Irene Göttgens

Under (de)construction

The operationalization of gender in Parkinson's research

UNDER (DE)CONSTRUCTION

THE OPERATIONALISATION OF GENDER IN PARKINSON'S RESEARCH

IRENE GÖTTGENS

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For reasons of consistency within this thesis, terminology have been standardized throughout the text, and therefore might slightly differ from the original publications.

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Chapter 1

General introduction and outline of the thesis

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The roots of sex- and gender-sensitive medicine

The roots of sex- and gender sensitive medicine (SGSM) trace back more than 50 years to the feminist movements in the US and Europe. The focus on women's health originated from the Women's Health movement during the '60 and '70s with its goals to improve care for all women through physical and sexual self-determination, and to gain control of their own reproductive rights.[1] This first wave was followed in the '80s by the entry of larger numbers of women into the medical profession, which contributed to a broader awareness within- and outside medicine of the longstanding lack of research in women's health. This coincided with a growing focus on differences in clinical signs and symptoms in women and men affected by the same condition, for numerous medical conditions.[2] By the '90s, 'gender-specific' research emerged as an innovative area of biomedicine, with an initial focus on filling the gap in knowledge about female symptoms and needs in a medical world that historically focused on male standards and on the identification of sex-linked differences in disease development and progression.[3]

Although it is beyond the scope of this introduction to include a comprehensive history of policies and initiatives that progressed the field of SGSM, some key initiatives are worth mentioning. With the adoption of the Health Revitalization Act in the US in 1993, the National Institutes of Health (NIH) established the first guidelines for the inclusions of women and underserved populations in clinical research.[4] A decade later, in 2003, the EU Parliament resolution on gender mainstreaming offered a first blueprint on how to integrate sex and gender analysis into basic science.[5] With this resolution, the EU required grantees to address "*whether, and in what sense, sex and gender are relevant in the objectives and methodology of the research project*".[6] Although the interest in- and attention towards the field of SGSM has increased in the past two decades, there is still a lack of robust and systematic instruments for the analysis of sex and, particularly, gender in (bio)medical research.[7]

The field of SGSM aims to differentiate between the incorporation of "*information about how biological sex characteristics and sociocultural aspects of gender dimensions affect health and illness of people*".[8,9] In the study of human subjects, the term 'sex' is used as a classification system based on biological attributes that are generally associated with male, female and intersex organisms (sex characteristics). From this perspective, individuals are often classified through the analysis of genes, gonads, and genitals (3G sex-system). This includes a focus on chromosomes, gene expression, hormone levels and function, and reproductive/sexual anatomy.[10] The term 'gender' is used as an overarching concept that includes multiple sociocultural ideas, behaviours and characteristics generally associated with a individuals' gender identity (gender dimensions). This includes a focus on gender identities, gender expressions, gender roles and norms, and gender relations (Box 1).[8] From this perspective, gender identities can match or differ from people's sex assigned at birth.

Box 1. Gender dimensions and descriptions

Gender dimension	Description
Gender identity	Refers to and individual's sense of self (i.e. identifying as a woman, man, non-binary person etc.)
Gender expression	Refers to the way an individual presents themselves to the world (i.e. how people present their body and identity through self-expression in e.g. clothing, hair, make-up, body language)
Gender roles and norms	Refer to social expectations associated with being a man, woman or non-binary person in a given society (i.e. societal structures that lead to shared ideas about what constitute e.g. masculinity and femininity)
Gender relations	Refers to ways in which power, authority and resources are distributed between sexes in a given society (the impact of gender on e.g. power dynamics in relationships)

Investigating gender in medical research

Researchers in social sciences already differentiated between the concepts of sex and gender in health in the 1970s. The constructivist perspective in social sciences holds the view that sex characteristics have a biological basis whereas gender dimensions are socially constructed and not natural phenomena. This position arose from the women's movement of the 1960's, when feminists argued that socially constructed gender differences have historically been mobilised to create and enforce inequalities between men and women in society and that these gender norms can be redefined to equalise the sexes. The constructivist perspective includes both 'sex as biological variables' (SABV) and 'gender as sociocultural variables' (GASV) paradigm in SGSM research.[11] Currently, both the Canadian Institute of Health Research (2010) and the European Commission (2014) have endorsed the inclusion of both SABV and GASV in biomedical research, whereas the US National Institute of Health (2016) tends to focus more on the inclusion of SABV.[12–14]

While the importance of the inclusion of SABV and GASV in biomedical research is increasingly acknowledged in research policies, the introduction of gender in the (bio)medicine research practices has encountered difficulties and resistance in the past and present. First attempts at introducing 'gender' in (bio)medical research and education frequently meant an interchangeable use with the term 'sex', and often without specification how 'sex' was being operationalised.[15] Efforts to address this practice in medical education revealed an initial lack of interest among medical students, as well as faculty, about the topic of gender, scepticism regarding the relevance of gender in medicine and a lack of time or willingness to learn about gender.[16–19] While SABV is gaining popular and preferential interest in biomedical research, critics of SABV in both social and precision medicine argue that an intensive focus on solely documenting differences in biological sex characteristics risks producing decontextualised results with limited relevance to human health and clinical practice.[20–22] Treating sex characteristics as binary (male/female) biological variables, uncoupled from research context, social environment, intersecting demographics and lifestyle variables, lacks the precision evidence-based medicine claims to seek.[23] Differences and similarities in sex characteristics reflect both biological and sociocultural influences and (bio)medical researchers should be careful to address observed differences between men and women solely as biological sex-related differences, regardless of their causes.[24] Investigating gender as socialisation characteristics allows us to contextualise observed sex-related similarities and differences and to reflect upon societal realities and developments within and between patient populations.

However, for the investigation of gender in medicine, there is currently no clear consensus on terminology or standards how to operationalise this construct. This makes gender-sensitive studies in medicine currently difficult to operationalise, let alone replicate. Furthermore, biomedical and health researchers are still developing their own understanding of gender as a dynamic multidimensional sociocultural construct.

Operationalising gender dimensions in medical research

This thesis is informed by the theoretical concepts of 'doing gender' (West and Zimmerman 1987) and 'gender performativity' (Butler 1988).[25,26] Both theories view gender as a performative accomplishment compelled by social norms and sanction. Gender includes behavioural and psychological traits that are stereotypically associated with one of the sexes and are facilitated and restricted by social consequences. Gender ascribes similarities within one sex and differences between sexes. Based on these differences and similarities, cultural ideas describe what is regarded as normative behaviours for each of the sexes and which roles and responsibilities are socially (performatively) desired. From this perspective, cultural comprehension of what e.g. a 'man' or a 'woman' is, evolves from what is understood as both differences and sameness. This process of ‘gendering’ is embedded in our daily lives by means of social cues and responses through which gendered performances are constructed and reproduced. This social process is a central part in the development of social identities and senses of self and facilitates the development of cognitive gender schemas through which behaviours and social interactions are interpreted and (self-)regulated. Best practice in the study of gender in medicine is to consider gender as a multidimensional performative concept, covering, at least, gender identities, gender norms and gender relations.[27]

As (bio)medical knowledge is mostly constructed through empirical research based on a positivist inquiry paradigm, it relies heavily on quantitative methodologies.[28] The availability of survey-based instruments to measure gender in medicine has increased in the last 20 years, however, most of them have been developed with a restricted study population of US-American students and in the field of psychology, focusing on binary representations of masculinity and femininity.[29] Furthermore, the underlying assumptions of the concepts under investigations are often not defined. For example, when researchers ask about participant’s ‘gender’, they often imply ‘gender identity’ while offering two mutually exclusive possible response options: “man/male” or “woman/female” .[30] This operationalisation lags behind the current thinking in biological and social sciences, as both sex and gender are considered multi-layered, variable and non-binary.[30-32]

While continued and valuable efforts are being made to quantitatively measure gender dimensions in (bio)medicine, a prerequisite for all these endeavours remains a thorough understanding of social theory on how gender is performed. Because gender is relational, constructed through human interaction and social processes, gender negotiations can be seen as situated performances.[33] To understand and measure gender as a situational, multi-layered construct, its analysis requires careful focus and contextualisation and therefor one-size-fits all measures might be less suitable to capture the impact of gender on people’s health. There is a need to understand what role gender plays in the illness experiences and disease expressions of particular patient populations to help inform the design of gender-sensitive measures and interventions in medicine that are contextually relevant and capable to inform population and personalised care management.

Investigating the impact of gender in the context of Parkinson’s disease

Parkinson’s Disease (PD) provides a valuable model condition for chronic (neurological) disorders to study the impact of different gender dimensions because the disease is common, with an incidence and prevalence that are rising due do demographic changes and possibly other factors.[34] The clinical phenotype of PD encompasses a wide range of non-motor and motor features and neuropsychiatric features for which sex/gender differences are reported but the concrete and interrelated impact of specific sex- and gender related features is still far from being fully elucidated.[35] Furthermore, PD has a long duration, spanning up to decades for affects patients and its management requires a multidisciplinary approach that includes complex pharmacotherapy, neurosurgical procedures, and various non-pharmacological interventions.[36] The challenges and consequences of the progression and long-term treatment of PD can disrupt existing gender roles and norms in family and community settings. Gender roles and norms affect attitudes, opportunities, experiences and behaviours of individuals, with important health consequences throughout the life course.[37] In this thesis, I investigate the impact of gender in the context of PD with the broader intention to extrapolate insights for the operationalisation of gender in medical research at large.

Parkinson's Disease

Parkinson's Disease is a chronic and progressive neurological movement disorder that is characterized by impairment of movement, cognitive functioning and behavioural and emotional regulation.[38] The disease is named after dr. James Parkinson, who first described the symptoms and signs in 1817.[39] The main underlying pathological factor is a loss of dopamine producing neurons in the midbrain (substantia nigra), which leads to a range of motor symptoms such as tremor, rigidity, bradykinesia (slowness of movement) and changes in axial mobility (gait, balance, posture). In addition to these clearly observable motor symptoms, PD can also cause a wide range of non-motor symptoms such as anxiety, depression, sleep disturbances, pain, autonomic dysfunction, and cognitive impairments. Since there is currently no cure or even a disease-modifying intervention for PD, and the treatment of PD is largely focused on the management of symptoms and the improvement of quality of life for people living with the disease. Box 2 provides an overview of both the motor and non-motor symptoms related to PD.

There is emerging evidence of PD becoming the fastest growing neurological disorder worldwide. The global number of people with PD is projected to exceed 12 million by 2040.[40] In observational studies, PD tends to affect men more frequently than women in most countries in the world (Japan being an example of a country where this is different), however, the reasons for this are largely unclear and sex/gender differences in PD prevalence may not be as pronounced as previously assumed.[41–43] While gender is considered an important determinant of health in PD research, studies that have investigated the impact of gender on PD have almost exclusively focused on self-reported gender identity; often as a proxy for sex characteristics and rarely included other dimensions of gender. This results in a limited and incomplete picture of the role of gender as contextual and multidimensional social construct and its impact on clinical outcomes and individual illness experiences of people with PD. The aim of this thesis was, therefore, to apply a multiphase investigation to study the impact of gender and its multiple dimensions in the context of PD.

Box 2. Motor and non-motor symptoms in Parkinson's Disease

Motor symptoms	Non-motor symptoms
• Resting tremor *Rhythmic muscle contraction and relaxation of mainly extremities, but also lips, chin, and jaw* • Rigidity *Stiffness and inflexibility of limbs, neck, or trunk* • Bradykinesia *Slow movement, decrementing amplitude, problematic fine motor control* • Postural instability *Loss of postural reflexes, poor balance, falls* • Gait disturbances *Freezing of gait, gait asymmetry, reduced arm swing* • Masked face • Dysphagia, contributing to drooling • Dysarthria • Flexed posture and other postural abnormalities	• Neuropsychiatric changes *Anxiety, apathy, depression, hallucinations, impulse control disorders* • Cognitive impairments *Impaired judgement and other frontal dysexecutive symptoms, bradyphrenia, dementia* • Autonomic symptoms *Orthostatic hypotension, urogenital problems, sexual dysfunction, sweating* • Gastrointestinal dysfunction *Constipation, delayed gastric emptying, small intestinal bacterial overgrowth* • Sensory problems *Pain, reduced smell (hyposmia)* • Sleep disorders *Rapid eye movement (REM) sleep behaviour disorder, sleep fragmentation, nightmares, excessive daytime somnolence, vivid dreaming* • Other non-motor symptoms *Fatigue, visual dysfunction, weight changes*

Outline of the thesis

This thesis encompasses several studies and publications on the impact of gender on health outcomes and illness experiences of people with Parkinson's Disease. An overview of the chapters and methodological approaches included in this thesis, is presented in figure 1.

Part I – Understanding the impact of gender on health outcomes and illness experiences

The first part of the thesis focuses on understanding the impact of several gender dimensions on health outcomes and illness experiences of people with PD. In **Chapter 2**, I provide a perspective on the current knowledge base regarding the impact of sex and gender on the multidisciplinary management of care for people with PD. Subsequently, I performed a rapid review of the literature to identify state-of-the-art options for the operationalisation of multiple gender dimensions and investigated their impact on PD specific quality of life domains, which is described in **Chapter 3**. To investigate if and how gender is situationally performed by people with PD and how PD related symptoms could impact their gendered illness experience, I performed a qualitative study in **Chapter 4** to explore the role of gender in the illness experiences of people with PD.

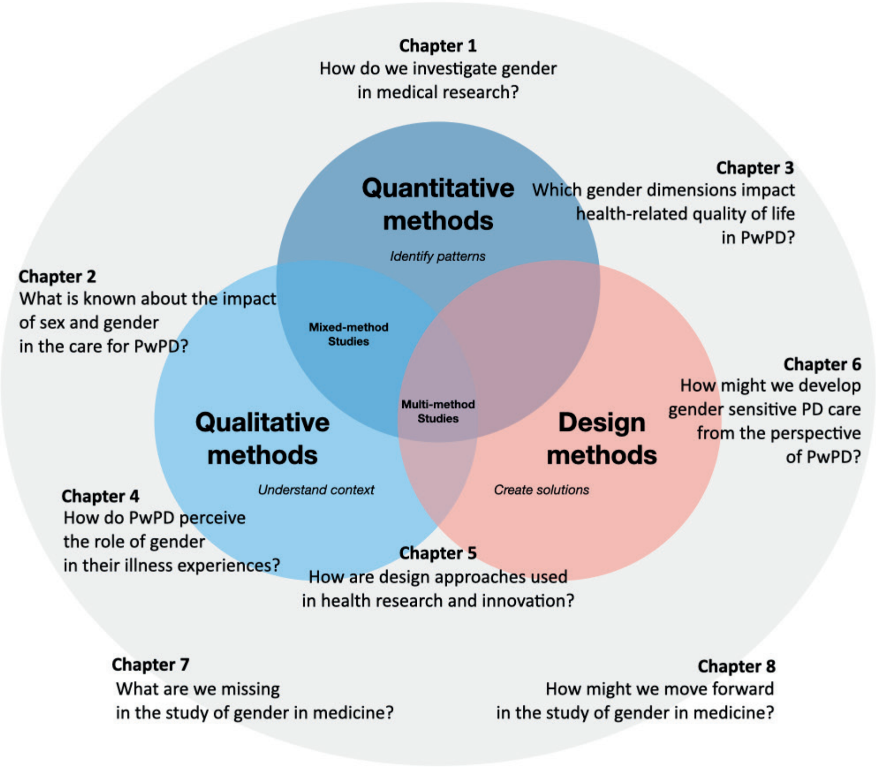

Figure 1. Overview of the included chapters and methodological approaches.

Part II – Advancing the study of gender medical research

The second part of the thesis focuses on ideas to advance the study and analysis of gender in medical research from a human-centred perspective. Human-centred approaches recognize the importance of behavioural, emotional, and environmental contexts and adopt a systems approach towards human needs. I explored how multi-method human-centred design approaches are being used in health research and innovation in **Chapter 5**. This study formed the basis for the conception of a novel design-based study, described in **Chapter 6**, to explore patient perspectives on the presence of gender norms and stereotypes in PD illness experiences and care delivery and to formulate recommendations for gender-sensitive PD care, using participatory design methods. In **Chapter 7,** I emphasize the need for contextualisation of gender in medical research to overcome the reproduction of ingrained preconception and stereotypes related to gender that can stand in the way of equitable and personalised care.

For the empirical studies in this thesis (**Chapter 3, Chapter 4** and **Chapter 6**), a step-wise explanatory approach was used to collect and analyse quantitative, qualitative, and design-based data separately on the phenomena of gender and PD.[44] Traditional explanatory mixed-method approaches explain or build upon initial quantitative results with an in-depth qualitative study. In this thesis, we added an additional design-based study to build upon the quantitative and qualitative findings (figure 2). The methodological consideration for operationalising and studying gender in PD research are discussed in **Chapter 8**.

Part III – Summary and discussion

In **Chapter 8** the main findings are discussed, as well as the implications for gender-sensitive Parkinson's and medical research and the future development of gender transformative care interventions. In the final part of this thesis, **Chapter 9** and **Chapter 10**, provide a summary of the results in English and Dutch.

