing	1	(0.3%)
Marital/relationship status		
Married/cohabiting	216	(75.3%)
In a relationship but not cohabiting	22	(7.7%)
Not in a relationship	49	(17.1%)
Missing	-	-
Country of residence		
Ireland	105	(36.6%)
UK	177	(61.7%)
Other	5	(1.7%)
Missing	-	-

Table 3.2

Descriptive statistics for continuous variables

Variable	Mean	SD	N	Range	Missing (%)
Age	52.15	15.63	287	19-87	0 (0%)
TSDX (years)	8.03	7.68	278	0-40	9 (3.1%)
HADS-A	10.36	4.74	285	0-21	2 (0.7%)
COVID anxiety	3.63	1.14	286	1-5	1 (0.3%)
MSPSS	52.92	14.43	271	0-72	16 (5.6%)
MSSE Control	51.87	21.25	245	10-100	42 (14.6%)
ACHC	29.89	7.74	261	10-50	26 (9.1%)
IUS-12	33.33	10.29	254	12-60	33 (11.5%)
GLTEQ	37.24	63.98	233	0-540	54 (18.8%)
Optimism	2.75	1.01	253	1-5	26 (9.1%)

Abbreviations: HADS-A (Hospital Anxiety and Depression Scale Anxiety Subscale), TSDX (Time Since Diagnosis), GLTEQ (Godin Leisure-Time Exercise Questionnaire), MSPSS (Multidimensional Scale of Perceived Social Support), MSSE control (Multiple Sclerosis Self-Efficacy Scale), ACHC (Acceptance of Chronic Health Conditions Scale), IUS-12 (Intolerance of Uncertainty Scale-12), Optimism (single item measure).

3.3.2 Hierarchical regression analyses

A correlational analysis was first conducted to explore the relationship between HADS-A scores and the other study variables (see Table 3.3). HADS-A was significantly correlated with all modifiable associates with the exception of the GLTEQ (more discussion of this measure in this study is included in section 3.4 and section 3.4.3). Gender and age also significantly correlated with HADS-A, with none of the other sociodemographic variables assessed correlating significantly with HADS-A scores. Table 3.4 displays the results of the hierarchical regression analyses, where HADS-A was the dependent variable. Block 1 comprised of sociodemographic variables including age, employment status, living status, relationship status, gender, country of residence, MS type, and time since diagnosis. Overall, this block was not significant, predicting 3.1% of the variance in HADS-A scores ($F(8,171) = 1.72$, $p > 0.05$). Block 2 consisted of the modifiable factors, specifically GLTEQ, MSPSS, IUS-12, ACHC, and MSSE control, and optimism. This block was significant, predicting a further 33.3% of the variance ($F(14, 165) = 8.33$; $p < .001$). Of the factors included, only ACHC scores and optimism did not contribute uniquely to the model's predictive power. Overall, the final model predicted 36.4% of the variance in HADS-A scores. In order of magnitude, the strongest predictors were self-efficacy ($\beta = -0.41$, $p < .001$), intolerance of uncertainty ($\beta = 0.35$, $p < .001$), social support ($\beta = -0.21$, $p < .005$) and exercise habits ($\beta = 0.19$, $p < .01$).

Table 3.3

Correlation matrix for hierarchical regression of HADS-A scores

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. HADS-A	-															
2. Gender [1=male, 2=female]	.181**	-														
3. Age	-.118*	-.112	-													
4. MS Type [1= RRMS, 2=Other]	-.011	-.180**	.382**	-												
5. Time since diagnosis	-.108	-.182**	.477**	.293**	-											
6. Employment Status [1=employed, 2=other]	.092	-.107	.313**	.01	.22**	-										
7. Living Status [1=lives alone;2=lives with others]	.010	.003	-.044	-.067	-.066	-.001	-									
8. Country of Residence [1=Ireland; 2= UK]	-.021	.133*	.06	-.065	-.145*	-.038	.051	-								
9. Relationship status [1=in a r'ship 2= not in r'ship]	.075	.072	-.171**	-.052	-.042	.094	-.526**	-.049	-							
10. GLTEQ	.01	-.061	-.269**	-.115	-.048	-.162	.006	-.074	.132	-						
11. MSPSS	-.32**	-.175**	-.029	-.031	-.018	-.097	.164**	.018	-.311**		-					
12. MSSE control	-.487**	-.095	-.105	-.113	-.029	-.238**	-.107	-.085	.004	.371**	.206**	-				
13. ACHC	-.327**	-.127*	.039	.004	.132*	-.121	-.03	.024	-.045	.239**	.296**	.513**	-			
14. IUS-12	.459**	.182**	-.095	-.098	-.117	.088	.069	-.065	.019	-.144*	-.229	-.376**	-.478**	-		
15. Optimism	.284**	-.002	.095	.013	.001	.15*	-.044	.058	.086	-.111	-.365**	-.471**	-.558**	.351**	-	
16. COVID-19 Anxiety	.49**	.139*	-.057	.023	-.126*	.121*	.017	-.017	.098	-.053	-.246**	-.378**	-.227**	.265**	.217**	-

**p<0.01 *p<0.05

Table 3.4

Hierarchical Regression Analysis Investigating Predictors of HADS-A Scores

Variables	**β**	**p**	**t**	**B**	**SE**	**CI95%**	
Step 1: Sociodemographic factors							
Gender [1=male, 2=female]	0.03	.675	0.42	0.46	1.10	-1.72	2.64
Age	-0.03	.706	-0.38	-0.01	0.04	-0.08	0.06
MS Type [1= RRMS, 2=Other]	0.03	.654	0.45	0.37	0.82	-1.25	1.98
Time since diagnosis	-0.13	.068	-1.84	-0.09	0.05	-.018	0.01
Employment Status [1=employed, 2=other]	0.01	.851	0.19	0.13	0.67	-1.19	1.44
Living Status [1=lives alone;2=lives with others]	-0.04	.544	-0.61	-0.84	1.38	-3.56	1.89
Country of Residence [1=Ireland; 2= UK]	-0.05	.478	-0.71	-0.45	0.63	-1.69	0.80
Relationship status [1=in a r’ship 2= not in r’ship]	-.008	.299	-1.042	-1.0	0.96	-2.89	0.89
Adjusted R^2 Change=0.031							
Step 2: Modifiable factors							
GLTEQ	0.19**	.006	2.78	0.04	0.02	0.01	0.07
MSPSS	-0.21**	.003	-3.01	-0.07	0.02	-0.11	-0.02
MSSE control	-0.41***	.000	-5.11	-0.01	0.02	-0.13	-0.06
ACHC	0.04	.616	0.50	0.03	0.05	-0.08	0.13
IUS-12	0.35***	.000	4.77	0.16	0.03	0.10	0.23
Optimism	-0.01	.346	-0.95	-0.36	0.38	-1.01	0.39
Adjusted R^2 Change=0.333							
Adjusted R^2 =0.364							

Statistical significance:*p < .05;**p < .01;***p < .001

3.3.3 Thematic analysis

347 responses were provided for the two open-text questions. From this, four main themes were identified. In addition to main themes, 11 sub-themes were constructed. Table 3.5 provides a summary of these themes along with representative quotes. These themes are discussed in more detail in the following sections.

Table 3.5

Themes Identified from the Open-text Responses

Theme	Sub-themes	N	Representative Quotes
Personal health concerns (n=121)	Health concerns related to catching COVID-19	68	*'Nothing like extensive self-isolation because everyone you know keeps saying only people with chronic illnesses are at risk. And you realise they haven't even considered that you fall into that category. My anxiety is now so consistent, it may as well be a personality trait.'*
	Anxiety about MS	18	*'I'm constantly worried and anxious since my MS diagnosis came during lockdown'* *'As my vision is impacted with MS I wake every morning wondering if I can see properly. The optic neuritis storyline in coronation st makes me anxious about the potential progress of my disease in the future'*
	Comorbid conditions to MS	11	*'I have ptsd and hate being indoors'* *'Had my first bipolar episode'*
	Uncertainty	13	*'its the uncertainty that stresses me most'* *'ms is so unpredictable, COVID is also unpredictable. I find this scary.'*
Social Concerns (n=71)	Lack of social interaction	43	*'Not being able to meet friends/family during COVID has affected me very significantly'* *'Isolation and being outdoors less has had an impact on my general well-being including anxiety levels'*
	Anxiety about family health	16	*'Friends and family have died - only one due to the impact of the pandemic - I'm worried about losing more of them and have difficulty not being able to hold proper funerals.'*

Responsibilities and additional external burdens (n=40)	Employment	25	*‘I have liquidated my business and am now unemployed and home schooling a 6 yr old. My husband works and we are fine on his income but I feel like I have lost my sense of self through this pandemic and my anxiety had increased hugely.’*
	Responsibility to dependents	16	*‘My anxiety levels vary daily. It depends on pressures such as home schooling, working full time’*
No effect/ Positive effect of the COVID-19 Pandemic (n=34)	No effect of COVID-19 on Anxiety	22	*‘I have not been more anxious’*
	Opportunity for reassessment	3	*‘I am using COVID-19 to look at how i react & cope with situations and people & looking at how to cope better in similar situations in future’*
	Health improvements	2	*‘I have been able to rest up when needed, as opposed to always being active and available (at work in the office). Being able to take regular breaks has greatly impr[o]ved my mental and physical health. Being able to prepare for presentations etc im my own space and time has improved anxiety around these issues, and helped the cog fog ease in these situations.’*
	Reductions in anxiety	7	*‘I actually think [sic] having to stay at home to work has helped ease anxiety. I do not really like to socialise as MS makes that difficult at times.’*

3.3.3.1 Personal health concerns

Many participants described personal health concerns experienced during the pandemic (n=121), making this the most common theme identified. Responses were further categorised into subthemes including experiences of uncertainty, anxiety about MS, and worry over coexisting conditions. However, the most frequently reported subtheme was health concerns relating to catching COVID-19 itself. While some participants simply reported general worries about catching the virus, many included a discussion of how their concerns had impacted their behaviour, for example resulting in a fear or avoidance of social situations (n=24), or how their concerns were heightened as a result of MS or undergoing specific treatments (n=15). Shopping or any experience involving potentially crowded places was a source of anxiety for many. While some participants seemed to experience anxieties only under certain social contexts, many reported anxieties that went beyond social situations extending to anxiety about existing outside the home, even sharing similarities with symptoms of agoraphobia. Not feeling comfortable in spaces outside the home has obvious negative connotations, with many participants reporting the resultant lack of social interaction and reduction in exercise as increasing both anxiety and MS symptoms.

Some participants highlighted how their MS or treatment (particularly immuno-suppressant treatments) increased their vulnerability to COVID-19, which in turn led to increases in anxiety. Furthermore, some participants reported that this increased anxiety had caused a worsening in MS symptoms. Expanding on this, many reported anxiety about MS that was unrelated to the perceived risk of contracting COVID-19. The restrictive nature of the pandemic caused a disruption to participants’ exercise behaviours which some participants (n=5) reported as negatively affecting their mobility. Even aside from the negative effects of reduced exercise, rumination about potential future difficulties surrounding MS was a source of anxiety for a number of participants, with perceived links reported between this anxiety and negative physical outcomes (e.g. increased pain).

A few participants (n=11) highlighted that they had conditions comorbid to MS. There were a range of comorbidities reported, the most frequent of which were psychological comorbidities (n=5). One participant reported experiencing anxiety, but that they were unclear that this was related to MS. Other participants' descriptions of comorbidity generally related to how they had made the pandemic a more difficult experience.

Perhaps unsurprisingly given the links between tolerance of uncertainty and anxiety, several participants discussed uncertainty they felt during the pandemic as the cause of their anxiety. Furthermore, one participant even drew direct links between uncertainty and worsening of their physical symptoms.

3.3.3.2 Social concerns

Many participants (n=71) reported concerns or anxieties relating to their relationships or interactions with others (predominantly family or friends). These concerns were divided into two clear categories: anxiety about family health, and lack of social interaction. This theme is distinct from the theme of fear or avoidance of social interaction described previously. Here the concern related to the effects of insufficient social interaction, whereas the previous theme dealt with concerns related to the actual act of engaging in a social situation. While some participants simply stated that they were experiencing a lack of social interaction, many made direct links between this and an increase in their anxiety. Participants noted that online as opposed to in-person interaction was unsatisfactory, with several participants noting how they felt less competent socially due to the isolation they had experienced. Many participants reported protective or restorative effects of social interaction and lamented the loss of these effects during the pandemic.

Anxiety about family health was another frequently reported subtheme (n=16). Interestingly, reports of worry or concern about the health of others was almost entirely centered on family health, with very little reports of concern for friend health comparative to the number of reports about the benefits of interacting with friends. Of those reporting concern about family health, the vast majority were concerned with their family catching COVID-19 or dying as a result of COVID-19. Some participants had experienced bereavement and reported this and the potential for further bereavement as their primary source of anxiety.

3.3.3.3 Responsibilities and additional external burdens

Many participants (n= 40) reported that their anxiety had been affected by factors relating to their responsibilities or burdens for which they were accountable. These responses were divided into two subthemes: responsibilities to dependents (n=14) and employment (n=24).

Of the group who raised concerns relating to their responsibility to dependents, many reported the increased burden of homeschooling their children, citing a resultant increase in stress and anxiety. Of those who did not refer to homeschooling, anxiety about future self-efficacy, either due to the symptoms of MS or the potential effects of COVID-19, were exacerbated by the perceived need to provide for their children and the perception that this provision is necessary for their children's well-being.

Given this perceived need for financial provision, it is unsurprising that many raised concerns about employment. While some of these concerns related to how employment enables this provision, most participants did not make reference to dependents. There were other elements to this anxiety as well, beyond financial concerns. While many participants simply stated that work had been a source of stress or anxiety, there was evidence that for some participants the loss of employment had resulted in a perceived loss of purpose. Reasons for concern around employment were split, with most participants describing how the pandemic had affected their work. Additionally, several participants described how the source of their anxiety was uncertainty as to their employability in the future, due to their MS.

3.3.3.4 No effect/positive effect of the COVID-19 Pandemic

While the majority of open-text responses, such as those above, referred to ways in which the COVID-19 pandemic increased anxiety or stress (n=141), a number (n=34) of participants reported that their anxiety had been unaffected or decreased during the pandemic. Some noted how they experienced an opportunity for reassessment, health improvements, and reductions in anxiety. Additionally, many reported reduced social and travel responsibilities, often as result of working from home - activities that had previously been the source of anxiety – that had led to a beneficial effect. Several participants reported that this reduced responsibility allowed for the management of MS symptoms with increased flexibility for resting.

3.4 Discussion

The findings of this study highlight how a range of potentially modifiable psychosocial factors are associated with anxiety in MS, thereby extending on the findings of **study 1**. Furthermore, results give an insight into the impact that the COVID-19 pandemic (specifically the period of January to April 2021, in which data collection took place) had on PwMS, illustrating how this affected a range of different domains of life. Taken together, these findings may help inform the development of interventions designed to decrease anxiety in this population, opening up promising directions for future research.

The experience of anxiety was elevated in our sample. Specifically, the mean HADS-A score was higher than in other studies involving MS populations prior to the pandemic (Pais-Ribeiro et al., 2018). In our sample, 72.2% of respondents scored above the recommended clinical cut-off for the HADS-A scale. A meta-analysis conducted before the COVID-19 pandemic estimated 22.1% prevalence of clinically significant anxiety in PwMS (Boeschoten et al., 2017) with some studies assessing prevalence during the pandemic reporting slightly higher rates (Ramezani et al., 2021, Valentine et al., 2022). While our results are somewhat reflective of the high levels of anxiety experienced during the COVID-19 pandemic and associated lockdowns observed in general populations (Hyland et al., 2020, Hyland et al., 2021), the extent of anxiety reported was higher than in population- based studies (), suggesting that PwMS were particularly impacted (57.7% reported an increase in anxiety). This may be partially attributed to the predominantly female (91.3%) sample in our study, as females generally report higher levels of anxiety than males, both in general populations and in PwMS (Théaudin et al., 2016, McLean & Anderson, 2009). However, it is clear that gender is not the only reason for the elevated levels of anxiety observed. Our results suggest that PwMS experienced a number of specific concerns related to the pandemic that may have contributed to this.

3.4.1 Predictors of anxiety

Despite existing evidence linking acceptance with anxiety in PwMS (Kiropoulos et al., 2019, Van Damme et al., 2016), acceptance of MS and optimism were the only non-demographic factors which did not significantly predict the variance in anxiety scores. However, examination of the findings show how a number of modifiable factors were associated with anxiety. Of these, perceived control (self-efficacy) was the strongest predictor in our model. This is consistent with **study 1** (Fahy & Maguire, 2022) and previous research that has highlighted the impact of self-efficacy on anxiety (Uccelli et al., 2016, Jongen et al., 2019, Jongen et al., 2016). Earlier research has shown how having an external locus of control (believing that events that occur are outside of one's control) has previously been linked with higher anxiety and higher emotional distress (Vuger-Kovačić et al., 2007, Brown et al., 2005). The concept of perceived control is an aspect of the concept of self- efficacy which has also been found to have an inverse relationship with anxiety, with some evidence to suggest that interventions targeting self-efficacy may have utility in anxiety reduction for PwMS (Uccelli et al., 2016, Jongen et al., 2019, Jongen et al., 2016). Our results suggest that this may have been particularly important in the context of the COVID-19 pandemic, with the extent of perceived control potentially reducing the likelihood of experiencing anxiety.

Intolerance of uncertainty has been found to significantly predict the variance in anxiety symptoms in the general population during the COVID-19 pandemic (del Valle et al., 2020), as well as being linked with heightened anxiety and lower control across a number of health conditions including MS (Alschuler & Beier, 2015). It is unsurprising then that we found a relationship between intolerance of uncertainty and anxiety. Furthermore, in the open-text responses many participants explicitly stated that their distress/anxiety was linked to increased uncertainty during the pandemic. Intolerance of uncertainty has been shown to be responsive to intervention in a recent pilot study involving PwMS (Molton et al., 2019), however it should be noted that this intervention was not associated with resultant changes in anxiety. As this was a pilot study, it is likely that more research is needed here.

Another notable finding from this study was the significant relationship observed between anxiety and exercise habits, with higher exercise associated with higher anxiety in the regression model. However, the direction of this relationship at multivariate level was the inverse of what was reported by the qualitative data, where some participants reported exercise to be a beneficial strategy for managing their anxiety. These conflicting findings may be explained by the measure of exercise used in this study. Specifically, there is evidence to suggest that some participants had considerable difficulty completing the GLTEQ, and we suggest that this may not be a good measure for use with samples who may experience cognitive difficulties. This is discussed further in section 3.4.3. Our qualitative findings here mirror our findings in **study 1.** Given the efficacy of home-based exercise interventions in improving anxiety and MS symptoms in PwMS (Aydin et al., 2014), there may be a need for the further promotion of such measures to balance the frequent reports of reduced exercise as a result of shielding (Fleming et al., 2021). Furthermore, as a modifiable lifestyle factor, exercise represents an excellent candidate for the creation of targeted interventions.

It is also clear from this study that social support may have a strong relationship with anxiety. There were frequent reports of the negative effect that reduced social support during the pandemic had on anxiety for PwMS, as well as reports of the positive impact that social support has on reducing anxiety. This was also evident in our findings of a significant relationship between social support and anxiety, which is consistent with findings from the wider literature as well as our findings in **study 1** (Henry et al., 2019, Ratajska et al., 2020, Altınkaynak Yılmaz & Ozdelikara, 2021). Similarly, reports of anxiety surrounding employment in the open-text responses aligned with findings of a positive relationship between anxiety and unemployment in our sample, however this relationship was not significant after accounting for Block 2's predictor variables. Other recent research from general populations have found significantly higher anxiety in those who lost income during the pandemic, as well as reporting findings of a significant relationship between employment status and anxiety symptoms in PwMS during the pandemic (Hyland et al., 2020, Alirezaei et al., 2022).

Building on the findings of **study 1,** it is possible that a number of supports may have benefitted PwMS who experienced elevated anxiety during the pandemic. For example, findings surrounding the importance of social support suggest the potential value of formalized peer support (Russell et al., 2023), which is explored in greater detail in subsequent chapters. Similarly, while findings related to exercise were inconclusive here, the findings of **study 1** and from wider literature (Fleming et al., 2021; Hasanpour-Dehkordi et al., 2016; Pilutti et al., 2014; Taspinar et al., 2015) suggest the potential efficacy of exercise interventions in assisting the management of anxiety symptoms. Furthermore, associated psychological factors can be targeted by a range of therapies and interventions. For example, self-efficacy may be positively influenced by engagement with CBT (Yang et al., 2022), SCT-based behavioral coaching (Coote et al. 2017) or through ACT (Wilson et al. 2020), with further research necessary to understand factors which influence the efficacy and acceptability of these approaches for alleviating negative experiences of anxiety in PwMS.

3.4.2 COVID-19 impacts on anxiety

Despite the majority of participants (57.7%) reporting that COVID-19 had a negative effect on their experience of anxiety, it is notable that a number of respondents reported reductions in anxiety. For some, this was attributed to being able to work from home (WFH), which has been previously established as having benefits for some PwMS, particularly for those whose work demands exceed their individual capacity for work (Doogan & Playford, 2014). Evidence from existing literature involving people with disabilities, as well as our qualitative data, suggests that WFH can benefit PwMS by helping with the management of symptoms such as fatigue and reduced mobility (Martel et al., 2021, Kruse et al., 2022). Taken together, these findings highlight the potential value of WFH accommodations for PwMS and suggests that employers should offer this opportunity to PwMS where possible, particularly to offset issues that many PwMS may experience with regards to full-time employment (Strober et al., 2020).

Reports of increased personal growth and posttraumatic growth following the SARS (Severe Acute Respiratory Syndrome) pandemic support the reports of benefits of reassessment experienced by some participants (Tamiolaki & Kalaitzaki, 2020). Posttraumatic growth here refers to the process by which one reevaluates and adapts following traumatic events such as loss of a family member which many would have experienced during the COVID-19 pandemic This reflects evidence suggesting a significant relationship between personal growth and anxiety in general populations (Liu et al., 2009). The potential for positive impacts during the pandemic was highlighted by Vacaras (et al., 2023), where reduced anxiety in PwMS was reported despite significant increases in stress. Given this potential, it is perhaps unsurprising that meta- analytic data suggests there may not have been an overall increase in anxiety in PwMS during the pandemic (Altieri et al., 2022).

Many factors could explain the discrepancy between our findings and this report, including differences in case numbers, risk perception, adherence to social health guidelines and lockdown restrictions between countries assessed, in addition to time period assessed, with data collection for **study 2** (January-April 2021) occurring later than any of the studies (latest of which ended data collection July 5th 2020) included Altieri et al.'s (2022) meta-analysis.

Unsurprisingly, the most commonly-reported sub-theme influencing anxiety was 'health concerns related to catching COVID-19'. While those vulnerable to the worst effects of COVID-19 were often advised to avoid situations which would increase their risk of contracting the virus (Simpson-Yap et al., 2021, Bsteh et al., 2021), it is clear from the responses that the anxieties experienced around this avoidance had detrimental consequences for some, which may not always have been proportionate to the risk involved. A recent study found evidence to support this claim, showing a relationship between psychological distress and factors such as age and psychological coping, with no relationship between psychological distress and COVID-19 risk factors (Alschuler et al., 2021). At the extreme end, fear of COVID-19 itself has potentially fatal consequences, with some incidents in the earlier stages of the pandemic of suicide in people (from a general population) who believed they had contracted COVID-19 but had not (Mamum & Griffiths, 2020, Goyal et al., 2020). In another study in general populations, fear of COVID was found to significantly influence mental well-being which in turn negatively affected quality of life (Alyami et al., 2021). The responses observed here suggest that this may be the case for a sizeable portion of PwMS.

3.4.3 Limitations

Due to the cross-sectional design of this study, it is difficult to determine the directionality of the relationships explored. While self-report measures are widely used, mostly due to their feasibility, they are subject to a number of potential biases. As also mentioned in the limitations of **study 1,** this is particularly problematic when assessing the relationship between anxiety and social support as there is evidence to suggest that individuals with high anxiety may underestimate the amount of social support they receive (Bruce & Arnott, 2009). Differing lockdown measures in the UK and Ireland may have also impacted our findings. Additionally, a number of participants may have had difficulty understanding the GLTEQ, with many providing answers in the incorrect format or reporting an implausible amount of exercise activity. While the GLTEQ has been used before in MS populations (Sikes et al., 2019) it is possible that cognitive difficulties played a role in the number and severity of the outlier responses and suggests that a simpler measure of exercise habits may have been preferable. Given the lack of association between the HADS-A and the GLTEQ at univariate level and these difficulties described here, it is important to suggest that our findings regarding the GLTEQ should be interpreted with caution. The is some evidence that depression could have been a confounding factor which may have influenced some of our findings, although this cannot be established. The sample was also more predominantly female (91.3%) than what would be expected from a general MS population (~66%) (Walton et al., 2020). Additionally, we did not have a relevant non-MS comparison group for this study, making it difficult to distinguish what findings are specifically relevant to PwMS.

3.4.4 Conclusion

Study 2 has identified a number of associates of anxiety in PwMS, which may provide a point of focus for the development of much-needed interventions to address specific MS-related concerns surrounding anxiety in this population. In particular, findings highlight concerns experienced in the context of the COVID-19 pandemic. By highlighting the prevalence of anxiety among PwMS, we hope to encourage diligent monitoring and proactive addressing of these issues by service providers. Similarly, we highlight how existing services which support PwMS (employment services, social support services etc.) may have additional utility through the relationship between these targeted variables and anxiety.

In order to build on the findings presented here, there is need for greater exploration of the experience of anxiety in PwMS in an Irish context during the COVID-19 pandemic. Additionally, while we have to this point (**study 1** and **2**) identified a number of associates of anxiety in PwMS, this thesis has not yet explored desired features of supports or the use of self-management strategies for the reduction of anxious symptomology in an Irish context. Chapter 4 describes **study 3** which addresses these aims, and objective 3 of this thesis, through use of a qualitative, semi-structured interview-based design.

Chapter 4:

Study 3: “Learning to control what you can, and accept what you can’t”: A qualitative study on the experience of anxiety in multiple sclerosis

The abstract for study 3 has been published at: Fahy, A., & Maguire, R. (2023). The Experience of Anxiety in People with Multiple Sclerosis Living in Ireland: A Qualitative Study. In *MULTIPLE SCLEROSIS JOURNAL* (Vol. 29, pp. 692-693). (see Appendix C)

Abstract

Background: Studies 1 and 2 have shown that anxiety is a common experience in PwMS, however less is understood about the exact nature of this experience and how it impacts the lives of those affected. **Aim**: This study aimed to (1) highlight and document the experiences of anxiety in PwMS, and (2) explore the supports that may potentially reduce anxiety in MS from the perspective of those affected. **Method**: Semi-structured interviews, designed with PPI input, were completed online with nine PwMS living in Ireland between July-October 2022. Reflexive thematic analysis was used to identify themes. **Results**: Five key themes were identified; (1) Anxiety as a familiar experience, (2) The fluctuating impact of COVID-19, (3) Awareness that anxiety can be reduced, (4) The value of support, and (5) Need for personalised care. Sub-themes highlighted the pervasive nature of dealing with anxiety as a PwMS, the considerable additional challenges and increased anxiety experienced during the pandemic, a set of strategies used by PwMS to successfully manage anxiety, an overwhelming desire for peer support, and the importance of considering the barriers to engagement with supports. **Conclusion:** Anxiety can impact PwMS in many different ways, however a peer-based support is one intervention that could help PwMS deal with the common, challenging and unique experience of anxiety.

4.1 Introduction

MS is a chronic, demyelinating, neurodegenerative disease and the most common cause of non-traumatic neurological disability in young adults (Filippi et al., 2018). In addition to physical symptomology, the previous chapters have illustrated how MS is associated with significant psychological burdens, potentially affecting psychological well-being, quality of life and social functioning (Gajofatto et al., 2018; Strober, 2017). Specifically, prevalence of anxiety and depression is significantly higher in people with MS (PwMS) than in the general population (Boeschoten et al., 2017), with very high levels (72%) of clinically significant anxiety (Hansson et al., 2009) reported in the participants in **study 2** (Fahy & Maguire, 2023a). Additionally, reduced social support during the pandemic may have had a detrimental effect on anxiety in some individuals (Fahy & Maguire, 2023a). Despite comparatively more research into depression in PwMS than anxiety, recent research has suggested that anxiety may have a greater impact than depression in relation to a number of important outcomes, including MS symptoms such as fatigue, pain, and sleep problems (Hanna & Strober, 2020). As previously outlined, as part of the biopsychosocial model of anxiety, both physical and psychosocial factors can contribute to the experience of anxiety (Greene et al., 2013). Although more recently there has been some evidence suggesting a physical link between atrophy in certain brain regions and anxiety in PwMS, the need to address the psychosocial factors associated with anxiety in PwMS remains paramount to our understanding of how to best support PwMS who experience anxiety (Ellwardt et al., 2022).

In spite of its clear impact on quality of life, there is a lack of targeted interventions specifically focused on anxiety in the MS population. Results of **study**

1 and **study 2** highlighted a number of potential modifiable lifestyle, social and psychological factors associated with anxiety in PwMS on which an intervention could be based. Evidence suggests that participation in psychological interventions may in turn lead to potential improvements in physiological symptomology (including fatigue, pain and sleep disturbances) in MS patients (Pagnini et al., 2014). Specifically, of the three studies in which anxiety was successfully reduced, two reported physiological improvements (Baron et al., 2011; Maguire, 1995), with the only anxiety intervention to not show significant change in anxious symptomology also showing no change in physiological symptoms (Forman & Lincoln, 2010).

While there is a clear need for the development of psychological supports for PwMS, there may be other forms of support which PwMS would find beneficial. Qualitative research offers opportunities for exploring the kind of supports which would be most useful for PwMS from the perspective of those affected. Qualitative research involving UK samples of PwMS have highlighted a significant stress and anxiety associated with MS as well as dissatisfaction with current healthcare and support practices (Hunter et al., 2021), along with a desire for a service to meet social support needs (Methley et al., 2017). Additionally, interview studies conducted in Iranian (Homayuni et al., 2021) and UK populations (Hunter et al., 2021), have both highlighted a desire for a familial support for PwMS. Conducting interview studies in an Irish context may help to identify the features and areas of support which should be developed and improved in Ireland.

Study 1 found that most research into anxiety in MS involves the use of quantitative tools such as the Hospital Anxiety and Depression Scale (HADS) (Bjelland et al., 2002). While the use of quantitative measures like HADS has shed light into the prevalence and associates of anxiety in MS, including the findings reported in **study 2** (Fahy & Maguire, 2022), this research can be limited in the extent to which it can provide insight into how anxiety is experienced in PwMS (Butler et al., 2019, Hornamand & Feinstein, 2009). The few qualitative studies which have explored this issue have highlighted the significant emotional impact of MS for those affected, including challenges in dealing with the unpredictability of the disease course (Blundell Jones et al., 2014; Butler et al., 2018). Such qualitative studies have the potential to highlight a number of factors and coping strategies which may benefit emotional wellbeing in PwMS, however there is a clear need for more research in this area to inform the development of appropriate supports (Butler et al., 2018).

In addition to persistent concerns around anxiety in PwMS, **study 2** highlighted how the COVID-19 pandemic may have been a particularly anxiety-inducing time for many (Fahy & Maguire, 2023). While longitudinal studies from the general Irish population indicate no increases in the prevalence of depression or anxiety during the pandemic (Hyland et al., 2021), the findings from **study 2** suggest that this may not have been the case for PwMS. This is further supported by findings of increased prevalence of anxiety in PwMS during the COVID-19 pandemic (Alirezaei et al., 2022; Strober et al., 2022). Along with the findings from **study 2**, research has shown how many PwMS may have felt vulnerable to the worst symptoms of COVID-19 due to immuno-suppressant effects of disease modifying therapies (DMTs) (Bhise & Dhib-Jalbut et al., 2021; Zheng et al., 2020). Additionally, given the links between social support and anxiety (both in general and MS populations) reduced social support as a result of lockdowns may have had a detrimental effect on anxiety in some individuals (Henry et al., 2019; Kotan et al., 2019). Furthermore, physical activity, particularly at moderate and high intensities is reported to have reduced among PwMS, during the pandemic with evidence from **study 1** and **2** suggesting the potential that this also may have negatively impacted on anxiety (Moumdjian et al., 2022). While examination of the open-text responses in **study 2** provides some insight into how anxiety was impacted in those living in the UK and Ireland during the height of the pandemic, this methodology did not allow for an in-depth exploration of these experiences. The use of semi-structured interviews would allow for the impacts of the pandemic on anxiety for PwMS living in Ireland to be explored more extensively.

Study 3 aims to document and understand the experiences of PwMS with anxiety living in Ireland in greater depth, both generally and within the context of the Covid-19 pandemic. To do this, this study seeks to address objective 3 of this thesis, by exploring the challenges associated with living with anxiety in Ireland as well as the strategies used by PwMS to manage their anxiety. As a secondary aim, this study will explore the factors which PwMS feel are important to consider in the development of supports for the unique experience of anxiety in PwMS.

4.2 Method

This study adheres to the consolidated criteria for reporting qualitative research (COREQ) (Tong et al., 2007).

4.2.1 Design

The study involved a qualitative design, where data collection took the form of semi-structured interviews. A strength of this study was that the design was informed by PPI, where a panel of PwMS, facilitated by MS Ireland, provided input on ethical considerations and study design. The PPI meeting informing this study took place in June 2022 on Microsoft Teams, where input was taken from some of the same panel members from **study 2.** During this meeting panel members were presented with findings from **study 2** (see Appendix D). A preliminary version of the semi-structured interview guide was provided during the meeting and panel members provided input on the questions included as well as any relevant ethical considerations. Following this meeting, the semi-structured interview guide and other elements of the study's design were amended based on this input. Ethical approval was granted by Maynooth University Social Research Ethics Subcommittee on 6th July 2022.

4.2.2 Epistemological approach

The current study employed an interpretative phenomenological approach (Merriam & Tisdell, 2015). This research aimed to describe and understand the experiences of PwMS with anxious symptomology. To achieve this and to prioritize participant experiences over the application of generalized theoretical framework, reflexive thematic analysis (Braun & Clarke, 2019) was chosen as the most suitable method of analysis. This approach allowed the researchers to consider the subjectivity and potential variability of participant experiences while accounting for the influence and biases of the researchers. The primary researcher comes from a perspective of a ‘male doctoral researcher with no experience of MS diagnosis, individually or in their immediate family’, while the research supervisor is a person living with MS, and has links with the MS Ireland, and therefore has the potential to identify with the participants in the study.

4.2.3 Participants

Participants were recruited via convenience sampling during July-October 2022. Inclusion criteria included having a diagnosis of MS, being 18 or older, living in Ireland, having no clinical diagnosis of anxiety or any other mental health condition, and being fluent in English. Recruitment was conducted with assistance from MS Ireland, and through personal social media accounts. Specifically, MS Ireland did not actively recruit participants, but instead posted the call for participants as well as other information relevant to the study, both on their website and on social media. All consenting participants who began the interview completed their involvement in the study resulting in no participants dropping out. No relationship between interviewer and participants was established prior to commencing the study. Participants were aware of research goals and the interviewer's reasons for pursuing the research topic.

4.2.4 Procedure

Participants who expressed interest in taking part in this study were provided with an information sheet and consent form via email (See Appendix E). Once participants had provided consent, they were asked to complete a short demographic questionnaire during which they were asked to provide their email address. They were then contacted via email to schedule an interview at a time which suited them. Participants were provided with the questions in advance of the interview. AF conducted all semi-structured interviews from a quiet, suitable setting (unaccompanied at home) between July and October 2022. It is worth noting that this data collection occurred at a time in which all COVID-19 related restrictions had eased. Interviews were conducted and recorded (with explicit consent from participants) using Microsoft Teams. Microsoft Teams requires recording of video; however, participants were encouraged to leave their cameras turned off if they so wished and were informed that the video recordings would be destroyed after transcription. Recordings were transcribed, with any identifiable data anonymised before recordings were destroyed. Interviews had a mean duration of 62 minutes (range from 30-79 minutes). No repeat interviews were carried out. Field notes were made after and not during interviews. Transcripts were not returned to participants for edit or comment, however participants were invited to attend a follow-up PPI meeting in January 2023 where they were given the opportunity to provide input on the study’s findings.

The interview guide (see Table 4.1) consisted of nine questions broadly categorized into two areas relating to the two aims of the study. The first six questions explored participants’ experience with anxiety, while the last three asked for input on the development of a support for anxiety in PwMS. The guideline was developed by AF and RM based on previous research and input by the PPI panel.

Table 4.1

Interview guide

Topic	Questions
1) Experience with anxiety	As a person with MS, could you briefly describe your personal experiences with anxiety?
	As a person with MS, what do you feel helps you reduce or maintain low levels of anxiety?
	When you successfully reduce your anxiety, what behaviours or thought processes do you engage in?
	Has your experience of anxiety changed over the course of the COVID-19 pandemic? If so, how has this changed?
	How did you use these behaviours/thought processes during the COVID-19 pandemic?
	To what extent, if at all, does MS contribute to your personal experiences with anxiety?
2) Informing an intervention for anxiety in PwMS	If you were to create a support for PwMS who may be dealing with anxiety, what kind of support would you create? What would be some key aspects of this support?
	What would be the ideal schedule and setting for this intervention? How could we make the support easier for PwMS to engage in?
	How could existing supports for PwMS be improved?

4.2.5 Data Analysis

Qualitative data analysis was conducted based on the principles of Braun and Clarke’s reflexive thematic analysis (Braun & Clarke, 2019). An inductive approach was employed in the analysis by allowing descriptions of participant experiences to guide our results rather than trying to apply pre-determined theory to these experiences (Levitt et al., 2022). Probing was used to allow participants to provide more detailed descriptions of their experience which may not have been accounted for in the interview guide. After data collection, both researchers (AF and RM) initially spent time familiarising themselves with the data by reading and re-reading transcripts before initial codes were generated by AF. This was followed by a stage where AF used these codes to construct initial themes. These themes were then reviewed and refined through discussion between AF and RM before AF produced the final report. The data was managed using MAXQDA 2020.

4.3 Results

4.3.1 Sample demographics

A total of nine PwMS participated in the interviews (1 male, 8 female). Sample demographics are outlined in Table 4.2 and 4.3. Participants ranged in age from 29-60 years old. Most (n=7) were diagnosed with RRMS, with one participant having a diagnosis of PPMS and one participant for which this data was missing. Time since diagnosis ranged from 3 months to 19 years (mean = 6.32 years).

Table 4.2

Sample demographics

Variable	**N**	**(%)**
Gender		
Male	1	(11.1%)
Female	8	(88.9%)
Missing	-	-
MS type		
Relapsing Remitting MS	7	(77.8%)
Primary Progressive MS	1	(11.1%)
Secondary Progressive MS	-	-
Clinically Isolated Syndrome	-	-
Missing	1	(11.1%)

Table 4.3

Descriptive statistics for continuous variables

Variable	Mean	SD	N	Range	Missing (%)
Age	38.29	10.69	7	29-60	2 (22.1%)
Time since diagnosis (years)	6.32	6.74	8	0.25-19	1 (11.1%)

4.3.2 Themes

Five themes were identified from the interview data. Three of the themes, ‘Anxiety as a familiar experience’, ‘Fluctuating impact of COVID-19’ and ‘Awareness that anxiety can be reduced’, highlight the sources, impacts and experiences of participants in managing their anxious symptomology. Two of the themes, ‘The value of support’ and ‘Need for personalised care’, highlight the need for support in relation to anxiety, as well as what supports participants currently benefit from and feel they would benefit from if available. Table 4.4 includes additional details on main themes and subthemes.

Table 4.4

Themes identified

Theme	Sub-themes	Representative Quotes
Anxiety as a familiar experience	MS as a constant source of anxiety	*“I've been so I am so well and then people say, Oh, you're grand and I said, I know, but it's it's always kind of there in the background. It's always kind of lurking like a a cloud and you know.”- participant 9*
	Difficulty dealing with uncertainty	*“It's about uncertainty on the short term in terms of like symptoms and then the longer term in terms of, yeah, overall outcome.”- participant 7*
	Life outside of MS as a contributor	*“Ohh, I'd say it 90% my anxiety would be MS related now. The others will be in relation to the children, the Internet with the children and everything else going on in the world.”- participant 5*
	Impacts on quality of life	*“I you're just kind of had to keep going. I was just living with it. You know what I mean?And I was working. But it was a very, very difficult couple of years. I was coming home in tears an awful lot. Or I was having a lot of panic attacks, falling.Yeah, I wasn't getting the resources. That's why you probably got so bad over that.”- participant 1*
The fluctuating impact of COVID-19	Increased anxiety during the pandemic	*“And my anxiety went through the roof. Thinking is this. Are we all just going to die from it. What's going to happen? And then over the course, the anxieties kinda went down.”- participant 5*

	Sustained anxiety due to medical vulnerabilities	*"Yeah. I mean it it the immediate thing was just huge relief because as I said, I really did get off very lightly. But the back, you know, back, in the back of your head is right when you know you got away lightly once and get away so lightly again you know." participant 2*
Awareness that anxiety can be reduced	Learning to control what you can, and accept what you can't	*"I suppose I just try to keep it in perspective and and I try to do everything I can do and I try to just accept that I'm doing everything I can and there is a random element to it that I can't kind of control and just kind of accept that, I suppose." participant 2*
	Impact of escapism and distraction	*"And I do like my own time as well. So any kind of time I do get a little bit on my own, whether that be to watch a movie or or turn on the PlayStation, listen to a bit of music, whatever that own kind of stuff is." participant 8*
	The role of positive health behaviours	*"I suppose for me then what can help to reduce it as well as kind of boxing that off during the day. So let's say like that I can't justify going for 1/2 hour walk in the middle of the day. But if I'm like, right, OK and when I finish work before I cook dinner, I'm gonna go for half hour walk and then I know that that's that's what I'm going to do for myself later on. That can make a difference, so that can help too, and that can." participant 6*
	Living in the present moment	*"Like not so much like a full on meditation, but I would do like a little kind of calming techniques and stuff like you know" participant 3*
The value of support	Desire for peer support	*"then you have the social aspect where I think in a group it could work so well because you might be kind of going "well I don't know what to do about this", but two other people might have the right answer for you and you just couldn't figure it out for yourself." participant 4*
	Recognition of healthcare providers and formal supports	*"But I just can't find people, groups just to talk isn't have to be therapy. You can just be for tea or coffee, just or for a walk. Anything at all would be beneficial, I think for me at this point the systems are very good in terms of medical care. Like physios, great nurses, great neurologists but the social aspect is where I think they could improve a little bit"- participant 1.*

Importance of information	*"Like, will that kind of negatively impact me in work and you know, so that kind of information for people would be really useful in terms of well you actually have the right to have anxiety and it not affect your your job. And that can be really useful because your average person doesn't know actually what the craic is with that, you know. And so that kind of like information source that provides all of that and then maybe links to podcast about Ms and anxiety or you know a webinar on Ms and anxiety and whatever." participant 6*

	Supporting the whole family	*"Definitely because we were given a small book. Didn't have much information in it. And that's kind of all we had." participant 6*
	Difficulty accessing support	*"There isn't anything unless you yourself was going to go pay for sessions with somebody" participant 3*
Need for personalised care	Challenges at different ages and stages	*"Now she was in her 20s and I even felt I was talking to her about three years ago and I said oh gosh 'I I sound so old' but you know, so maybe if she had a younger person and they could, the issues they're going through at 20 years. You know in the early 20s. Oh God this and that and relationships and you know, there's so much to it. So so age appropriate pairings." participant 9*
	Importance of flexible support	*"Kind of doing hybrid, You will get people who feel like they want to go out and socialize with people face to face. Where other days you might just want to sit in your pajamas and do it all at home over the screen, you still have the social aspect. You're still talking to people, but you don't have to put as much energy into it." participant 5*
	Varying preferences for engagement	*"And I think it again, that's probably gonna be down to the individual, but for myself, I'm I like, I would respond quite well to a weekly activity or fortnightly activity, whether that be yoga or something like that. Obviously, that's not gonna be feasible for for everybody." participant 8*

4.3.2.1 Theme 1: Anxiety as a familiar experience

All participants expressed having dealt with some level of anxiety. While there was variability in how successfully participants felt they managed this experience, there was a notable level of commonality in the sources and impacts of anxiety.

4.3.2.1.1 MS as a constant source of anxiety

All participants described the pervasive nature of MS-related anxiety. They described how MS has the potential to impact on many different aspects of life (e.g., relationships, employment, finances) and thus, when considering these areas (which can be sources of anxiety in and of themselves), MS creates additional unwanted concerns. The regularity at which these additional anxieties were experienced was particularly challenging for participants.

"Yeah, because MS is always in the background of all the decisions that you make. So it's like, you know, is this the right thing to do? And what if my MS gets worse like, one of the things now would be for me now that I've taken on a mortgage? It's like, well, what if my MS got bad and I had to leave work and how is this going to so like, it's. I'm not saying it causes, like, massive anxiety for me, but it's always there. So it's there in every decision you make." participant 6

4.3.2.1.2 Difficulty of dealing with uncertainty

One of the more challenging ways MS can contribute to anxiety is through the uncertainty and unpredictability it creates. Several participants described how having a plan can reduce anxious symptoms but noted that MS disrupts their ability to plan and anticipate outcomes.

"Complete uncertainty. It's not not. Well. Everything's uncertain anyway. But it's just no, I can't really plan 2 years ahead for something because I couldn't guarantee

I'd be able to walk by then. Can't guarantee I won't be doing something in the hospital by then" participant 5

Many participants described feelings of anxiety (sometimes acute levels of anxiety) when dealing with uncertainty surrounding both their disease course and elements of their life that MS could affect.

"You just have so much uncertainty and so many unanswered questions that it can just lead to total panic and and that kind of a a bit of a meltdown or a freak out." participant 4

4.3.2.1.3 Life outside of MS as a contributor

Many participants described experiencing "normal anxieties" or having sources of anxiety that they did not see as related to or affected by MS. There was some variability in these reports, with most suggesting these may be less acute sources of anxiety, while others described how dealing with MS had made their "normal anxieties" seem less significant by comparison, thus lessening their impact.

"you know, I would've have been what have been normal anxieties, I suppose. I mean, I have a [anonymised] daughter. If you are a parent, you kind of live with anxiety of some form kind of all the time, but you know it's like the the normal anxieties, I think that go with you know, being a parent, having a full time job and you know, obviously work is like, you know, you're not down the mines or anything I'm not going to go making out that it's it's terribly stressful. But you know, it's busy." participant 2

While there was considerable variability in the non-MS related anxieties described, (and variability in how participants defined a non-MS related anxiety) a few participants expressed experiencing anxiety related to current events.

"*For like, getting myself so worked up about small things. Like I'll give you an* *example when the when Russia invaded Ukraine. I didn't sleep for days" participant 6*

4.3.2.1.4 Impacts on quality of life

The negative impact of anxiety on quality of life was unanimously reported. Issues experienced as a result of anxiety ranged from stress, to insomnia, to symptoms resembling agoraphobia in some participants.

"So my anxiety peaked about last March or may? And and that's what I started having difficulty like even leaving the house, going a few steps from the house.I started having a lot more panic attacks and disturbed sleep. I lost about 10-15 kilos over the year" participant 1

4.3.2.2 Theme 2: Fluctuating impact of COVID-19

Participants described the COVID-19 pandemic and social restrictions as a time in which a number of important life areas and quality of life outcomes including anxiety were impacted. While there was some variability in the severity and nature of these impacts, with some reports of WFH benefits, participants generally described the COVID-19 pandemic as a challenging period particularly in regard to anxiety.

4.3.2.2.1 Increased anxiety during the pandemic

The vast majority of participants described experiencing increased levels of anxiety at some point during the COVID-19 pandemic. While many described health anxieties related to potential impacts of catching the COVID-19 virus, other descriptions of anxieties related to additional burdens resulting from lockdowns. Necessary health and safety measures also caused anxiety in some participants.

"Every lockdown the anxiety would go through the roof. Couldn't go anywhere, couldn't do much because everything was shut down. Home schooling. That sent the anxiety up, and it didn't come down for quite a while." participant 5

4.3.2.2.2 Sustained anxiety due to medical vulnerabilities

Many participants described experiences of increased levels of anxiety (particularly health-related anxiety) after the end of the COVID-19 lockdowns due to the persistence of their vulnerability to the most negative effects of the COVID-19 virus. Additionally, many participants discussed frustration with a perceived lack of consideration and lack of adherence to safety precautions (such as social distancing, mask wearing etc.) from members of the public who they felt acted as though the virus no longer existed once lockdowns had ended.

"And even since I mean I'm I'm fully vaccinated, I've had all the boosters I can have but just the particular immunosuppressant I'm on it does seem to mean that the vaccine doesn't have a very strong effect because it it impacts on my my T cells and means I don't really produce a response. So obviously that was very anxiety making" participant 4

4.3.2.3 Theme 3: Awareness that anxiety can be reduced

Participants had a high level of awareness that anxiety was reducible with many able to provide detailed and varied descriptions of how they had learned to manage their anxiety.

4.3.2.3.1 Learning to control what you can, and accept what you can't

Descriptions of control and acceptance were inextricably linked and were central to management of anxious symptomology.

"For me overall I think I yeah, as [I] mentioned that I didn't, I, I can't control anything. So I, I think it was a case of putting in what I can do organizing what I can organise and I, I think for me fundamentally if everything's in order and everything's in this place and I control what I can control then I'm in a good mood, I'm happy" participant 3

Differentiating when to be proactive and conversely when to apply more acceptance-based coping was described as critical by participants. Being proactive in situations where control could be exercised was described as imbuing participants with a positive sense of self-efficacy. Inversely, trying to ‘solve’ problems with no clear solution, where an acceptance-based approach was described, was linked with frustration and increased anxiety, making the ability to differentiate between these scenarios highly valuable.

4.3.2.3.2 Impact of escapism and distraction

Disengaging or detaching from rumination was commonly described as a crucial element of anxiety management. This most common way of achieving this was by engaging in a separate activity.

“Oh yeah, I wouldn't be able to sit down and think about it because I drive myself crazy. I have to do something. Be it like that with hair and makeup, Hoover. Sit doing Spanish. I also like to watch true crime that detaches me from everything.” participant 5

There was a great amount of variation in the nature of these helpful distracting behaviours and even explicit indications that the specific nature of the activity is less relevant. Instead, these activities were described as beneficial simply for the escapism they provided.

4.3.2.3.3 The role of positive health behaviours

Many participants described how engaging in positive health behaviours helped them with anxiety reduction. While some of these activities may include the additional benefit of escapism outlined above, other positive health behaviours such as having a good diet were described as providing benefit in reducing anxiety.

“Yeah, I definitely for me, it's the exercise I have to get my walk every day. Even if it's raining, I will go out in it to the walk and yeah. I definitely think that that helps

me [in reducing anxiety]" participant 3

4.3.2.3.4 Living in the present moment

Another commonly described method of anxiety management was engaging in mindfulness. While not always explicitly described as mindfulness, participants regularly described the importance of focusing on the 'here and now' and avoiding spending too much time focused on future outcomes in particular.

"Yeah, like different breathing, I I've I've been going. I've gone to mindfulness now, God, four or five years and went, during the pandemic I did a zoom mindfulness class with my mindfulness teacher so that was good. And yeah, so those techniques have always been with me and have been really helpful when it comes to anxiety and Ms." participant 9

4.3.2.4 Theme 4: The value of support

Descriptions from participants firmly highlighted the importance of good quality supports for PwMS. All participants expressed the need for additional supports and potential for supports to have positive impacts on their quality of life.

4.3.2.4.1 Desire for peer support

There was an overwhelmingly unanimous desire for the availability of some form of peer support with other PwMS. Most participants described this as the form of support they felt was most lacking in the current system, with the highest potential to positively impact anxiety. Many participants described how they would benefit (and in some cases anecdotally had benefited) from talking with people who could truly empathise with their experiences as a PwMS.

"So I'd say something like a AA But for people with chronic illnesses or MS specifically, where you can meet up with others in your area, you could have coffee, maybe some snacks, talk about experiences, how you're feeling with other people who are feeling the same, going through the same stuff." participant 5

The group forum setting was explicitly and individually named by several participants with many suggesting that through this type of support they believed they would develop friendships and relationships that would continue to benefit them even outside of the formal group forum setting.

4.3.2.4.2 Recognition of health care providers and formal supports

Many participants reported having had good experiences with health care providers and other supports, such as those provided by MS Ireland. While there was some criticism of healthcare systems, mostly centred around wait times for results and a perceived pressure and lack of guidance in choosing treatment options following diagnosis, many participants felt they received relatively adequate support in this area.

"My nurse is always available. The doctors and neurologists are always available via e-mail or phone call, so in terms of information, talk to family, I feel adequately supported there." participant 1

4.3.2.4.3 Importance of information

The majority of participants highlighted the importance of being well-informed such that good quality information provided a sense of certainty and guidance.