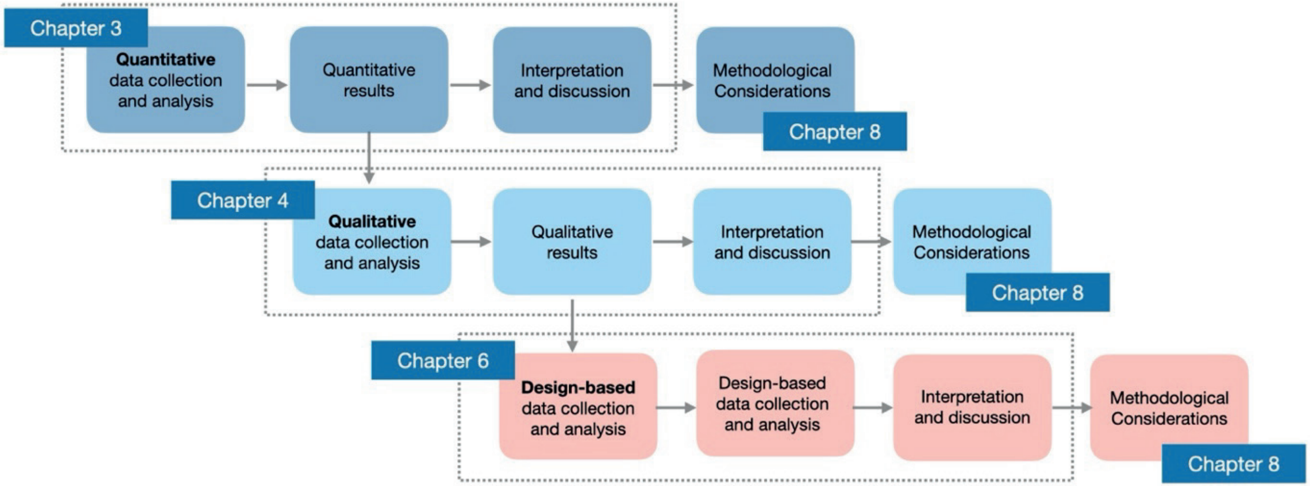

Figure 2. Explanatory multimethod approach applied in this thesis.

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Part 1

Understanding the impact of gender on health outcomes and illness experiences


2

Chapter 2

The impact of sex and gender on the multidisciplinary management of care for persons with Parkinson´s disease

This chapter is based on the following publication:

Göttgens I, van Halteren AD, de Vries NM, Meinders MJ, Ben-Shlomo Y, Bloem BR, Darweesh SKL and Oertelt-Prigione S (2020) The Impact of Sex and Gender on the Multidisciplinary Management of Care for Persons With Parkinson's Disease. Front. Neurol. 11:576121. doi: 10.3389/fneur.2020.576121

Abstract

The impact of sex and gender on disease incidence, progression and provision of care has gained increasing attention in many areas of medicine. Biological factors–sex–and sociocultural and behavioural factors–gender–greatly impact on health and disease. While sex can modulate disease progression and response to therapy, gender can influence patient-provider communication, non-pharmacological disease management and need for assistance. Sex and gender issues are especially relevant in chronic progressive diseases, such as Parkinson´s disease (PD), because affected patients require multidisciplinary care for prolonged periods of time. In this perspective paper, we draw from evidence in the field of PD and various other areas of medicine to address how sex and gender could impact PD care provision. We highlight examples for which differences have been reported and formulate research topics and considerations on how to optimise the multidisciplinary care of persons with PD.

Introduction

Sex and gender impact disease incidence, progression and provision of care in different medical disciplines.(1) "Sex" differences are based on biological variations due to differences in genetics, hormones and physiology. "Gender" differences are rooted in different expressions of identity, adherence to norms and socially defined behaviours.(2) Sex can impact the biological bases of disease progression, response to diagnostics and therapies, while gender can influence access to healthcare, coping with disease, compliance with therapies and patient-provider communication. Taken together, these aspects warrant consideration in the provision of care to people living with a disease.

The influences of sex and gender on care delivery are especially relevant for chronic diseases that are characterized by a heterogeneous and progressive spectrum of clinical features. A prime example of such a disease is Parkinson's disease (PD), which is the second most common neurodegenerative disease worldwide and which demonstrates a rapidly rising prevalence.(3) PD is partially characterized by motor features, but affected persons typically also experience a highly variable combination of non-motor features. Given the multifaceted and heterogenous nature of the disease, care delivery to people with PD typically involves healthcare professionals from a wide range of different professional disciplines to accommodate the specific clinical features, needs and coping styles of a person with PD.(4–7) Ideally, any person with PD should be treated by a diverse, multidisciplinary team, consisting of a general practitioner, neurologist, PD nurse specialist, physiotherapist, occupational therapist, speech- and language therapist, neuropsychologist, dietician or other healthcare professionals, depending on the needs of the patient.(7)

At the time of clinical diagnosis, differences in the prevalence of motor and non-motor features might exist between men and women with PD. For instance, men might experience more rigidity and women more tremor.(8) As the disease progresses, sex and gender differences can emerge in the incidence of clinical features, such as postural instability or depressive symptoms (8,9). In addition to these differences in clinical phenotype, coping styles may also vary between men and women with PD.(10) Given this broad spectrum of potential differences, the consideration of sex- and gender-specific problems and needs of people with PD appears to be essential to provide personalised care. However, to date, empirical insight on the influence of sex and gender on disease progression and care for people with PD remains scarce.

This perspective paper addresses how sex and gender may impact care for people with PD, drawing from both the PD literature as well as from other fields of medicine. We will specifically focus on the following domains: 1) motor features, 2) non-motor features,

3) lifestyle and 4) coping and informal care. To illustrate the potential impact of sex or gender, we highlight examples for which differences have been reported in PD, although the level of evidence varies substantially. For each section, the reviewed data on sex and gender differences in PD are summarized, and considerations for multidisciplinary and sex- and gender-sensitive care for people with PD are highlighted.

Sex and gender aspects in PD

Sex and gender aspects in motor features

PD is primarily known as a clinical syndrome described as 'Parkinsonism', which entails bradykinesia in combination with at least one of the following: resting tremor, rigidity or postural instability.(11,12) As the disease progresses, people with PD are prone to develop fluctuations in motor impairments related to dopaminergic therapy, as well as to freezing of gait.(13) Several differences in motor features between men and women with PD have been reported and have been summarized elsewhere.(8,14,15) However, the relevance of these differences for care provision to people with PD remains largely unknown.

The potential impact of sex or gender differences on multidisciplinary care for mobility impairments comes from other fields of medicine, such as recent recommendations for osteoporosis screening guidelines based on underlying sex differences.(16) Osteoporosis predominantly affects postmenopausal females(17) but also impacts many elderly males.(18,19) Given the higher mortality of men with bone fractures, several osteoporosis and endocrinology societies now recommend screening in all men above 65 or 70 years (19,20), but this recommendation is not routinely implemented in clinical practice.(16)

Similarly, it is possible that sex or gender differences in the prevalence of common motor features in PD may influence clinical recommendations in the future. Now, however, several gaps in empirical evidence hamper development of such sex- and gender-sensitive guidelines. In Table 1, we highlight key questions that, once addressed, could guide the implementation of sex- and gender-sensitive approaches to care for people with PD.

An illustration of the current gaps in knowledge is the recent observation that postural instability appears to be more common among women with PD than among men.(8,21) This observation is based on a few relatively small studies, rendering uncertainty on whether this reflects a true sex difference in the prevalence of this feature. If larger studies replicated this finding, it would encourage preferential referral of women with PD to a physiotherapist for preventive and symptomatic interventions, such as technology-assisted balance training. But for this selective referral to be effective, we also need insight on whether the effectiveness of symptomatic interventions differs between men and women with PD. Future studies should be adequately powered to examine clinically meaningful effect modification by gender, which requires larger sample sizes.

Furthermore, knowledge about the impact of gender-specific differences in activities of daily living (ADL) among people with PD is relatively scarce. The available literature, however, suggests that causal influences on ADL may differ substantially by gender. For instance, women report greater difficulty shopping and cleaning compared to men with PD, highlighting not only the practical consequences of mobility impairment, but also its gendered dimension.(22) If these differences are replicated in other studies, this would encourage the development of gender-sensitive targeted occupational therapy interventions for ADL impairment.(23) Taken together, empirical evidence for targeted care interventions which consider sex and gender differences in mobility impairment could eventually influence clinical guidelines for people with PD.

An additional area of potential sex- or gender-related influences on care revolves around interactions between patients and healthcare professionals. In the field of surgery, two gender-related factors have affect the indication for total joint arthroplasty(24): less referral of women by their primary care physician, i.e. reflecting a potential bias on the side of the physician; and less requests by women to undergo surgery, i.e. bias on the side of the patient. A recent study suggests that women with PD are less likely to undergo Deep Brain Stimulation (DBS) surgery than men with PD.(25,26) This is of particular note given that the current literature suggests that women may experience a greater improvement in quality of life after DBS than men.(9,27) This imbalance needs to be further investigated to remove potential referral or request bias through targeted interventions on the provider or patient side. (26,28)

Sex and gender aspects in non- motor features

Although PD is widely (and inadvertently) perceived as being primarily characterized by motor symptoms, non-motor symptoms are actually at least as common, and importantly, these can have a considerable impact on quality of life in persons with PD. In this section, we discuss two examples that highlight the potential impact of sex and gender differences on multidisciplinary care for people with PD: impulse control disorders and depressive symptoms.

Impulse control behaviours (ICBs) are associated with dopamine replacement therapy in PD. Overall, ICBs are generally more common in men compared to women with PD.(29) However, the direction of these differences might differ by the specific type ICB: hypersexuality and gambling are more common in men, while compulsive buying is more common in women.(30) Analogous differences have been reported for compulsive disorders in people without PD, with women presenting more contamination/cleaning symptoms or eating disorders whereas men more commonly present with sexual and aggressive symptoms.(31,32) It remains to be investigated if these differences are due to different disease entities or simply to socially-acceptable gendered behaviours (Table 1).

Depressive symptoms and anxiety are among the most common non-motor symptoms in people with PD.(33,34) Depressive symptoms and anxiety in PD are likely to be multifactorial, related to the influence of PD pathology and the indirect impact of impaired mobility and social isolation.(35,36) Sex differences in depression have been linked to differences in expression of susceptibility genes and hormonal influences as well as gender-related differences in reporting.(37,38) Although females and males with PD experience similar physical symptoms, the associated psychological burden appears to differ. Men primarily report difficulties in self-presentation, whereas women report greater psychological burden and larger impact on their intimate relationships.(39,40) This associates with a significant reduction in quality of life in women with PD.(41) Also, higher anxiety levels have been reported in women with PD, especially in the early clinical phase of the disease.(42–44).

However, to date, the impact of sex and gender differences in anxiety and depressive symptoms on care provision for people with PD has remained limited. Again, the field of PD is not unique in this regard. In 2008, the masculine depression scale (MDS) was developed to facilitate diagnosis of masculine depressive symptoms.(45) A recent study found that men and women who endorse a masculine gender role are relatively more likely to display externalising symptoms (e.g., anger, somatic symptoms, using substance or sex to feel better) in response to negative life events, and less likely to report typical, internalising depressive symptoms, as measured by, e.g., the widely used Beck Depression Inventory (e.g., depressed mood or crying).(46) Therefore, clinicians should be aware that individuals who strongly adhere to masculine gender roles, whether they be men or women, might display different signs and symptoms and may respond differently to behavioural interventions for depression and anxiety than individuals who adhere more strongly to a feminine gender role (Table 1).

Gender aspects in lifestyle

Few differences in lifestyle between men and women with PD have been reported. In this section, we discuss two examples that highlight the potential impact of such differences on multidisciplinary care for people with PD: weight loss and physical activity.

Progressive weight loss is common among people with PD , likely due to a combination of physical inactivity (causing muscle loss), lower intake of solid foods due to oropharyngeal dysphagia and a catabolic state.(15,47) A decreased intake of solid foods may result in less consumption of fresh foods and vegetables, which leads to a risk of malnutrition.(47) Researchers in other fields consistently reported healthier food choices among women compared to men, including increased consumption of fresh fruit and vegetables and reduced consumption of processed food and alcohol.(48,49) Encouragement by nutritionists of the consumption of healthy, solid, foods should consider these gender norms, as well as direct assessment of the ability to prepare and consume foods due to disease-related physical limitations. Again, this is an area in which a gender-sensitive care intervention for people with PD could be informed by data from other fields. However, to our knowledge, no studies have examined the effectiveness of gender-sensitive approaches to nutrition among people with PD to date.

Once validated, gender-sensitive approaches may also help to better understand differences in body weight related impairments between men and women with PD. A useful example here comes from the field of cardiometabolic diseases, in which the observation of body fat distribution differences between women and men led to the identification of the hip-to-waist ratio as a better predictor of risk than BMI, especially for women.(50) Among people with PD, weight loss generally associates with higher mortality and worse quality of life.(51) While unexplained weight change is reported more commonly in women with PD (52,53), clinically significant weight loss is reported to be associated with lower 1-year survival rates in men, compared to women with PD.(54) Future studies should examine the sex-specific prognostic utility of weight loss among people with PD.

Gender considerations are also relevant in the context of physical activity. Women worldwide appear to engage less frequently in physical activity compared to men.(55) Different drivers can modulate the uptake of physical activity in women and men with PD. Women appear to rely on enjoyment as the primary motivator while men describe self-efficacy as the primary driver for physical activity.(56) In different regions, gender-related factors might also be at play. For example, in a qualitative study in Jordan, women with PD reported family commitment and support as important elements to initiate and maintain an exercise program. However, gender norms acted as barriers as unequal division of household tasks and childcare limited the time available for exercise.(57) Different motivation strategies might be needed for women and men with PD and gender norms should be made explicit to reduce barriers to exercise (Table 1). Examples could be drawn from gender-sensitive programs to increase physical activity and promote healthy weight such as WISEWOMAN in the United States and Football Fans in Training (FFIT) in the UK.(58,59)

Gender aspects in coping and informal care

Several differences in care management between men and women with PD have been reported. In this section, we discuss two examples that highlight the potential impact of such differences on multidisciplinary care for people with PD: coping strategies and informal care.

Gender can influence individual coping strategies and should be taken into account in systematically measuring differences in distress and coping.(43) General studies on gender differences coping strategies are conflicting. Some authors report that women use more emotion-focused coping strategies while men prefer focusing on avoidant coping.(60,61) However, a study targeting coping strategies among people with PD reported the opposite, with women reporting more problem-focused coping strategies compared to males.(10) Interestingly, less polarized gender roles might associate with better quality of life in women. Specifically, androgynous women with PD, expressing masculine and feminine personality traits equally, scored significantly better on quality of life than androgynous men with PD.(62) Similar to the impact of gender roles on the response to negative life events in the context of depression, clinicians should be aware of the potential impact of gender roles on (in)effective coping strategies. Additionally, researchers should continue to explore the impact of different gender dimensions on coping strategies and health-related quality of life in people with PD.

In the context of informal care, women with PD report less social support and less informal caregiving resources compared to men.(8) Women worldwide are still more frequently active caregivers than men, although this is changing in younger generations.(63) Previous studies describe fewer negative outcomes and less impaired quality of life in male caregivers.(64,65) Women caregivers reported exhaustion, social constraints and time limitations more frequently than men and women report more adverse consequences from the progression of the disease of their partners, such as feelings of manipulation, excessive demands and lack of freedom.(38) One study noted that women caregivers appeared to experience a higher incidence of depression and dysfunctional fear of progression compared to men caregivers(66), but another failed to find any gender differences in psychological, social and health outcomes.(67) Progression of disease and the potentially associated cognitive decline, which is higher in men with PD compared to women, also places a higher burden on caregivers with potential impact on their health.(14,68–71)

Table 1. Considerations for sex- and gender sensitive multidisciplinary PD care.

Domain	Feature (s)	Reported to be more common in
Motor Features	Poor balance	Women
	Dyskinesia	Women
Non-motor features	Impulse control disorders	Men
	Episodes of depression and anxiety	Women
Lifestyle	Weight loss related impairment	Men
	Limited physical activity	Women
Care Support	Less informal care resources	Women
	Higher caregiver strain	Women

Possible sex- and gender sensitive care intervention(s) for this feature	Key questions that could guide sex- and gender-sensitive approaches
• Referral to (technology-assisted) balance training interventions	• Are differences between men and women considered when assessing the effectiveness of balance training intervention? • Do men and women prefer different features in technology-assisted balance training interventions?
• Deep brain stimulation	• What are the underlying reasons for delayed access to deep brain stimulation surgery, on average, in women compared to men? • Do underlying gender-biases influence the shared decision-making process concerning deep brain stimulation surgery?
• Reduction or discontinuation of dopaminergic therapies • Cognitive behaviour therapy	• Are gender differences in ICBs due to different disease entities or socially accepted gender behaviours? • How are patients addressed and informed about sex differences in response to dopamine replacement therapies? • Do sex or gender predict outcome in psychotherapy interventions such as cognitive behaviour therapy?
• Referral for coping skills training e.g.: mindfulness-based interventions • Social support interventions	• Do screening measures for depression and anxiety take differences in gender roles into account? • Do gender traits predict or affect the responsiveness to depression and anxiety care interventions?
• Regular weight self-monitoring • Development and regular review of diet plan	• Are differences in food choices and practices between men and women considered in weight monitoring? • Do sex and gender aspects contribute to differences in food intake and processing?
• Exercise enhanced by motivational app elements • Physical exercise interventions	• Do exercise apps take different drivers and motivations for exercise between men and women into account? • Do exercise apps take gender-specific triggers and rewards into account in their design?
• Proactive identification of social network and care capacities of the patient • Referral to social support interventions/ cognitive behavioural therapy	• Are social support interventions taking gender-specific drivers and motivators into account? • Are there gender differences in social support needs and social support perception and how are these considering?
• Regular screening of caregiver burden • Care giver education about disease progress, symptoms, and experiences	• Do screening measures of caregiver burden take gender differences in caregiver experiences into account? • Are there gender differences in information and education needs about disease progression and (advanced) care planning?