"So I do think support kind of peer support is really important. But I do think insights from, you know, good, good, empathetic professionals who know their stuff and keep up with the research. You know, and are active in field is really invaluable and I think there is no substitute for that" participant 2

While most participants either expressed a desire for information or were open to the idea of receiving information-based updates as part of their support, this feeling was not unanimous. Some felt that enough information was available to them and wanted to prioritise dealing with the lack of peer support they felt they received.

“I would be attending this kind of meeting for the connection, for the human touch. I don't really want to be lectured at at the moment.” participant 1

4.3.2.4.4 Supporting the whole family

Many participants expressed preference for a potential support to include some element that helped support their families as well. This may include information about MS but more specifically participants wanted resources to help their families manage discussing and managing their expectations surrounding participants’ experiences with MS. A couple of participants provided examples of supports which had successfully done this and outlined the resulting positive impacts on their familial relationships.

“That somebody can sit down, you know with somebody in their family to be able to this is who you're gonna live with on a daily basis, how are you gonna manage with that so I do think that definitely helps as well so to have maybe something like that.” participant 3

4.3.2.4.5 Difficulty accessing support

Many participants highlighted considerable difficulties they had as PwMS accessing mental health supports. From a general lack of availability to financial barriers to engagement, there was a general consensus that mental health supports (particularly counselling services) were far less accessible than participants felt they should be.

“But yeah, that kind of idea I think is is so important it's not available and unless you go and pay privately, and if you are not working, you can't just go and pay for it privately you know it's, there is that. And I know talking to a lot of people and and a lot of people would benefit from that sort of one to one.” participant 4

4.3.2.5 Theme 5: Need for personalised care

Responses highlighted the idiosyncratic nature of engagement in supports through the variability of preferences presented. Despite this variability, there are clear pathways through which we can account for this variability to avoid unwanted barriers to engagement.

4.3.2.5.1 Challenges at different ages and stages

Several participants described how they felt some existing supports did not suit them due to differences in their age and/or disability levels as compared to others engaging in the support. While some participants with higher levels of disability described hesitancy engaging in supports which may be physically challenging, some with lower levels of disability described a hesitancy towards engaging in supports with individuals with higher disability levels.

"I, I think I would like, I would have always liked a group with MS with people who were in a similar situation to me in that you know... I suppose not meaning to sound derogatory or anything, but people who are very affected or they don't work or they, you know, whereas I want like some maybe young more young people who are out there trying to work and trying to be as 'normal' as possible. You know a group in that perspective would have been, would be great." *participant 8*

4.3.2.5.2 Importance of flexible support

The need for flexibility in support was evident from the data. Due to the unpredictability of disease symptoms and the potential for quick changes in symptomology, our sample described a need for supports that would cater to these needs. Additionally, avoiding mandating attendance of supports could be beneficial where possible, as not wanting to 'cancel' was a barrier which prevented some participants from engaging in certain supports.

"The online facility has its benefits of if you're not feeling good, on any given day,

you can still kind of meet and talk to people without meeting them in person. And butI do think there's huge benefits and actually going out into the world and meeting people kind of face to face. So I definitely think the hybrid model of the two." participant 8

4.3.2.5.3 Varying preferences for engagement

There was no clear decisive schedule for the potential support that universally catered to all participants. In general, most participants seemed relatively satisfied with the idea of a support that ran on a fortnightly basis with some participants wanting slightly longer or slightly shorter between meetings.

"And yeah, if it was only an hour. I would say weekly. If it was three hours. I would think maybe fortnightly and if it was half a day I would say once a month." participant 3

In terms of timing, there was less agreement with some participants wanting to engage during weekday working hours when it was earlier and they felt less fatigue, and others whose employment would prevent them from engaging except for evenings and weekends.

"Whereas I suppose you could kind of have a meeting midweek and then another one on the weekend for when people be off work." participant 5

4.4 Discussion

Echoing the results from **study 2**, the findings from **study 3** suggest the experience of anxiety is common in MS, however the nature of this varies significantly across individuals, with differing impacts. A notable finding is that there is a need for greater support in helping PwMS deal with anxiety, with peer-based support identified as being particularly beneficial.

Unsurprisingly, uncertainty caused by the inherent unpredictability of MS was a core contributor to anxiety in participants. The unpredictability of health outcomes associated with MS is well documented (Wilkinson & Nair, 2013), as is the potential of these outcomes to impact on a variety of important domains of life, such as employment and relationships (Miller & Dishon, 2006). Uncertainty itself has also been linked with lower health related quality of life outcomes in participants with chronic illness (Abu Tabar et al., 2021). This unpredictability was described by participants as creating uncertainty and, as a result, anxious feelings surrounding many of these important life outcomes. Uncertainty as a concept inherently makes decision making more difficult and is linked to a lower sense of control and self- efficacy (Bar-Anan et al., 2009), two key associates of anxiety in PwMS (**study 1** and **2**) (Fahy & Maguire, 2022, 2023a), which were also reported by participants in this study. Much of the uncertainty surrounding MS is linked with worries surrounding potential disease progression and potential future disability, concepts which are often coupled with negative affect. As such, uncertainty is more likely to be perceived as a threat, as opposed to an opportunity (Brashers, 2001). It is clear, however, that participants differed in their tolerance of uncertainty, with findings consistent with research documenting that such tolerance mediates the relationship between anxiety and uncertainty (Strout et al., 2018). In addition, we reported a direct association between IU and anxiety in **study 2**. Given that tolerance of uncertainty has shown to be modifiable both in general and in MS populations, these findings suggest it may be a good factor to target when providing PwMS with psychosocial support (Molton et al., 2019).

Also following on from the results of **study 2**, the findings from **study 3** suggest that the COVID-19 pandemic and subsequent lockdowns were particularly challenging and anxiety-inducing times for many PwMS. Due to the immunosuppressant effects of some disease-modifying therapies (DMTs), many PwMS felt particularly vulnerable to the worst effects of the COVID-19 virus (Bhise & Dhib-Jalbut, 2021; Jeantin et al., 2024), and interviews suggest that these worries persisted after restrictions eased. Separately, reduced capacity to receive social support as a result of lockdowns appeared to have negatively impacted coping systems relied on to reduce anxiety for some participants, which is consistent with existing research in the area (Ratajska et al., 2020; Shaygannejad et al., 2021) and also the findings from **study 2**. Additionally, findings show that anxiety related to COVID-19 remained a significant factor for some PwMS at time of data collection, suggesting that continued research is needed to evaluate the longer-term impact and prevalence of COVID-19 related anxiety post lockdowns.

While results clearly highlight the frequency and impact of anxiety for PwMS, equally evident was the awareness and battery of anxiety-reducing behaviours participants had developed to cope with these challenges. The finding that control and acceptance were reported as important facets of anxiety management is consistent with previous research (Blundell Jones et al., 2014; Han, 2021), including the results of **study 2** where we reported significant associations between control and anxiety. However, findings also show how the ability to distinguish between when it is beneficial to exercise control (e.g., problem-focused coping) or acceptance (e.g., emotional-focused coping) is crucial. These findings emphasising the importance of control, distraction and mindfulness align with previous qualitative research on anxiety in PwMS (Blundell Jones et al., 2014). Furthermore, these concepts align closely with the concept of cognitive flexibility, a concept which describes an individual's ability to assess the controllability of a given situation (Masuda & Tully, 2012). Cognitive flexibility also plays a role in goal-related behaviours particularly with helping individuals to practice flexible goal adjustment (Van Bost et al. 2022), a process which may be of particular importance for PwMS who may need to make adjustments based on the unpredictable presentation of symptoms. It should also be noted that in **study 1** flexible goal adjustment was associated with better anxiety outcomes (Fahy & Maguire, 2022). Cognitive flexibility may be a good target for intervention in PwMS, with evidence to suggest that CBT (Abedi et al., 2023), and as a central concept, ACT (Graham et al., 2016; Thompson et al., 2022) may be used to improve this and other outcomes for PwMS, however, this is an area which warrants further investigation. In addition, there is some evidence to suggest that cognitive flexibility can be impaired in some PwMS, particularly those with higher levels of disability, strengthening the argument for the creation and provision of supports that target this concept (Cerezo García et al., 2015).

One of the ways in which participants exercised control was through engaging in positive health behaviours. Positive health behaviours such as diet and exercise have been associated with better physical outcomes and mental wellbeing in PwMS as described in **study 1** and **2** (Riccio & Rossano, 2015). However, despite the clear benefits of engaging in exercise, MS symptoms, most notably fatigue and mobility limitations, can create significant barriers towards engagement (Stroud et al., 2009). Despite these barriers, findings suggest that it is important to promote and encourage exercise where possible, particularly given evidence that regular exercise can reduce barriers to engagement as regular physical activity can reduce atrophic disease progression and alleviate symptoms of fatigue (White & Dressendorfer, 2004). In order to promote greater exercise engagement in PwMS it is important to educate PwMS on the potential benefits to exercise, provide exercise supports which account for and attempt to avoid exercise-induced fatigue and other potential barrier towards engagement (Stroud et al., 2009). Perceived self-efficacy is again a crucial factor here where higher self-efficacy predicts exercise engagement, again highlighting the importance of promoting self-efficacy in PwMS (Motl & Snook, 2008; Snook & Motl, 2008). Finally, mindfulness-based techniques were described as anxiety reducing for our sample, which is in line with research consistently linking mindfulness to reduced anxiety in PwMS (Han, 2021) and which was also found in **study 1** (Fahy & Maguire, 2022).

When considering what supports would be helpful in alleviating anxiety, the most desired within participants was the availability of a structured peer support. Having a hybrid or online setting was of particular interest as it was seen as providing a greater degree of flexibility and reducing potential barriers to engagement such as location, fatigue and other symptoms. It should be noted though that online settings come with their own barriers (e.g. low computer literacy, socioeconomic barriers) (Kierkegaard et al., 2022). Research in this area, while scarce, is encouraging, with support group identification (identifying oneself as a member of an MS support group) associated with both reduced anxiety and increased life satisfaction (da Silva et al., 2011, Wakefield et al., 2013). Additional research generally supports the efficacy of peer support programmes for PwMS, (Mohr et al., 2005; Ng et al., 2013; Schwartz, 1999). There are findings however, which favour other forms of intervention and highlight the greater potential benefits for those with more significant affective and suggest potential adverse effects for those with high mental health functioning (Schwartz, 1999; Uccelli et al., 2004). It is possible that grouping peer support groups by age or disability may reduce the likelihood of any adverse experiences, with our findings here mirroring recommendations made by Daniel et al. (2023). More needs to be done to evaluate the potential efficacy of online peer support groups for PwMS, as highlighted by a recent systematic review which found only one purely online intervention study focusing on verbal communication (the form of peer support requested by our study's participants) with several other studies focusing on asynchronous text-based communication instead (Gerritzen et al., 2022). While many other peer support programmes exist for PwMS, these findings highlight the lack of studies exploring the efficacy of these supports (Maguire et al., 2022). Given the links between social support (particularly from friends) and reduced anxious symptomology found in both **study 1** and **study 2** (Fahy & Maguire, 2022, 2023a), as well as proven efficacy of peer support in reducing anxiety in other populations (Parent & Fortin, 2000; Tan et al., 2022) there is a clear need for more research into and greater availability of this form of support for PwMS.

In addition to the need for peer support, several participants described a desire for some form of familial support which is unsurprising given the potential for burden of care as well as familial and relationship stress which can result from a worsening in symptomology (Holland et al., 2011). These findings mirror findings from UK (Hunter et al., 2021) and Iranian (Homayuni et al., 2021) populations on the impact of MS on families of PwMS as well as the desire for a familial support which may help to address these challenges. A meta-analysis investigating psychosocial interventions for chronic illness which involved family members found significant potential for improved mental well-being in both patients and caregivers (Martire et al., 2004).

4.4.1 Limitations

Due to the sensitive nature of the topic discussed the data presented may be biased with information excluded if a participant felt uncomfortable presenting it. The sample included just one male participant who was also the only participant in the study who did not have a diagnosis of RRMS (they had a diagnosis of PPMS). Thus, our sample was more predominantly female (91.3%) than what would be expected from a general MS population (~66%) (Walton et al., 2020). It is unclear if findings are generalisable across genders and between different MS types as we had no participants with SPMS or Clinically Isolated Syndrome. Additionally, for ethical reasons our study excluded participants who had received a clinical diagnosis of anxiety. As such, our results may not be generalisable to samples with more severe anxious symptomology. As with all research involving reflexive thematic analysis, the positionality of the researchers, (AF- a postgraduate student with no diagnosis of MS themselves or in their immediate family, RM- an associate professor and researcher with an MS diagnosis) may have impacted our findings. In order to enhance the validity of our findings, results from this study were disseminated to a PPI panel. This study featured a smaller sample size (n=9) which may have had an impact on findings.

4.4.2 Conclusion

Study 3 highlights the need for greater supports for anxiety in PwMS. Findings suggest that the experience of anxiety is common in MS, but that this can vary significantly across individuals. Additionally, this study highlights the significant challenges faced by PwMS during the pandemic as well as confirming that, for some PwMS, these challenges persist post-lockdowns. While there are a variety of health, contextual and psychosocial factors which can contribute to the experience of anxiety in MS, encouragingly results suggest a number of ways in which this may be managed. Specifically, a number of important modifiable factors relevant to anxiety in PwMS, including control, acceptance, and positive health behaviours, should be highlighted as key factors for PwMS to consider in the management of anxious symptomology. Future research is needed to test the efficacy of targeted anxiety supports, particularly of peer supports which were heavily reported as desirable. Finally, this study details accounts of successful anxiety management in PwMS and promotes some of the strategies used to do so, which may help other PwMS in anxiety management as well.

It is clear from these findings that there is a need for greater support for PwMS living in Ireland. Identifying ways to help alleviate anxiety is one area in which there is a need for support. More generally, it is worth exploring the needs for psychological and social support in an Irish context. The findings of **study 2** and **3** also suggest that these needs may vary among individuals, so the development of tailored interventions may be beneficial. Additionally, in order to assist the identification of those who have an increased likelihood of having social or psychological support needs, there is a need to assess the relationship between these needs and sociodemographic and MS-related factors. **Study 4**, described in Chapter 5, aims to address objective 4 of this thesis by exploring these issues through the use of a mixed-methods, secondary data analysis of a large sample of PwMS living in Ireland.

Chapter 5:

Study 4: Needs for Psychosocial and Social Support in People with MS in Ireland

Abstract

Background: Many people with MS experience needs for psychological or social support to help manage anxiety associated with MS. These needs may be met by community-based services. Despite this, relatively little research has been conducted to investigate the predictors of support needs and the extent to which community services can help to address these needs. **Aim:** This study aimed to investigate the sociodemographic and disease-related predictors of psychological and social support needs for PwMS, and to explore the extent to which these needs are met through engagement with services at MS Ireland. **Method:** Data collected from 349 PwMS as part of a previous project conducted with MS Ireland were analysed using logistic and hierarchical regression to investigate the predictors of psychological and social support needs, as well as the importance that PwMS place on having access to services that address these needs. Reflexive thematic analysis was used to analyse open-text survey responses relating to how psychological or social support needs were met by community workers in MS Ireland. **Results:** PwMS who were younger and had a diagnosis of RRMS placed a greater importance on having access to services to meet needs for psychological support, while those who were female, younger, not in a relationship and had requirements for care placed greater importance on having access to services to meet needs for social support. Separately, reporting a need for social support was significantly associated with older age, being single and requiring care. Reporting a need for psychological support was not significantly associated with any of the variables explored. Key themes from the open-text responses were ‘Community worker as a source of social support’, ‘The role of MS Ireland in facilitating peer and psychological support’, ‘Online services, greater accessibility with fewer social benefits’ and ‘Privacy as a barrier to support’.

Conclusion: While some demographic and disease-related variables may predict support needs in PwMS, results imply that psychosocial factors are more likely to contribute to this. Future research should continue to identify relevant factors to assist with the identification of psychological and social support needs in PwMS.

5.1 Introduction

The mean global prevalence of MS is 67.8 per 100,000, with a prevalence in Ireland of 180 per 100,000, classifying Ireland as a ‘very high’ prevalence country (Carney et al., 2018; Wade, 2014). Due to the challenges presented by the unpredictable, potentially debilitating disease course associated with MS, people with MS often experience a need for support. Highly ranked among these are the needs for social and psychological support (Lorefice et al., 2013; McCabe et al., 2015).

The previous chapters have noted how prevalence rates for both anxiety and depression are estimated to be two to three times higher in PwMS than in the general population (Beiske et al., 2008). Recently, challenges presented by the COVID-19 pandemic may have exacerbated these issues for many PwMS, with increased prevalence of depression and worsening of MS symptoms (sleep problems, fatigue) reported during the pandemic (Motolese et al., 2020). Results from **study 2** indicate an increased prevalence of anxiety in PwMS, while findings from **study 3** suggest that some of the challenges related to the pandemic continue to persist. This implies that needs for support may have recently increased. Depression has been linked with a number of undesirable outcomes for PwMS, including lower quality of life, fatigue and increased disability (da Silva et al., 2011; Hanna & Strober, 2020; Siegert & Abernethy, 2005). Similarly, this thesis has discussed how anxiety has been linked to increased disability, substantial pain and lower quality of life (Jones et al., 2013; Marck et al., 2017; Salehpoor et al., 2014). Given the prevalence of both anxiety and depression in MS (lifetime prevalence 35.7 and ~50% respectively) (Korostil & Feinstein, 2007; Siegert & Abernethy, 2005) as well as these linked outcomes, it is clear that psychological support should be an essential element of effective symptom management in PwMS (Shaygannejad, 2021).

While it is established that PwMS have needs for psychological support, the extent of these needs may vary depending on various characteristics, with more research needed to determine factors which predict needs for psychological support in PwMS (Maguire et al., 2022). PwMS come from a wide range of backgrounds (Hwang et al., 2022), with variations in levels of disability (Conradsson et al., 2018; Ytterberg et al., 2008). Research which aims to improve our understanding of how these factors impact on needs for support is merited.

Separately, social support has been shown to be associated with psychological wellbeing (including anxious and depressive symptomology), both in general (Kawachi & Berkman, 2001) and MS populations (Ratajska et al., 2020; Suh et al., 2012). The links with social support and anxiety were also clearly shown in studies **1- 3** (Fahy & Maguire, 2022, 2023a). Beyond having the potential to reduce anxiety, social support has been suggested to have a buffering effect on the negative impacts of stress, mediating the relationship between stress and depression (Kirchner & Lara, 2011). **Studies 2** and **3** suggest that the lack of social support available during the COVID-19 lockdowns in Ireland may have created particularly significant challenges for PwMS, a finding echoed by others (Bonavita et al., 2021; Matvienko-Sikaret al., 2021). However, even outside of this context, MS symptomology can create significant barriers for social support for many PwMS (Hakim et al., 2000). Symptoms such as pain, fatigue and disability can make engaging in certain social situations challenging, while the unpredictability of how these symptoms manifest on a day-to-day basis can create challenges in planning and committing to social engagements (Sá, 2008). Interventions aimed at fostering and improving perceived social support generally show good efficacy (Hogan et al., 2002). Given the results of **study 1** in which perceived social support was a modifiable factor frequently associated with anxiety, it follows that the development of social supports has the potential to promote positive outcomes for PwMS. However, while the need for social support is clear, the variability in how this need presents as well as the identification of factors which predict this need in PwMS are areas which require additional research (Maguire et al., 2023).

Community-based organisations play a key role in supporting the needs of many PwMS, particularly in countries such as in Ireland where needs are not sufficiently met by state-funded social and health services alone (Lonergan et al., 2015). MS Ireland is a community-based patient support organisation which provides a number of crucial services to PwMS in Ireland, including the provision of online supports (Fogarty et al., 2014). Recently, the FRaMeS (FRamework for Multiple Sclerosis Service Evaluation) project (Maguire et al., 2023) explored the extent to which community work services in Ireland meet a range of needs of PwMS, including needs for psychological and social support, which were ranked highly among areas in which support was needed. This project, which involved mixed-methods surveys of both MS Ireland community workers and service users highlighted examples of good practice in the context of service provision (e.g. informational support, good coordination of care) as well as highlighting some key challenges in meeting the needs of PwMS (e.g. lack of external services, lack of control over outcomes) (Maguire et al., 2023). Overall, the study suggested a good level of satisfaction with the efficacy of services provided by MS Ireland.

Initial findings from Maguire et al. (2023) suggest a high importance placed on having access to services that meet the needs for psychological and social support, however it is likely that these needs differ according to sociodemographic and health-related characteristics of service users. So far, this thesis has largely focused on modifiable factors that are associated with anxiety (and consequently, needs for psychological support), but having an appreciation of the role that less modifiable sociodemographic or health factors may play in needs for support is merited. Identifying the type of PwMS who are most likely to benefit from supports may aid the provision of tailored interventions which may in turn help with the management of anxiety among PwMS. This study therefore aims to explore sociodemographic and health-related factors that predict the need for psychological and social support in PwMS. Additionally, this study aims to highlight any important idiosyncrasies relating to the provision and use of psychological/social support in an Irish context, specifically in relation to community work services at MS Ireland.

5.2 Method

5.2.1 Data sources

The FRaMeS project was a mixed-methods study conducted in May-June 2021 (Maguire et al., 2023). As part of this project, a cross-sectional survey was distributed among service users at MS Ireland to evaluate the needs of PwMS as well as the perceived efficacy of MS Ireland community workers in meeting these needs. Community workers are employed by MS Ireland to meet the needs of PwMS on an individual basis as well as supporting carer and familial needs. This is frequently achieved through the provision of information, signposting to relevant services and supports and through coordination of care (Maguire et al., 2023). Data was collected on participants' sociodemographic background, including their age, gender, location of residence (urban/rural), relationship status, as well as characteristics of their MS (MS type, time since diagnosis), whether they required care from others and whether they received any financial support for their MS. Information on various needs, including needs for psychological and social support, were gathered, based on a framework of needs by Kinyanjui et al. (2018). To capture this information, participants were asked how important it was for them as people with MS to have access to services that support these needs on a scale of 1-10. Participants who knew their community worker were asked a further set of questions regarding their experience of having their needs (including social/psychological support needs) met. This included an item where participants were asked to indicate for each category of need if they 1) had this need and had discussed it with their community worker, 2) had this need but had not discussed it with their community worker, or 3) did not have this need. For the purposes of analysis, this item was dichotomised into a binary variable to represent whether participants had or did not have the needs in question. Additionally, participants who knew their community worker were asked a series of open text questions which gathered information of how their needs were met (including what needs they had discussed with community workers). Participants who indicated that they had engaged in some form of online service delivered by MS Ireland since the start of the COVID-19 pandemic were asked to complete a series of open-text items related to online service provision. These questions were included given that this was a time in which many of the services for MS Ireland had moved online due to the pandemic.

Reflexive thematic analysis (Braun & Clarke, 2019) was conducted on responses to 13 open-text questions. Three of these questions related to the use of online services, specifically the types of online service used, the benefits of the online delivery of this service and the challenges related to the online provision of this service. Ten of the items asked about participants' needs as well as their experience working with their community worker in meeting these needs. Specifically, these items asked for examples of needs met, examples of things that their community worker had difficulty helping with, an item which asked about needs discussed with community workers, an item which asked for descriptions of how well these needs were met, an item which asked about communication received from community workers, three items where participants could report positive impacts from engaging with community workers, an item which asked for examples of obstacles towards meeting service user needs and an item where participants could report the importance of accessing a given service.

Surveys were designed with assistance from PPI input from both service users and caseworkers at MS Ireland and the project was led by a person with MS. Participants did not receive compensation for their participation. The survey was hosted using Qualtrics online software. Ethical approval for the FRaMeS project was granted from Maynooth University Ethics Committee in April 2021, while the secondary analysis for the current study was granted ethical approval from Maynooth University Ethics Committee in March 2023. Table 5.10 (See Appendix F) contains a list of the survey questions analysed in this study.

5.2.2 Participants

Participants in the FRaMeS project included 367 PwMS. Of these, 353 participants consented to having their data used for secondary analysis. A further 4 were removed from analysis due to missing data. 70 participants indicated that they did not know their regional community worker and thus did not answer open-text questions related to their experiences with said community worker. 166 participants indicated that they had engaged in some form of online service delivered by MS Ireland since the start of the COVID-19 pandemic and were asked to complete items related to the provision of the service.

5.2.3 Data analysis

A mixed methods approach was used to analyse the data. Firstly, descriptive statistics were calculated for those who consented to have their data used in secondary analysis, with frequencies presented for categorial variables, and means, ranges and standard deviations calculated for continuous variables. Two hierarchical multiple regression models were constructed to assess the relationship between the perceived importance of having services to meet (1) psychological/emotional needs and (2) social support needs and socio-demographic and disease related variables. Socio-demographic factors were entered into block one of these models (age, gender, location, relationship status) and MS and care-related factors were entered into block 2 (MS type, time since diagnosis, financial support for MS, and requirement of care). The decision to use hierarchical regression models for analysis was taken to allow for the comparison of sociodemographic and MS-related factors which may influence support needs. Additionally, two logistic regressions were run to assess whether the same set of independent variables could predict whether PwMS engaging with community work services had needs for psychological or social support (either currently or previously). In these regressions, psychological and social support needs were based on separate items which asked participants if they discussed each need for support which their community worker (see section 5.2.1). The 70 participants who did not know their caseworker were excluded from this analysis as they did not answer this question. The decision to use logistic regression was taken to allow for the investigation of sociodemographic and MS-related variables in relation to a binary outcome, reporting a need for support.

Qualitative data analysis was conducted on the open-text responses based on the principles of Braun and Clarke’s reflexive thematic analysis (Braun & Clarke 2019). This followed the approach taken to the analysis of the open text responses in **study 2**. Specifically, researchers initially spent time familiarising themselves with the data before generating initial codes, followed by a stage where initial themes were constructed by AF. These themes were then reviewed and refined through discussion between AF and RM, until the point of data saturation, where no other themes or codes could be identified by the reviewers, before the final report was produced.

A contiguous approach was used to integrate qualitative and quantitative findings (Fetters et al., 2013). A contiguous approach was chosen given its utility for research where qualitative research aims to provide contextual information that expands upon quantitative findings where the quantitative (factors associated with psychological and social support needs) and qualitative approaches (experience of PwMS with support provision in Ireland) have different focuses. This process involves reporting quantitative (section 5.4.1) and quantitative findings (5.4.2) in separate sections within a singular report (Yaqoob & Barolia, 2023).

5.3 Results

5.3.1 Descriptive statistics

Descriptive statistics are displayed in Tables 5.1 and 5.2. In line with population norms for MS, most of the sample was female (71%) with ages ranging from 20-82 years (mean age=51.72 years, SD=11.83). The majority were married (71%) with almost an equal number of participants living in urban (53%) and rural (47%) areas. In terms of MS type, most (64%) reported having relapsing remitting MS (RRMS). Just under half (47%) were in receipt of financial support for their MS and 38% required care from others.

The perceived importance of having access to services that meet needs for psychological/emotional support (mean=6.76, SD=2.65) and social support (mean=6.62, SD=2.71) were both high. Separately, 46.9% of participants who knew their community worker indicated that they had a need for psychological support, with 43.9% of participants indicating that they had a need for social support.

Table 5.1

Sample Demographics, MS-related factors and Binary Needs for Psychological and Social support

Variable	N	(%)
Gender		
Male	102	29.2%
Female	247	70.8%
Other	-	-
Missing	-	-
MS type		
Relapsing Remitting MS	223	63.9%
Primary Progressive MS	53	15.2%
Secondary Progressive MS	51	14.6%
Unknown	20	5.7%
Other	2	0.6%
Missing	-	-
Location		
Urban	183	52.6%
Rural	165	47.4%
Missing	1	0.3%
Relationship Status		
Married/cohabiting	246	70.5%
In a relationship but not cohabiting	16	4.6%
Single	58	16.6%
Other	28	8.0%
Missing	1	0.3%
Financial support for MS		
Yes	163	46.7%
No	186	53.0%
Missing	1	0.3%
Require care from others		
Yes	132	37.8%
No	217	62.2%
Missing	-	-
Need for psychological or emotional* support		
Yes	105	37.6%
No	119	42.7%
Missing	55	19.7%
Need for social support*		
Yes	97	34.8%
No	124	44.4%
Missing	58	20.8%

Note. *based on sample of 279 PwMS who indicated they knew their community worker

Table 5.2

Descriptive Statistics of Continuous Variables

Variable	Mean	SD	N	Range	Missing (%)
Age	51.72	11.83	345	20-82	4 (1.4%)
Time since diagnosis (years)	13.9	9.90	342	0-52	7 (2.4%)
Importance of access to psychological support [1=low importance, 10=high importance]	6.75	2.65	318	1-10	31 (9.74)
Importance of access to social support [1=low importance, 10=high importance]	6.54	2.71	315	1-10	34 (8.9%)

5.3.2 Hierarchical regression analysis on importance of having access to services that meet needs for psychological and social support

In order to identify the predictors of needs for psychological and social support, two hierarchical regression analyses were conducted. Correlational analysis was first used to assess the relationship between the dependent variables of perceived importance of having access to services that meet needs for psychological and social support, and the predictor variables. Results of these correlational analyses are presented in Tables 5.3 and 5.4. This analysis showed no multicollinearity, with the assumptions of linearity and homoscedasticity also met. Unsurprisingly, there was a strong relationship (r=.659, p<.01) between the importance placed on having access to services to meet psychological and social support needs. Additionally, there was a moderate correlation (r=.457, p<.01) between reporting a need for psychological and social support.

Table 5.3

Importance of having access to services that meet support needs Means, Std. Deviations and Correlation Matrix

Variable	*n*	*M*	*SD*	1	2	3	4	5	6	7	8	9	10
1. Importance of psychological support	318	6.75	2.64	—									
2. Importance of social support	315	6.54	2.71	.659**	—								
3. Gender [1=male, 2=female]	349	1.71	.46	.12*	.15*	—							
4. Age	345	51.72	11.83	-.24**	-.04	−.09	—						
5. Location [1=Urban, 2= Rural]	348	1.47	.50	.03	.05	.08	.05	—					
6. Relationship status [1=in a r’ship 2= not in r’ship]	348	1.25	.43	.55	.12*	.14*	.03	-.14**	—				
7. MS Type [1= RRMS, 2=SPMS or PPMS]	329	1.32	.47	-.23	.-.05	−.13*	.41**	.03	.07	—			
8. Time since diagnosis	349	1.76	.43	-.10	.03	.01	.38**	.07	−.07	.16**	—		
9. Financial Support [1=Yes, 2=No]	348	1.53	.50	-.06	-.10	.05	.05	.01	−.09	-.03	-.07	—	
10. Requirement of care [1=Yes, 2=No]	349	1.62	.49	.04	.17**	.14*	-.30**	−.02	.04	.39**	-.25**	.30**	—

*p<.05, ** p< .01

Table 5.4:

Binary Needs Means, Std. Deviations and Correlation Matrix

Variable	*n*	*M*	*SD*	1	2	3	4	5	6	7	8	9	10
1. Need for psychological support [1=Yes, 2=No]	224	1.53	.50	—									
2. Need for social support [1=Yes, 2=No]	221	1.56	.50	.457**	—								
3. Gender [1=male, 2=female]	349	1.71	.46	−.13	.03	—							
4. Age	345	51.72	11.83	.19**	.12	−.09	—						
5. Location [1=Urban, 2= Rural]	348	1.47	.50	-.08	.04	.08	.05	—					
6. Relationship status [1=in a r'ship 2= not in r'ship]	348	1.25	.43	−.05	−.17**	.14*	.03	-.14**	—				
7. MS Type [1= RRMS, 2=SPMS or PPMS]	329	1.32	.47	.03	.-.02	−.13*	.41**	.03	.07	—			
8. Time since diagnosis	349	1.76	.43	.13	.03	.01	.38**	.07	−.07	.16**	—		
9. Financial Support [1=Yes, 2=No]	348	1.53	.50	.08	.08	.05	.05	.01	−.09	-.03	-.07	—	
10. Requirement of care [1=Yes, 2=No]	349	1.62	.49	-.01	.13*	.14*	-.30**	−.02	.04	.39**	-.25**	.30**	—

*p<.05, ** p< .01

Table 5.5 displays the results of the first hierarchical regression analysis, in which the dependent variable was perceived importance placed on having access to services that meet emotional or psychological support needs. This overall model predicted 10.7% of the variance. Only Block 1 ($F(4, 291) = 6.60$; $p < .001$) significantly contributed to the model. In the final model age ($\beta = -.21$, $p < .05$) and MS type ($\beta = -0.16$, $p < .05$) were significant predictors of the importance placed on having access to services that meet psychological support needs. Specifically, being younger and having RRMS were significantly associated with greater perceived importance placed on having access to psychological support. Overall, the model was significant ($F(8, 287) = 4.28$; $p < .001$).

Table 5.5:

Hierarchical Regression Analysis Investigating Predictors of Perceived Importance of Having Access to Services That Meet Emotional or Psychological Support Needs.

Variables	**β**	**p**	**t**	**B**	**SE**
Step 1: Sociodemographic factors					
Gender [1=male, 2=female]	.463	.172	1.370	.463	.338
Age	-.049*	.003	-2.98	-.049	.016
Location [1=Urban, 2= Rural]	.288	.338	.960	.288	.300
Relationship status [1=in a r'ship 2= not in r'ship]	.538	.129	1.521	.538	.354
R^2 Change=0.083					
Step 2: MS characteristics and support					
MS Type [1= RRMS, 2=SPMS or PPMS]	-.158*	.016	-2.427	-.893	.368
Time since diagnosis	-.013	.850	-.190	-.003	.018
Financial support [1=Yes, 2=No]	-.046	.450	-.757	-.242	.319
Requirement of care [1=Yes, 2=No]	-.075	.265	-1.118	-.408	.365
R^2 Change=0.023					
Adjusted R^2 =0.107					

Statistical significance:*p < .05;**p < .01;***p < .001.

Table 5.6

Hierarchical Regression Analysis Investigating Predictors of Perceived Importance of Having Access to Services That Meet Social Support Needs

Variables	β	p	t	B	SE
Step 1: Sociodemographic factors					
Gender [1=male, 2=female]	.117*	.049	1.977	.698	.353
Age	-.087	.236	-1.187	-.020	.017
Location [1=Urban, 2= Rural]	.061	.296	1.047	.327	.313
Relationship status [1=in a r'ship 2= not in r'ship]	.124*	.035	2.114	.785	.372
R^2 Change=0.031					
Step 2: MS Characteristics and support					
MS Type [1= RRMS, 2=SPMS or PPMS]	-.085	.197	-1.293	-.492	.381
Time since diagnosis	.042	.543	.609	.012	.019
Financial support [1=Yes, 2=No]	-.011	.859	-.177	-.059	.332
Requirement of care [1=Yes, 2=No]	-.232**	.001	-3.433	-1.286	.375
R^2 Change=0.048					
R^2 =0.079					

Statistical significance:*p < .05;**p < .01;***p < .001.

Table 5.6 displays the results of the second hierarchical regression analysis, in which the dependent variable was perceived importance placed of having access to services that meet social support needs. In this analysis, the overall model predicted 7.9% of the variance in scores. Block 1 was not significant (F(4,288) =2.29; p>.05), with only Block 2 (F(8,284) =3.04; p<.005) significantly contributing to the model. In the final model, gender (β = .117, p< .05), requirement of care (β = -0.23, p< .001) and relationship status (β = 0.12, p< .05) significantly predicted the importance placed on having access to services that meet needs for social support.

Specifically, being female, requiring care and not being in a relationship were associated with increased perceived importance of having access to services to meet needs for social support.

5.3.3 Logistic regression analysis of binary needs for psychological and social support

Two logistic regression analyses were conducted to assess the relationship between the same factors included in the previous models and the binary variables that captured the expressed needs for (1) emotional/psychological support and (2) social support.

Table 5.7 displays the results of the first logistic regression analysis assessing needs for psychological support. The only continuous variable, age, was tested using the Box Tidwell test and passed the assumption that age (the continuous independent variable) is linearly related to the logit of the dependent variable. Overall, the model was statistically significant, $\chi 2(8) = 16.868$, $p < .05$, and explained 10.3% (Nagelkerke R2) of the variance in need for psychological support and correctly classified 61.0% of cases. However, there were no significant predictors in this model with age, gender, location of residence, relationship status, MS type, time since diagnosis, requirement of care and receipt of financial support not significantly associated with a need for emotional or psychological support.

Table 5.8 displays the results of the second logistic analysis which investigated the predictors of social support needs. Again, the assumption of linearity of the logit was passed. Overall, the model was statistically significant, $\chi 2(8) = 21.994$, p = .005, explaining 13.5% (Nagelkerke R^2) of the variance in need for social support scores and correctly classified 64.3% of cases. When holding other factors constant, those who require care were 2.298 times more likely to have a need for social support than those who do not require care (OR=2.298, 95%CI [1.1, 4.8]). Additionally, being single was associated with a 69.1% increase in likelihood of needing social support (OR=.309, 95%CI [.15, .64]). Older age was associated with a 4% increase in the odds of needing social support (OR=1.04, 95%CI [1.0, 1.1]). Location of residence, MS type, gender, time since diagnosis and receipt of financial support were not significantly associated with need for social support scores.

Table 5.7

Logistic Regression Analysis of Need for Psychological or Emotional Support

Source	B	SE B	Wald χ^2	P	OR	95% CI	
						LL	UL
Gender (1=male, 2=female)	-.455	.327	1.937	.164	.635	.335	1.204
Age	.030	.015	3.765	.052	1.030	1.000	1.061
Location (1= Urban, 2= Rural)	-.347	.301	1.325	.250	.707	.392	1.276
Relationship status (1=in a relationship, 2= single)	-.254	.356	.510	.475	.775	.386	1.559
MS Type (1= RRMS, 2= Progressive MS)	-.138	.366	.142	.707	.871	.425	1.785
Time since diagnosis (1=<5 years, 2= >5 years)	.662	.374	3.138	.076	1.938	.932	4.031
Financial support (1=Yes, 2=No)	.408	.309	1.741	.187	1.504	.820	2.759
Requirement of care (1=Yes, 2=No)	.226	.363	.387	.534	1.253	.616	2.550

Note. *OR* = odds ratio. *CI* = confidence interval, *UL* = Upper Limit, *LL*=Lower limit

Table 5.8

Logistic Regression Analysis of Need for Social Support

Source	*B*	*SE B*	Wald χ^2	*P*	*OR*	95% *CI* Lower	95% *CI* Upper
Gender (1=male, 2=female)	.367	.335	1.198	.274	1.443	7.48	2.782
Age	.040	.016	6.330	.012	1.040	1.009	1.073
Location (1= Urban, 2= Rural)	-.115	.310	.138	.711	.891	.486	1.636
Relationship status (1=in a relationship, 2= single)	-1.175	.372	9.980	.002	.309	.149	.640
MS Type (1= RRMS, 2= Progressive MS)	-.056	.373	.023	.881	.945	.455	1.965
Time since diagnosis (1=<5 years, 2= >5 years)	.166	.384	.188	.665	1.181	.557	2.506
Financial support (1=Yes, 2=No)	.025	.316	.006	.937	1.025	.552	1.905
Requirement of care (1=Yes, 2=No)	.832	.372	4.993	.025	2.298	1.108	4.770

Note. *OR* = odds ratio. *CI* = confidence interval, *UL* = Upper Limit, *LL*=Lower limit

5.3.4 Thematic analysis

Of the 847 open text responses received from 10 open-text questions analysed, 206 responses were identified as making reference to need for psychological and/or social support in the context of engagement with community workers. Additionally, of the 419 responses received in response to the 3 questions investigating online provision of services, 68 responses were deemed to reference psychological and/or social support needs.

Four main themes were identified from these open text responses. Two of the themes ‘Community worker as a source of social support’ and ‘The role of MS Ireland in facilitating peer and psychological support’ highlight good practice and general reports of satisfaction with, or praise for, service providers. Two of the themes, ‘Privacy as a barrier to support’ and ‘Online services, greater accessibility with fewer social benefits’ highlight challenges faced in providing social or psychological support in online contexts. Table 5.9 includes additional details on these themes along with some representative quotes.

Table 5.9

Themes Identified from the Open-text Responses

Theme	**Representative Quotes**
Community worker as a source of social support	*'Just keeping in contact.'* *'Listening ear'* *'Just someone to talk to'* *'Being there to chat through what going on but just there to listen'*
The role of MS Ireland in facilitating peer and psychological support	*'I was feeling anxious and depressed after I was diagnosed. My CW helped me to socialise with MS coffee mornings monthly or pamper day out yearly. It gave me something to look forward to and to be with people who understood me.'* *'Put me in touch with someone else with MS. Made me realise Life can go on successfully.'* *'Helped me get Counselling when first diagnosed.'*
Online services, greater accessibility with fewer social benefits	*'No need to travel & use up energy. Interacting with others of similar interest & health issues.'* *'The fact that I don't have to travel anymore, I just turn my computer on and I'm there! I don't have to worry about parking or where the toilet is.'* *'Technical faults. Its just not the same as in person. We like everyone else need human touch.'*
Privacy as a barrier to support	*'People can be very private about their illness and afraid of admitting weakness.'* *'Im quite secretive about my MS and dont like sharing too much with people outside my close family and friends.'* *'Confidentiality, some people don't want to bother others with their needs but they shouldn't be afraid to ask for help'*

5.3.4.1 Community worker as a source of social support

Following on from the findings of Maguire et al. (2023), while much of the work of community workers involves signposting and facilitating access to supports, it is clear from this analysis that many service users benefitted from the social relationship they had developed with their community workers. Some responses also reported benefits of service provider interactions, even when interactions did not have a specific support outcome. For example, the value of community workers '*Just keeping in contact'* was beneficial in itself. Additionally, service users frequently provided positive descriptions of their community worker's personality or social skillset, e.g., noting that they were a *'Sincere person', 'she is very pleasant always and its easy to talk with her any time i contact her',* or that the community worker acted as *'a listening ear as to someone like me who was newly diagnosed'*

5.3.4.2 The role of MS Ireland in facilitating peer and psychological support

Responses generally expressed a high level of satisfaction with the ability of community workers to facilitate peer support, which was seen as valuable. For example, one respondent noted how they '*Built a strong social group as my community work as the first point of contact when first diagnosed'.* Most responses referring to psychological support also suggested a good level of efficacy in facilitating these supports. '*She helped get me counselling when 1st diagnosed. And got counselling for my girls when younger'* which also highlights the role of community workers in supporting the whole family. However, despite this generally high level of satisfaction, compared to peer support, there were more expressions of difficulty or obstacles in the facilitation of psychological support, usually involving practical issues such as lack of access or funding. *'Psychological support- not funded* *in my area at least'*.

5.3.4.3 Online services, greater accessibility with fewer social benefits

Responses referring to online services clearly outlined a balancing of benefits and challenges faced by PwMS who availed of services delivered through this medium. Many responses indicated an appreciation for online classes (another service provided by MS Ireland), specifically how they provided greater accessibility, ease of access and helped facilitate engagement for those with disability. *'It is a big effort for a wheelchair user like me to leave my home and can take a lot of energy and time and this has been eliminated.'* Despite these positives, many participants expressed feeling that social engagement in online classes was restrictive compared to face-to-face interactions, resulting in participants feeling fewer social benefits from engaging. *'Loss of social contact, not the same as being physically present, social isolation, some people have not engaged on line and have lost contact.'*

5.3.4.4 Privacy as a barrier to support

By far the most frequently reported obstacle towards accessing peer or psychological support was participants' desire for privacy and anonymity. *'Im quite secretive about my MS and dont like sharing too much with people outside my close family and friends.'* Responses indicate that some individuals may prioritise privacy over availing of support due to perceptions of stigmatization *'Shame. Fear of people knowing'*.

5.4 Discussion

5.4.1 Predictors of support needs

The findings from **study 4** suggest that needs for psychological and social support vary among people with MS which may have implications for the provision of supports relating to anxiety specifically. Interestingly, sociodemographic and health factors had different relationships with the importance PwMS placed on having access to services to meet these needs. However, it is also clear from this analysis that the factors investigated here cannot solely explain the reasons for why support needs exist. Findings from studies **1-3** imply that there are additional psychosocial, lifestyle and MS-related factors not investigated here that may contribute to support needs for PwMS. Also, while results suggest that these needs can often be met through community work services, such as those provided by MS Ireland, it is clear that greater efforts are needed in order to fully address unmet psychological and social needs among PwMS.

There was more support for individual predictors of social support needs in this analysis in comparison to predictors of psychological support needs. Specifically, PwMS who were not in a relationship and were in receipt of care were more likely to place importance on having access to services that facilitate social support, and such individuals were also more likely to experience needs in this area. The observed association between relationship status and social support needs align with those reported in other samples of PwMS (Baharian et al., 2023; Gulick, 1994; Williams et al., 2004). It has also been shown that marital status can indirectly impact mental health through social support (Sherbourne & Hayes, 1990), however, there was no increased need for psychological support among single PwMS in our sample.

Requirement of care, often owing to increased disability or MS symptom severity, has previously been associated with a number of factors which may increase the need for psychological support, such as psychological stress (Weygandt et al., 2016), depression (Galeazzi et al., 2005; Solaro et al., 2016) and, notably for this thesis, anxiety (Butler et al., 2016; Carvalho et al., 2022; Tan-Kristanto & Kiropoulos, 2015). Despite these associations, having a requirement for care did not significantly predict need for emotional or psychological support in our sample, but did have associations with needs for social support.

While the challenges associated with increased disability can be a significant source of stress, it has been suggested that some of the associations between disability and need for support can be resultant of psychosocial pressures such as participation restrictions (Bogart et al., 2015). Furthermore, how individuals cope with disability has a significant impact on psychological outcomes. For example, strong disability identity (affirming one’s identity as a person with disability) can increase support seeking (Dunn & Burcaw, 2013), which is associated with lower anxiety and depression (Bogart et al., 2015) and may be influenced through means such as disability affirmation therapy (Olkin, 2009). Additionally, while it has been reported that PwMS generally use less support seeking coping strategies than controls (McCabe & Di Battista, 2004; McCabe et al., 2009), as described in study 1 there is a suggestion that a greater sense of control may result in greater support seeking (Fahy & Maguire, 2022; Lode et al., 2009). It is possible that the findings of non-significance between requirement of care and need for emotional or psychological support may suggest good coping, disability identity or control related self–efficacy in this sample, however as these factors were not explored in this analysis the reasons for our findings here are unclear.

As mentioned above, while there were no associations between requirement of care and psychological support needs in this sample, requirement for care was associated with a need for social support. While the relationship between disability and social support outcomes is unclear at this point, and requires further research, these findings align with suggestions that higher levels of disability may interfere with social relationships by making participation in certain social activities more difficult (Baharian et al., 2023; Ratajska et al., 2020). Future research should continue to explore factors relating to coping strategies, particularly for those with high levels of disability, with a view to creating interventions which promote positive coping and strong disability identity.

Despite literature which has found that newly diagnosed PwMS are particularly vulnerable to comorbid depression (Lode et al., 2009), and lower quality of life (Klevan et al., 2014), findings did not reveal any relationship between time since diagnosis and social or psychological support needs, suggesting that these needs persist across all stages of the disease trajectory. While some studies suggest increased psychological support needs in newly diagnosed PwMS (Güner et al., 2020; Lode et al., 2009; Rintala et al., 2019), several studies have similarly failed to find an association between time since diagnosis and psychological well-being (anxiety and depression) including in **study 2** (Beiske, et al., 2008; Bogart, 2015; Fahy & Maguire, 2023a). Further research is necessary to understand the cause for the variability in findings surrounding the association between time since diagnosis and need for psychological support, as well as the mechanisms driving this association.

While time since diagnosis was not a significant predictor of needs for support, it is notable that both age and MS type were. For example, younger participants and those with RRMS were more likely to place importance on having access to services that meet needs for psychological support. Given that progressive forms of MS are more common in later stages of MS than in newly diagnosed PwMS (Beal et al., 2007), this may have masked associations with time since diagnosis. The finding of greater importance placed on having access to services to meet needs for psychological support at younger age aligns with previous findings of an association between younger age and increased depression rates in PwMS (Beal et al., 2007; Patten et al., 2000). Our finding of a greater need for social support at older ages aligns with findings of potentially smaller social networks and potentially reduced social support in some older individuals (Bowling, 2011). Given associations between social isolation and a number of unwanted health outcomes in older adults (depression, reduced physical activity, greater tobacco use) it may be particularly important to provide support to this demographic (Adams et al., 2016; Gardiner et al., 2018). Despite a need for social support being reported more frequently in older individuals, an interesting finding is that being younger was significantly associated with placing greater importance on having access to services to meet needs for social support. Having social support and being younger has been associated with greater awareness of community support services in general populations (Denton et al., 2008; Tindale et al., 2011). It is possible that having greater awareness of support services influences the perception of importance of these services, however more research is needed to determine the relationship between age, social support needs and the importance placed on having support services which address these needs. With some participants expressing a lack of awareness of available supports, this may suggest a need for improving awareness of existing supports.

Our findings of a greater importance placed on having access to psychological support in individuals with RRMS does not align with some existing literature which suggests that progressive MS is associated with higher psychological support needs (depression, suicidality) (Bakshi et al., 2000; Jones et al., 2012; Pompili et al., 2012). However, while greater depression rates have been reported in individuals with progressive MS, RRMS has been associated with greater levels of anxiety (Jones et al., 2012; Podda et al., 2020). Additionally, using clinical diagnosis as a measurement for depression, rather than self-report measures, may impact these findings as well as the inverse (lower rates of depression associated with progressive disease types) has also been reported using these means (Zabad et al., 2005). Similarly, while this study and **study 2** dichotomised MS type for analysis to compare RRMS to progressive forms of MS (SPMS and PPMS), studies have suggested significant differences in psychological wellbeing between people with SPMS and PPMS, with those with PPMS showing significantly better psychological functioning (Bakshi et al., 2000; Jones et al., 2012; Vleugels et al., 1998). While findings from the wider literature are mixed, the findings presented here do align with our findings of a non-significant relationship between anxiety and MS type in **study 2** (Fahy & Maguire, 2023a). Further research is needed to understand the specific mechanisms that determine psychological needs in different MS types.

Despite research suggesting men may score lower than females on social support measures (Kneavel, 2021), being female significantly predicted higher perceived importance on having access to services meeting needs for social support. However, the logistic regression found no significant association between gender and the presence of this need in our sample. Studies have shown that males can have relative difficulty in acknowledging their need for social support (Flaherty & Richman 1989; Rosiak & Zagożdżon, 2017) and generally engage in less social support seeking than females (McCabe et al., 2009; Reevy & Maslach, 2001; Upton

& Taylor, 2015), which can exacerbate social support related issues and lead to men having smaller social networks (Caetano et al., 2013). This suggests that men with MS may be less likely to seek out social support which could mean the development of forums or peer support groups specifically for this group may be beneficial. Potentially due to these biases, findings of an association between gender and social support are inconsistent across samples, with some studies reporting a lack of an association between these variables in PwMS (Nikolaev & Vasil'eva, 2017). This may have a particular effect on our findings as it may affect men's willingness to express a need for social support.

We also found no association between gender and need for psychological support. This finding may be seen as surprising given links between being female and increased levels of fear of relapse (Shaygannejad et al., 2021), anxiety (Théaudin et al., 2016), and some suggestions of higher rates of depression (da Silva et al., 2011; Patten et al., 2003), all concepts which could be associated with greater need for psychological support. This finding may be related to evaluating psychological support as whole as there may be differing gender differences within different forms of psychological support needs. For example, a large-scale survey study suggested that while women generally have higher levels of anxiety, men report higher levels of depression (Jones et al., 2012). Our findings here do align with findings of no significant relationship between anxiety and gender in **study 2** (Fahy & Maguire, 2023a), with further research needed to explore gender differences in relation to support needs in PwMS.

5.4.2 Experiences of PwMS with service provision

Results from the qualitative analysis of open-text responses highlighted some important considerations related to service provision for PwMS with psychological or social support needs. Findings which describe community workers as a source of social support adds to research suggesting the importance of the relationship between service users and service providers (Mayo et al., 2021). There is some debate around the feasibility of social support provision by service providers themselves, with some arguments that the unidirectional nature of the relationship should result in categorizing this support as ‘professional support’ rather than social support as it is traditionally understood (Hupcey & Morse, 1997). Regardless of how we categorise these interactions however, it is clear from evidence both within (Liković & Buljevac, 2023) and outside (Biederman et al., 2013) of the MS community that some service users benefit from the social interactions and relationships they form with their service providers.

Findings of a generally good level of efficacy of community workers in facilitating psychological and peer support highlight good practice in this area, with some expression that the facilitation of psychological support could be aided with better funding, as has been highlighted previously regarding Irish MS service provision (Lonergan et al., 2015). Findings related to online service provision highlight both the challenges, and potential benefits of this mode of service delivery. While this mode of delivery has clear accessibility advantages which facilitate engagement and help the management of variable symptoms (which can make committing to engagement in support service challenging), also highlighted as being of high importance in **study 3**, significant drawbacks, including the lack of non-verbal communication, reduce reported social benefits relative to in-person peer support (Gerritzen, 2022). Findings of the desire for privacy and anonymity as a frequent barrier towards engagement may reflect findings of significant stigmatization of MS (Maurino et al., 2020; Pérez-Miralles et al., 2019; Vitturi et al., 2022) and given the association between stigmatization and psychological outcomes and psychological support seeking (Barta & Kiropoulos 2023; Pérez-Miralles et al., 2019; Tworek et al., 2023) further highlights the importance of working to combat this stigma (Cooke, 2019; Grothe et al., 2021).