Proactive identification of social network and care capacities of the patient, for example by a PD nurse specialist, is needed to prevent gender disparities in care support (Table 1). Furthermore, caregiver strain might affect female and male caregivers differently. This aspect should be actively explored, as caregivers might refrain from addressing it directly. Targeted options such as logistic support through social workers and social support through caregiver associations, should be discussed with caregivers. Psychological and educational support might be needed and should be proactively addressed with the caregiver (Table 1).

Discussion

In this perspective paper, we highlight the potential impact of sex and gender on care for people with PD and identify key knowledge gaps that hamper immediate implementation of sex- or gender-sensitive approaches. The intersection between biological differences and social norms and behaviours highlights the complexity of individualised care. Although knowledge regarding the role of sex and gender in PD is increasing, the current state of evidence does not yet allow for specific recommendations for sex- and gender sensitive approaches for individual patients. In the case of PD, few studies have focused on the role of gender and the ones that did, lacked a clear definition of the concept of gender itself. Gender consists of several dimensions, such as identity, roles and relations, and these should be clearly defined and operationalised when embarking into its investigation.(72) As the previously described studies on quality of life demonstrated, gender rather than sex was predictive.(62) This is in line with findings in the field of cardiology and highlights the continuous nature of the concept opposed to the simple man/woman dichotomy.(73) More methodological precision in the analysis of sex and gender differences in PD will aid the transferability of the acquired knowledge into practical steps towards individualised care.

Furthermore, while the prevalence of PD has typically been higher in men than in women in clinical studies, population-based studies which include door-to-door screening and validation have demonstrated a markedly smaller gender difference in the prevalence of PD.(3,74) This discrepancy suggests that women with PD are not being referred to clinical settings as readily as men. In fact, a previous study showed that there is a considerable delay in referral of women with PD to movement disorder specialists.(75) Furthermore, women are also underrepresented in clinical trials on PD and efforts to bridge this gender gap in future RCTs should be undertaken.(76)

The present perspective has highlighted various areas in need of additional research. Gender-specific preferences and priorities in health care provision need to be further investigated. Which symptoms are more burdening for women and men with PD and which potential barriers exist towards optimal care provision? Are there gender-specific dimensions that contribute to long-term maintenance of quality of life? How do gender roles impact the patient´s choices and can addressing them affect coping strategies? Answers to these important questions could support further refinement of multidisciplinary care programs tailored specifically to the needs of people with PD and remove potential unconscious gender-specific barriers.

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3

Chapter 3

The impact of multiple gender dimensions on health-related quality of life in persons with Parkinson's disease: An exploratory study.

This chapter is based on the following publication:

Göttgens, I., Darweesh, S.K.L., Bloem, B.R. *et al*. The impact of multiple gender dimensions on health-related quality of life in persons with Parkinson's disease: an exploratory study. *J Neurol* **269**, 5963–5972 (2022). https://doi.org/10.1007/s00415-022-11228-2

Abstract

Background

There is a growing recognition that sex characteristics and gender-related aspects can have a substantial impact on the health-related quality of life (HRQoL) of persons with Parkinson´s disease (PD). Gender is a multidimensional construct, including dynamic social norms and relations that influence health and impact quality of life. Even when gender is investigated in the field of PD, it is frequently conceptualized as gender identity while other dimensions, such as roles or relations, are generally ignored. The aim of this study was to explore the impact of several gender dimensions on HRQoL among people with PD.

Method

We performed a survey-based, cross-sectional study in the Netherlands to explore the impact of several gender dimensions, namely, gender identity, gender roles and gender relations on HRQoL (PDQ-39) of people with PD.

Results

In our study population (N=307), including 127 (41%) women, we did not observe an association between gender identity and overall HRQoL. In contrast, an androgynous gender role and higher engagement in household tasks were associated with better overall HRQoL among people with PD.

Conclusion

This study offers the first detailed description of the impact of different gender dimensions on the HRQoL of people with PD and highlights the need for more precise gender-measures to inform actionable gender-sensitive health interventions for people with PD.

Introduction

Parkinson's disease (PD) is the second most common neurodegenerative disease worldwide and an increasing challenge to global health due to its rapidly rising prevalence.[1,2] This trend places a considerable burden on societies, individuals and health systems, as PD-related disabilities significantly reduce health-related quality of life (HRQoL).[3] In addition, the current knowledge base around PD poorly represents the diversity of people that live with the disease. The under-representation of different socioeconomic and ethnic groups, as well as women in PD research, result in an incomplete picture of the true impact on individual quality of life. [4-7]

There is a growing recognition of the need to increase diversity and representation in PD studies, especially a better consideration of sex and gender. Studies into sex-linked associations with PD have reported a higher risk in females of developing dyskinesia, and a lower risk of developing cognitive impairments compared to male patients.[8,9] Nevertheless, the pathophysiological insights underlying such sex-specificity in determining PD-associated risks remain scarce. Furthermore, findings about the impact of gender on HRQoL among people with PD are inconclusive to date, highlighting the need for methodologically-sound sex and gender sensitive clinical research.[10–12] Aside from potential differences in sex, which refer to a spectrum of biological and physiological characteristics, people with PD may also differ in gender, which refers to a multidimensional continuum of socially constructed behaviours, roles and relations associated with men, women and gender-diverse people.[13] The association between sex-linked characteristics, gender-related aspects and a given health outcome, can depend on one, both or neither of the two concepts. Therefore, any investigation within this field requires critical conceptual clarity in the operationalization of sex and gender.[14]

Gender-related aspects are essential elements of people's lived experiences and entail dynamic social norms and relations that influence health and quality of life.[15] Studies that investigate the impact of gender on PD have almost exclusively focused on self-reported gender identity and rarely included other dimensions of gender. Moreover, if self-reported gender identity is included in PD research, it is often applied as an all-encompassing representation of the construct "gender" and used interchangeably with the construct of "sex" or used as a proxy for biological sex-linked characteristics.[10,16,17] This lack of conceptual clarity limits the generalizability of these research findings and contributes to an incomplete representation of gender, its potential interaction with sex-linked characteristics and its impact on health of people with PD.[14]

It is important to precisely study the impact of different gender dimensions in the context of PD because social roles and relations can be affected by emerging disabilities and can change over time due to a growing burden of disease.[18] The objective of this study is to explore the impact of the distinct gender dimensions of gender identity, gender roles and gender relations, on the health-related quality of life in people with Parkinson's disease.

Methods

Study design

We conducted a cross-sectional survey study among persons with PD living in the Netherlands. We recruited the participants between March 2020 and March 2021 as part of a large prospective cohort study; the PRIME Parkinson Evaluation Study (PRIME-NL Study).[19] The PRIME-NL Study has been approved by the Ethical Board of the Radboud University Medical Centre (CMO file number 2019-5618). All participants signed a digital informed consent before inclusion in the study.

Study population

Participants were eligible for this study if they met the following criteria: Diagnosed with Parkinson's disease or Parkinsonism; 18 years of age or older; Able to read and understand Dutch; Willing and able to complete an online survey; Providing digital written informed consent.

Clinical assessments

The following demographic and clinical data were recorded: age, disease duration, years living with symptoms, clinical disease duration, and education level.

Health-related quality of life

We used the Parkinson Disease Questionnaire (PDQ-39), a disease-specific, a self-evaluative health-related quality of life (HRQoL) instrument, to assess HRQoL. Participants are asked to score each of the 39 items on a 5-point Likert scale from 0 (never) to 4 (always). Followingly, we calculated the eight subscale scores and an index summary score (PDQ-SI), with all answers being transformed to a 0–100 scale and higher scores representing worse HRQoL. The eight PDQ-39 subscales are mobility (MOB), activities of daily living (ADL), emotional well-being (EMO), stigma (STIG), social support (SOC), cognitive impairment (COG), communication (COM), and bodily discomfort (BOD).

Gender dimensions assessments

To capture multiple gender dimensions in our survey, we performed a literature review to identify state-of-the-art options for operationalizing the gender dimensions applied to this study: Gender identity, gender roles and gender relations (Supplement 1).

Gender identity

The dimension of gender identity refers the gendered sense of self of a person.[20] Gender identity was operationalized through self-reported gender identity, sex assigned at birth and sexual orientation. Self-reported gender identity refers to the self-identification of a person – the response options were woman/man/non-binary or a 'none of the above' with an open text option. Sex assigned at birth refers to the sex categorization of a person at birth, with the response options of female/male/intersex/other. Sexual orientation refers to the gender identity of those to whom a person is sexually and romantically attracted to, with response options of heterosexual/homosexual/bisexual/other.

Gender roles

Gender roles refers to stereotypical behaviours, roles and attitudes that are defined, in a specific cultural context, as more appropriate or desirable for men or women. Gender roles was operationalized through gender expression and gender role orientation. Gender expression refers to how feminine or masculine people see and present themselves. We measured gender expression with a unidimensional 7-point Likert scale, ranging from very feminine to very masculine.[20] Gender role orientation refers a person's orientation towards personality traits that are culturally associated with stereotypical masculine and feminine behaviours. The 60-item Bem Sex Role Inventory (BSRI) was used to assess people's perceptions of their psychological gender role orientation. [21] The BSRI measures stereotypical masculine and feminine personality traits as independent dimensions, thereby making it possible to characterize a person as masculine, feminine, androgynous, or undifferentiated as a function of the difference between their endorsement of masculine and feminine characteristics. The instrument uses a 7-point Likert scale ranging from 1 (never or almost never true) to 7 (always or almost always true) for stereotypically masculine (n = 20; e.g. ambitious, dominant) and feminine (n = 20; e.g. affectionate, gentle) descriptors, plus neutral filler items (n = 20; e.g. sincere, conscientious). Individuals with an androgynous self-concept score high on both the masculine and feminine characteristics, while the undifferentiated individuals score low on both masculine and feminine characteristics. People with a strong masculine or feminine self-concept score high only one of these dimensions.

Gender relations

Gender relations define how people, according to cultural context, interact with others and how others relate to them, depending on their attributed sex or perceived gender identity.[22] Gender relational experiences occur on personal and intimate levels as well as on societal and institutional levels.[23]. For this study, we focused on gender relations in the private domain and the medical domain.

We operationalized gender relations in the private domain through living situation and childcare, division of household labor, relative household income, paid and unpaid labor. Living situation was assessed by asking participants about their marital/partner status (living with/without a partner/spouse) and whether they were taking care of children (With/without children living at home).

Division of household labor was measured with the question: "In your household, who usually does the following task?". Participant rated their housework responsibilities on 7 core tasks (cooking meals, cleaning the kitchen, grocery shopping, house cleaning, laundry, maintenance & repairs and financial administration).[24-26] Response options were: spouse/partner, shared equally, respondent, or someone else. Mean scores were computed, with higher scores indicating increased participant involvement in housework. Division of household tasks was recoded as unequally distributed or equally distributed between spouses/partners in their household.

Relative household income was assessed by asking participants about their proportional earnings in their household. Relative income was categorized ranging from 0% – 100%. Relative income was recoded and labelled unequally distributed or equally distributed between spouses/partners in their household.

Paid and unpaid labor was measured with the question: "On average, how many hours a week do you usually do paid/unpaid work?" and categorized into 4 categories for paid and unpaid work.

Gender relations in the medical domain was operationalized though the attributed gender identity of the primary and attending healthcare provider by the participant. The primary health care provider was defined as "the PD related healthcare provider that the participant visits most often" and the attending healthcare provider was defined as "the PD related healthcare provider who is considered the main responsible care provider by the participant".

Pre-testing of the gender assessments

The survey was pre-tested in a convenience sample of 10 random patients, diverse in age and gender identity. The survey pre-test was performed digitally with regards to comprehension, answer retrieval, comfortability with answering the questions and completeness of the response options per item. The survey was optimized based on the pre-test feedback. Tourangeau's four-stage model was used to inspire the development of the pre-test evaluation questions.[27,28]

COVID-19 stressors questionnaire

Since April 2020, the PRIME-NL questionnaire included eight statements about different situations that could have occurred during the COVID-19 pandemic, based on the DynaCORE questionnaire.[29] The question that accompanied each statement was: 'Could you indicate how you experience or experienced these situations because of the COVID-19 pandemic?' Each question was scored on a six-point Likert-scale ranging from ‘this situation did not occur’ to ‘very troublesome’. A social stressors score was calculated, summarizing statements about loss of social contacts, cancellation of social events and tension or conflict at home, and a care stressors score, summarizing statements about problems with access to care, medication and nursing. Two additional COVID-19 stressors, regarding COVID-19 symptoms and physical activity and relaxation, were not included in the sub scores, but were summed up in the stressors sum score including all eight items. A detailed description of the questionnaire can be found in Supplement A.

Statistical analysis

We performed descriptive statistics on the participants demographic and gender dimension variables. Differences between demographic, gender related data with sex assigned at birth and gender identity were compared using Kruskal-Wallis rank sum test or the Fisher exact test.

For univariate and multivariate regression analyses of gender dimensions and HRQoL, self-reported gender identity was included as a proxy for the dimension of gender identity, gender role orientation (BSRI) for the dimension of gender roles and household task division and relative income for the dimension of gender relations. Living situation included a dichotomous measure of being married/living with a partner or not and was used as a determinant for private gender relations. Therefore, only participants that indicated that they were married/living together with a partner were included in the analyses related to gender relations.

The association between 1) gender identity (self-reported gender identity) and HRQoL (PDQ-SI scores), 2) gender role orientation (BSRI score) and HRQoL and 3) gender relations (household task division and relative income) and HRQoL was determined using multiple linear regression, which were adjusted for age, clinical disease duration and COVID-19 stressors. A multiplicity adjusted P-value < 0.0127 indicated statistical significance for the PDQ-SI scores. Statistical analyses were performed using R Studio Version 1.1.463. The data that support the findings of this study are available from the corresponding author upon reasonable request.

Results

Population characteristics.

A total of 307 people with PD were included, of which 127 (41%) were female and 179 (58%) were male and 1 (0.6%) person was self-reported as intersex (Supplement 2). The mean age was 67.5 ± 8.3 years and the mean age at diagnosis was 61.5 ± 9.4 years. These subgroup characteristics correspond with the baseline characteristics of the PRIME cohort.[30] Differences in clinical characteristics were observed between the sexes with females with PD being younger in both current age ($p = 0.002$) and age at diagnosis ($p < 0.001$), they had a longer disease duration ($p = 0.009$) and had relatively more comorbidities from musculoskeletal diseases compared to the males in our sample ($p = 0.006$). In contrast, no significant differences were found between the reported sex assigned at birth and education level, Self-Assessement Parkinson's Disease Disability Scale score (SPDDS), Parkinson Disease Questionnaire Summary Index score (PDQ-39 SI) and COVID-19 stressor score.

On the dimension of Gender Identity, 127 (41%) as woman and 180 (59%) participants identified as man. None of the participants identified as non-binary or otherwise and 96% of the participants were heterosexual (Table 1). Significant differences in gender characteristics were found between gender identities ($p < 0.001$) with women being less represented than men in our sample.

On the dimension of Gender Roles, 112 women (88%) scored themselves as mostly or strongly feminine, whereas 164 men (91%) scored themselves mostly or strongly masculine on the unidimensional gender expression scale. However, the gender role orientation (BSRI) score showed that 106 participants (35%) scored low on both masculine and feminine personality traits and 97 (32%) scored high on only feminine traits. Forty-six participants (15%) were classified androgynous, scoring high on both masculine and feminine traits. Significant differences were observed between the unidimensional measure of masculine and feminine gender expression and the two-dimensional gender role orientation scale measured by the BSRI ($p < 0.001$).

Table 1. Characteristics related to gender dimensions of the study population.

	Overall (n= 307) N (%)	**Women** (n= 127) N (%)	**Men** (n= 180) N (%)
Gender Identity			
Sex assigned at birth			
Female	127 (41)	127 (100)	0 (0)
Intersex	1 (0.3)	0 (0)	1 (0.6)
Male	179 (58)	0 (0)	179 (99)
Self-reported gender identity			
Woman	127 (41)	127 (100)	0 (0)
Man	180 (59)	0 (0)	180 (100)
Non-binary	0 (0)	0 (0)	0 (0)
None of the above	0 (0)	0 (0)	0 (0)
Sexual orientation			
Heterosexual	291 (96)	119 (95)	172 (96)
Bisexual	7 (2.3)	2 (1.6)	5 (2.8)
Homosexual	6 (2.0)	4 (3.2)	2 (1.1)
Unknown	3	2	1
Gender Roles			
Gender expression			
Feminine	112 (36)	112 (88)	0 (0)
Both masculine and feminine	31 (10)	15 (12)	16 (8.9)
Masculine	164 (53)	0 (0)	164 (91)
Gender role orientation			
Feminine	97 (32)	64 (51)	33 (18)
Androgynous	46 (15)	14 (11)	32 (18)
Masculine	58 (19)	9 (7.1)	49 (27)
Undifferentiated	106 (34)	40 (31)	66 (37)
Gender Relations			
Living situation			
Married/With partner	241 (81)	87 (72)	154 (88)
Not married/Without partner	55 (19)	34 (28)	21 (12)
Unknown	11	6	5
Childcare			
With children living at home	33 (11)	16 (13)	17 (9.8)
Without children living at home	263 (89)	105 (87)	158 (90)
Unknown	11	6	5

Table 1. Continued.

	Overall (n= 307) N (%)	**Women** (n= 127) N (%)	**Men** (n= 180) N (%)
Division of household labour			
Household labour score (Mean ± SD)*	12.8 ± 3.2	14.1 ± 3.8	12.1 ± 2.6
Equally distributed	115 (48)	39 (46)	76 (49)
Unequally distributed	123 (52)	45 (54)	78 (51)
Unknown	3	3	0
Relative income			
0% - 25%	26 (12)	24 (35)	2 (1)
26% - 50%	46 (21)	21 (30)	25 (17)
51% - 75%	67 (31)	20 (29)	47 (32)
76% - 100%	77 (36)	4 (6)	73 (50)
Equally distributed	113 (52)	41 (59)	72 (49)
Unequally distributed	103 (48)	28 (41)	75 (51)
Unknown	25	18	7
Paid work			
None	251 (82)	107 (86)	144 (80)
1-20 hours	26 (8.5)	12 (9.6)	14 (7.8)
21-40 hours	23 (7.5)	5 (4.0)	18 (10)
More than 40 hours	5 (1.6)	1 (0.8)	4 (2.2)
Unknown	2	2	0
Unpaid work			
None	72 (24)	27 (22)	45 (26)
1-10 hours	169 (57)	67 (54)	102 (59)
11-20 hours	44 (15)	23 (18)	21 (12)
More than 20 hours	14 (4.7)	8 (6.4)	6 (3.4)
Unknown	8	2	6

On the dimension of Gender Relations in the private domain, 239 (81%) participants indicated to be married or to live together with a partner and the majority (89%) reported no children living at home. For the group that was married and/or lived together with a partner, the household task division was equally distributed in 48% of the cases, whereas relative income was equally distributed in 52% of the cases. Most of the participants did not perform any paid work (82%) and performed between 1 – 10 hours of unpaid work (57%) on average on a weekly basis. Significant differences were found between household task divisions and relative income and gender identity, with men being less engaged with household task ($p < 0.001$) and having more relative income ($p < 0.001$) compared to their partner/spouse.

Table 2. Interaction between gender identity, gender role and gender relations in the private domain and health-related quality of life

Health-Related Quality of Life (PDQ-39)			
	PDQ-SI	**MOB**	**ADL**
Gender Identity	**β (SE)**	**β (SE)**	**β (SE)**
Self-reported gender identity			
Woman	1.67 (1.60)	9.89*** (2.79)	0.71 (2.55)
Gender Roles			
Gender role orientation			
Feminine	2.85 (1.67)	5.14 (2.98)	1.93 (2.66)
Androgynous	-5.55[2] (2.12)	-8.35* (3.81)	-7.48* (3.38)
Masculine	-2.45 (1.90)	-5.25 (3.39)	-2.34 (3.03)
Undifferentiated	2.36 (1.65)	3.90 (2.94)	4.30 (2.61)
Gender Relations			
Household task division			
Household labour score	-0.86[2] (0.28)	-1.87*** (0.49)	-1.57*** (0.44)
Equally distributed	-2.37 (1.76)	-5.61 (3.11)	-5.85* (2.77)
Relative income			
0% - 25%	-1.04 (3.37)	6.71 (5.92)	-6.23 (5.10)
26% - 50%	-2.23 (2.49)	-2.24 (4.37)	-6.03 (3.76)
51% - 75%	-3.50 (2.17)	-1.07 (3.80)	-5.73 (3.28)
Equally distributed	-3.55[1] (1.78)	-4.61 (3.20)	-5.31 (2.70)

PDQ Index Score: [1]p = [0.0127 – 0.050]; [2]p < 0.0127.

*PDQ Single Domain Scores: *p < 0.05; **p < 0.01; ***p < 0.001.*

Gender identity category ‘non-binary’ is excluded from the table due to the absence of results in this category.

EMO β (SE)	STIG β (SE)	SOC β (SE)	COG β (SE)	COM β (SE)	BOD β (SE)
4.04 (2.18)	2.34 (2.28)	3.15 (2.29)	-5.15* (2.12)	-8.05*** (2.39)	6.39* (2.56)
4.26 (2.28)	2.31 (2.39)	2.08 (2.40)	2.84 (2.24)	-1.09 (2.56)	5.30 (2.69)
-3.33 (2.94)	-6.79* (3.04)	-5.03 (3.07)	-0.68 (2.88)	-6.34 (3.26)	-6.38 (3.45)
-6.06* (2.58)	-1.01 (2.72)	-1.01 (2.73)	0.36 (2.55)	-0.09 (2.91)	-4.18 (3.07)
2.40 (2.26)	2.53 (2.35)	1.71 (2.37)	-2.63 (2.21)	4.87 (2.51)	1.77 (2.67)
-0.53 (0.38)	-0.05 (0.37)	0.03 (0.38)	-0.96** (0.37)	-1.28** (0.42)	-0.62 (0.45)
-3.87 (2.34)	-1.96 (2.29)	-0.77 (2.39)	0.54 (2.31)	-0.85 (2.67)	-0.62 (2.81)
3.89 (4.67)	-4.47 (4.16)	-3.32 (4.92)	-0.85 (4.54)	-6.15 (5.06)	2.08 (5.54)
-3.35 (3.44)	-3.02 (3.07)	-2.15 (3.63)	-0.17 (3.35)	-3.54 (3.73)	2.69 (4.09)
-4.98 (3.00)	-2.22 (2.67)	-2.94 (3.16)	-1.23 (2.92)	-5.87 (3.25)	-3.94 (3.56)
-5.34* (2.43)	-2.73 (2.25)	-2.36 (2.55)	-1.27 (2.37)	-5.27 (2.71)	-1.47 (2.93)

For each independent variable, the analysis was adjusted for age and disease duration and COVID-19 stressor sum score. β coefficients are presented for gender roles as compared to the other categories (category (1) - reference groups (0)). For relative income, the 75%-100% category was used as reference group.

Table 3. Interactions between gender relations in the medical domain and health-related quality of life

Health-Related Quality of Life (PDQ-39)			
Primary Healthcare Provider	**PDQ-SI** **β (SE)**	**MOB** **β (SE)**	**ADL** **β (SE)**
Same gender identity	1.66 (1.50)	1.83 (2.70)	-0.01 (2.38)
Female provider	-2.81 (1.56)	-0.62 (2.81)	-2.52 (2.50)
Attending Healthcare Provider			
Same gender identity	2.22 (1.66)	4.10 (3.00)	2.51 (2.66)
Female provider	-1.86 (1.65)	1.46 (2.98)	-3.76 (2.63)

PDQ Index Score: $^1p = [0.0127 - 0.050]$; $^2p < 0.0127$.
PDQ Single Domain Scores: $*p < 0.05$; $**p < 0.01$; $***p < 0.001$.

On the dimension of gender relations in the medical domain, participants indicated that their primary healthcare provider (defined as "the PD related healthcare provider that the participant visits most often") was in most cases the physiotherapist (55%), followed by the neurologist (21%) (Supplement 3). The attending healthcare provider (defined as "the PD related healthcare provider who is considered the main responsible care provider by the participant") was in most of the cases the neurologist (87%), followed by the general practitioners in 9% of the cases. Significant differences were found between the gender identity of the participants and the reported gender identity of their treating neurologist, with women with PD (76/127 (61%)) visiting a female neurologist more often than men (78/180 (44%)) (p = 0.004).

Associations between gender dimensions in the private domain and health-related quality of life.

Self-reported gender identity did not show a significant association with overall HRQoL (PDQ-39 index score) (Table 2). In contrast, the results of the Bem Sex Role Inventory showed that an androgynous gender role significantly predicted a better overall HRQoL (B= -5.55, p = 0.009), compared to all the other gender roles. Backwards regression showed that specifically the gender-related traits of "Athletic", "Assertive", "Self-sufficient" and "Happy" were contributing to better overall HRQoL. The results on the dimension of gender relations showed that higher engagement with household tasks was associated with slightly better overall HRQoL (B-0.86, p= 0.002). No significant association was found between equal distribution of household tasks and HRQoL. Furthermore, a nominally significant association was found between equal distribution of relative income and better overall HRQoL (B= -3.55, p = 0.048).

EMO	STIG	SOC	COG	COM	BOD
β (SE)	**β (SE)**	**β (SE)**	**β (SE)**	**β (SE)**	**β (SE)**
4.05* (2.00)	0.11 (2.07)	4.76* (2.00)	-0.40 (1.93)	1.37 (2.32)	1.56 (2.42)
-2.88 (2.11)	-1.81 (2.17)	-4.02 (2.10)	-4.12* (2.00)	-3.02 (2.42)	-3.47 (2.53)
1.64 (2.23)	2.90 (2.26)	2.29 (2.31)	-0.09 (2.10)	3.22 (2.54)	1.21 (2.67)
0.84 (2.21)	-0.61 (2.24)	-2.68 (2.28)	-3.51 (2.06)	-6.31* (2.49)	-0.28 (2.65)

β coefficients are presented for categorical variables as compared to the other category (category (1) - reference group (0)).

Associations between gender relations in the medical domain and health-related quality of life.

No significant differences were found between the reported gender identity of the primary or attending healthcare provider and overall HRQoL of the participants (Table 3).

Discussion

We conducted the present study to explore the impact of the different gender dimensions - gender identity, gender role orientation and gender relations - on health-related quality of life (HRQoL) among people with Parkinson's disease (PD). We found no significant association between self-reported gender identity and overall HRQoL, whereas an androgynous gender role orientation and higher engagement in household tasks (gender relations in the private domain) were each associated with better overall HRQoL among people with PD. These results highlight the need to specifically define and operationalize the gender dimensions under investigation to aid the clinical implementation of gender-sensitive results in the care of people with PD.

The impact of gender on clinical outcomes has been postulated in other fields[31,32],however, the use of composite indices rather than the investigation of specific gender dimensions limits the transferability of these findings into clinical practice. We recently demonstrated the impact of gender roles on HRQoL in long-term cancer survivors and their relative underestimation in men with cancer.[33] These results were only possible when disentangling the gender identity dimension from gender roles.[34] Although most current research focuses on gender identity, other dimensions such as gender roles, norms and behaviours probably impact health behaviour and illness more significantly. Our present study supports this assumption and offers the first detailed description of the impact of different gender dimensions on the QoL of people with PD. In fact, in our population gender identity did not impact overall HRQoL, yet an androgynous gender role orientation (GRO) associated with better overall HRQoL. This particular finding is in line with previous reports outlining the importance of gender roles in PD.[35–37]

Overall, these findings build on the Sex Role Adaptability hypothesis stating that psychologically androgynous individuals are more flexible in their choice of situationally effective behaviours and can, hence, better adapt to varying challenges.[38] Psychosocial and behavioural interventions hold great promise as non-pharmacological approaches for managing a variety of motor and non-motor symptoms in PD, particularly in reducing stress, anxiety and depression; all of which impact HRQoL.[39,40] Psychosocial interventions aiming to improve HRQoL of people with PD could strengthen a persons' practice of supportive gender-related traits to cope with the evolving reality of a chronic disease and its impact on quality of life, while remaining attentive to their sociocultural normative aspects.

Previous literature described the impact of chronic disease, and PD in particular, on identity, loss of valued social roles and the development of new ones.[41,42] In living with PD, the activities that define one's identity and social relations decline as the disease progresses, leading to a potential loss of the former gender role.[41] These role changes can have an overwhelming negative impact on psychological well-being and quality of life.[43] In line with this, the behaviours attributed to impulse control disorders related to dopamine replacement therapy in PD could be seen as an attempt to embolden one´s gender role. Previous studies have reported a higher prevalence of impulse control behaviours (ICB) such as hypersexuality and gambling behaviours in men, while compulsive buying appears more common among women with PD.[44,45] It remains to be investigated whether these differences in behavioural expressions related to ICB are due to differences in pathophysiology or a result of socially acceptable gender-related behaviours that reinforce gender roles.

In our study population, more engagement in household tasks associated with slightly better overall health-related quality of life. More engagement might be explained by less PD-related disabilities and therefore higher HRQoL. However, unequal gender relations in household labour negatively affected the HRQoL of women more compared to men, potentially due to traditional gender relations that attribute the burden of household and informal care work mostly to women regardless of mounting PD-related disabilities.[46] In line with earlier findings [47], our study suggests that relatively equal financial resources in the relationship of people with PD and their partner, slightly improved their health-related quality of life, possibly due to reduced financial stressors. Equal relative income distribution between partners/spouses could also potentially reduce financial stressors due to less dependency on a single income, which might be compromised if the person with PD is the primary provider.

Study Limitations

Gender assessments can contain sensitive questions and health researchers need to be mindful of the risk of social desirability bias. For this study, we strived to reduce socially desirable responses and non-responses by using a validated questionnaire when available[21] and by systematically pre-testing survey items for which no validated or translated measure was available. Additionally, we studied the effect of private gender relations through involvement in household tasks and relative income using independent samples of men and women, without collecting data from participant spouses/partners. We analysed the perceptions of participants about their own involvement compared to their partner's involvement. We also used the BSRI to operationalize gender roles. Although the BSRI has encountered criticism over the years [48], it is still the most widely used instrument to measure gender roles in healthcare. Nevertheless, the ongoing debate about the categorization of the investigated traits to feminine, masculine or androgynous can be problematic as described by Nielsen and colleagues.[36] For example, in our study we found that the gender-related traits of “Athletic”, “Assertive”, “Self-sufficient” and “Happy” were contributors to better overall HRQoL and these could possibly be used as direct predictors of HRQoL rather than as components of a specific gender role.

Conclusion

This study offers a first detailed description of the impact of different gender dimensions on the QoL of people with PD. Our findings showed that specific gender dimensions can impact health-related quality of life differently among people with PD. Insights from this study help to improve gender-sensitive investigations by highlighting the need for more rigorous analysis regarding the impact of various gender dimensions on the quality of life and experience of care of people with PD. Particularly, more in-depth explorations into the significance of gender roles and relations on health behaviour can support clinicians in their considerations for more targeted gender-sensitive psychosocial interventions, which can contribute to important improvements in quality of life. Overall, the precise investigation of the impact of gender dimensions on PD holds much promise for targeted psychosocial interventions and should be further explored.

Supplements

Supplement 1. Overview of the included gender dimensions assessments

Dimension	Endpoint	Instrument
Gender identity	Self-defined gender identity	Single Item Question
	Sex assigned at birth	Single Item Question
	Sexual orientation	Single Item Question
Gender Roles	Gender Expression	Single Item Question
	Gender Role Orientation	Bem Sex Role Inventory
Gender Relations	Private - Living Situation	Singe Item Question
	Private - Childcare	Single Item Question
	Private - Division of household labour	Seven Item Question
	Private - Relative income	Single Item Question
	Private – Paid and Unpaid labour	Single Item Question
	Medical – Gender identity of the primary healthcare provider	Single Item Question
	Medical – Gender identity of the attending healthcare provider	Single Item Question

Supplement 2. General and clinical characteristics of the study population

	Overall (n= 307) Mean ± SD	Female (n= 127) Mean ± SD	Intersex (n= 1) Mean ± SD	Male (n= 179) Mean ± SD
Age (years)	67.5 (8.3)	65.6 (8.6)	66.0 (NA)	68.8 (7.8)
Age at diagnosis (years)	61.5 (9.4)	58.8 (9.7)	60.0 (NA)	63.5 (8.6)
Disease duration (year)	6.1 (4.6)	6.9 (4.7)	6.0 (NA)	5.5 (4.4)
SPDDS score (0 – 100)	34.3 (10.9)	36.0 (13.2)	25.0 (NA)	33.1 (8.7)
PDQ-39 SI Score (0 – 100)	24.8 (12.5)	26.5 (12.3)	17.9 (NA)	23.7 (12.6)
COVID-19 Stressor score (0-40)	2.5 (0.9)	2.5 (0.9)	2.4 (NA)	2.5 (0.9)
	Overall (n= 307) N (%)	**Female** (n= 127) N (%)	**Intersex** (n= 1) N (%)	**Male** (n= 179) N (%)
Medication use for PD (Yes)	294 (94)	121 (96)	1 (100)	172 (97)
Education level				
None	0 (0)	0 (0)	0 (0)	0 (0)
Primary education	6 (2.0)	2 (1.6)	0 (0)	4 (2.2)
Secondary – prevocational	50 (16)	25 (20%)	0 (0)	25 (14)
Secondary – higher	30 (9.8)	15 (12)	0 (0)	15 (8.4)
Intermediate – vocational	54 (18)	22 (17)	0 (0)	32 (18)
Higher - professional	164 (54)	62 (49)	1 (100)	101 (57)
Other	1 (0.3)	0 (0)	0 (0)	1 (0.6)
Comorbidities				
Heart diseases	62 (20)	21 (17)	0 (0)	41 (23)
Lung diseases	29 (9.5)	11 (8.7)	0 (0)	18 (10)
Musculoskeletal diseases	93	50 (40)	0 (0)	43 (24)
Neuropsychiatric diseases	20 (6.6)	8 (6.3)	0 (0)	12 (6.7)
Endocrine or Metabolic diseases	32 (10)	13 (10)	0 (0)	19 (11)
Cancer	16 (5.2)	6 (4.8)	1 (100)	9 (5.1)
None of the above	130 (43)	52 (41)	0 (0)	78 (44)

Supplement 3. Characteristics related to gender relations in the medical domain.