Overall, the findings of **study 4** suggest that while some sociodemographic and MS related factors may predict needs for psychological and social support, as well as the perceived importance of having access to services that meet these needs, there are clearly other factors that contribute to these needs but that were not investigated in this analysis. A number of psychosocial factors in studies **1-3**, such as self-efficacy, exercise behaviours and coping styles, are likely to influence needs for psychological support, given known associations with anxiety or depression in PwMS (Fahy & Maguire, 2022; Gay et al., 2010). In addition, need for social support has been shown to be associated with a number of factors such as resilience (Golzari Movaghar et al., 2015; Silverman et al., 2017), and religious factors (Papa et al., 2021) which were outside the focus of this analysis.

5.4.3 Limitations

Due to this study's cross-sectional design, the directionality of the relationships assessed here is difficult to determine. **Study 4** involved a secondary data analysis which meant that the variables included in the models were limited to the data which was collected in the original project, with no validated measures of anxiety or other measures of psychological wellbeing included. Additionally, only participants who indicated that they knew their MS Ireland community worker were asked to complete the measure on actual needs for psychological and social support, which may have had an impact on the findings presented here. For example, those who completed these measures may have had higher levels of disability, display high use of support seeking strategies, or be more likely to report support group identification, all of which have implications for social and psychological support needs (Wakefield et al., 2013). Self-report measures are commonly used due to the feasibility of delivering these measures, however, as previously mentioned in the limitations of previous studies, a number of biases are common with self-report measures which have the potential to impact our results. There are specific concerns surrounding self-reporting social support levels, as characteristics such being male (Flaherty & Richman, 1989; Rosiak & Zagożdżon, 2017) or having high anxiety (Bruce & Arnott, 2009), are associated with underestimating and under reporting levels of social support received. As with **study 2**, data collection for this study was conducted during the COVID-19 pandemic in 2021, which may limit the generalisability of these findings outside of this context. Data on race or ethnicity were not available for this sample, so it is unclear whether our sample was representative in this respect.

5.4.4 Conclusion

Study 4 has identified a number of demographic and disease- related variables associated with psychological and social support needs in PwMS, which may assist service providers in identifying who may be in greatest need of these services. Additionally, findings have highlighted some important considerations relating to the provision and use of psychological and social support within an Irish context. Future research should continue to aim to identify relevant factors to assist with the identification of support needs in PwMS.

These findings extend on those from **study 3** which highlighted participants' positive feedback on the supports provided by MS Ireland. Both these studies imply that supports exist in Ireland which can help with the management of anxiety through targeting one or more of the modifiable factors identified in studies **1** and **2**.

Supports offered by MS Ireland may also target other important outcomes including improvements in physical symptomology, however the efficacy of many of these programmes in the management of anxiety in PwMS has not been formally explored. In addition, once efficacy is established, the mechanisms through which a support may reduce anxiety also needs exploration, such that these supports may continue to be developed as well as informing the creation of additional supports in this area. One such programme offered by MS Ireland, entitled the MoveSmart programme, fits this description by offering a structured exercise, SCT (self-efficacy) based behavioural coaching and peer support programme for PwMS. **Study 5** will address objective 5 of this thesis by exploring the efficacy of the MoveSmart programme as well as the mechanisms through which the programme may impact on anxiety. In addition, this study explores the role of sociodemographic, health, psychological and exercise factors in predicting levels of anxiety which may help with the identification of at-risk individuals, thereby also further addressing objective 4.

Chapter 6:

Study 5: Evaluation of an online structured exercise, SCT-based behavioural coaching and peer support programme on anxiety in multiple sclerosis.

Abstract

Background: While exercise interventions may have a variety of benefits for PwMS, the impact of exercise on anxiety has received little attention in an Irish context. **Aim:** This study aimed (1) to assess the efficacy of a physiotherapist-led structured online exercise programme (MoveSmart) in relation to anxiety, (2) to identify the role of sociodemographic, health, psychological and exercise factors in anxiety, (3) to investigate how changes in these factors predict changes anxiety following completion of the programme, and (4) to explore the experiences of PwMS in relation to their participation in the programme. **Method:** Data from 284 participants who took part in the MoveSmart MS programme between January 2021 and June 2022 were analysed. Participants provided sociodemographic and health information at baseline and completed measures of anxiety (STAI), exercise self-efficacy (EXSE), fatigue (MFIS), physical activity (GLTEQ), and the physical impact of MS symptoms (MSIS-29) at baseline and again on completion of the programme. Follow up focus groups were conducted in August, 2021 with 25 participants to explore their experiences of taking part in the programme. Data were analysed using two hierarchical regressions to investigate the predictors of anxiety at baseline and changes in anxiety following competition of the MoveSmart programme. Focus-group qualitative data was analysed using reflexive thematic analysis. **Results:** Participation in the MoveSmart programme was associated with significant reductions in anxiety. Younger age, lower PDDS, higher physical impact of MS and higher fatigue were significantly associated with higher baseline anxiety scores, however, only changes in the physical impact of MS predicted changes in anxiety scores. Key themes identified through thematic analysis included ‘Benefits of peer support’, ‘Benefits of goal setting’, ‘Noticed improvements’ and ‘Praise for programme execution’. **Conclusion:** Participation in a physiotherapist-led structured exercise programme resulted in significant improvements in anxiety, in part through reducing the impact of physical MS symptoms on quality of life. Qualitative results suggest that peer support and increased goal setting may have contributed to reductions in anxiety. Future research should continue to explore mechanisms behind anxiety improvements in MS with a view to informing the development of targeted supports.

6.1 Introduction

Throughout this thesis, a number of modifiable associates of anxiety in PwMS have been identified which may have value for use in targeted interventions. Notably, in **study 1** and **study 2**, exercise activity was shown to predict anxiety in PwMS (higher exercise activity associated with lower anxiety) (Fahy & Maguire, 2022, 2023a), which is consistent with findings from general populations (Carek et al., 2011). Several interventions based on exercise activity in PwMS show promising efficacy in improving a number of outcomes for PwMS including anxiety reduction (Fleming et al., 2021; Hasanpour-Dehkordi et al., 2016; Pilutti et al., 2014; Taspinar et al., 2015), however, findings here are mixed. While some exercise programmes have been associated with anxiety reducing effects, others have found no such effect on anxiety (Gascoyne et al., 2020). This may be due to the considerable variability in recruiting methods, delivery of the interventions (e.g. online vs. in-person, group vs. individually delivered), measures of anxiety used and sample characteristics. A recent review investigating the potential impact of exercise interventions on anxiety in PwMS, highlighted the paucity of research in this area and the urgent need for more systematic evaluations of exercise interventions for anxiety in PwMS, (Šilić et al., 2023). In other chronic health conditions, such as fibromyalgia and coronary heart disease (Herring et al., 2010) as well as in general populations (Sawchuk & Olatunji, 2011) exercise has been shown to reduce symptoms of anxiety. There is therefore a clear need for a better understanding of the relationship between exercise and anxiety in PwMS as well as the potential utility of exercise as a target intervention for improving anxious symptomology.

One potential mechanism through which exercise may impact anxiety is through self-efficacy, which, as highlighted in previous chapters, describes one’s perception of one's own abilities (Chen et al., 2016). In some theoretical models of anxiety, including the Intolerance Uncertainty Model (IUM) and the Contrast Avoidance Model (CAM) described in Chapter 1, it is suggested that self-efficacy influences anxiety through negative problem orientation, a concept associated with increased anxiety, where higher self-efficacy predicts lower negative problem orientation (Llera & Newman, 2023). Additionally, self-efficacy is a core concept in Social Cognitive Theory (SCT), with evidence suggesting that self-efficacy (as well as other concepts core to SCT such as goal setting) is associated with physical activity in PwMS (Silveira et al., 2020; Uszynski, Casey et al., 2018). Furthermore, in a recent review investigating future oriented cognitions in PwMS it was found that self- efficacy was the strongest predictor of quality of life (with higher self-efficacy predicting higher quality of life), suggesting that improvements in self-efficacy could have a number of benefits for PwMS (Maguire et al., 2021). Exercise programmes which include SCT educational components have previously been shown to have efficacy in improving walking related outcomes in PwMS, however the potential impact of these programmes on anxiety, while promising, is less clear (Coote et al., 2014; Hayes et al., 2017; Pilutti et al., 2014). In an Irish context, one study found that self-efficacy significantly predicted the variance in physical activity scores, with anxiety at lower or mean levels significantly moderating the relationship between self-efficacy and physical activity (Casey, Uszynski et al., 2018). This suggests exercise may have particular efficacy for those with less severe anxiety symptoms. Given research showing that exercise can increase self-efficacy in PwMS (Snook, 2008), as well as evidence associating increased self-efficacy with lower anxiety in PwMS (**study 1** and **2**) (Fahy & Maguire, 2022, 2023a), exercise programmes that increase self- efficacy may be particularly beneficial in reducing anxiety in PwMS.

It should be noted that promotion of physical activity in PwMS should be done with care. While exercise behaviours can provide PwMS with a sense of control over certain symptoms, poor adherence to prescribed exercise can create feelings of guilt and worry that disease progression is the ‘fault’ of the PwMS (Adamson et al., 2018). While modifiable psychosocial constructs like self-efficacy play an important role in exercise outcomes, evidence suggests that MS symptoms such as fatigue and walking limitations coupled with these psychosocial constructs explain more of the variance in physical activity than psychosocial constructs alone (Uszynski, Herring et al., 2018). Additionally, meta-regression analysis of exercise programmes for PwMS found significantly larger antidepressant effects of the programmes in which there were significant improvements to fatigue symptoms (Herring et al., 2017). These findings highlight the importance of targeting both physical and psychosocial factors in the promotion of physical activity for PwMS.

MS Ireland recently developed a suite of structured exercise programmes (collectively termed the "MoveSmart" programme) designed for different cohorts of PwMS (MS Ireland, n.d.). This physiotherapist-led programme is conducted over a 10-week period and features symptom-focused exercise, behavioural coaching based on the principles of SCT and peer support for PwMS. This programme builds on a successful RCT of the “Step it up” programme which also combined exercise and SCT based behavioural coaching in PwMS with low to moderate disability. This RCT was shown to have positive impacts on walking related outcomes (Coote et al., 2014; Hayes et al., 2017), as well as anxiety, depression and on the physical impact of MS (Coote et al., 2017). Furthermore, qualitative evaluations of this programme highlighted potential psychological benefits, including reduced anxiety and improved self-efficacy (Russell et al., 2023). In addition, the peer support experienced during the programme was highlighted as beneficial, with suggestions that peer support elements were as important to participants as planned exercise activities (Russell et al., 2023). Given findings that there is a strong expressed desire for peer support (from **study 3**) and that levels of need for social support are high (**study 4**), there may be particular value in having this as an element of this programme. It should be noted that while these results are promising, anxiety was not the primary outcome assessed in any of the Step it up studies, and furthermore, the mechanisms for impacting change in anxiety were not investigated.

This study aims to 1) explore if and how the experience of anxiety changed among PwMS who engaged in the MoveSmart exercise programmes, as well as 2) identifying any sociodemographic, health, psychological or exercise related associates of anxiety at baseline. Additionally, this study aimed to 3) explore the likely mechanisms behind any change in anxiety and 4) explore participant experiences with the MoveSmart programmes.

6.2 Method

6.2.1 Data sources

This study involves secondary analysis of data from participants who took part in the MoveSmart MS programme. The MoveSmart MS programme consisted of 10-weeks of online group-based behavioral coaching with one session per week. Sessions included covering SCT-based self-efficacy, goal setting and adjustment and symptom management and with the order of the sessions dependent on the disability level of the group. Participants were asked to complete a survey which included questions on demographics (age and sex), health information (type of MS, Patient Determined Disease Steps Scale (PDSS) (Learmonth, Motl et al., 2013), as well as validated measures relating to psychological well-being, lifestyle and disease-related variables both pre and post their participation in the MoveSmart MS programme. More detail on the specific measures used is described in section 6.2.2. Qualitative data was collected through three focus groups which were conducted with a total of 25 participants. The focus group participants consisted of 8 men and 17 women, 20 of whom had a diagnosis of RRMS, 4 with a diagnosis of SPMS and one participant with PPMS. In addition, the mean age of focus group participants was 55.6 years, with a mean time since diagnosis of 16 years. Focus group interviews were conducted online in three groups on 5th, 19th and 20th of August 2021. Questions explored participant experiences with the programme's delivery and content, as well as any criticisms or benefits derived from the programme. All participants in the MoveSmart programme between January 2021 and June 2022 received an email invitation to be involved with focus group qualitative data collection, with all those who accepted the invitation included. Ethical approval for this study was granted by the University of Limerick ethics committee on December 12th 2020, with permission for the authors to conduct analysis on the anonymised data set and transcribed focus group data on July 19th 2023.

6.2.2 Measures

6.2.2.1 Anxiety

Anxiety was measured using the State-Trait Anxiety Inventory trait-subscale (STAI-T) (Spielberger, 1983). This measure consists of 20 items (e.g. “I worry too much over something that really doesn’t matter”), with answers logged on a 4-point Likert scale (e.g., from “Almost Never” to “Almost Always”). Total STAI-T scores range from 0-60 with higher scores indicative of higher level of trait anxiety. The STAI is a commonly used means of evaluating anxiety in PwMS, with 9 of the studies included in our **study 1** review using this measure of anxiety.

6.2.2.2 Mobility disability

Patient reported mobility disability was assessed using the Patient Determined Disease Steps scale (PDDS) (Learmonth, Motl et al., 2013). This measure consists of nine items with participants selecting the item that best describes their current level of disability. Items are scored as follows: 0 – normal; 1 – mild disability; 2 – moderate disability; 3 – gait disability; 4 – early cane; 5 – late cane; 6 – bilateral support; 7 – wheelchair/scooter; and 8 – bedridden, with higher scores indicative of higher levels of disability. A recent systematic review found good validity and test re-test reliability with recommendations for use in samples of PwMS with mild to moderate disability (Ann Marrie et al., 2023).

6.2.2.3 Exercise self-efficacy

The Exercise Self-Efficacy Scale (EXSE) was used to assess participant beliefs about their ability to exercise at moderate intensity, three times per week, for a minimum of 40 minutes per session (McAuley, 1993). The six-item version of the EXSE asks participants to indicate their confidence in maintaining this level of exercise for 1, 2, 3, 4, 5, and 6 weeks with each time period represented by a single item (e.g. I am able to continue to exercise three times per week at moderate intensity, for 40+ minutes without quitting for the NEXT TWO WEEKS). Responses are logged using an 11-point Likert scale ranging from 0% to 100% in 10% intervals. These scores are then converted, totalled and averaged with total scores ranging from 0-100. The EXSE has been used frequently to evaluate exercise self-efficacy in MS populations, with one study (Snook & Motl, 2008) reporting an estimated internal consistency of 0.99.

6.2.2.4 Fatigue

The Modified Fatigue Impact Scale (MFIS) was used to assess levels of fatigue experienced by participants in this sample (Téllez et al., 2005). The full 21-item version was used with dimensions of physical, cognitive and psychosocial fatigue assessed (e.g. “I have been less able to complete tasks that require physical effort”). Responses are indicated using a 5-point Likert scale (never, rarely, sometimes, often, almost always). Total scores range from 0-84 with higher scores indicative of higher levels of fatigue. The MFIS has been used frequently to assess fatigue in MS populations (Larson, 2013), with good internal consistency (Cronbach’s Alpha > 0.9) (Kos et al., 2005).

6.2.2.5 Physical impact of MS

The Multiple Sclerosis Impact Scale –29 (MSIS-29) physical impact subscale was used to assess perceived physical impact of MS in this sample (Hobart et al., 2001). The physical impact subscale of the MSIS-29 contains 20 items assessing different dimensions of disability, physical symptomology and quality of life impacts in a timescale which includes the last two weeks (e.g. “In the past two weeks, how much have you been bothered by...” “Having to cut down the amount of time you spent on work or other daily activities?”). Answers are logged using a 5-point Likert scale (not at all, a little, moderately, quite a bit and extremely) where each item is scored 1-5, with total scores ranging from 0 to 100. The MSIS-29 has been used frequently in MS populations (Jones et al., 2013) and has been shown to have good reliability and sensitivity (Cronbach’s Alpha > 0.8) (McGuigan & Hutchinson, 2004).

6.2.2.6 Physical activity

The Godin Leisure Time Exercise Questionnaire (GLTEQ) was used to assess physical activity in this sample (Godin & Shephard, 1997), which was also used in **study 2**. While descriptions of this measure and its psychometric properties is available in section 3.2.2.3, it should be noted that GLTEQ weekly leisure activity scores (GLTEQ WLA) as opposed to GLTEQ health contribution scores (GLTEQ HCS) were used. GLTEQ WLA scores account for low, moderate and high intensity exercise, while the GLTEQ HCS scores account only for moderate and high intensity exercise. The decision to use GLTEQ WLA scores was taken to account for PwMS who exercise at lower levels of intensity.

6.2.2.7 MSWS

The Multiple Sclerosis Walking Scale (MSWS) was used to assess walking ability in this sample (Hobart et al., 2003). The MSWS contains 12 items which ask participants to indicate the extent to which MS has impacted on different abilities related to standing and walking during the last two weeks. (e.g. limited your balance when standing or walking?). Answers are logged on a 5-point Likert scale (not at all, a little, moderately, quite a lot, extremely). These scores were then standardised to range from 0-100, where higher scores indicate greater difficulty with walking. The MSWS has shown good reliability for use in MS populations (Learmonth, Dlugonski et al., 2013).

6.2.2.8 Additional measures

Participants also completed the Quick Inventory of Depressive Symptomology (QIDS) (Rush et al., 2003) and the psychological subscale of the MSIS-29 (Hobart et al., 2001) as part of the pre vs post-test battery, however, these factors were considered outside the focus of the current study due to conceptual overlap between these factors and anxiety.

6.2.3 Data Analysis

A mixed-methods approach was used for data analysis. Descriptive statistics were calculated with means, ranges and standard deviations presented for continuous variables and frequencies calculated for categorical variables. Power calculations conducted using G*Power software (Faul et al., 2009) indicated that a sample of 166 participants was suitable for this analysis. To address this study's first aim, a paired sample t-test of pre vs. post intervention anxiety scores was conducted. After conducting correlational analyses to assess assumptions of multicollinearity, linearity and homoscedasticity, hierarchical regression modelling was used to assess associations between (1) sociodemographic factors (age, sex), (2) MS characteristics (MS type, time since diagnosis, PDDS), (3) subjective health measures (EXSE, MFIS, MSIS-29 physical subscale), (4) exercise activity (GLTEQ) and anxiety at baseline. This approach was taken to extend on the findings from the previous studies so that the role of demographics and MS characteristics would first be explored in relation to anxiety, before examining how the impact of MS and engagement in exercise predicted anxiety. To address the study's third aim, a separate hierarchical regression model was run using the same sociodemographic factors collected at baseline, and the pre vs. post-test changes in health status, MS related factors and exercise scores in their extent to which they could predict changes in anxiety (pre vs. post programme anxiety scores). Furthermore, a sensitivity analysis comparing baseline data from completers vs non-completers was conducted to assess any potential differences between these groups on the measures employed. Finally, to address this study's fourth aim, Reflexive Thematic analysis, based on the principles of Braun & Clarke (2019), was used to analyse qualitative data collected from focus groups about participants' experiences of the MoveSmart programme. As with the approach taken to analysing the qualitative data collected in **studies 2-4**, this analysis began with an initial period of the researchers (AF and RM) familiarising themselves with the data, after which initial codes were constructed by AF using MAXQDA 2020. AF used these initial codes to create initial themes, which were then presented to RM. These initial theme names and definitions were further refined through review and discussion until the point of data saturation, the point at which no new codes or themes could be identified. At this point AF created the final report based on these discussions.

Narrative integration was used to integrate qualitative and quantitative findings (Fetters et al., 2013). Specifically, a weaving approach was chosen given its utility for research where qualitative and quantitative results are thematically connected and where both types of data 'weave' back and forth around similar concepts. This process involves reporting findings theme by theme or concept by concept, describing findings from both quantitative and qualitative methods in the same section (Yaqoob & Barolia, 2023).

6.3 Results

6.3.1 Descriptive statistics

294 participants completed the MoveSmart MS exercise programme pre-test questionnaire. 170 participants completed post-programme questionnaire however 10 of these were excluded from analysis due to missing pre-programme data, resulting in a 54.4% attrition rate for the post-intervention survey. All participants were invited to participate in a follow up focus group of which a small selection of participants (n=25) accepted.

Table 6.1 and 6.2 include descriptive statistics for this sample. In line with population norms, the sample was mostly female (82.7%) with an age range of 24-88 years (mean age=50.37, SD=11.75). Time since diagnosis ranged from less than a year to 53 years (mean=12.45 years, SD=10.51). In terms of MS type, most participants (64.8%) reported having RRMS, followed by SPMS (15.8%) and PPMS (14.4%).

After adjusting STAI scores in accordance with the guidelines from Santangelo et al. (2016), using the one standard deviation non-gendered clinical cut off (STAI= 32.59), 20.4% of the sample scored above the cut off for clinical levels of anxiety at baseline. Using the same cut-off, only 6.25% of participants' scores indicated clinical levels of anxiety post-programme.

Table 6.1:

Sample demographics for categorical variables

Variable	**N**	**(%)**
Gender		
Male	49	(17.3%)
Female	235	(82.7%)
MS type		
Relapsing Remitting MS	184	(64.8%)
Secondary Progressive MS	45	(15.8%)
Primary Progressive MS	41	(14.4%)
Other	14	(4.9%)
Missing	-	-

6.3.2 Sensitivity analysis

An independent samples t-test was used to assess any potential differences between completers and non-completers of the MoveSmart programme post-test measures in terms of their baseline characteristics. The 160 participants who completed post-test measures were compared to the 124 participants who completed only pre-test measures. There were no significant differences at baseline in any of the measures used in this analysis, but non-completers (M = 48.05, SD = 11.91) were significantly younger on average, *t*(281)= 2.95, *p*= .003, than completers (M = 52.15, SD = 11.35) with a shorter time since diagnosis, *t*(282)= 2.15, *p*= .033 for non-completers (M = 10.94, SD = 10.5) than completers (M = 13.63, SD = 10.39).

6.3.3 Paired samples t-tests

Paired samples t-tests were used to investigate the difference between pre- and post-programme scores for anxiety, as well as all validated measures for participants with both pre and post-programme data (see Table 6.2). The results indicated that pre-programme STAI scores (*M*= 20.69, *SD*=10.85) were significantly higher than post-programme STAI scores (*M*= 17.79, *SD*= 10.18), *t*(159)= 4.926, *p*<.001. In addition, pre-programme GLTEQ scores (*M*= 16.99, *SD*=1.35) were significantly lower than post-programme GLTEQ scores (*M*= 19.59, *SD*= 1.558), *t*(157)= -6.564, *p*<.001. Furthermore, pre-programme MFIS scores (*M*= 44.11, *SD*=15.17) were significantly higher than post-programme MFIS scores (*M*= 36.12, *SD*= 13.07), *t*(159)= 8.785, *p*<.001. Pre-programme MSIS-29 psychological scores (*M*= 38.92, *SD*=21.66) were significantly higher than post-programme MSIS- 29 psychological scores (*M*= 28.37, *SD*= 18.29), *t*(158)= 7.343, *p*<.001. Similarly, pre-programme MSIS-29 physical scores (*M*= 40.74, *SD*=21.42) were significantly higher than post-programme MSIS-29 physical scores (*M*= 31.37, *SD*= 20.34), *t*(154)= 8.327, *p*<.001. Pre-programme MSWS scores (*M*= 52.89, *SD*=30.28) were also significantly higher than post-programme MSWS scores (*M*= 44.97 *SD*= 31.15) *t*(160)= 6.104, *p*<.001. Interestingly, no statistically significant difference was found between pre-programme EXSE scores (*M*= 69.19, *SD*=30.04) and post-programme EXSE scores (*M*= 72.76, *SD*=26.82) *t*(159)= -1.588, *p*>.05.

Table 6.2

Sample demographics for continuous variables and paired samples t-tests results

Variable	**Baseline**					**Post-test**					**Change M**	**t**	***p***
	N	**Missing**	**M**	**SD**	**Range**	**N**	**Missing**	**M**	**SD**	**Range**			
STAI	284	-	20.36	11.26	0-54	160	124 (43.7%)	17.73	10.27	0-46	-2.90	4.926	p<.001
Age	283	1 (0.4%)	50.37	11.75	24-88	-	-	-	-	-	-	-	-
Time Since Dx	284	-	12.45	10.51	0-53	-	-	-	-	-	-	-	-
PDDS	282	2 (0.7%)	3.00	2.16	0-7	-	-	-	-	-	-	-	-
MFIS	284	-	43.51	14.95	0-84	160	124 (43.7%)	36.12	13.07	7-72	-7.99	8.785	p<.001
EXSE	284	-	68.02	30.92	0-100	160	124 (43.7%)	72.76	26.82	0-100	3.58	-1.588	p>.05
MSIS-29 physical	277	7 (2.5%)	39.48	22.73	0-98.33	156	128 (45.1%)	31.36	20.27	0-90	-9.38	8.327	p<.001
GLTEQ-WLA	284	-	20.12	18.80	0-110	158	126 (44.4%)	29.18	19.59	0-101	9.11	-6.564	p<.001
MSWS	284	-	49.75	32.24	0-100	160	124 (43.7%)	44.97	31.15	0-100	-7.93	6.104	p<.001

6.3.4 Hierarchical regression analysis

Correlational analysis was first used to assess the relationship between pre-test STAI scores and the predictor variables (see Table 6.3). These tests revealed significant multicollinearity between MSWS and PDSS (.849), and between MSWS and MSIS physical scores (.788). As a result, MSWS scores were not included in the hierarchical regression analysis.

The first hierarchical regression analysis assessed the relationship between Pre-STAI scores and four blocks of predictor variables. Block 1 consisted of sociodemographic factors, specifically age and gender. Block 2 consisted of MS characteristics, including MS type (dichotomised into RRMS vs progressive MS (SPMS and PPMS)), time since diagnosis, and PDDS scores. Block 3 consisted of self-reported subjective health measures including MFIS scores, EXSE scores, and MSIS-29 physical subscale scores. Block 4 consisted of levels of physical activity specifically GLTEQ-WLA scores.