	Overall (n= 307) N (%)	**Women** (n= 127) N (%)	**Men** (n= 180) N (%)
Healthcare Professionals' Gender			
General Practitioner			
Woman	149 (50)	65 (53)	84 (49)
Man	147 (50)	58 (47)	89 (51)
Unknown	11	4	7
Neurologist			
Woman	154 (51)	76 (61)	78 (44)
Man	146 (49)	48 (39)	98 (56)
Unknown	7	3	4
Parkinson Nurse			
Woman	247 (96)	98 (95)	149 (97)
Man	9 (3.5)	5 (4.9)	4 (2.6)
Unknown	51	24	27
Physiotherapist			
Woman	170 (67)	34 (32)	49 (34)
Man	83 (33)	73 (68)	97 (66)
Unknown	54	20	34
Speech therapist			
Woman	98 (94)	31 (100)	67 (92)
Man	6 (5.8)	0 (0)	6 (8.2)
Unknown	203	96	107
Primary Healthcare Provider			
General Practitioner	26 (9.4)	10 (9)	16 (9.6)
Neurologist	57 (21)	22 (20)	35 (21)
Parkinson Nurse	34 (12)	9 (8.1)	25 (15)
Physiotherapist	154 (55)	67 (60)	87 (52)
Speech therapist	7 (2.5)	3 (2.7)	4 (2.4)
Unknown	29	16	13
Attending Healthcare Provider			
General Practitioner	18 (7.6)	7 (6.7)	11 (8.3)
Neurologist	206 (87)	90 (86)	116 (87)
Parkinson Nurse	14 (5.9)	8 (7.6)	6 (4.5)
Physiotherapist	0 (0)	0 (0)	0 (0)
Speech therapist	0 (0)	0 (0)	0 (0)
Unknown	69	22	47

Supplement A. Overview of COVID-19 Stressors.

Categorisation of stressors		Stressors	Translated statements questionnaire
COVID-19 stressor sum score	Care stressors	Problems access care	Problems with access to care
		Problems access mediation	Problems with access to medication
		Problems access nursing	Problems with access to nursing
	Social stressors	Loss social contacts	Loss of social contacts
		Social events cancelled	Social events which are cancelled
		Tension or conflict at home	Tension or conflict at home
		Unable to perform physical activity or to relax	Not being able to perform physical activity or to relax
		COVID-19 symptoms	Showing COVID-19 symptoms or symptoms that could be related to COVID-19

Question that accompanied the statements: 'Could you indicate how you experience or experienced these situations because of the COVID-19 pandemic?'

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4

Chapter 4

The salience of gender in the illness experiences and care preferences of people with Parkinson's Disease

This chapter is based on the following publication:

Göttgens I, Modderkolk L, Jansen C, Darweesh SKL, Bloem BR, Oertelt-Prigione S. The salience of gender in the illness experiences and care preferences of people with Parkinson's disease. Soc Sci Med. 2023 Mar;320:115757. doi: 10.1016/j.socscimed.2023.115757. Epub 2023 Feb 1. PMID: 36738652

Abstract

Rationale

In recent years, interest in sex characteristics and gender dimensions of Parkinson's disease (PD) has increased. Yet, much remains to be understood about how gender-related aspects specifically impact the illness and experiences of care in persons living with PD.

Objective

The purpose of this study was to explore the salience of gender-related aspects in the illness experiences and care provision preferences of people with PD.

Methods

A descriptive qualitative study including semi-structured life story interviews was conducted with men and women living with PD in the Netherlands. Between September 2020 and February 2021, forty people with PD (20 men and 20 women) participated in digital interviews of which thirty-one (18 men and 13 women) were included in the thematic analyses for this specific study.

Results

Overall, most participants did not consider gender-related aspects salient towards their illness experiences. However, when prompted, several participants described several stereotypical views about gender as related to the visibility of PD, emotional experiences, help seeking, role patterns and physical appearance. While most men and women with PD did not express specific gender-related preferences for their healthcare providers, those that did, all preferred women as healthcare providers. These preferences were generally related to attributed feminine traits which are considered relevant in routine, particularly sensitive, physical examinations of people with PD.

Conclusion

This study demonstrates that although every person has a gender identity, the salience attributed to gender varies with illness experiences and in care provision preferences between people with PD. These findings highlight the need for precise and personalized methodologies to capture more nuanced insights into the impact of gender dimensions on PD. Furthermore, drivers behind gender-related preferences in care provision are multifactorial and warrant further investigation among people with PD.

Introduction

Parkinson's disease (PD) is the second most common neurodegenerative disorder and is the fastest growing in prevalence and disability.[1,2] Retaining social role performance is an essential health outcome for people with PD and the clinicians who treat them.[3] Social role functioning encompasses performance in specific social roles, or "expected ways of behaving," which are established by both an individual's personal goals and societal norms. Although the relevance of gender as a particular social role determinant in PD is increasingly recognized [4-7], much still needs to be understood about how gender-related aspects impact PD outcomes and vice versa.

Recent research demonstrated that distinct gender dimensions, such as gender identity and culturally shaped gender roles and relations, can impact health outcomes differently among people with PD.[8] This study highlighted the importance of accurately conceptualizing socio-cultural dimensions of gender in PD research, in association with- and distinct from sex-linked characteristics. One of the few studies examining the impact of gender identity as a particular social identity and maintaining "masculine" or "feminine" social roles in living with PD found that while men and women face similar somatic symptoms, the experience of these impairments was gendered.[9] For example, women emphasized on/off effects and "thinking problems" that affected their ability to organize and fortify social relationships, consistent with a stereotypical view of feminine social role as "communal organizers". In contrast, men's narratives were characterized by attention to appearance and strength, consistent with masculine norms emphasizing physical performance. Loss of physical performance can be an important challenge for aging men in later life and chronic illness can lead men to re-evaluate their place in the gendered social order. According to the authors, gender is a salient social category for people with PD through which the meaning of illness experiences is produced.

Earlier social studies in medicine also emphasize the relevance of gender related aspects in illness experiences.[10,11]. However, the impact of gender on illness experiences is mediated by how strongly committed a person is towards their gender identity and related aspects and in which context this becomes salient in a person's lived experience ("doing gender"). The more strongly committed a person is to their gender identity, the more likely they are to perform roles and cultivate relations that are consistent with socio-cultural role expectations associated with that gender identity.[12] This approach to gender challenges the idea that just because every person has a gender identity, their perspectives, attitudes and behaviours can be directly interpreted as gendered representations. Rather, gender becomes relevant when either people themselves or their environment make it relevant through normative ideas, language or behaviours derived from gender schema.[13,14] This raises questions about when and how gender-related aspects as contextual factors become salient in healthcare settings and when it is used as a social frame of reference by people with PD or the healthcare professionals that take care of them. In this study, we explored the salience of gender-related aspects in the illness experiences and care preferences of a sample of people with PD in the Netherlands.

Materials and methods

Design

This qualitative research study was embedded in the PRIME-NL cohort study.[15] A semi-structured life story-based interview approach with a reflexive thematic analysis was used to explore gender related self-concepts in the illness experiences and care provider preferences of people with PD. The life story interviews focused on the impact of PD on the daily lives of men and women with PD. This paper reports on a specific section of the interviews, where participants were asked about their gender identity in relation to living with PD and gender-related care provider preferences. The reporting is guided by the Consolidated Criteria for Reporting Qualitative Research (COREQ) checklist.[16] This study has been assessed by the Ethical Board of the Radboud University Medical Centre, The Netherlands (CMO file number 2020-6643).

Sample

Between September 2020 and February 2021, men and women with PD were recruited through the PRIME-NL Gender Study in the Netherlands.[8] People were eligible to participate when they met the following criteria: aged 18 years or older; diagnosed with Parkinson's disease or parkinsonism; absence of serious cognitive and/or communication impairment; able to participate in an online interview. Men and women who participated in the PRIME-NL Gender survey study were asked at the end of the questionnaire whether they were willing to participate in this online interview study. The PRIME-NL Gender survey study already included a purposive and relative homogeneous sample of participants with relevant characteristics for the purpose of this qualitative study, therefore, a convenience sampling method was used until the recruitment goal of N=40 (20 men and 20 women) was reached. According to recent research on qualitative sample sizes and capturing salient ideas and prevalent items, smaller samples sizes (n = 10) can collect some to most of the salient ideas, whereas a larger sample size (n=20) is more sensitive and can collect more prevalent and salient ideas as well as less prevalent ideas among participants, especially with probing.[17] Guest et al (2020) determined that approximately 12 interviews would be needed per sampling group to reach higher degrees of saturation.[18] As the aim for this study was to inductively explore gender-related aspects in illness experiences and care preferences, a recruitment goal of 20 participants per gender identity sample was considered ample to achieve this objective.

All individuals who indicated willingness to participate in this PRIME-NL qualitative gender sub-study received an email invitation. Participants who accepted the invitation to join the interview were contacted by the interviewer (LM) via phone 1) to explain the purpose of the interview, 2) to confirm their participation, 3) to schedule an appointment for the digital interview and 4) to provide support with any technical questions related to the use of the secure online conference meeting platform for the digital interview. The interviewer had no therapeutic relation with the participant and the participants did not receive any compensation for their participation. All participants signed a digital informed consent before inclusion in the study.

Data collection

The data collected for this paper were captured through semi-structured life story interviews focused on the impact of PD on daily life. The digital interviews lasted between 45 and 90 minutes. After hearing the initial story, the interviewer encouraged the participant to provide more details about topics related to gender in their illness experiences and care provider preferences. This section was operationalized in the interviews through the questions: "*Are there aspects of living with Parkinson's disease that are specific for you as a man/woman?*" and "*Is it important for you whether healthcare providers involved in your care are men or women?*" and probed for deeper exploration and context by asking for more information, examples or referring to prior responses. This paper reports on the outcomes of this particular interview section.

Data analysis

The interviews were audio-recorded and professionally transcribed verbatim. Data analyses was informed by Judith Butler's concept of gender performativity[19] and conducted using a reflexive thematic analysis approach.[20-22] The analyses was guided by the following questions: "*When and how does gender become salient in the illness experiences of people with PD?*" and "*Are there gendered preferences regarding healthcare providers involved in the care for people with PD?*". First, the text was read and re-read to familiarize the researchers with the data. Second, open coding was applied, independently by LM and IG, to identify meaningful text units. In this stage, text that explicitly addressed gender aspects in illness experiences was separated from text related to gender aspects in care provider preferences for separate analyses. Codes were discussed and categorized according to similarities and differences in content. An iterative process of identifying and defining themes and topics was performed. Final themes and topics were analysed and discussed in consultation with CJ, SOP and SKLD. Data was coded with the use of ATLAS.ti (version 22.0.11)

Research team and reflexivity

IG is a female PhD researcher with training and experience in qualitative research and gender studies. LM is a female junior researcher with training and experience in ethnographic research and storytelling. CJ is a female certified listening professional and consultant in the field of narrative medicine. SKLD, male, and both a neurologist in training and senior researcher in the field of epidemiology and movement disorders; BRB is a male consultant neurologist and professor of Movement Disorders; SOP is a female professor of sex- and gender-sensitive medicine. Due to COVID-19 related restrictions, all interviews were conducted online.

Results

40 participants (20 men and 20 women) were invited to participate in this interview study, and none declined the invitation. All participants indicated to be either married or living with a partner. In one interview, a partner of the participant was present in the background and without interference, all the other interviews were in a one-on-one setting between the interviewer and the participant. After the first 8 interviews, it became apparent to the research team that, even though participants knew that this study focused on the impact of gender on their illness experiences, they did not report gender as an explicit aspect in their illness experience unless explicitly asked. The research team was aware that analysing participant responses as gendered experiences solely based on their gender identity would aggregate individual responses to group level and would not adequately capture individual understanding of gender related aspects in their illness experiences and within-group heterogeneity. Specific interview questions related to the impact of participants' gender identities were added to the interview guide to explore gender dimensions more explicitly. In total, 31 participants, 18 men and 13 women, were explicitly asked about the salience of their gender related self-concepts in their illness experiences and care provider preferences and are therefore included in this paper. As described in the method section, approximately 12 interviews per sub-sample would be sufficient for higher degrees of saturation and therefor no additional interviews were added to supplement the remaining interviews. Table 1 shows the selected demographic and clinical characteristics of the participants.

Analysis revealed three main themes with four topics from the data related to the salience of gender in illness experiences and two themes related to gendered care provider preferences. The themes are summarized in table 2 with practical exemplar question for clinicians and researchers.

Salience of gender in illness experiences of people with PD

Obscureness of gender

In most of the interviews, gender-related aspects were not explicitly made relevant or reported in the lived experiences of participants. When participants were explicitly asked whether there were aspects of living with PD that they felt were specific to their gender identity, a common response was a sense of confusion. Several participants stated that they lacked the reference from another gender identity to be able to answer the question, highlighting how the understanding of their own gendered experience hinged on the comparison with a different gender identity.

> "Interviewer: "*Are there aspects of Parkinson's disease that you think are specific for you as a man?*

Table 1. Selected participants characteristics

Characteristic	Overall (N=31)	Men (n=18)	Women (n=13)
Mean (SD) Age in years	65.5 (7.0)	67.6 (4.6)	62.5 (8.8)
Mean (SD) Clinical disease duration in years	5.1 (3.6)	3.5 (2.0)	7.3 (4.1)
n (%) Education level			
None	0 (0)	0 (0)	0 (0)
Primary education	0 (0)	0 (0)	0 (0)
Secondary - prevocational	2 (6.5)	2 (11)	0 (0)
Secondary – higher	2 (6.5)	1 (5.6)	1 (7.7)
Intermediate – vocational	6 (19)	3 (17)	3 (23)
Higher – professional	21 (68)	12 (67)	9 (69)
n (%) Ethnicity			
Dutch	31 (100)	18 (100)	13 (100)

> Interviewee: *" No, I don't believe so. I don't have any comparison material. I'm just thinking out loud, but I can't judge whether I would experience it differently if I were a woman, but maybe that's not what you mean*." [Interview 19. Man]

> "Interviewer: "*Are there aspects that in your experience are specific to you as a woman living with Parkinson's?*
> Interviewee: *Compared to a man, you mean*?" [Interview 21, Woman]

Participants diverted their answers towards aspects of their illness experiences that they considered more impactful than gender. Particularly some women felt their illness experiences were more influenced by behavioural coping aspects related to taking agency [Interview 20, Woman] [Interview 23, Woman] [Interview 14, Woman], and being literate about the disease rather than by their gender identity or gender related aspects.

> *"No, not really. Men can take care of themselves just as well as I do. But it depends a bit on whether you want it. I did notice in the early years [of living with Parkinson's], especially when a man had Parkinson's and I had such a meeting of fellow [Parkinsonians], the woman came with a handful of pills and made sure that he got pills, the pills he needed at that moment and on time. I think you should do that yourself whether you are a man or a woman because there were also women who said: which pills do you take? I have white ones. Yes, but what are they called? They didn't know that, but they did know the colour. Then I think 'how stupid'. You should know what you're taking. I have always loudly proclaimed: Know of your own ailment. Know about your illness.*" [Interview 20, Woman]

Table 2. Summary of the findings and gender-sensitive guiding questions for clinicians and researchers.

Theme	**Topic /** Subtopic
Salience of gender in illness experiences	**Obscureness of gender**
	Gendered stereotypical views related to PD
	Gendered invisibility of PD
	Gendered emotional experiences
	Gendered help-seeking behaviours
	Gendered role patterns
	Relevance of physical appearance
Salience of gender in healthcare provider preferences	**Preference for professional behaviour rather than gender identity**
	Preferences for women as care providers and associated traits

One man lived together with his wife, who was also diagnosed with PD and offered a unique opportunity to provide more insights into the potential relevance of gender related self-aspects as compared to his spouse. Although this participant brings forward a stereotypical view related to masculine presentation ("Be looked at more pityingly" in relation to "Look at that man there shaking"), this was not experienced as a salient aspect in his own life.

Description	Questions that could guide gender-sensitive approaches to care for people with PD
Topics that were considered more relevant than gender in illness experiences.	When and how does gender become a relevant contextual factor in the individual illness experiences of people with PD?
Experiences related to stereotypical views about gender related behaviours, roles, or norms.	Which gender-related stereotypical beliefs or attitudes can limit or stimulate effective coping strategies in people with PD?
Experiences related to gender differences in the expression and social visibility of PD.	How do gendered stigmata related to PD impact social support or access to care?
Experiences related to gender differences in dealing with emotions and emotional support	When and how do gendered norms related to emotional expression impact coping strategies in people with PD?
Experiences related to stereotypical gender traits or behaviours regarding help-seeking behaviours	When and how do gendered norms related to help-seeking behaviour impact coping strategies in people with PD?
Experiences related to renegotiating stereotypical relations role patterns such as household tasks.	How do people with PD and their partners effectively adapt and renegotiate gendered role patterns related to family care and household management?
Experiences related to the impact of PD on physical appearance.	How do gendered norms related to physical appearance affect illness experiences of people with PD?
Professional behaviours that were considered more relevant than gender-related aspects in preferences for healthcare providers.	When do gender-related care preferences become relevant for people with PD?
Experiences related to preferences for women as care providers and associated stereotypical feminine traits in the context of PD care.	What are the drivers behind gender-related care preferences among People with PD?

> "Interviewer: *Now, you have unique comparison material: Are there aspects of living with Parkinson's disease that you think are specific to you as a man?*
> Interviewee: *That's one to think about for a moment. Living with Parkinson's disease as a man. I think you might be looked at a bit more pityingly sometimes. Look at that man there shaking. I actually think that's the only thing I could think of.*

> Interviewer: *And where do you think that difference comes from?*
> Interviewee: *I think that in some areas it is true that a man is still expected to hide his flaws and with a woman it is usually less so. Perhaps not in your own circle, but for an outsider, a third party does.*
>
> Interviewer: *Yes, yes, and is that something you've felt or thought about yourself? I shouldn't show it?*
> Interviewee: *No, no, never. I've never felt it and never thought about it, but I've heard about it, let me put it this way.*" [Interview 34, Man]

Gendered stereotypical views related to PD

Several participants mentioned stereotypical views about gender related behaviours, roles, or norms. In these cases, gender was made salient through stereotypical beliefs related to PD and wider normative notions of femininity, masculinity, women, and men in general. It is important to emphasize that in most of the interviews, many of these stereotypical views were not reconstructed in the personal contexts of participants as they often did not feel that they, or the people close to them, performed or 'fitted in' these stereotypical gendered views themselves. For a clear example of how a participant can bring forward a stereotypical statement, followed by a deconstruction; see the quote of interview 34 above. Though in some cases, a stereotypical view was confirmed in the personal experiences of the participant. To emphasize this distinction, we will use an Asterix (*) when stereotypical performances of gender related aspects were also confirmed in the lived experience of the participants themselves.

Gendered invisibility of PD

According to some participants, PD is often considered to affect mostly men and affected women are less visible.

> "Interviewer: *Do you think there are aspects of Parkinson's, or your experience with Parkinson's, that are specific to you as a woman?*
> Interviewee: *I find that difficult because I, I've already thought about that because I knew that the conversation was about this. A lot of people told me that they all thought of men when they heard that I had Parkinson's. Men get it anyway and men who are a bit older, and then you immediately think of all those movement disorders but yes, I had none of those [symptoms].*" [Interview 13, Woman]*
>
> *"The first thing is, I think, a man with Parkinson's just shuffles down the street, with or without a [supportive] tool or a woman on his arm. And if I pay close attention, when I walk through the mall I would, I think, I see them. [...] I think that women*

> *prefer to hide it. I don't know any women with Parkinson's either. I also haven't heard of women I should know with Parkinson's. Well from people in the area that I've heard of and then I think 'gosh him too?'. I had no idea. So, you hear that more, men with Parkinson's."* [Interview 15, Man]*

The idea that women with PD are less visible was mentioned by several participants through the lens of gendered relations and role patterns. For example, the idea that women, even under the burden of disease, continue to feel responsible for taking care of household and family duties [Interview 26, Woman], whereas men are taken care of more readily [Interview 15, Man], making them more visible in social context. Another man also expressed an idea that it might be more difficult for women when PD symptoms get more visible, referring to a potential stronger norm for women in upholding conventional feminine standards for their physical appearance [Interview 14, Man].

Gendered emotional experiences

Changes in emotional regulation due to PD-related therapies was brought up by several men in a masculine normative manner suggesting that 'men don't cry'. For some men this stereotypical belief was more or less pervasive as a gendered emotional experience of PD.

> *"The last few years I have had emotional outbursts a number of times. Well, outburst sounds heavy. I reacted intensely emotionally, to which my environment reacted like 'gosh, what is going on?' I was not embarrassed, and I didn't know it had to do with Parkinson's. Yes, a man should not cry, it has been said once, but I don't mind that."* [Interview 39, Man]*

> *"Yes, there is also something there, that has to do with emotions. All you have to do is ask me a question for an examination and tears will trickle down my cheeks. I only have to hear a piece of music and I start to cry. Yes, men don't cry. That's how I was raised, yes and that, I have practiced this all my life; that men don't cry. Until now in recent years and that is a strange sensation."* [Interview 32, Man].*

Some women spoke out more specifically about their need to share their emotions with others, particularly with other women. They expressed that, partly due to feminine norms related to openly sharing emotions, it might be easier for women to find emotional support and ask for help compared to men.

> *"Me as a woman? Yes, I think the most important thing is my need to share my emotions without anyone coming up with advice. I'm a bit allergic to that. Yes, just tell my story. And I think I can talk about that better with women in general than with men. Yes, a friend of mine who is solution oriented. My girlfriends' men often do too. Yes, but I need to go to a deeper level. I think that's the most important thing about being a woman. I recognize it more in women in general."* [Interview 25, Woman]*

One man stated that he felt somewhat uncomfortable asking for help as a man while bringing forward a masculine norm related to 'having physical strength' that is increasingly impacted by PD.

> "Interviewee: *Maybe [as a man] you should ask for help sooner. That women -- Yeah, not all women, of course, then you generalize 'the helpless woman'. But I don't want to be the helpless man of course.*
>
> Interviewer: *With what kind of things would you find that annoying?*
> Interviewee: *Well, the power also gradually diminishes in your hands. So, suppose you have to ask someone else "can you open that bottle for me?" Now I'm the one who unscrews the bottle when it's stuck and things like that, little practical things. Yes, you don't know which way it's going, do you, how I'm going to walk in the future or not be able to walk anymore. I have no idea."* [Interview 14, Man]*

Gendered help-seeking behaviours
Several answers of the participants about the salience of gender in their lived experiences with PD referred to stereotypical gender traits or behaviours regarding help-seeking behaviours of men and women in general.

Multiple women expressed that they felt little to no barriers in asking for help in general. This was partly explained by a more overall comfortability among the women to talk about their emotions with others. Some men confirmed this as a stereotypical characteristic of women, though they did not directly express that they personally felt more difficulties in asking for help [Interview 31, Man], [Interview 18, Man], [Interview 15, Man]. Yet, one woman explained the low threshold in asking for help as a way to cope with multitasking the many responsibilities in household, childcare and professional jobs.

> *"Well, I think women of… Yeah, it's a bit of a generalization of course, generally do more multi-tasking. So that is what I experience. And that women do more in the household, with the children, with the job. They have more control and remember everything and know where everything is. Men are slightly more focused on the*

> *core task they are doing. I think we're just a little better at [multitasking]. Historically, that we do and can do that more. As a result, I also think that women have a little less and later symptoms, because we can communicate more in the head. I also think that women are a little easier at coming up with tricks and that we just get away with it longer. That our brains are just a little more flexible in that regard.* [Interview 36, Woman]*

One man expressed that a barrier for help-seeking by men could be related masculine norms related to 'toughness' [Interview 18, Man], while another expressed that men rather focus on problem-solving than sharing emotions with others as a coping strategy [Interview 29, Man]*.

Gendered role patterns
Some participants expressed experiences of changes in gender role patterns in their relationship with their spouse, due to increased PD related disabilities.

> *"I think that being a woman, certainly of the generation we are from, where we still assume a certain role pattern, that you are a bit more impaired as a woman [with PD] than as a man [with PD]."* [Interview 30, Man]

For example, one woman with PD shared that she experienced some difficulties in renegotiating new household task divisions and standards between her and her husband.

> *"Specific for me as a woman? In my relationship with [my husband], I think the element of care is more obvious to me than to [him] and I also have to teach him that at times. Also, the care element in the house, the whole cleaning story also partly has to do with the fact that he has a much easier attitude towards it than I do, and I also have to live in it."* [Interview 17, Woman]*

One man expressed that he was not able to complete household maintenance tasks that he considered his responsibility. From his three children, one daughter and two sons, the sons were supportive in taking over these tasks.

> "Interviewee: *I was always busy refurbishing things in the house, painting, wallpapering, I liked sticking wallpaper on the wall, doing repairs of small things that break. I counted that among my tasks, but whether that really has to do with being a man, yes, I think for me it does, yes. […] That is no longer possible. I'm not going to stand on a ladder anymore.*

> Interviewer: *No, exactly, so something changes in the division of tasks.*
> Interviewee: *Yes, in that sense, and that's where it comes in handy if you have two sons. Because they do this now.*" [Interview 32, Man]*

Relevance of physical appearance

Two women particularly mentioned the importance of their physical appearance and beauty care as a relevant aspect of their womanhood in relation to PD.

> *"Well, I think being a woman, and maybe some men have that too, I think physical appearance is important too. I know my face; my face has just become so different. And it's nice to look good and be able to move smoothly. I also fell because of Parkinson's. I broke an ankle and broke my knee and therefore I walked a bit strangely. It wasn't like 'here comes a charming lady'. It felt awkward."* [Interview 25, Woman]

> *"What I have started to do is very consciously always dress well. Make sure I look well groomed. That has become more important as I got sicker."* [Interview 22, Woman]

Salience of gender in care provision preferences

Preference for professional behaviour rather than gender identity

In response to our question whether gender identity mattered in preferences towards healthcare providers, most of the men and women with PD stated that behavioural traits were more important than provider's gender identity. Traits that enabled care experiences such as '*being treated with respect*' [Interview 20, Woman]. [Interview 34, Man], [Interview 35, Man], '*being empathic*' [Interview 23, Woman], [Interview 24, Man], '*being understood*' [Interview 26, Woman], and '*feeling supported and encouraged*' [Interview 16, Man], [Interview 12, Man], were mentioned as particularly relevant. Moreover, these traits were not associated with gendered traits in terms of masculinity or femininity, but rather in terms of gender-neutral professional behaviours.

> "Interviewer: *Does it matter to you whether your healthcare provider is a man or a woman?*
> Interviewee: *No, my Parkinson's nurse is a man, and my neurologist is a woman. What matters to me is that they understand me.*" [Interview 26, Woman]

> *"Maybe I'm not allowed to say this, but man or woman doesn't really matter to me at all, but how people treat you is much more important"* [Interview 12, Man]

Preferences for women as care providers and associated traits

Although gender identity was not considered relevant in care provider preferences by most participants, some participants, both men and women, mentioned gendered care preferences explicitly related to women as care providers and associated feminine attributes. Particularly, men related their preferences to stereotypical feminine traits such as 'being friendlier' and 'being more empathic' [Interview 15, Man] or gender norms related to care taking. Both men and women that expressed gender identity preferences towards healthcare providers referred to 'feeling more comfortable' with a woman as care provider while expressing diverse motivations for this.

> *"Well, I have to say, I have a woman as neurologist, and I really like that. Yeah, so I guess I like a woman the most. I think I'm more comfortable talking to a woman about intimate things like peeing and stuff like that, and whatever else might happen in the future."* [Interview 13, Woman]

One man explained that he preferred to see a woman psychologist as it was easier for him to talk about his emotions without a sense of competition.

> *"I'll confess something to you. A few years ago, when I needed a referral from the GP for a psychologist, I said: "I prefer a woman, is that crazy?" She says: "No, that's not crazy, but you're going to have to explain to that lady why you chose a woman." I do feel that I talk about my feelings more easily with women than with men. We are still roosters, and you don't want to be inferior to each other. You don't like to be a weakling or the weakest. No, I talk more easily with women than with men, but you don't always have a choice."* [Interview 19, Man]

One woman mentioned having an uncomfortable experience with a man physiotherapist and therefore now more strongly prefers women as therapists.

> *"I do feel more at ease [with a woman as care provider]. I've had a man as physiotherapist before and he, yes, how do I say that nicely? He did things that I felt were not appropriate. And since then, I've had physical therapists who-- Yeah, I just don't want a man therapist. Yes, I think due to that experience, I prefer women care providers. I just feel much better about that and then at least I know for sure that nothing weird happens."* [Interview 21, Woman]

Two men expressed feeling more comfortable with a woman as nurse by referring to gender norms related to care taking. Particularly when it comes to physical care activities such as helping with personal hygiene and getting dressed.

> *"I have not yet met a man who can fulfil a care function like a woman can, even though I am being treated for neck complaints by a male physiotherapist and I have his arms around my neck once every 3, 4 months. But really when it comes to nursing, the traditional nursing, yes, I feel better with a woman than with a man. Perhaps this has to do with the fact that a woman is there day and night during the first years of a child's life and provides care in that way. She is therefore more experienced in this than a man. But I'm probably very old fashioned about that."* [Interview 39, Man]

> *"I think that has to do with an experience that women can take better care than men and rationally I think it's nonsense that I think that because I don't think that is the case. But that is how I experience it, that is how I feel it."* [Interview 32, Man]

A few women also mentioned that they particularly preferred a woman as care provider when it comes to physical examinations.

> *"When it comes to physical examination, I really like having a woman. Yes. Someone who can simply empathize and sympathize, that is important. From my experience you then end up with a woman more often than with men. Yes, there is still something for men to learn."* [Interview 17, Woman]

Discussion

Key findings

In this study, we investigated the salience of gender-related aspects in the illness experiences and care provider preferences among men and women with PD. In most interviews, gender-related aspects were not strongly salient in the illness experiences of participants. For these participants, gender was not used as a frame of reference in their illness experience and several participants, particularly some women, felt their illness experiences were more influenced by effective coping skills such as taking agency and being literate about the disease rather than by their gender identity or gender related aspects. Men and women that expressed gender salience in their illness experience, referred to the general invisibility of women with PD, gendered norms and preferences related to emotional expression, different drivers for help-seeking behaviour and the impact of gendered role patterns in personal relationships. Furthermore, most participants did not have explicit gender preferences related to their healthcare providers. These participants expressed to value professional behaviours over the gender identity of their healthcare providers. Particularly behaviours that enabled respectful treatment, adequate understanding of their concerns and feelings of being supported. Participants that did express preferences in healthcare providers' gender identity, expressed particular preferences for women as healthcare providers. These preferences were mostly rooted in preferences for stereotypical feminine behaviours such as 'friendliness' and 'empathic' or gendered norms related to 'care taking'. For some, higher comfortability with women as healthcare providers were also motivated by a sense of 'feeling safe', specifically in the context of physical examinations or care.

Comparison with previous literature

In general, participants revealed knowledge of stereotypes commonly associated with their gender identity, however, the majority did not evaluate their own experiences in terms of these stereotypical views. These findings are supported by the gender schema theory, which states that some people are more likely to regulate their perceptions and behaviours according to sociocultural ideas about gender ('gender schematic people') while for others, gender is a less important frame of reference ('gender a-schematic people').[23] Previous literature also demonstrated that when gender salience is low, so is self-stereotyping.[24] Self-stereotyping involves the ascription of typical gender in-group attributes to the self, along with the accentuation of differences from the gender out-group and is a product of interpersonal context.[25] Even-though gender identity salience was cued explicitly during the interview by the framing of our questions, it appeared not to be the most salient social identity in the illness experiences of many participants. This finding might not be surprising given that the context of the interviews focused on the illness experiences of men and women with PD. Other social identities besides gender, such as their illness or disability identity, or more specifically a 'Parkinsonian identity'[26], was also cued in the interviews and likely to be more salient than gender for these participants.[27] It remains to be investigated how the salience of gender related aspects in illness experiences might differ in various social groups of people with PD when viewed from an intersectional perspective.[28]

Rohmer et al (2009) conducted an intersectional study into the salience of disability, gender and ethnicity and concluded that disability could be considered a superordinate social category, especially when disabilities are visible.[11] In line with other studies, these findings support the hypothesis that particularly visible and chronic disabilities are predominant as a salient characteristic in a person's identity management.[29] Earlier studies on the impact of PD on identity management echo the challenge of maintaining, renegotiating and developing new 'senses of selves' and relationships with others as the disease progresses. Being able to effectively cope with this process is essential for the well-being of people with PD.[3,30,31] Healthcare professionals should be aware that in people with PD whose gender identity is highly salient, the adaptability in identity management and the development of effective coping strategies is influenced by self-stereotyping behaviours. They are also more likely to conform to social pressures communicated through gendered norms, regardless of whether these behaviours are harmful or beneficial to their physical or mental health. Cultivating competence in healthcare professionals to be able to notice contextual 'red flags' regarding harmful gendered norms or behaviours that could complicate care is central to the practice of gender-sensitive care for people with PD.[32]

Clinical considerations

Providing gender sensitive and contextualized Parkinson care requires an awareness of what to look for. Contextual red flags can include something that a patient says, an observation of the individual situation of the patient, or behaviour that suggests unaddressed contextual factors might be contributing to problems with their care.[33] We observed some clinically relevant contextual flags related to gender that could contribute to problems with care of people with PD in this study. For example, one man in our study expressed "the strange sensation" of renegotiating self-stereotypical behaviours which he had practiced all his life related to a gender norm of 'men don't cry' [Interview 32]. This is an illustration of how non-motor symptoms (increased emotionality) activate restrictive gender norms related to emotional coping in this patient. Probing further during a medical consultation could reveal that this non-motor symptom is ineffectively coped with due to restrictive self-stereotyping behaviours (i.e. the contextual factor). Once the contextual factor is revealed, it can open avenues for treatment and support, in this case by referring the patient to a specialized social worker who could support the patient in the renegotiation process of self-limiting beliefs and behaviours towards effective coping strategies.