The first regression analysis predicted 30.5% of the variance in pre-programme STAI scores (see Table 6.4). Block 1 ($F(2, 257) = 8.81$; $p < .001$) and Block 3 ($F(8, 251) = 13.79$; $p < .001$) significantly contributed to the model. In the final model age ($\beta = -.186$, $p = .003$), PDDS ($\beta = -.349$, $p < .001$), MFIS ($\beta = .168$, $p = .039$), and MSIS-29 physical impact ($\beta = 0.464$, $p < .001$), were significant predictors of pre-test STAI scores. Specifically, higher mobility disability, higher physical impact of MS, higher fatigue and younger age were significantly associated with increased STAI scores. Overall, the model was significant ($F(9, 250) = 12.21$; $p < .001$).

Table 6.3

Correlation matrix for hierarchical regression of baseline STAI scores

Variable	*n*	*M*	*SD*	1	2	3	4	5	6	7	8	9	10
1.pre-STAI	284	21.45	11.14	—									
2. Age	283	50.37	11.75	-.28**	—								
3. Gender	284	1.83	.38	.05	−.12*	—							
4. MS Type [1= RRMS, 2=SPMS or PPMS]	270	1.47	.74	−.15*	.38**	-.30**	—						
5. Time since diagnosis [1= 5 years or less, 2= longer than 5 years]	284	1.67	.47	−.20**	.39**	-.07	.16**	—					
6. PDDS	282	3.00	2.16	−.13*	.45**	-.21**	.57**	.40**	—				
7. pre-MFIS	284	43.51	14.95	.35**	.08	-.05	.13*	.05	-.30**	—			
8. pre-EXSE	284	68.02	30.92	-.14*	-.04	.09	-.04	−.09	-.15*	-.26**	—		
9. pre-MSIS-29 physical subscale	277	39.48	22.73	.29**	.23**	-.19**	.36**	.23**	.65**	.69**	-.27**	—	
10. Pre-GLTEQ-WLA	284	20.12	18.80	-.03	-.14*	-.06	-.08	-.18**	-.23**	-.28	.30**	-.26**	—

*p<.05, ** p< .01

Table 6.4

Hierarchical regression analysis investigating predictors of pre-programme STAI scores

Variables	B	95% CI		SE B	β	R^2	ΔR^2
		LL	UL				
Step 1: Sociodemographic factors						.064	.064**
Constant	31.349	22.328	40.369	4.581			
Age	-.173*	-.287	-.059	.058	-.186*		
Gender [1=male, 2=female]	1.268	-1.874	4.410	1.595	.045		
Step 2: MS Characteristics						.07	.006
Constant	33.929	23.967	43.891	5.059			
MS Type [1= RRMS, 2=SPMS or PPMS]	-.497	-2.461	1.467	.997	-.034		
Time since diagnosis [1= 5 years or less, 2= Longer than 5 years]	-1.274	-4.067	1.518	1.418	-.054		
PDDS	-1.774*	-2.659	-.888	.450	-.349***		
Step 3: Subjective Health						.305	.236**
Constant	23.500	13.589	33.411	5.032			
Pre-EXSE	-.055	-.059	.020	.020	-.055		
Pre-MFIS	.168*	.006	.237	.059	.168*		
Pre-MSIS-29 physical impact subscale	.464	.127	.315	.048	.464		
Step 4: Exercise Habits						.305	.000
Constant	23.316	13.104	33.528	5.185			
Pre-GLTEQ WLA	.009	-.061	.071	.849	.009		

Statistical significance:*$p < .05$;**$p < .01$;***$p < .001$. CI = confidence interval; LL = lower limit; UL = upper limit.

A separate hierarchical regression was used to investigate change in STAI scores following completion of the programme using the four blocks of predictor variables. Results of correlational analyses used to assess the relationship between change STAI scores and the predictor variables are presented in Table 6.5. Block 1 and 2 consisted of the same variables used in previous models. Block 3 consisted of (pre-programme vs. post-programme) MFIS change scores, EXSE change scores, and MSIS-29 physical subscale change scores. Block 4 consisted of GLTEQ-WLA change scores.

This analysis predicted 24.2% of the variance in STAI change scores (see Table 6.6). Only Block 3 ($F(8, 135) = 5.40$; $p < .001$) significantly contributed to the model. In the final model, change in MSIS-29 physical impact ($\beta = 0.372$, $p = .001$) was the only significant predictor of change in STAI scores. Specifically, reductions in the physical impact of MS were significantly associated with decreased STAI scores. Overall, the model was significant ($F(9, 134) = 4.76$; $p < .001$).

Table 6.5

Correlation matrix for hierarchical regression of STAI change scores

Variable	*n*	*M*	*SD*	1	2	3	4	5	6	7	8	9	10
1.STAI change	160	-2.9	7.45	—									
2. Age	283	50.37	11.75	.17**	—								
3. Gender	284	1.83	.38	-.07	−.12*	—							
4. MS Type [1= RRMS, 2=SPMS or PPMS]	270	1.47	.74	.11	.38**	-.30**	—						
5. Time since diagnosis [1= 5 years or less, 2= longer than 5 years]	284	1.67	.47	.19*	.39**	-.07	.16**	—					
6. PDDS	282	3.00	2.16	.04	.45**	-.21**	.57**	.40**	—				
7. MFIS change	160	-7.99	11.50	.37**	.13	-.07	.15	.11	.07	—			
8. EXSE change	160	3.58	28.49	-.11	-.11	.13	-.12	−.12	-.13	-.24**	—		
9. MSIS-29 physical subscale change	158	-9.38	14.02	.48**	.12	-.09	.12	.19*	.01	.69**	.19*	—	
10. GLTEQ-WLA change	155	9.11	17.44	-.16*	-.08	-.02	-.09	-.12	-.07	-.20*	.08	-.30**	—

*p<.05, ** p< .01

Table 6.6

Hierarchical regression analysis investigating predictors of change STAI scores

Variables	B	95% CI		SE B	β	R^2	ΔR^2
		LL	UL				
Step 1: Sociodemographic factors						.037	.037
Constant	-6.866	-15.128	1.396	4.179			
Age	.075	-.030	.181	.053	.117		
Gender [1=male, 2=female]	-.173	-3.118	2.772	1.498	-.010		
Step 2: MS Characteristics						.078	.041
Constant	-12.321	-21.818	-2.824	4.803			
MS Type [1= RRMS, 2=SPMS or PPMS]	.594	-1.169	2.356	.891	.066		
Time since diagnosis [1= 5 years or less, 2= Longer than 5 years]	2.061	-.669	4.791	1.380	-.054		
PDDS	-.298	-1.008	.412	.359	.124		
Step 3: Subjective Health Measures						.242	.164**
Constant	-8.306	-17.157	.545	4.476	-.084		
EXSE change	-.001	-.040	.039	.020	-.003		
MFIS change	.037	-.098	.171	.068	.058		
MSIS-29 physical impact change	.200	.082	.318	.060	.372**		
Step 4: Exercise Habits						.242	.000
Constant	-8.224	-1.008	.412	4.591			
GLTEQ WLA change	-.003	-.070	.064	.034	-.007		

Statistical significance:*p < .05;**p < .01;***p < .001. CI = confidence interval; LL = lower limit; UL = upper limit.

6.3.5 Thematic analysis

Transcribed data from three focus group interviews was analysed resulting in the identification of four main themes. Three of these themes, ‘Benefits of peer support’, ‘Benefits of goal setting’ and ‘Noticed Improvements’, focus primarily on participant outcomes and elements of the MoveSmart programme that participants felt impacted/would impact these outcomes. The final theme ‘Praise for programme execution’ focuses specifically on elements related to engagement in and the delivery of the MoveSmart programme. Table 6.7 includes additional details on main themes and subthemes.

Table 6.7

Themes identified from focus groups

Theme	Subtheme	Representative Quotes
Benefits of peer support	Shared experience provides comfort and knowledge	*'I also want to say that it, the, the, the people that I encountered online during the program, it was interesting to hear about their different strategies and their, their problems where, and how they got over them. So I think it's one of the best programs I've ever done.'*
	Desire for face-to-face	*'So, uh, the only thing I'd like add in is that maybe once a year, we all get together physically, just to say hello you know.'*
	Continued meet-ups encouraged continued exercise habits	*'our group has been trying to still meet up every week and do the exercises and that's I think everybody is liking that, and like everybody doesn't manage to do it every week, but it's, it's, it's a help that we're continuing it on'*
Benefits of goal setting	Flexible challenges inspire action and autonomy	*'I had this whole notion of adjustable goals eh ok if you plan to do a session today and you didn't manage to it's okay. Just,reset your goals and get back to do it tomorrow.'*
	Routine	*'I don't know about the rest of ye that every week, you have the same sessions and every week you, um, you had, you knew the routines and I think I was great that, um, that it was consistent.'*

Noticed improvements	Symptoms	*‘And, um, my daughter who lives with me says, um, mum, she said you've improved so much such she said since you've started that because she used to be so wobbley she said, and slow and steady, and now you've become much stronger’*
	Self-efficacy	*And again, It probably gave me the confidence in my body to, to adapt, you know, and to hone in on the areas to help my body function, the way it should be*
	Understanding of MS	*‘Um, it gave me, um, a greater understanding of the, um, the different types of balance issues and dizziness, uh, people can experience with Ms. Um, I just assumed everybody who said they have balance problems like me, but actually there's lots of nuances to it. Um, so that gave me a greater understanding’*
Praise for programme execution	Online setting	*‘I thought it was great eh, especially because, eh, we couldn't go out anwhere, you know, eh, and, I think as well, it's the fact that all you have to do is turn on the computer and boom you're there like , you know sometimes the logistics, well the logistics for me, for getting to a meeting. It would often be a nightmare. To find parking, where's the jacks, where am I going to have any energy,em, all that's out the window where I'm at home and you just turn on the computer, and there you are’*
	Programme coordinators	*‘Yeah, likewise. I thought it was excellent. I really felt that I was in the hands of professionals. Uh, you know they knew what they were doing and, it worked very well.’*

6.3.5.1 Theme 1: Benefits of peer support

While the primary focus of the MoveSmart programme was exercise habits and symptom management, it is clear that the programme also provided an excellent source of peer support, which may potentially contribute to the observed psychological benefits. Responses indicated that participants experienced benefit from this peer support in a number of ways including a sense of comradery and understanding *'I would value the program for the contact with other people who are experiencing this stuff and it's for good morale I think, and it certainly would have cheered me up. Perfect.'.* Additionally, the sharing of experiences allowed for the sharing of strategies or tips from those with similar challenges, with this facilitation of open forum receiving high praise *'through the sharing with the group you pick up ideas, you pick up possible solutions…'.*

Finally, it was apparent that those who had continued to meet after the programme had, by self-report, maintained good levels of physical activity, with participants who had not had the additional meetups noting that this had resulted in lower exercise levels than during the programme. *'And we set up a WhatsApp group,…, one of these days I am going to do a zoom with the lot of us and see could we do a little bit of exercise or could we do something, do I continue the exercises?.*

6.3.5.2 Theme 2: Benefits of goal setting

In terms of the psychological impact of the programme, goals were reported as a central concept by many. Goal adjustment and reengagement in particular allowed participants to engage in goal setting while allowing for the impact of MS symptoms, a process generally described as being empowering and motivating. *'I* *wasn't expecting the kind of discussion about the MoveSmart object..., the smart objectives and setting objectives, and setting goals for yourself. And I found that really useful that, it translated to other elements of my life that had, say, nothing to do with the exercises. So it exceeded my expectations.'*

Additionally, the structure and regularity provided by the MoveSmart programme received considerable praise and seemed to help participants work towards their individual goals, as well as generally providing something for participants to *'look forward to'* which was reported as positively impacting morale. '*And, um, yes, certainly the routine was lovely because we were not meeting people socially, but we had our Thursday morning group and I used to look forward to meeting up with the buddies, um, from different counties'.*

6.3.5.3 Theme 3: Noticed improvements

Participants reported that they had experienced noticeable improvements in MS-symptoms (dizziness, gait etc.) with several participants reporting that people around them (friends, family etc.) had made comments on these improvements, resulting in a positive psychological impact. *'because I'm not using the stick it is quite obvious. So people have noticed, basically anyone, any of my friends um, have noticed, yeah'.*

Participants also described an improved understanding of MS in general, as well as the impacts and strategies that can be used to mitigate against the impact of symptoms. *'Yes, it did impact on my understanding of MS and the whole way I could approach things. Um, and yes, it, will change, has changed things as I go forward, because I am building in little bits of exercise every day'.* This understanding was often (though not exclusively) tied to the expression of improved self-efficacy both in terms of greater perceived control and greater perception of one's abilities. *'I think having the confidence made a difference to when I get it when, you know, if I, if I, I'd be waiting for dizziness. So do you know, it's hard to explain. I'm not doing that now. If it comes along, I can deal with it. I don't have to be nervous about it I can deal with it.'*

6.3.5.4 Theme 4: Praise for programme execution

Responses regarding the quality of the experience of the MoveSmart programme indicated a very high level of satisfaction, with little to no consistent criticisms. The online setting received consistently high levels of praise with suggestions that it facilitated greater ease of engagement and symptom management *'I eh thought it was very good , eh, again, eh, you know, I wasn't dependent on anyone if I had to go to outdoor I wasn't dependent on getting someone to bring me there or anything. Just so easy to just go into the room set it up and everything like. Probably, if it goes in, you know have to travel, I probably wouldn't have got to do it all'.*

Despite satisfaction with the online delivery of the programme, some participants expressed a desire for some in-person meet ups. It was suggested that these may occur irregularly and the potential to provide additional social benefits through these irregular meet ups was highlighted. *'So, uh, the only thing I'd like add in is that maybe once a year, we all get together physically, just to say hello you know.'.*

Praise for programme coordinators was also very high. Participants highlighted programme coordinators understanding, clear dissemination of information and their ability to make participants feel inspired. *'I thought it was excellent. I think it was put together with such professionalism, expertise and* *sensitivity. Really I've no complaints'*. '*And I must say like they, um, the physios as well, like, you know, ANONYMISED?. She was very good in making sure that, um, she could see you. Do you know what I mean? And making sure that you were safe'*.

6.4 Discussion

Study 5 highlights that the MoveSmart programme resulted in a number of benefits for PwMS, including significant reductions in anxiety. These results suggest however that this may not necessarily be due to the greater engagement in exercise itself, but rather could be attributable to a range of other benefits associated with the programme.

Interestingly PwMS had significantly reduced STAI scores following completion of the MoveSmart programme. In addition, 20.4% of participants scored above the cut-off for clinically significant anxiety at baseline, with 6.25% of participants scoring above that same cut-off post-programme. Despite trait anxiety theoretically being more stable over time than state anxiety, results of this study suggest that it is also amenable to change and align with previous findings in this area (Newman et al., 2011, Wells et al., 2010; Winroth et al., 2019). Given the association between trait anxiety and a number of mood disorders, programmes which can effectively reduce trait anxiety may be of particular value for PwMS (Raymond et al., 2016; Weger & Sandi, 2018). In addition, improvements in a range of symptomology beyond anxiety were reported following the programme, including improvements in exercise habits and fatigue, as well as reductions in the reported physical and psychological impact of MS.

A number of sociodemographic and health-related factors were associated with anxiety at baseline, which is consistent with previous research (Broch et al., 2021; Butler et al., 2016). Notably, the finding of an association between younger age and higher anxiety has been previously reported in MS populations (Butler et al., 2016) and suggests that PwMS of a younger age may be more likely to experience anxiety. However, this is not consistent with the results of **study 2** (Fahy & Maguire, 2023a) in which, no significant associations between age and anxiety were found (see also Butler et al., 2016).

It is interesting to note that higher anxiety at baseline was associated with lower disability (as measured by the PDDS), but higher physical impact from MS (as measured by the MSIS-29). However, while these findings may appear contradictory, it is important to note that these two measures capture different aspects of experience among PwMS. While the PDDS specifically measures one aspect of disability, specifically mobility disability, the MSIS physical subscale captures a range of impacts of MS, beyond mobility impacts. The experience of MS symptoms can vary greatly with some individuals experiencing low disability in terms of mobility, but a number of other physical issues which impact daily functioning (e.g. neurogenic bladder) (Khalaf et al., 2016; Zwibel, 2009). MSIS-29 physical subscale is not an objective measure of the sum of these physical issues but instead measures the extent to which these issues impact on an individual's quality of life (Hobart et al., 2001). Thus, our findings suggest that, while those with less mobility disability may be at risk of experiencing higher anxiety, identifying additional supports and help with coping strategies to lessen impact of physical MS symptomology on quality of life may be the most beneficial way to help alleviate anxious symptomology.

This study also includes a separate measure of fatigue, which is one of the most common and impactful symptoms associated with MS (Broch et al., 2021; Oliva Ramirez et al., 2021). It is perhaps unsurprising therefore that fatigue at baseline independently predicted pre-programme anxiety, aligning with previous findings of an association between anxiety and fatigue in PwMS (Broch et al., 2021; Podda et al., 2020). While significant associations have previously been found between disability and fatigue (Taveira et al., 2019), when accounting for level of disability, fatigue has been found to independently predict quality of life outcomes in PwMS (Schmidt & Jöstingmeyer, et al., 2019; van Zanten et al., 2021; Young et al., 2021). However, previous research has reported considerable variance in the strength of associations between fatigue and anxiety (Hartoonian et al., 2015). Additionally, there is some suggestion that cognitive fatigue has a stronger association with anxiety than motor fatigue (van Zaten et al., 2021), as well as a stronger association with anxiety in people with progressive MS (Rooney et al., 2019), however investigation of these relationships was outside of the scope of this analysis. The directionality of the relationship between fatigue and anxiety remains unclear (van Zanten et al., 2021), however there is considerable suggestion that fatigue and anxiety may have a bi-directional relationship, suggesting potential efficacy for anxiety supports to impact fatigue symptoms in PwMS (Chalah et al., 2019; Rooney et al., 2019).

Despite the MoveSmart programme successfully and significantly improving anxiety and exercise habits (the target variable of the programme), changes in exercise habits had no significant association with change in anxiety, suggesting that improvements in anxiety were due to other factors. Indeed, change in reported physical impacts of MS following participation in the MoveSmart programme was the only significant predictor of improvements in anxiety which indicates that this may be a key driver of the observed change. This finding highlights the importance of addressing the impact of MS symptoms on quality of life, with associations (and a potentially bi-directional relationship) between quality of life and anxiety well established (Alsaadi et al., 2017). This finding also highlights the importance of the physical symptoms of MS in influencing the experience of anxiety in PwMS. However, while changes in the physical impact of MS on quality of life predicted a significant percentage of the variance in change in anxiety, it is possible that other factors not included in our model also contributed to this change. For example, while social benefits were described in the qualitative data, mirroring findings from Russell et al. (2023), there was no quantitative measure which captured level of social support in the pre- and post- programme surveys. It is known that social support has strong associations with anxiety (**study 1** and **2**) (Fahy & Maguire, 2022, 2023a), and that PwMS have a desire for peer support, particularly for supporting the management of anxious symptomology (**study 3** and **4**). It is possible that the peer support experienced as part of the programme was a key factor in improving psychological wellbeing.

Focus group findings of considerable praise for programme execution align with previous research (Maguire et al., 2023) as well as the findings from **study 3** and **4**, in which participants praised the execution of services provided by MS Ireland. While this research highlighted the considerable desire for peer supports among the MS population, descriptions of the value of peer support received during the MoveSmart programme further highlight the importance of the availability of these supports for PwMS.

Another interesting finding from this analysis is that, while improvements in self-efficacy were noted by focus-group participants, exercise self-efficacy scores did not significantly change following completion of the programme. These findings mirror those of Coote et al. (2017), where improvements for anxiety were reported following completion of the SCT version of the “Step it Up” programme, with only small, non-significant improvements reported for exercise self-efficacy. One possible explanation for this is that while some participants saw expected self-efficacy improvements, other participants may have overestimated their exercise abilities prior to engaging in MoveSmart programme, gaining a more realistic understanding of their current abilities through engaging in additional exercise. Additionally, it is feasible that some participants experienced benefits related to general self-efficacy, with SCT based behavioural coaching aimed at fostering this improvement, but did not improve in exercise self-efficacy which is a more specific construct. Qualitative findings surrounding the benefits of flexible goal adjustment are supported by general population studies showing associations between goal disengagement, goal reengagement and higher quality of life (Barlow et al., 2020). The experienced benefit from both goal setting and routine creating elements of MoveSmart are echoed by qualitative evaluations of the "Step it Up" programmes (Russell et al., 2023). MS research involving concepts of goal setting and goal adjustment remains limited, with considerable need for further research, but limited research in this area suggests a potentially significant relationship between anxiety and goal related behaviours (Fahy & Maguire, 2022; Van Damme et al., 2016; Van Damme et al., 2019).

6.4.1 Strengths and limitations

To our knowledge, this is the first study to assess an exercise intervention for PwMS which included anxiety as a primary outcome (Šilić et al., 2023). The longitudinal design of this study allows for comparison of factors at multiple time points. Other strengths of this study include its large sample size and real-world pragmatic approach to evaluation of a support service being used in a clinical setting. However, while this approach has many benefits, including allowing for direct recommendations for clinical care, this approach does not allow for the same level of control as an RCT. Additionally as discussed in the limitations of previous studies, self-report measures, used here for feasibility reasons, are subject to a number of biases which may have impacted results. For example, evidence suggests that self-reported physical activity may only be weakly correlated with objective physical activity in PwMS (Sikes et al., 2019). Similarly, PDDS scores have recently been shown to only weakly correlate with the Expanded Disability Status Scale (EDSS), a neurologist-led assessment of disability (Foong et al., 2024). While a considerable number of participants did not complete post-programme measures, our analysis found no significant differences in completers vs. non-completers on validated measures. Data was taken from participants who have engaged with an exercise programme and therefore may not be fully representative of all PwMS. As some data collection may have taken place during and immediately following the COVID-19 pandemic, it is unclear if this context impacted on the findings presented here. While there may have been improvements in anxiety and other outcomes immediately after the programme, it is unclear the extent to which these improvements sustained in the time following completion of post-programme measures. Data on race or ethnicity were not available for this sample, so it is unclear whether our sample was representative in this respect. We did not have a record of if participants were taking any medication for anxiety or depression which may have impacted our results. In addition, no data was collected on exercise dose so it is unclear how these may have impacted programme outcomes. While the STAI-T remains a commonly used measure of trait anxiety in both general and MS populations (Menculini et al., 2023; Stern et al., 2021), there is some suggestion that the STAI-T may be a better measure of non-specific negative affect than trait anxiety, with further suggestion that measures should be developed which can more accurately assess individual’s typical threat responses (Knowles & Olatunji, 2020).

6.4.2 Conclusion

The MoveSmart MS programme shows good efficacy in improving several concepts related to physical and mental wellbeing in PwMS. Quantitative analysis of the mechanisms through which the programme achieved improvements in participant trait anxiety suggest that reductions in the impact of physical symptoms on quality of life may play a key role in this outcome. Additionally, qualitative data collected from focus groups suggest that peer support and concepts related to goal setting and flexible goal adjustment were seen as particularly valuable by programme participants. Additionally, several concepts associated with anxiety at baseline were identified, including younger age, lower mobility disability, higher fatigue and higher physical impact of MS on quality of life, which may help with the identification of individuals who may have a need for psychological support, building on the findings of the previous studies described in this thesis. Future research should continue to explore the associates of anxiety as well as the mechanisms driving anxiety improvements, with a view to improving existing supports and informing the development of future supports for PwMS.

In Chapter 7, the final chapter in this thesis, a general discussion of the findings from studies **1-5** is presented, along with a set of recommendations for policy and clinical care based on these findings. Finally, potential directions for future research are suggested.

Chapter 7:

General Discussion

The primary aim of this thesis was to explore the experience of anxiety in PwMS with a focus on identifying means through which anxiety may be reduced. In addition, potential associates of anxiety were explored, including modifiable lifestyle and psychosocial factors, as well as demographic and disease-related factors, with a view to helping identify individuals who may be at an increased risk of anxiety. A key finding of this thesis is that anxiety is a common (although not universal) experience for many PwMS, but that there is a lack of utilization of formalised supports in the healthcare system for helping people cope with anxiety. In addition, the impact of the COVID-19 pandemic on anxiety in PwMS has been highlighted, as well as the means through which PwMS successfully reduce their experience of anxiety. This thesis contributes to the existing literature in a number of areas, as well as having the potential to inform the development of targeted supports. A more detailed overview and analysis of the thesis findings is provided in section 7.1.

7.1 Overview of thesis findings

The five studies presented in this thesis paint an interesting picture of the associates and experience of anxiety among people with MS. The different designs and measures employed in these studies gave rise to a number of notable findings which may be applied to help people with MS, and those who support them, to better manage anxiety. In **study 1** (Chapter 2), a systematic review was conducted of recent literature which aimed to identify modifiable associates of anxiety in PwMS. By focusing on modifiable rather than more fixed demographic and health-related factors, the goal was to identify factors which could be effectively targeted by interventions and supports for anxiety in PwMS. This review identified a number of lifestyle, psychological and social factors which were significantly associated with anxiety in MS population, many of which were reflected in the findings of the later studies.

The findings of this systematic review suggest that there may a number of suitable targets for anxiety interventions, despite also highlighting that there were few studies specifically focused on targeting anxiety in this population. In addition, the findings of this review highlighted the importance of considering factors related to a number of areas of functioning when providing support for anxiety in PwMS. Findings add to existing literature highlighting the potential efficacy of interventions targeting exercise (Coote et al., 2017; Fleming et al., 2021; Hasanpour-Dehkordi et al., 2016; Keikhaei et al., 2018; Taspinar et al., 2015;), self-perceptions (Jongen et al., 2016; Jongen et al., 2019), coping strategies (Anagnostouli et al., 2019; Oz & Oz, 2020), and social support (Forman & Lincoln et al., 2010), while suggesting that investigating how these factors are used in the provision of a comprehensive support for anxiety in PwMS may help improve support practices. In addition, the review findings support the potential efficacy of mindfulness-based interventions for anxiety management in PwMS (De la Torre et al., 2020; Mioduszewski et al., 2018; Pagnini et al., 2019). Finally, given reported associations between cognitive fusion and anxiety, it is feasible that PwMS may benefit from ACT, which has been shown to indirectly impact on anxiety through stigma (Valvano et al., 2016). Additionally, a number of studies have reported a positive impact for ACT on depression, anxiety, quality of life, pain perception and fatigue (Pakenham et al., 2018b; Sesel et al., 2018; Sheppard et al., 2010; Davoodi et al., 2019). It should be noted that a more recent review and meta-analysis of the use of ACT found no significant impact of ACT on anxiety, quality of life, or depression, however given the small sample sizes and wide confidence intervals in this meta-analysis it is likely that the impact of ACT on anxiety outcomes for PwMS deserves additional investigation (Thompson et al., 2022).