Another example in our study consisted of a woman who shared that she experienced difficulties in renegotiating new role patterns related to household task divisions with her husband, because the care roles were more obvious for her as a woman in their relationship [Interview 17]. Previous research shows that role changes in relationships affected by PD are common, if not inevitable.[34-36] How couples adapt ('dyadic resilience') to the advancing stages of PD depends on a number of relational features, such as commitment and equality within the dyad.[37] Therefore, for the woman in our study, an inability to effectively renegotiate or reorganize household and caring tasks with her husband could become a contextual stressor that aggravates the symptoms of PD. When a clinician observes that this contextual stressor complicates the care for this woman, the clinician can encourage dialogue regarding relational changes, and explore whether there is a need to provide the couple with information on how to get further help. Our study could therefor aid healthcare providers to identify new targets of symptomatic treatment by recognizing that people with PD may have subtle ways of 'doing gender' as a means of preserving a sense of self and social relationships that could complicate their care.[38]

Aside from the novel gender-related findings in illness experiences of the individual participants in our interviews, we also observed that many participants in our study expressed that professional behaviours were deemed more relevant in their preferences for healthcare providers than gender identity and most participants did not express strong preferences for provider's gender identities in general. However, social interactions in medicine are not free from reproducing gender stereotypes. Both men and women that expressed specific gendered preferences towards women healthcare providers did so because it made them feel more comfortable, particularly under conditions of intimate care and examinations. There were diverse motivational drivers behind feelings of comfortability with woman care providers. For some, mostly men, this was driven by stereotypical views related to 'women as carers' and attributed feminine traits such as 'friendliness', 'empathic' and 'easier to talk to'. One woman expressed a sense of feeling physically safer with women providers after she shared an experience with a man provider that involved physical contact that she felt was inappropriate. These findings contrast previous studies reporting stronger same-gender preferences among both men and women patients who felt that same-gender providers where then more easier to talk to and feeling more comfortable during physical exams.[39-41]

Preferences in providers' gender identity appear to become particularly salient under conditions in which delicate communications or the performance of sensitive physical examinations or care take place and require a sense of trust in the patient-physician relationship.[42] Factors that affect a patient-physician relationship are multifactorial, however previous research determined that physicians, regardless of their gender identity, can evaluate and experience what is considered 'trust' in this relationship differently from patients; e.g. on the basis of their ability to solve patient's problems through technical expertise, reliability and knowledgeability, whereas patients might focus more on interpersonal aspects such as care, appreciation, empathy and ability to listen.[43] There is evidence that women physicians engage more in rapport building behaviours with patients that include attentive silences, verbal encouragements, non-verbal positive communications and affective behaviours such as expressing concern and empathy.[44] To better understand how communication and rapport building behaviours and gender identities influence contextual patient preferences, further research is necessary that disentangles the effects of physicians and patients' gender identities and physicians communication and rapport building styles.[45] This allows a more nuanced investigation into the effect of socially desired or stereotypical behavioural preferences *related to* gender identity, in which gender identity becomes instrumental rather than solely explanatory for patients' care provider preferences.

Notwithstanding the clinical relevance of our novel findings, caution is warranted to avoid 'making' gender salient in healthcare communications or medical consultations when it is *not* perceived as important by the individual person with PD. A study by Puntoni et al (2011) into gender identity and the perceived vulnerability to breast cancer showed that a defensive response regarding personal risk perceptions can be triggered when health communication messages are not aligned with- or threaten self-concepts that people wish to preserve about themselves.[46] Across a series of experiments, they demonstrated that health communications regarding breast cancer screening that heightened gender identity and stereotypical gender aspects (e.g. using pictures of women and including pink colours and ribbons in advertisements) decreased breast cancer risk perceptions among women compared to more 'gender neutral' communications. These results contrast the generally accepted 'gender congruency effect', according to which the salience of a particular identity should increase associated risk perceptions. With increased calls for more (sex- and) gender-specific PD research and care [5,7,47], it is simultaneously important to carefully consider and operationalize these constructs in research and health communications. Healthcare providers should be aware that, although every person has a gender identity, the salience of gender-related experiences vary between people with PD. Highlighting gender identities and associated aspects in health communications could have unintended consequences on the effectiveness of the communication when; 1) it is not a salient characteristic of a person's lived experience; 2) it threatens or is not aligned with a person's perception about their gendered self or 3) it overemphasizes or generalizes differences between people of other gender identities which are not well understood yet.

Methodological limitation and consideration

Due to Covid-19 restriction, the interviews for this study were conducted virtually. This option enhanced long-distance participation and is cost- and time-effective. However, technical difficulties can be a barrier for both participation and the quality of the interviews. We strived to mitigate technical issues by providing technical support to participants and by testing before the actual interview took place. Furthermore, digital interviews can help to enrich data concerning sensitive topics, which can include gender-related topics, as participants can participate in a (private) location of choice. Yet, visual cues can be more difficult to read through a camera and might fail to work during the actual interview. Conducting virtual field work requires balancing the advantages and disadvantages compared to face-to-face interview.[48,49]

In this study we applied an inductive approach by making gender relevant through our interview questions to capture gendered experiences. We refrained from using a deductive approach as this, often used, approach risks perpetuating and reinforcing (Western) stereotypical views which are invariably subject to change and differ through culture, context, and time. We aimed to uncover gendered norms, views, and behaviours that participants made salient themselves, rather than gendering their experiences, as researchers, by using existing gendered frameworks for analyses. However, this approach is likely to elicit gendered perception in participants who are already more inclined to process gender-related information about themselves and therefore likely to be more gender-schematic. That is not to say that all gender-schematic people are consciously aware of the gender schemas applied in their evaluation of life experiences. On the contrary, many people, both gender schematic and a-schematic, are unaware of how their perceptions are organized based on gender and when or how they are 'doing gender' as a normative social practice in daily life. This might also explain the initial sense of confusion that many of the participants in this study expressed when they were explicitly asked about the role of gender in their illness experience. More refined research methodologies are needed to explore the impact of different gender dimensions on illness experiences of- and care for people with PD. Gender schemas of which people are less consciously aware within themselves or their environment are challenging to capture inductively without a (personalized) gendered frame of reference. When using existing gendered frameworks for analyses, researchers should test for fit and relevance in their specific research setting where possible.

Meanwhile, some gender theorists argue that the way forward in gender theory entails exploring not only when and how gender is socially constructed and performed, but also considers the biological grounding of some patterns of behaviour. In this interactionist perspective, social and biological processes are intertwined in producing the phenomena of gender/sex.[50,51] This interaction is perhaps particularly relevant in the context of medicine, in which surgical, pharmacological and psychosocial interventions can influence both social and biological processes. We have yet to develop more precise and personalized methodologies that can capture more nuanced insights into when and how these biopsychosocial interactions and interventions for people with PD become "gendered", "sexed", or "gendered/sexed".[51–53]

Furthermore, the sample in this study was limited in diversity with regards to social demographics such as age, education level and ethnicity, despite, or perhaps due to, our convenience sampling strategy. Homogeneous sampling in qualitative research is used when the goal is to understand and describe a particular group experience in depth by limiting group variations and could therefore be considered a strength for this particular study. However, there have been calls to action to promote more diversity, equity and inclusion in Parkinson's research in general.[28] The current knowledge base around PD is generally a poor representation of the diversity of people with the disease and data remains scarce on many traditionally underrepresented groups such as Black, Latino, Asian and Indigenous groups, LGBTQAI+ and people with lower socioeconomic status. We encourage future investigations that seek to describe health and illness experiences of people with PD within multiple social categories such as ethnicity *and* gender, rather than by ethnicity *or* gender, and which utilize an intersectional gender approach in both participant selection and data analysis.[54,55] Prioritizing gender identity as an entry point into more complex analysis that includes intersecting social characteristics of people with PD would allow for a more nuanced understanding into how gender dimensions are informed by other social characteristics and when, how and for whom they become relevant in illness experiences.

Future directions

Our findings emphasize the individual and contextual character of gender-related aspects in the illness experiences and care preferences of people with PD. These findings highlight the need for more precise and personalized methodologies to create more nuanced insights into the impact of gender on PD and to cultivate competence in healthcare professionals to notice contextual factors related to gendered norms or behaviours that could complicate care. Preferences in providers' gender identity, particularly in the performance of sensitive physical examinations or care, appeared multifactorial and warrant further research to better understand potential drivers behind these gendered provider preferences among people with PD.

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Part 2

Advancing the study of gender in medical research

5

Chapter 5

The application of human-centred design approaches in health research and innovation: a narrative review of current practices.

This chapter is based on the following publication:

Göttgens I, Oertelt-Prigione S. The Application of Human-Centered Design Approaches in Health Research and Innovation: A Narrative Review of Current Practices. JMIR Mhealth Uhealth. 2021 Dec 6;9(12):e28102. doi: 10.2196/28102. PMID: 34874893; PMCID: PMC8691403.

Abstract

Background

Human centred design (HCD) approaches to healthcare strive to support the development of innovative, effective, and person-centred solutions for healthcare. Although their use is increasing, there is no integral overview describing the details of HCD methods in health innovations.

Objective

This review aims to explore the current practices of HCD approaches for the development of health innovations, with the aim of providing an overview of applied methods for participatory and human centred design processes and highlight shortcomings for further research.

Method

A narrative review of health research was conducted based on systematic electronic searches in PubMed, CINHAL, Embase, Cochrane Library, Web of Science, PsycInfo and Sociological Abstracts (2000 – 2020) using keywords related to *"human-centred design"*, *"design thinking"*(DT) and *"user-centred design"*(UCD). Abstracts and full-text articles were screened by two reviewers independently based on predefined inclusion criteria. Data extraction focused on (a) the methodology employed throughout the research process, (b) the choice of methods in different phases of the innovation cycle and (c) the level of engagement of end-users.

Results

This review summarizes the application of HCD practices across various areas of health innovation. All approaches prioritized users' needs and the participatory and iterative nature of the design process. The design processes consisted of several design cycles during which multiple qualitative and/or quantitative methods were used in combination with specific design methods. HCD/DT-based research primarily targeted understanding the research context and defining the problem whereas UCD-based work focused mainly on the direct generation of solutions. While UCD approaches involved end-users primarily in the role of tester and informant, HCD/DT approaches involved end-users most often as design partners.

Conclusions

We provide an overview of currently applied methodologies and HCD guidelines to assist healthcare professionals and design researchers in their methodological choices. HCD design-based techniques are challenging to evaluate with traditional biomedical research methods. Previously proposed reporting guidelines are a step forward but would require a level of detail incompatible with the current publishing landscape. Hence, further development is needed in this area. Special focus should be placed on the congruence between chosen methods, design strategy and achievable outcomes. Furthermore, power dimensions, agency and intersectionality need to be considered in co-design sessions with multiple stakeholders, especially when including vulnerable groups.

Introduction

Health systems are experiencing a progressive imbalance between available resources and increasing needs. The world population is growing, the incidence of chronic diseases rising, and the funds allocated to healthcare are limited.[1], [2] Calls to provide optimized, individualised, and person-centred care are growing. Addressing these competing needs and complex problems, requires novel and creative approaches for the development of healthcare solutions. Design approaches to healthcare promise to aid the development of innovative, effective and person-centred solutions to health challenges, supporting the realisation of a future for healthcare that is preventative, personalised and participatory.[3], [4] Different medical disciplines are increasingly applying human-centred design (HCD) for a range of complex questions, from process optimization to product design and social innovation.[5]–[7] HCD is often described as an iterative, collaborative and people-centred approach for designing products, services and systems and is argued to be particularly well-suited for solving complex challenges.[8]

In recent years, a growing number of healthcare professionals have applied HCD to develop person-centred healthcare solutions in collaboration with patients.[9] For example, the department of obstetrics and gynaecology at Mayo Clinic used HCD to develop a new prenatal care model, designed to de-medicalise the healthy pregnancy experience.[10] By enabling women to meaningfully participate in the process through the use of self-measurement tools, their levels of engagement, sense of control, confidence and reassurance significantly increased. Another example is a nurse-led quality improvement project at Kaiser Permanente Northern California. HCD principles were employed for a patient-centred approach to improve inpatient pain management. The experiences of frontline nurses, patients and managers were collected, evaluated, and applied to improve the care experience of patients as well as the work experience of care providers.[11]

The application of HCD beyond the design sector and its adoption within health research is, however, still in its infancy.[4], [12] The number of HCD studies that describe a full project cycle is limited, and even fewer publications focus on the evaluation of research projects that employed HCD.[13] A recent scoping review on the application of HCD in global health provided a first overview of its application and health outcomes in public health. The review concluded that increased methodological rigor in the application and reporting of HCD is needed to allow for more acceptance and integration of design practices into research and development.[13], [14] However, currently there is no integral collection of HCD approaches and methods used for the development of health innovations. We performed the present review to fill this gap.

HCD evolved from the collaborative design movement and covers a range of overlapping collaborative processes and techniques such as, and not limited to participatory design, ethnography, co-creation, contextual design, co-design, and empathic design. These processes share several principles: the active involvement of users; an iterative design process and the organisation of multidisciplinary teamwork.[15]–[17] The term HCD, as a collaborative multi-method approach, is often used interchangeably with terms as 'design thinking' (DT) or 'user-centred design' (UCD) due to their similar design philosophies. DT is an approach that prioritizes developing empathy for users, working in collaborative multidisciplinary teams and using an iterative process with 'rapid prototyping' techniques for potential solutions.[18] Similarly, UCD, while deeply rooted in human computer interaction, is described as both a philosophy and a set of methods in which end-users actively influence and are involved in the design process.[13] As these principles are akin to those of HCD, this review includes both DT and UCD as variations that apply HCD principles to further explore their similarities and differences.

In this review, we systematically explored the following question: how is HCD, and the closely related approaches of DT and UCD, applied for the development of innovations in health research? We specifically focus on the applied research methodologies and the design methods employed throughout the study. We investigated the level of engagement of end-users during the HCD design processes. As a result, we provide an overview of the current application practices of HCD in health research and a practice-oriented collection of the employed design methods to aid future researchers in their choice of methodology.

Method

Two librarians, one from the medical sciences and one from social sciences, assisted with the development of a search strategy and the selection of the appropriate databases. Our research included health research related to biomedical, nursing, and allied health and public health sciences. We performed multiple test runs to optimize the search strategy, before the first search in July 2019. A final search was performed in August 2020 to update the included publications. The protocol for this review can be found in supplement 1.

Search Strategy

We performed electronic searches in the following databases: PubMed, CINHAL, Embase, Cochrane Library, Web of Science, PsycInfo and Sociological Abstracts. Grey literature searches were not included. We searched for studies in the English language, published between 2000 and 2020. For the medical databases the following terms were employed: "*Human-centred*" OR "*Human-centred*" OR "*User-centred*" OR "*User-centred*" AND "*Design OR approach*" OR "*Design thinking*". For the non-medical databases, the following search terms were added: "*Health*" OR "*Medic*" OR "*Clinic*". The exact search algorithms per database can be found in supplement 2.

Eligibility criteria

We included health research studies that 1) applied human-centred design (HCD), user-centered design (UCD) or design thinking (DT), 2) focused on the development process of a health innovation and 3) provided a detailed description of the design process, which included: 4) the applied process steps and/or phases, 5) the applied design methods per process step and/or phase and 6) a description of the involved design team and end-users. We excluded studies if 1) the study did not focus on the design process and 2) the study did not provide a detailed description of the design process and the HCD/DT/UCD methods used in the study. No specific criteria were formulated related to the end-user population.