After identifying a number of lifestyle-related and psychosocial modifiable associates of anxiety in **study 1,** in **study 2** (Chapter 3) the associations between these factors and anxiety in an Irish and UK context was explored further. It is important to note that while the studies included in the review mostly took place prior to the COVID-19 pandemic (2015-2021), emerging evidence suggested that the COVID-19 pandemic may have had an impact on anxiety in the general population (Hyland et al., 2021) as well as for PwMS (Ramezani et al., 2021). With suggestions that some PwMS may have felt particularly vulnerable to COVID-19 compared with the general population, especially given evidence suggesting worse outcomes of COVID-19 associated with some forms of DMTs (Barzegar et al., 2021), including those on anti-CD20 therapies (Jeantin et al., 2024), the need to explore the experience of anxiety in MS populations during this time was clear. Furthermore, social-distancing and lockdown restrictions may have impacted the experience of PwMS, such as restricting access to social support (**study 3**) and exercise (Moumdjian et al., 2022), both of which were found to associate with anxiety in **study 1** and **2**. Perhaps unsurprisingly, a notable finding then from **study 2** was that 58% of the sample indicated that their anxiety had increased during the COVID-19 pandemic, suggesting that these hypothesized challenges may have had a significant impact. These findings were mirrored by qualitative findings from **study 3.** Furthermore, 72% of our sample scored above the recommended clinical cut-off for HADS-A anxiety scores (>8; Hansson et al., 2009), indicating a very high prevalence of clinical levels of anxiety in this sample. Results of the qualitative analysis of open-text responses in **study 2** detailed challenges which helped to explain these findings. Notably, participants reported significant personal health and social concerns during the pandemic, as well as considerable additional burdens related to responsibilities, dependents and employment. These findings are consistent with studies in other MS populations, with reports of additional challenges regarding employment and MS treatment during the pandemic (Moss et al., 2020; Motolese et al., 2020; Vogel et al., 2020).

As well as exploring the impact of the pandemic on anxiety among PwMS, **study 2** also included a quantitative analysis of potential predictors of anxiety more generally. These results mirrored findings from **study 1,** with self-efficacy, social support and exercise habits all significantly predicting the variance in anxiety scores. In addition, intolerance of uncertainty was the strongest predictor of anxiety in our sample, which reflects findings from Alschuler (2021) suggesting that elements of the IUM may be applicable to the understanding of anxiety in this population. Given the uncertainty associated with the progression and symptoms of MS, these findings suggest that IU is a concept that would benefit from greater exploration in the context of anxiety treatment in PwMS. Taken as a whole, the findings of **study 2** highlighted the prevalence of anxiety experienced by PwMS during the pandemic, as well as identifying a number of associates which could be applied to targeted interventions to reduce anxiety in this population.

Study 3 (Chapter 4) aimed to build on the subsequent two studies by gathering more detailed qualitative data surrounding the experience of anxiety in PwMS in an Irish context. Specifically, the aim here was to explore, i) the experience of anxiety in PwMS in Ireland both generally and within the context of the COVID-19 pandemic, ii) any relevant strategies used by PwMS in the management of anxiety, and iii) desired features of supports which could help with managing anxious symptomology. Consistent with findings from **study 2,** results captured the common and pervasive nature of anxiety in PwMS. Interviews revealed how anxiety related to MS impacted a wide variety of domains of daily functioning and important life areas such as relationships, employment, finances and long-term goals, with these areas themselves and how MS may impact upon them being a significant source of distress for participants. Once again, the findings of **study 3** highlighted increased anxiety and additional challenges faced by PwMS during the COVID-19 pandemic, as well as showing that some PwMS continued to experience increased anxiety following lower levels of adherence to safety precautions among the population (such as social distancing and mask wearing), despite their experience of sustained vulnerability. More positively however, findings of **study 3** suggested high levels of awareness that anxiety could be reduced with PwMS reporting individual sets of strategies used in anxiety management. Acceptance and control (self-efficacy) were the most central concepts to these strategies, with mindfulness, positive health behaviours and the value of escapism (as opposed to rumination) also highlighted.

The balance of acceptance and control highlighted in interviews suggests the importance of flexible regulatory strategies, highlighted theoretically in the EDM model of anxiety (Hoffman et al., 2012). This is also consistent with other findings highlighting the relevancy of mindfulness **(study 1)**, self-efficacy and physical activity **(study 1** and **2)** to the management of anxiety in PwMS. In addition, participants reported using escapism (hobbies, media consumption etc.) as a means of avoiding worry and rumination. While the MCM suggests that negative perceptions or avoidance of worry are associated with increased anxiety (Belloch et al., 2007; Wells, 2010), these theories are largely based on generalized anxiety and may not be applicable to the specific concerns related to MS. While one study investigating this relationship found that denial based coping strategies have been associated with anxiety in PwMS, self-distraction strategies described here were not significantly associated with anxiety (Tan-Kristanto & Kiropoulos, 2015). Similarly, Brajković et al. (2009), reported no association between mental disengagement (which includes self-distraction) and anxiety in a sample of PwMS, while Hanna & Strober (2020) also failed to report an association between anxiety and this form of coping. While avoidant and disengagement-based strategies are generally seen as maladaptive, it is possible that creating individual environmental circumstance through activities like hobbies and media consumption help reduce the likelihood of engagement in excessive worrying and rumination, with positive impacts for PwMS. The potential for these ‘generally maladaptive’ strategies to be adaptive in certain contexts is highlighted by evidence that suggests that denial-based strategies may be an adaptive response to some chronic illnesses at certain time points (e.g. illness onset) (Kortte & Wegener, 2004). Furthermore, engaging in distraction strategies was found to be significantly associated with better emotional well-being during the COVID-19 pandemic, with intent to distract more important than activity type (Leslie-Miller et al., 2023), mirroring the qualitative findings of study **2** and **3**. Overall, the evidence presented here emphasizes the importance of individual context in assessing the adaptiveness of coping strategies.

Another notable finding from **study 3** is the overwhelming desire for peer support reported in the sample. This builds on the findings of **study 1** and **study 2** which found strong associations between social support, particularly from friends, and anxiety, aligning with findings from other MS populations (Kever et al., 2021; Ratajska et al., 2020). In addition, it was interesting that participants expressed a desire for peer support grouped according to age or disability reflecting the variability of MS presentations. Preferences for engaging in peer support with those with similar abilities and facing similar challenges to themselves mirror recent findings in other MS populations (Daniel et al., 2023) and offers one practical direction for interventions.

While the aforementioned studies focused on the modifiable psychosocial and lifestyle-related associates of anxiety, **Study 4** focused on how demographic and MS disease-related variables associated with needs for psychological and social support in PwMS, with a view to the identification of common characteristics of at-risk individuals. Interestingly, while PwMS who were younger and had a diagnosis of relapsing remitting MS (RRMS) placed more importance on having access to services to meet needs for psychological support, actually reporting a need for psychological support was not significantly associated with any of the variables explored in this analysis. This suggests that need for psychological support is unlikely to be determined by demographic characteristics and that healthcare professionals should take care to evaluate psychological needs among all PwMS, regardless of their background. Separately, while being female and younger age was associated with placing more importance on having access to services to meet needs for social support, reporting a need for social support was significantly associated with *older* age, being single and requiring care. This suggests the importance of the availability of social supports in MS across the lifespan, but in particular for those who have greater care needs and who may be already isolated. Following on from studies **1-3**, we may infer that those who lack adequate social support may be at risk of experiencing greater anxiety.

Additionally, **study 4** aimed to explore experiences related to psychological and social support needs of service users at MS Ireland. Thematic analysis showed how community-based organisations such as MS Ireland are key in providing social and psychological support and also note how the move to online services at MS Ireland led to greater accessibility, but that privacy concerns acted as a barrier to support. Findings surrounding the potential benefits and viability of online service provision add to the growing evidence that online provision of services can help mitigate transport and accessibility barriers for PwMS (Ghahfarrokhi et al., 2021). However, despite the accessibility benefits of online service provision, the findings of **study 4** suggest there may be concerns surrounding the potential for greater social isolation. This fits with recommendations that, where possible, increased social engagement from online supports should be ‘live’ as opposed to pre-recorded to partially address this associated risk (Koopmans & Pelletier, 2022; Wilson-Menzfeld, et al., 2022).

Study 4 demonstrated the importance of MS Ireland in supporting PwMS in Ireland. In particular, many participants praised the support offered by community workers (see also Maguire et al., 2023). A number of the participants in **study 3** also acknowledged the role played by MS Ireland. However, while some participants had engaged with the physiotherapy and peer support programmes offered by MS Ireland, other participants expressed a lack of awareness of available supports.

The final study in this thesis, **study 5**, was designed to more systematically evaluate a structured set of programmes, collectively termed the MoveSmart programme, in their ability to reduce anxiety in PwMS. Several elements of the MoveSmart programme provided by MS Ireland include the targeting of factors which were separately identified in **study 1-4** as potentially important targets for anxiety supports. These included fostering greater self-efficacy (SCT), physical activity, goal setting and peer support. In addition, Coote et al. (2017) which was included in the review presented in **study 1**, previously showed the potential efficacy of combining SCT based behavioural coaching with an exercise intervention in the reduction of anxiety in PwMS. We conducted **study 5** with the aims of i) evaluating the efficacy of the Move Smart programme in reducing anxiety, ii) investigating the associates of anxiety at baseline in an Irish sample of PwMS, iii) exploring the mechanisms through which the Move Smart programme may impact anxiety and iv) highlighting important considerations related to the experience of PwMS with the MoveSmart programme.

Consistent with expectations, we found a significant improvement in anxiety scores in participants who completed the MoveSmart programme. Younger age, lower PDDS, higher physical impact of MS and higher fatigue were all significantly associated with higher baseline anxiety scores. Interestingly, results of a significant association between age and anxiety contrasted with **study 2** which failed to find a relationship between these factors. This discrepancy may be due to the differing measures of anxiety used in these studies (HADSA vs. STAI-T). With suggestion from general population studies that younger age is associated with higher anxiety, but lower COVID-related anxiety during the COVID-19 pandemic (Hyland et al., 2020; Varma et al., 2021), it is possible that the context of data collection also may have influenced these findings.

The only significant predictor of improvements in anxiety scores post-programme was reduced physical impact of MS. The significant association found between these factors is unsurprising given both associations between the physical symptoms of MS and anxiety (Broch et al., 2021; Marck et al., 2017). However, it was interesting to note that, despite our previous findings and focus group data suggesting that improvements in self-efficacy associate with reduced anxiety, the quantitative improvements noted in exercise self-efficacy were not statistically significant in **study 5**, nor did exercise self-efficacy predict anxiety at baseline. It should however be noted that exercise self-efficacy, captured in **study 5** by the EXSE (McAuley, 1993), differs from the MS-related control self-efficacy (Rigby et al., 2003) captured by the MSSE control subscale in **study 2,** which may explain this discrepancy. It is also worth noting that similarly Coote et al. (2017) reported significant reductions in anxiety (HADS-A) despite no significant difference in EXSE scores. An important element of the MoveSmart programme is the emphasis placed on peer support. Online peer support programmes have previously shown to be effective in promoting self –efficacy both in MS (Bijani et al., 2022) and other populations with chronic illness (Hossain et al., 2021). While focus group data suggested that peer support and goal-related behavioural coaching played a key role in the psychological benefits of the programme, we could not investigate this effect quantitatively as there was no measure of peer support or goal-related behaviours included in the pre or post programme battery. Additional focus group findings highlighted satisfaction with the programme's delivery.

Findings here add to existing evidence that self-management interventions for PwMS have good efficacy for improving health-related quality of life as well as having the potential to reduce experiences of anxiety (Kidd et al., 2017). Taken together, the findings of these studies can help provide a greater insight into the experience of anxiety in PwMS, as well as the factors that may help reduce this. In the following section, the implications of these findings are discussed in more detail.

7.2 Implications and recommendations

The findings from this thesis suggest that a number of PwMS have clinically significant levels of anxiety, however those who do not necessarily report severe or clinically significant levels of anxiety may also regularly experience feelings of anxiety in their daily lives, suggesting there is a need for strategies to manage anxious symptomology in this population. Given the prevalence of high levels of anxiety in PwMS, as well as the challenges faced by PwMS, particularly with regards to uncertain outcomes, it is important to suggest against pathologizing the experience of anxiety in PwMS. Findings also highlight the pervasive nature of anxiety related to MS, which may owe in part to the uncertainty associated with the disease and, in the context of COVID-19, to heightened medical vulnerabilities. The need for strategies to cope with the uncertainty inherent in the MS disease course was described as a near universal experience for PwMS in the interview study, while the qualitative findings from both **study 2** and **3** suggest that MS can impact on a variety of important life areas (e.g. employment, social and familial relationships, and life goals), making corresponding anxieties challenging. Identifying ways in which PwMS, and those who support them, can help navigate these challenges is important to consider. This may include raising greater awareness of MS among employers, as well as in family members, as was discussed in **study 3**.

Encouragingly, our research suggests that anxiety in PwMS is amenable to change. We identified several modifiable factors which could be targeted to theoretically bring about that change. For example, given the associations between self-efficacy (control) and anxiety reported in studies **1** and **2** as well as qualitative reports of the value of self-efficacy improvements in studies **3** and **5**, there is strong evidence presented here to suggest that interventions fostering self-efficacy improvements in PwMS may offer one means through which anxiety can be managed in this population. Furthermore, we found considerable evidence suggesting that many PwMS have developed individualised strategies for the management of anxiety in their daily lives, suggesting that empowering PwMS to engage in self-management strategies may offer benefits. Additionally, associations between higher MS acceptance and improved anxiety outcomes in **study 1** and **study 3**, as well as associations between intolerance of uncertainty and anxiety in **study 2**, and goal-related behaviours in **study 1** and **study 5** suggest the importance of promoting positive coping strategies in clinical settings. Theoretically these forms of positive coping could be achieved through CBT (Yang et al., 2022) or ACT (Wilson et al., 2020) which can both be used to foster positive acceptance and self-efficacy behaviours. Similarly, DBT may also have utility for PwMS, particularly in cases of more severe anxiety or where anxiety presents coupled with severe depression.

Similarly, we provide additional evidence to support associations between anxiety and exercise behaviours in studies **1** and **2** as well as qualitatively in studies **3** and **5.** The outcomes of **study 5** in particular provide good support for the potential value of exercise interventions for PwMS in relation to anxiety, which contrasts to previous research, in which the evaluation of such interventions has focused on their utility in supporting management of the physical symptoms of MS (Demaneuf et al., 2019; Moss-Morris et al., 2021).

While we found some associations between socio-demographic factors and psychological and social support needs, taken as a whole our findings suggest that, in clinical practice, care should be taken to assess the psychological needs of PwMS regardless of demographic predictors. Of the sociodemographic factors investigated, age was the most significant to emerge as a possible contributor to needs, with younger age associated with an increased importance placed on having access to social and psychological support services in **study 4,** and a significant association reported between younger age and baseline anxiety levels in **study 5.** However, it should be noted that there was no significant relationship between age and anxiety in **study 2,** and that older age was associated with reporting a need for social support in **study 4.** While these associations with demographic factors may help with the identification of at-risk individuals, overall our findings suggest that psychosocial, MS-related and lifestyle factors may play a greater role in the experience of anxious symptomology in PwMS, highlighting the importance of assessing and addressing these factors as part of routine clinical care.

Currently in Ireland there is a lack of lack of psychosocial care embedded in the care of PwMS, with 49% of healthcare professionals reporting that they do not assess, nor do they provide any information to PwMS regarding mood, mental health, or psychosocial difficulties. (Hynes et al., 2022). It is worth noting that these issues are not unique to Ireland, with many of these issues reported in UK samples as well as reports of healthcare professionals “ignoring” mental health issues in PwMS due to lack of available supports (Methley et al., 2017). While many PwMS turn to charitable organisastions such as MS Ireland to help meet their needs for care, funding and resource implications may limit the extent to which such organisations can meet the needs of this population. Further, as highlighted in **study 3**, there is often a lack of awareness among the supports that may be available, with regional differences in these supports apparent. Additionally, there is a need for more consistency across measures used to assess these difficulties, with considerable need for additional policies and training to address these shortcomings.

The findings from this thesis provide additional evidence supporting the efficacy of online service provision for supporting PwMS (Marziniak et al., 2018;

Wilson-Menzfeld, et al., 2022). We highlight the flexibility and accessibility of online supports in assisting with the unpredictable barriers to engagement presented by MS symptoms, particularly fatigue, as well as the value of ‘live’ online sessions for increased social participation (Koopmans & Pelletier, 2022; Wilson-Menzfeld, et al., 2022). We also highlight concerns surrounding reduced social benefits from online vs. face-to-face engagement, and suggest that increasing feeling of social participation is a key area to focus on in the future development of effective supports.

Our findings strongly suggest that social and peer support may play key role in the reduction and management of anxiety in PwMS as well as highlighting a desire for formal supports to help facilitate the promotion of these factors. Collectively, our findings provide additional evidence to support recommendations made by Lahelle et al. (2018) that peer support should be included as part of rehabilitation programmes for PwMS. Additionally, findings highlight the considerable desire for supports which consider the unique MS-related experience of anxiety. Our findings suggest that, in an Irish context, valuable supports exist which can help with the management of anxious symptomology in PwMS, however these supports may not be universally accessible. These supports should be further explored, informed and promoted to continue to explore and enhance efficacy and allow for greater availability and engagement from PwMS.

7.3 Future directions

Results of this thesis suggest that supports which promote self-efficacy in PwMS may assist in the reduction of anxiety in PwMS, however additional research is required to explore how best to promote self-efficacy and perceptions of control for PwMS (Hemmati Maslakpak & Raiesi, 2014; Ryan et al., 2020). Findings from **study 3** and **study 5** indicate the importance of the participant-therapist/service provider relationship, a finding which Ryan et al. (2020) assert is crucial in the promotion of self-efficacy. We assert that both the impacts and means through which these relationships can be improved are worthy of further exploration. Additionally, while the findings here add to an existing body of evidence suggesting the importance of social and peer support for PwMS (Hanna & Strober, 2020; Henry et al., 2019; Ratajska et al., 2020), future research should continue to explore how to best promote these factors.

We reported mixed findings surrounding the association between age and anxiety, with some suggestion that age may predict anxiety levels independent of time since diagnosis and RRMS disease course. Further research should be conducted to explore this association to better understand the association between younger age and increased anxiety in PwMS. Additionally, while we suggest that several of the associations detailed in this thesis may be bi-directional, there is a need for greater exploration of the directionality of the relationships described here. While the relationship between psychological well-being and exercise is explored in some detail in this thesis, the relationship between other lifestyle factors (specifically dietary factors, alcohol consumption etc.) and anxiety in PwMS has seen less exploration in MS populations relative to exercise (Marck et al., 2021).

Further exploration of these factors may reveal utility for targeting through supports

(Platero et al., 2020). Similarly, while in **study 1** we explored some specific fears related to MS (e.g. fear of falling, fear of progression), with some of these fears discussed in **study 3,** more research is needed to explore the drivers of these fears in PwMS, as well as how they may be decreased.

Additionally, while many PwMS benefit from online service provision, there is a need to explore how additional challenges related to this medium (computer or internet access, computer literacy etc.) can be mitigated to ensure the inclusivity of the creation of these supports (Kierkegaard et al., 2022). Furthermore, as detailed by the drop-off from participants who completed pre-test vs. post-test measures in **study 5,** research should be conducted which aims to address factors related to reports of diminishing engagement with remote services over time (Yeroushalmi et al., 2020).

Findings of **study 3** detail a number of strategies used by PwMS in the management of anxiety. While some of these strategies align with what we may consider theoretically adaptive strategies (e.g. exercise and social support seeking), other strategies (hobbies, media consumption etc.) are less clearly defined. Quantitative evaluations of these forms of coping could help understand the qualitative reports of value for these behaviours in the reduction of anxiety.

While **study 5** highlighted the efficacy of the MoveSmart programme in the reduction of anxiety, it is likely that other supports are being provided, both within and outside of an Irish context, which also may have efficacy in this regard but have not been formally evaluated. The identification of these supports, as well as the mechanisms which drive their efficacy, is an important step towards greater availability and awareness of effective practice in the management of anxiety in PwMS. By improving the understanding of the mechanisms through which anxiety is reduced in effective supports, future research can help to inform the development of new supports which consider unique MS-related experiences of anxiety for PwMS.

7.4 Strengths and limitations

There are a number of key strengths of this research thesis which should be highlighted. First, this project consistently made use of PPI, from the creation of study aims to the interpretation of results, in order to enhance the integrity, and relevancy of the research to those who the research was designed to support (Gray et al., 2023; Tomlinson et al., 2018). Additionally, as the research supervisor for this thesis is a person living with MS, the ongoing guidance they provided was crucial in ensuring the value and relevancy of the research presented here. Furthermore, engaging with MS Ireland throughout this research helped to ensure that the research presented here was designed to meet the needs of PwMS.

The mixed-methods approach to this research thesis represents another key strength. This thesis explored the experience of anxiety in PwMS qualitatively but also through validated quantitative measures, while employing cross-sectional, systematic review and longitudinal research designs. Furthermore, the consistency of many of the findings across samples and research designs provides a stronger basis for the recommendations made here. Our samples also featured a wide range of demographics which were largely representative of the MS population, which strengthens the generalisability of the findings.

Data collection for studies **2-5** took place between January 2021-October 2022, which provides a snapshot of the experiences of PwMS during the COVID-19 pandemic in an Irish and UK context. While recruitment for studies **2** and **4** took place during a period in which restrictions related to COVID-19 in Ireland were in place, recruitment for **study 3** took place after all restrictions related to COVID-19 in Ireland had eased, with recruitment for **study 5** spanning both time periods, allowing us a broader picture of the experience of PwMS during this time. In addition, this thesis’ focus on modifiable factors gives practical recommendations for supporting PwMS.

However, in addition to the strengths outlined above, there are a number of key limitations that should be noted when considering the findings presented in this thesis. Firstly, while a strength of these research is that data collection took place during the COVID-19 pandemic, this may also be seen as a weakness as we are unable to confirm the generalisability of our findings outside of this context. Due in part to the restrictive nature of this context, this thesis largely relied on the use of self –reported measures. For example, our research used self-reported measures of physical activity which were not confirmed by an objective measure. While this is common practice in online research, and particularly during the context of the COVID-19 pandemic where often an objective measure of physical activity would have been infeasible, it is worth noting that evidence suggests subjective reports of physical activity are higher than objective measures (Casey, Coote et al., 2018). Furthermore, data collection for the studies featured in this thesis, largely took place online, including the recruitment of participants to studies **2** and **3**. This means that the cohort of PwMS who have lower levels of digital literacy/do not engage with online platforms may have been excluded, which may have impacted on findings, particularly those related to online service provision. In addition, despite the GLTEQ (Godin, 2011) being commonly used in MS populations (Sikes et al., 2019; So & Kalron, 2020), we reported significant difficulties with completing this measure in **study 2**. Social support scores also may have been impacted by use of self-report measures, particularly given evidence to suggest that individuals with high anxiety may under report the level of social support they receive (Bruce & Arnett, 2009). While our measures for anxiety, HADS and the STAI, are commonly used in MS populations these measures may not capture all relevant forms of anxiety, and do not consider specific considerations of PwMS. Those with low literacy also may have been underrepresented in our findings due to some of the methods used in data collection.

7.5 Conclusion

This thesis was conducted to explore the experiences of PwMS with anxiety, with a view to informing the development of supports which may have efficacy in the reduction of anxious symptomology. In addition, the studies presented here aimed to identify common traits of those who may be at-risk of experiencing higher levels of anxiety as well as documenting and describing the impact of the COVID-19 pandemic on these experiences. MS has a number of physical impacts with most MS research focusing on how best to treat and manage these symptoms, however, the research presented here has shown that there is also a clear psychological impact which may be less routinely acknowledged. There is a clear need for HCPs, patients and family members to recognise and manage potential psychological impacts in clinical and social contexts. In addition, results highlight the prevalence and pervasiveness of the impacts related to the experience of anxiety for PwMS. Additionally, we suggest that not only is anxiety (both general and trait anxiety) amenable to change in PwMS, but that there are several associates which can be targeted to achieve this end. We also highlight the value of incorporating several of these associates related to different areas of functioning (psychological, social, lifestyle) in the use of targeted supports. Our findings here contribute to existing literature and with recommendations made for supporting PwMS in both clinical and service-based settings

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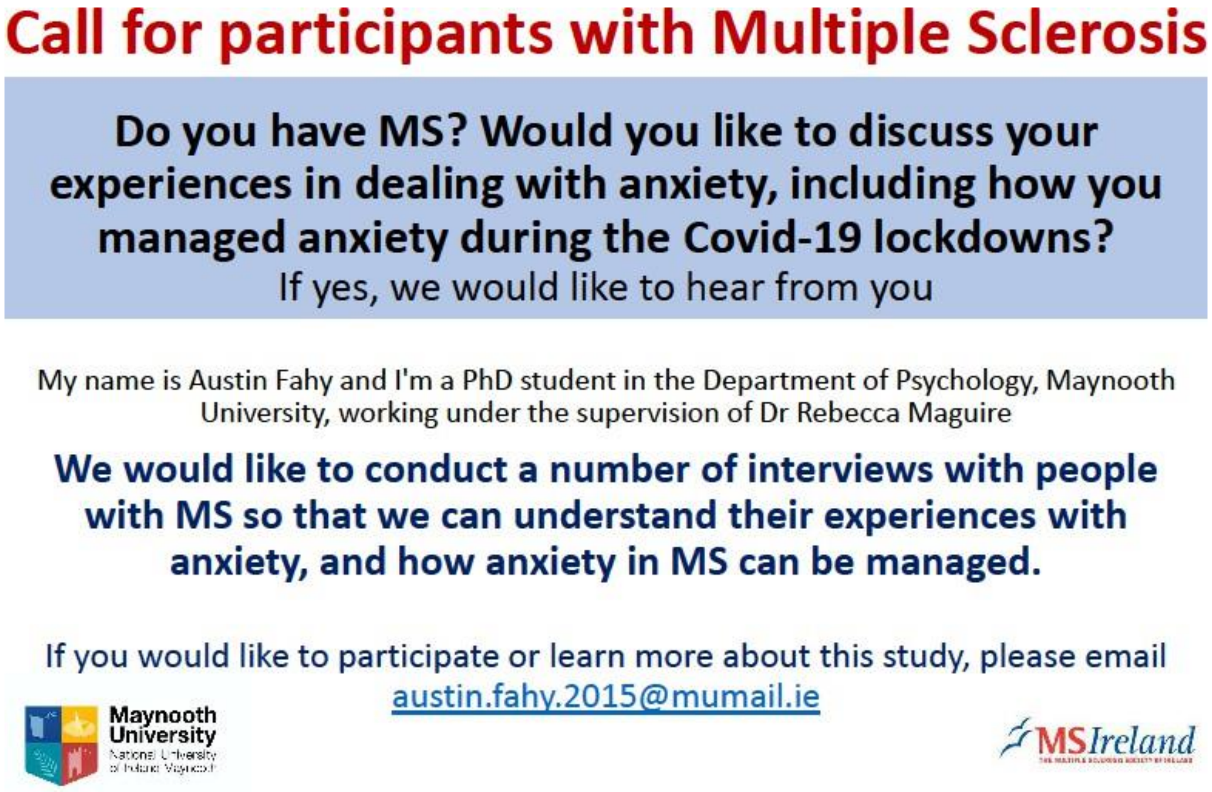
Appendix A

Call for participants for **Study 2**



Call for participants with Multiple Sclerosis

Do you have MS? Would you like to discuss your experiences in dealing with anxiety, including how you managed anxiety during the Covid-19 lockdowns?

If yes, we would like to hear from you

My name is Austin Fahy and I'm a PhD student in the Department of Psychology, Maynooth University, working under the supervision of Dr Rebecca Maguire

We would like to conduct a number of interviews with people with MS so that we can understand their experiences with anxiety, and how anxiety in MS can be managed.

If you would like to participate or learn more about this study, please email
austin.fahy.2015@mumail.ie

Maynooth University
National University
of Ireland Maynooth

MS Ireland

Appendix B

Information Sheet and Consent form for Study 2

Maynooth University
National University
of Ireland Maynooth

Purpose of the Study. I am Austin Fahy, a postgraduate student in the Department of Psychology, Maynooth University. I am undertaking a research study in collaboration with Dr. Rebecca Maguire also of Maynooth University, which aims to investigate factors relating to anxiety in people with MS.

What will the study involve? You will be asked to complete a number of questions about your general wellbeing and experience of MS. The full set of questions will take approximately 10-20 minutes for you to complete.

Who has approved this study? This study has been reviewed and received ethical approval from Maynooth University Research Ethics committee. You may have a copy of this approval if you request it.

Why have you been asked to take part? You have been asked to take part because you are over 18, living with MS, and have not received a clinical diagnosis of anxiety.

Do you have to take part? No, you are under no obligation whatsoever to take part in this research. However, we hope that you will agree to take part and give us some of your time to complete the short questionnaire. It is entirely up to you to decide whether or not you would like to take part. If you decide to do so, you will be asked to complete a consent form.

What information will be collected? You will be asked some questions about yourself (e.g. age, gender) and your MS (e.g. type of MS, when you were diagnosed). You will then be asked a series of questions relating to your experience of anxiety, tolerance to uncertainty and MS acceptance. In addition, you will be asked a series of question on the social support you receive, your exercise habits and your perception of your own abilities.

Will your participation in the study be kept confidential? Yes, all information that is collected about you during the course of the research will be kept confidential. No names will be identified at any time. All electronic information will be encrypted and held securely on MU PC or servers and will be accessed only by Austin Fahy or Dr. Rebecca Maguire.

No information will be distributed to any other unauthorised individual or third party. If you so wish, the data that you provide can also be made available to you at your own discretion.

'It must be recognised that, in some circumstances, confidentiality of research data and records may be overridden by courts in the event of litigation or in the course of investigation by lawful authority. In such circumstances the University will take all reasonable steps within law to ensure that confidentiality is maintained to the greatest possible extent.'

What will happen to the information which you give? All the information you provide will be kept at Maynooth University in such a way that it will not be possible to identify you. On completion of the research, the data will be retained on the MU server. After ten years, all data will be destroyed (by the PI). Electronic data will be reformatted or overwritten by the PI in Maynooth University.

What will happen to the results? The research will be written up and presented in a MSc Thesis and may be published in a scientific journal or presented at National or International Conferences. A copy of the research findings will be made available to you upon request to the researchers (contact details below).

What are the possible disadvantages of taking part? You may experience some distress when asked to think about potential experiences of anxiety or feelings about MS.

What if there is a problem? If you experience any further distress following the study, you may also contact MS Ireland on 1850 233 233, or if living in the UK, MS-UK on 0800 783 0518.

Any further queries? If you need any further information, you can contact me: Austin Fahy, austin.fahy.2015@mumail.ie, or my supervisor Dr Rebecca Maguire at Rebecca.maguire@mu.ie

If you agree to take part in the study, please complete the consent form on the next page.

Thank you for taking the time to read this

Consent Form

Please tick each statement below

I am over 18 and have not received a clinical diagnosis of an anxiety disorder ☐

The purpose and nature of the study has been explained to me in writing. ☐

I am participating voluntarily. ☐

It has been explained to me how my data will be managed. ☐

I understand the limits of confidentiality as described in the information sheet ☐

I understand my data will be used for a study that will be published as part of an MSc thesis. ☐

I understand that my data, in an anonymous format, may be used in further research projects and any subsequent publications if I give permission below: ☐

I agree for my data to be used for further research projects ☐

I do not agree for my data to be used for further research projects ☐

If during your participation in this study you feel the information and guidelines that you were given have been neglected or disregarded in any way, or if you are unhappy about the process, please contact the Secretary of the Maynooth University Ethics Committee at research.ethics@mu.ie or +353 (0)1 708 6019. Please be assured that your concerns will be dealt with in a sensitive manner.

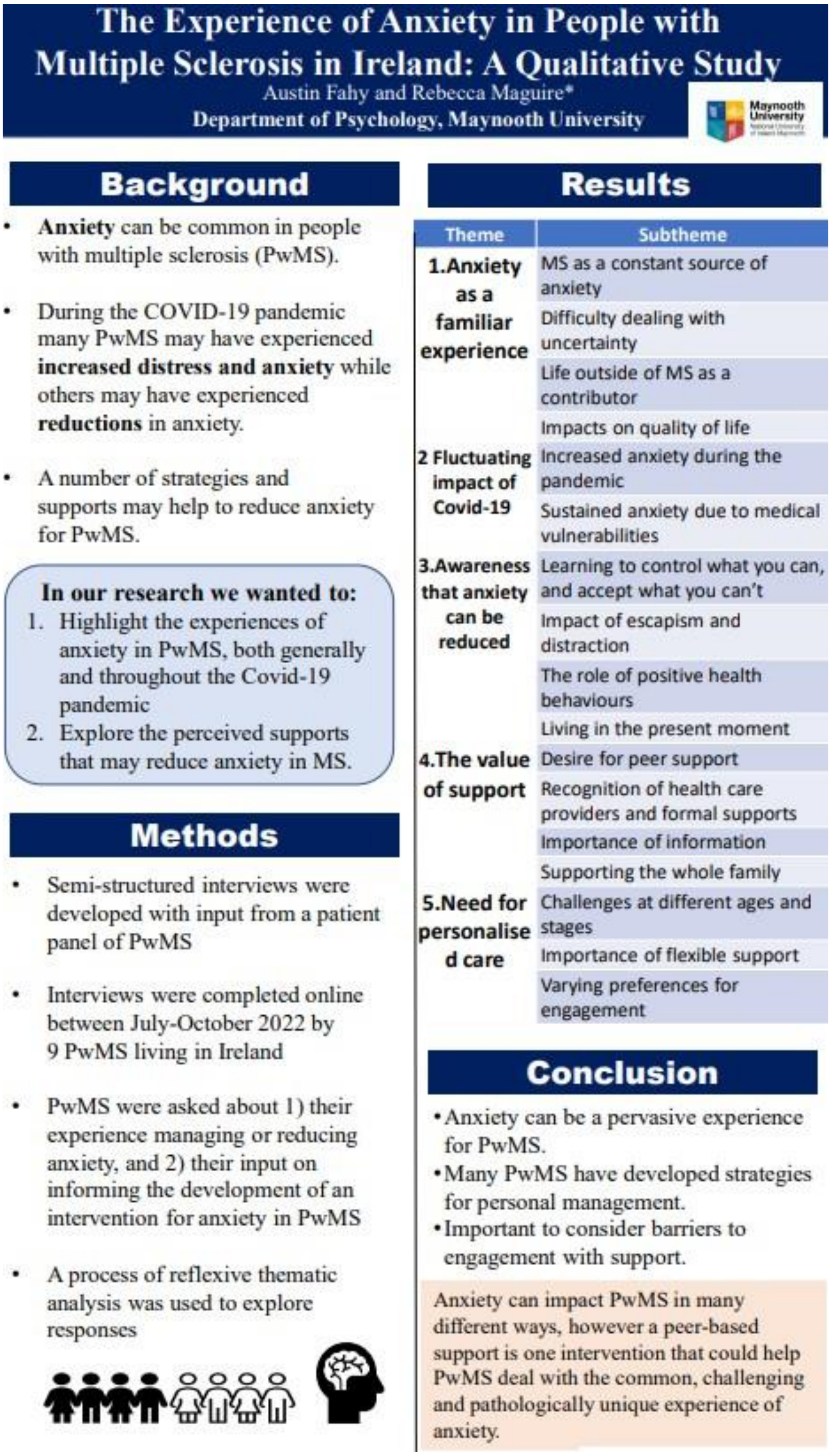
For your information the Data Controller for this research project is Maynooth University, Maynooth, Co. Kildare. Maynooth University Data Protection officer is Ann McKeon in Humanity house, room 17, who can be contacted at ann.mckeon@mu.ie. Maynooth University

Data Privacy policies can be found at https://www.maynoothuniversity.ie/data-protection.

Two copies to be made: 1 for participant, 1 for PI

Appendix C

ePoster for MS Milan 2023



The Experience of Anxiety in People with Multiple Sclerosis in Ireland: A Qualitative Study

Austin Fahy and Rebecca Maguire*

Department of Psychology, Maynooth University

Background

- **Anxiety** can be common in people with multiple sclerosis (PwMS).
- During the COVID-19 pandemic many PwMS may have experienced **increased distress and anxiety** while others may have experienced **reductions** in anxiety.
- A number of strategies and supports may help to reduce anxiety for PwMS.

In our research we wanted to:

1. Highlight the experiences of anxiety in PwMS, both generally and throughout the Covid-19 pandemic
2. Explore the perceived supports that may reduce anxiety in MS.

Methods

- Semi-structured interviews were developed with input from a patient panel of PwMS
- Interviews were completed online between July-October 2022 by 9 PwMS living in Ireland
- PwMS were asked about 1) their experience managing or reducing anxiety, and 2) their input on informing the development of an intervention for anxiety in PwMS
- A process of reflexive thematic analysis was used to explore responses

Results

Theme	Subtheme
1.Anxiety as a familiar experience	MS as a constant source of anxiety
	Difficulty dealing with uncertainty
	Life outside of MS as a contributor
	Impacts on quality of life
2 Fluctuating impact of Covid-19	Increased anxiety during the pandemic
	Sustained anxiety due to medical vulnerabilities
3.Awareness that anxiety can be reduced	Learning to control what you can, and accept what you can't
	Impact of escapism and distraction
	The role of positive health behaviours
	Living in the present moment
4.The value of support	Desire for peer support
	Recognition of health care providers and formal supports
	Importance of information
	Supporting the whole family
5.Need for personalised care	Challenges at different ages and stages
	Importance of flexible support
	Varying preferences for engagement

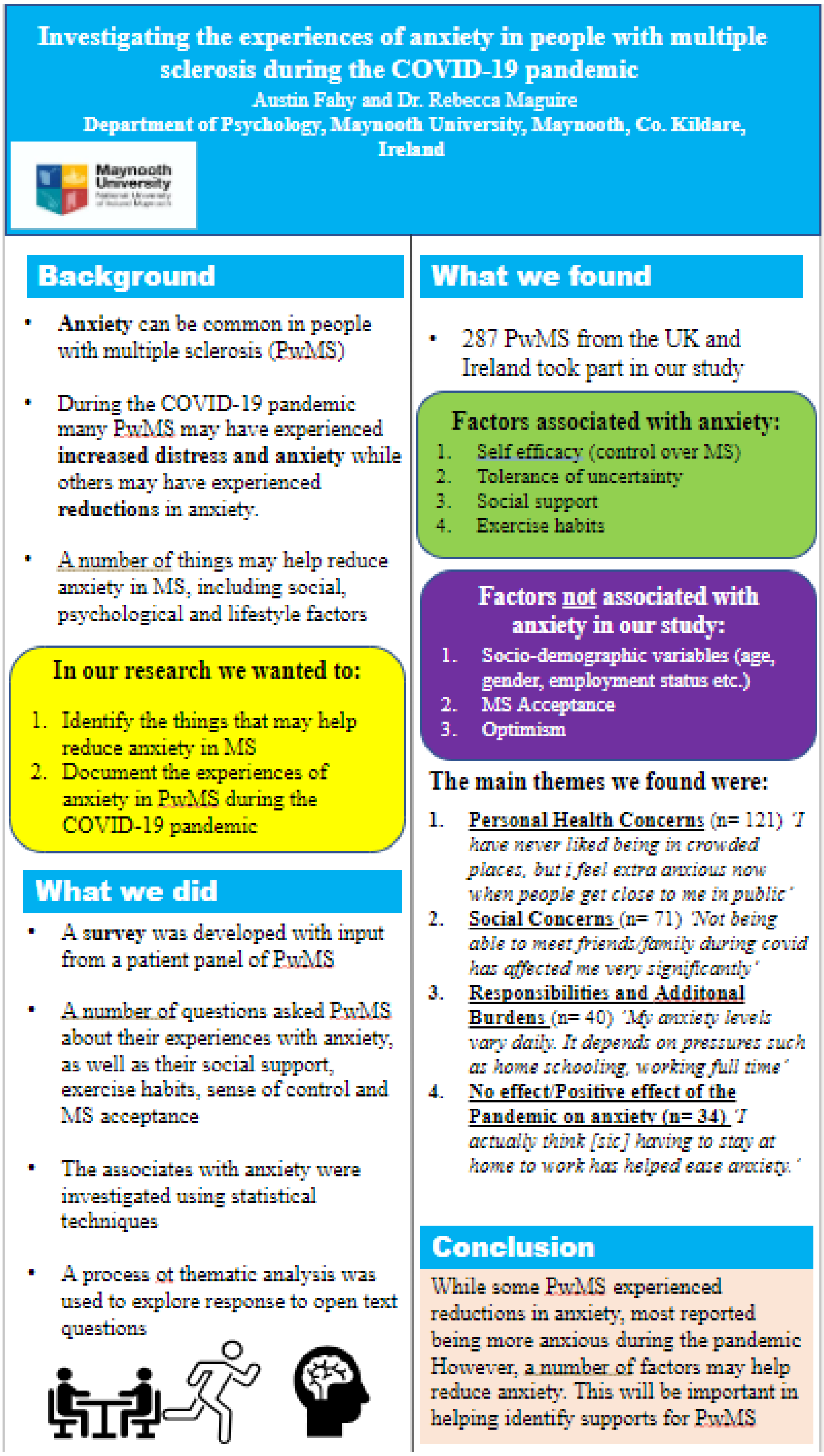
Conclusion

- Anxiety can be a pervasive experience for PwMS.
- Many PwMS have developed strategies for personal management.
- Important to consider barriers to engagement with support.

Anxiety can impact PwMS in many different ways, however a peer-based support is one intervention that could help PwMS deal with the common, challenging and pathologically unique experience of anxiety.

Appendix D

PPI poster for dissemination of results of **Study 2**



Investigating the experiences of anxiety in people with multiple sclerosis during the COVID-19 pandemic

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Background

- **Anxiety** can be common in people with multiple sclerosis (PwMS)
- During the COVID-19 pandemic many PwMS may have experienced **increased distress and anxiety** while others may have experienced **reductions** in anxiety.
- A number of things may help reduce anxiety in MS, including social, psychological and lifestyle factors

In our research we wanted to:

1. Identify the things that may help reduce anxiety in MS
2. Document the experiences of anxiety in PwMS during the COVID-19 pandemic

What we did

- A **survey** was developed with input from a patient panel of PwMS
- A number of questions asked PwMS about their experiences with anxiety, as well as their social support, exercise habits, sense of control and MS acceptance
- The associates with anxiety were investigated using statistical techniques
- A process of thematic analysis was used to explore response to open text questions

What we found

- 287 PwMS from the UK and Ireland took part in our study

Factors associated with anxiety:

1. Self efficacy (control over MS)
2. Tolerance of uncertainty
3. Social support
4. Exercise habits

Factors not associated with anxiety in our study:

1. Socio-demographic variables (age, gender, employment status etc.)
2. MS Acceptance
3. Optimism

The main themes we found were:

1. **Personal Health Concerns** (n= 121) *'I have never liked being in crowded places, but i feel extra anxious now when people get close to me in public'*
2. **Social Concerns** (n= 71) *'Not being able to meet friends/family during covid has affected me very significantly'*
3. **Responsibilities and Additonal Burdens** (n= 40) *'My anxiety levels vary daily. It depends on pressures such as home schooling, working full time'*
4. **No effect/Positive effect of the Pandemic on anxiety (n= 34)** *'I actually think [sic] having to stay at home to work has helped ease anxiety.'*

Conclusion

While some PwMS experienced reductions in anxiety, most reported being more anxious during the pandemic However, a number of factors may help reduce anxiety. This will be important in helping identify supports for PwMS

Appendix E
Information Sheet and Consent Form for Study 3

Maynooth University
National University of Ireland Maynooth

Information Sheet

Purpose of the Study. I am Austin Fahy a doctoral student in the Department of Psychology, Maynooth University.

As part of the requirements for a Doctor of Psychology degree, I am undertaking a research study under the supervision of Dr. Rebecca Maguire.

The study is a follow-up to a review and survey study investigating the modifiable associates of anxiety in people with multiple sclerosis (PwMS). In this study we wish to hear the perspectives of PwMS on their experiences with reducing anxiety as well as on what kind of supports for anxiety they would like to have made available. It is our hope that the information gathered will be useful in directly informing the creation of a support for anxiety in PwMS, which we plan to do as the final part of my doctoral programme.

What will the study involve? The study will involve a 60 minute interview to discuss your perspectives on these topics. Three questions on each of the two topics will be presented allowing you to provide your perspective. Participants will also be provided the interview questions in advance. If you do not wish to respond to any question or area of questioning you can choose not to answer those questions. You may also terminate the interview at any time. Microsoft Teams requires recording of video, however, you are encouraged to leave your camera turned off if you so wish. Video recordings will be destroyed after transcription. Your interview will be recorded to allow for transcription to occur. Once the interview has been transcribed, the recording will be deleted. Prior to the interview some short demographic information will be gathered. All information will be anonymous, with pseudonyms used.

Who has approved this study? This study has been reviewed and received ethical approval from Maynooth University Research Ethics committee. You may have a copy of this approval if you request it.

Why have you been asked to take part? You have been asked because you are over 18, have been diagnosed with MS (for at least 1 year) and do not have a clinical diagnosis of anxiety or any other mental health condition.

Do you have to take part?
No, you are under no obligation whatsoever to take part in this research. However, we hope that you will agree to take part and give us some of your time to complete the interview. It is entirely up to you to decide whether or not you would like to take part. If you decide to do so, you will be asked to complete a consent form and given a copy and the information sheet for your own records. If you decide to take part, you are still free to withdraw at any time without giving a reason and/or to withdraw your information up until such time as the data in made anonymous. A decision to withdraw at any time, or a decision not to take part, will not affect your relationships with MS Ireland.

What information will be collected? Two primary types of data will be collected. Firstly, some demographic data will be gathered. This will include age, gender, MS type and time since diagnosis. Interview questions will then be asked on your experience reducing anxiety (generally and in the context of the COVID-19 pandemic) as well as your input on a prospective support designed to help reduce anxiety in PwMS.

Will your participation in the study be kept confidential? Yes, all information that is collected about you during the course of the research will be kept confidential. No names will be identifiable at any time. All hard copy information will be held in a locked cabinet at the researchers' place of work, electronic information will be encrypted and held securely on MU PC or servers and will be accessed only by us, Austin Fahy and Dr. Rebecca Maguire.

No information will be distributed to any other unauthorised individual or third party. If you so wish, the data that you provide can also be made available to you at your own discretion.

It must be recognised that, in some circumstances, confidentiality of research data and records may be overridden by courts in the event of litigation or in the course of investigation by lawful authority. In such circumstances the University will take all reasonable steps within law to ensure that confidentiality is maintained to the greatest possible extent.

What will happen to the information which you give? All the information you provide will be kept at Maynooth University in such a way that it will not be possible to identify you. On completion of the research, the data will be retained on the MU server. After ten years, all data will be destroyed (by Austin Fahy). Manual data will be shredded confidentially, and electronic data will be reformatted or overwritten by the Principal Investigator in Maynooth University.

What will happen to the results? The research will be written up and presented as a doctoral dissertation. It is our hope that the information to be presented at National or International conferences and may be published in a scientific journal. A copy of the research findings will be made available to you upon request.

What are the possible disadvantages of taking part? You may experience some distress when asked to think about your general psychological well-being or feelings about MS. If distress is experienced, you will be provided with contact details for publicly available supports. These include
Samaritans
Emotional support to anyone in distress or struggling to cope.
Contact: jo@samaritans.ie
Freephone: 116 123
every day 24 hours a day
Aware
Information, support and peer groups for people experiencing anxiety, mild to moderate depression, bipolar disorder and mood-related conditions. Support also for friends and family members.
Contact: supportmail@aware.ie
Freephone support line: 1800 80 48 48
10am to 10pm every day
MS Ireland
NATIONAL OFFICE
Multiple Sclerosis Ireland National Office ,
80 Northumberland Road, Dublin 4.
Tel: (01)6781600
Fax: (01)6781601
Email: info@ms-society.ie

What if there is a problem? At the end of the programme, I (Austin Fahy) will continue to be available if you wish to discuss how you found the experience and how you are feeling. If you experience any further distress following the study, you may also contact MS Ireland or any of the supports listed above.

Any further queries? If you need any further information, you can contact Dr Rebecca Maguire, rebecca.maguire@mu.ie, 01 474 7624.

If you agree to take part in the study, please complete and sign the consent form overleaf.
Thank you for taking the time to read this

Consent Form

I……………………………………agree to participate in Austin Fahy's research study titled 'Experiences reducing anxiety in people with multiple sclerosis with a view to creating a new support: a qualitative analysis'.

Please tick each statement below:

The purpose and nature of the study has been explained to me verbally & in writing. I've been able to ask questions, which were answered satisfactorily. ☐

I am participating voluntarily. ☐

I am over 18, have been diagnosed with MS (for at least 1 year) and do not have a clinical diagnosis of anxiety or any other mental health condition. ☐

I give permission for my interview with Austin to be audio-recorded ☐

I understand that I can withdraw from the study, without repercussions, at any time, whether that is before it starts or while I am participating. ☐

I understand that I can withdraw permission to use the data right up to the date at which data is anonymized. The date for anonymization is set at December 1st 2022. ☐

It has been explained to me how my data will be managed and that I may access it on request. ☐

I understand that video recording will take place and have been informed that I can have my camera switched off if I so desire. ☐

I understand the limits of confidentiality as described in the information sheet ☐

Signed……………………………………. Date……………….

Participant Name in block capitals ……………………………………………...

I the undersigned have taken the time to fully explain to the above participant the nature and purpose of this study in a manner that they could understand. I have explained the risks involved as well as the possible benefits. I have invited them to ask questions on any aspect of the study that concerned them.

Signed……………………………………. Date……………….

Researcher Name in block capitals AUSTIN FAHY

If during your participation in this study you feel the information and guidelines that you were given have been neglected or disregarded in any way, or if you are unhappy about the process, please contact the Secretary of the Maynooth University Ethics Committee at research.ethics@mu.ie or +353 (0)1 708 6019. Please be assured that your concerns will be dealt with in a sensitive manner.

For your information the Data Controller for this research project is Maynooth University, Maynooth, Co. Kildare. Maynooth University Data Protection officer is Ann McKeon in Humanity house, room 17, who can be contacted at ann.mckeon@mu.ie. Maynooth University Data Privacy policies can be found at https://www.maynoothuniversity.ie/data-protection.

Appendix F

Table 5.10

Survey Questions Analysed

Questions	**Response options**
What is your gender?	Male Female Other (open)
What age are you?	Open
How would you best classify the area in which you live?	Urban Rural
What is your martial or relationship status?	Married/Cohabiting In a relationship but not cohabiting Single Other (open)
How many years have you been diagnosed with MS?	Open
What type of MS are you living with?	Relapsing Remitting MS Secondary Progressive MS Primary Progressive MS I don't know Other (specify)
Are you in receipt of any financial support for your MS (e.g. invalidity pension, disability payments)?	Yes No

Do you require any care from others in helping you carry out your daily activities?	Yes No
As a person living with MS, how important is that you have access to services that address the following needs? (rate each on a scale of 1-10 with higher scores relating to needs that you feel are very important) (psychological support)	1-10
As a person living with MS, how important is that you have access to services that address the following needs? (rate each on a scale of 1-10 with higher scores relating to needs that you feel are very important) (social support)	1-10
As a person living with MS, how important is that you have access to services that address the following needs? (rate each on a scale of 1-10 with higher scores relating to needs that you feel are very important) Other (specify)	Open
Do you know who your regional community worker/case worker is?	Yes No
What kind of communication do you receive from your community worker? (Other)	Open

Thinking about the needs listed earlier, have you ever discussed the following with your regional caseworker? (Need for emotional or psychological support)	Yes No, but I would like to No, I don’t have this need
Thinking about the needs listed earlier, have you ever discussed the following with your regional caseworker? (Need for social support)	Yes No, but I would like to No, I don’t have this need
Thinking about the above question, can you give some examples of when your community worker has helped you to meet your needs?	Open
In contrast, what things have you found it difficult for your community worker to help with?	Open
If you can, list the three most positive impacts that your community worker has had for you:	1. Open 2. Open 3. Open
Have you engaged with any online services delivered by MS Ireland since the start of the COVID-19 pandemic?	Yes No
What type of online services have you engaged with?	Open
Thinking about your responses to the above questions, what have the main benefits been regarding the move to online	Open

delivery of services?	
In contrast, what have been some key difficulties of moving services online?	Open
Finally, if there is anything else you would like to add in relation to any of the questions in this survey, please do so in the space below.	Open