We conceptualised a ´health innovation' as it is applied within the context of health research according to the World Health Organization concept of: *"Health innovation identifies new or improved health policies, systems, products and technologies, and services and delivery methods that improve people's health and wellbeing."*

Screening and data extraction

We downloaded relevant papers into the Endnote bibliographic software (Clarivate Analytics, Philadelphia, PA, USA) and removed the duplicates. We then uploaded the Endnote database with the remaining papers into Rayyan, a web application that supports the initial screening of publication titles and abstracts.[19] Two reviewers screened the titles and abstracts independently for inclusion eligibility and subsequently screened the full-text articles independently for inclusion. We resolved disagreements by discussion. To determine the level of agreement, both Cohen's *k* and the percentage of agreement were calculated.

Data retrieval and analysis

We conducted a stepwise analysis of the included publications, focusing on 1) *Study characteristics*, *including design phases and methods*, 2) *Level of end-user involvement* and 3) *Quality assessment*.

Study characteristics

We extracted the following data from each article: year of publication, first author, title of the study, aim of the study, end-user of the innovation, type of innovation, study design, design approach, design approach reference, design process phases and applied research and design methods and the design-based problem-solving strategy.

For the classification of the applied *qualitative and quantitative research and design methods*, research methods were defined as; 'methods traditionally used within scientific research, oriented towards understanding' and design methods were defined as; 'methods not traditionally used with scientific research, oriented towards action or solution creation for defined problems'.[20], [21] These distinctions were made based on discussions between the authors. To define the design-based problem-solving strategy, we used the categories of problem-focused strategy (PFS) versus solution-focused strategy (SFS). Studies that use a PFS aim at defining or reframing the problem before formulating possible solutions. Studies that use a SFS approach focus the development of a predefined solution, investing little time in defining or reframing the problem.[22]

Level of involvement of the end-user

To define the level of engagement of the end-user we adopted a modified framework proposed by Druin[23], which was originally used to categorize the participating role of children in a design process. Participating roles are *user, tester, informant,* or *design partner*, with increased levels of involvement for each role. *Users* help researchers and designers to understand the problem context and/or user needs. The role of *tester* builds upon this role by including end-users as part of initial or functional prototype testing. In the role of *informant*, the end-users are involved during various stages of the design process and contribute to idea generation and providing feedback on initial and functional prototypes. In the role of *design partner,* end-users are considered equal partners to the design team and are involved at all stages of the design process and are fully included during decision making processes.

Quality assessment

We assessed the quality of reporting and analysis of the study designs with the Mixed Methods Appraisal Tool (MMAT), which allows for the appraisal of studies for literature reviews that include qualitative, quantitative, and mixed methods studies.[24] As most HCD studies apply a multi-method approach, we considered this tool fit for purpose. The MMAT contains two general screening questions and five study design specific criteria for assessing quantitative and qualitative studies. For mixed methods studies, we applied both sets of criteria, in addition to five specific mixed method criteria. Scores per item can vary between 'Yes' (criterion is met), 'No' (criterion is not met) and 'Can't tell' (paper does not report appropriate information to rate this criterion).

One author first performed the data retrieval and conducted the stepwise analysis described above. Subsequently, both authors reviewed and discussed the results.

Results

In the following sections we will provide an overview of the literature search results and the study characteristics of the included studies. Subsequently, several aspects of studies are highlighted, including the applied design theories, guidelines, strategies, and design process steps. Furthermore, we evaluate the applied research and design methods and the role in which end-users were involved throughout the studies.

Our literature search identified 7560 records. After removal of 4072 duplicates and exclusion on the basis of abstract (3097) and full text (309), 82 articles were included into the final analysis (figure 1). Interrater agreement on the inclusion and exclusion of the studies was 96%, with a Cohen's Kappa of 0.81.

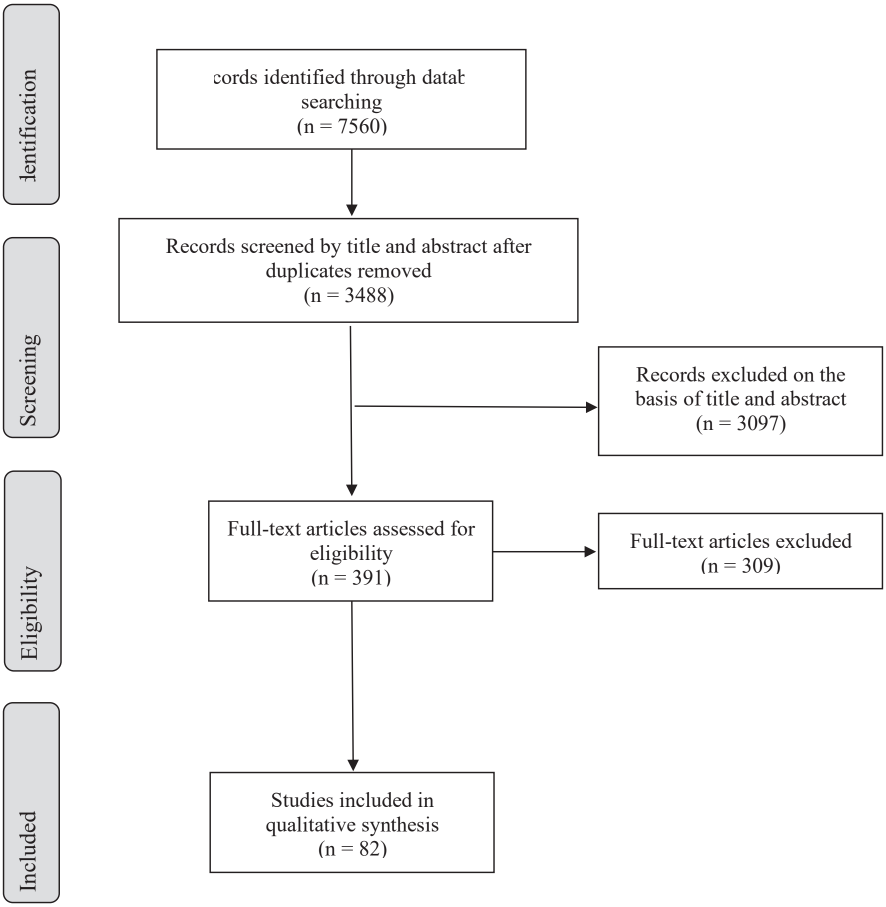

Figure 1. PRISMA Flowchart of the screening process

Study characteristics

68 articles (83%) were published between 2015 and 2020 and most of the studies originated from the USA (n= 34, 41%), the Netherlands (n= 7, 9%), the UK (n= 6, 7%) and Canada (n= 6, 7%). Many of the studies focused on patients as end-users and developed health innovations with a focus on improvement of patient care. The most common type of study design was a mixed-methods strategy (n= 47, 57%), i.e. a combination of qualitative, quantitative and design methods. 33 (40%) of the studies combined only qualitative methods with design methods (figure 2). A detailed overview of the study characteristics is presented in table 1.

Design theories and methodologies

This review explored the various applications of human-centred design approaches, including human-centred design (HCD), user-centered design (UCD) and design thinking (DT). HCD was used in 21 (26%) of the studies, 4 (4%) applied a DT approach and the majority (n= 57, 70%) employed a UCD approach. All approaches prioritized users' needs and the participatory and iterative nature of the design process. Some HCD definitions included a focus on a multiple stakeholder or system perspective, whereas some UCD definitions aimed at increasing usability or user friendliness of the solution. These design approaches are generally characterized using different standards or models.

Three standards or models were frequently mentioned in the studies and used as reference. These models overlap in their attempt to classify the distinct phases of the design process but operationalise the steps differently. The UCD ISO Standard 9241-210 for human-centred design of interactive systems encompasses a 5-phased design process including: 1) understanding and specify context of use, 2) specify user requirements, 3) produce design solution, 4) evaluate design against requirements and 5) deliver design solution that meets user requirements. The HCD IDEO Field Guide to Human-Centred Design and the HPI School of Design Thinking models are characterized by different versions of a similar 3-phased design process: 1) Inspiration, 2) Ideation, 3) Implementation. Studies that applied DT worked with a multi-phased approach that included versions of the following phases: 1) empathize with stakeholders, 2) define the problem, 3) generate ideas for solutions, 4) prototype solutions, 5) test solutions. In figure 2 we illustrate how the different approaches to the human-centred design process align.

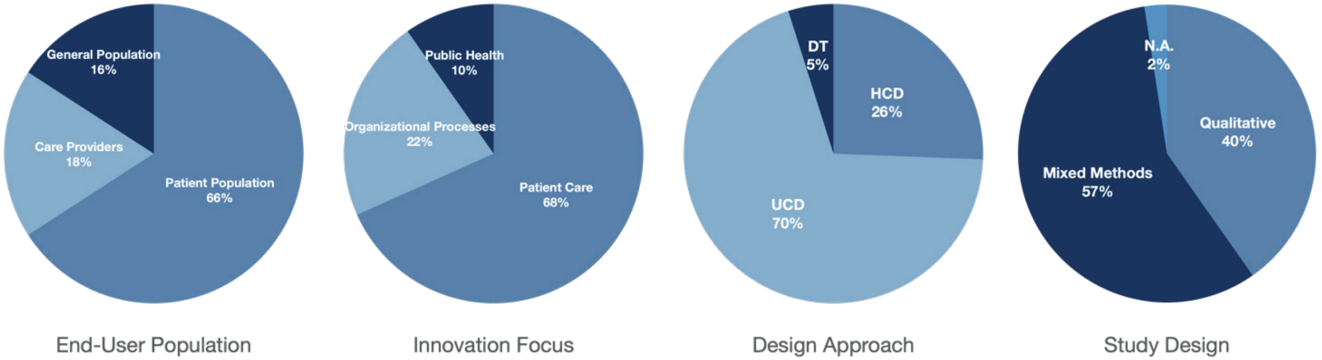

Figure 2. Summary overview of the study characteristics.

Table 1. Characteristics of the included studies.

Author (Year), Location	**Title**
Bae, J. (2009), Korea.[25]	Development of a user-centered health information service system for depressive symptom management.
Birnie, K. A. (2019), Canada.[26]	ICanCope PostOp: User-centered design of a smartphone-based app for self-management of postoperative pain in children and adolescents.
Brox, E. (2017), Norway.[27]	User-Centered Design of Serious Games for Older Adults Following 3 Years of Experience With Exergames for Seniors: A Study Design.
Cairn, N. (2018), UK.[28]	Rethinking the foam cosmesis for people with lower limb absence.
Carey-Smith, B.E. (2013), UK.[29]	A user-centred design process to develop technology to improve sleep quality in residential care homes.
Caro, K. (2017), Mexico.[30]	FroggyBobby: An exergame to support children with motor problems practicing motor coordination exercises during therapeutic interventions.
Catalani, C. (2014), Kenia.[31]	A clinical decision support system for integrating tuberculosis and HIV care in Kenya: A human-centered design approach.
Cawood, T. (2016), New Zealand.[32]	Creating the optimal workspace for hospital staff using human centred design.
Civan-Hartlzer, A. (2010), USA.[33]	Bringing the Field into Focus: User-centred Design of a Patient Expertise Locator.
Connelly, K. (2016), USA.[34]	Development of an Ecological Momentary Assessment Mobile App for a Low-Literacy, Mexican American Population to Collect Disordered Eating Behaviors.
Crespin, O.M. (2018), Canada.[35]	Feasibility of adapting the fundamentals of laparoscopic surgery trainer box to endoscopic skills training tool.
Curtis, K.E. (2015), UK.[36]	Targeting Parents for Childhood Weight Management: Development of a Theory-Driven and User-Centered Healthy Eating App.
Dabbs de Vito, A. (2009), USA.[37]	User-Centered Design and Interactive Health Technologies for Patients.
Das. A. (2013), Norway. [38]	Human-centred methods in the design of an e-health solution for patients undergoing weight loss treatment.
Davies, A. (2020), UK.[39]	Recommendations for Developing Support Tools With People Suffering From Chronic Obstructive Pulmonary Disease: Co-Design and Pilot Testing of a Mobile Health Prototype.

End-user population	Innovation type	Design Approach	Study Design
Patients who experience depression.	Web-based system.	User-centred system development	Mixed Methods
Children and adolescents who recently have undergone any type of day surgery.	Pain self-management app.	User-centred design	Mixed Methods
Seniors.	Serious Game.	User-centred design	Mixed Methods
People with lower limb absence.	Foam cosmesis for prosthetic limbs.	User-centred product design	Mixed Methods
Older people with sleep/wake pattern disturbance.	Sleep improvement technology.	User-centred design	Qualitative
Children with motor coordination problems.	Exergames for children with motor problems.	User-centred design	Qualitative
HIV Clinical care providers.	Clinical shared decision support system.	Human-centred design	Mixed Methods
Hospital staff.	Non-clinical workspaces.	Human-centred design	Qualitative
Breast cancer survivors.	Patient expertise locator for online health communities.	User-centred design	Qualitative
Mexican American women.	Patients experiences assessment app.	User-centred, iterative design	Mixed Methods
Surgeons and gastroenterologists.	Laparoscopic surgery training box.	User-centred design	Mixed Methods
Parents of children with weight management problems.	Healthy eating app.	User-centred design	Mixed Methods
Lung transplant patients.	Personal health tracking application.	User-centred design	Mixed Methods
Patients undergoing weight loss treatment.	E-health solution for weight loss treatment.	Human-centred design	Mixed Methods
People with COPD.	Mobile app for COPD self-management.	User-centred, iterative design	Mixed Methods

Table 1. Continued.

Author (Year), Location	Title
Dijkstra. N. (2018), The Netherlands.[40]	Development of ehome, a mobile instrument for reporting, monitoring, and consulting drug-related problems in home care: Human-centered design study.
Eberhart, A. (2019), USA.[41]	Using a human-centered design approach for collaborative decision-making in paediatric asthma care.
Erol Barkana, D. (2013), Turkey.[42]	Improvement of design of a surgical interface using an eye tracking device.
Erwin, K. (2019), USA.[43]	Development of a Framework and Tool to Facilitate Cost-of-Care Conversations With Patients During Prenatal Care.
Ettinger, K. (2016), South Africa.[44]	Building quality mHealth for low resource settings.
Fabri, M. (2016), UK.[45]	Using design thinking to engage autistic students in participatory design of an online toolkit to help with transition into higher education.
Farinango, C. (2018), Columbia.[46]	Human-centered design of a personal health record system for metabolic syndrome management based on the ISO 9241-210:2010 standard.
Ferris, T. (2013), USA.[47]	The design of neonatal incubators: A systems-oriented, human-centered approach.
Foley, K. (2019), USA.[48]	Primary Care Women's Health Screening: A Case Study of a Community Engaged Human Centered Design Approach to Enhancing the Screening Process.
Fortuna, K. (2017), USA.[49]	Adapting a Psychosocial Intervention for Smartphone Delivery to Middle-Aged and Older Adults with Serious Mental Illness.
Furberg, R. (2018), USA.[50]	A digital decision support tool to enhance decisional capacity for clinical trial consent: Design and development.
Gacnik, M. (2017), Slovenia.[51]	User-centred app design for speech sound disorders interventions with tablet computers.
Garvelink, M. (2016), Canada.[52]	Development of a decision guide to support the elderly in decision making about location of care: an iterative, user-centered design.
Garvelink, M. (2017), Canada.[53]	Deciding How to Stay Independent at Home in Later Years: Development and Acceptability Testing of an Informative Web-Based Module.
Garvin, J. (2019), USA.[54]	Descriptive Usability Study of CirrODS: Clinical Decision and Workflow Support Tool for Management of Patients With Cirrhosis.

End-user population	Innovation type	Design Approach	Study Design
Home care nurses, general practitioners, and pharmacists.	E-home solution for monitoring and consulting.	Human-centred design	Mixed Methods
Parents and children that are dealing with asthma management in a lower income environment.	Physical decision-making aids.	Human-centred design	Qualitative
Surgeons that perform kidney tumour cryoablations.	Eye tracking device.	User-centred design	Qualitative
Patients receiving prenatal care.	Conversation framework.	Human-centred design	Qualitative
Community healthcare workers.	mHealth app to inform clinical decision making.	Human-centred design	Mixed Methods
Students with autism.	Online toolkit.	Design Thinking	Mixed Methods
Individuals at risk for metabolic syndrome.	Personal health record system.	Human-centred design	Mixed Methods
Infants, medical practitioners, and family members.	Neonatal incubators.	Human-centred design	Qualitative
Women receiving health screening in primary care.	Health screening tool.	Human-centred design	Qualitative
Middle-aged and older adults with serious mental illness.	Mobile app for medical and psychiatric self-management.	User-centred design	Qualitative
People diagnosed with fragile X syndrome and clinicians.	Tablet-based decision support tool.	User-centred design	Qualitative
Children with speech-language pathology.	App for speech sound disorder therapy.	User-centred design	Mixed Methods
Elderly people and their informal caregivers.	Decision guide (physical).	User-centred design	Mixed Methods
Seniors with loss of autonomy.	Interactive website.	User-centred design	Qualitative
Clinicians caring for patients with cirrhosis.	Clinical decision and workflow support tool (digital).	User-centred design	Mixed Methods

Table 1. Continued.

Author (Year), Location	**Title**
Garzo, A. (2018), France.[55]	Design and development of a gait training system for Parkinson's disease.
Gaynor, M. (2020), USA.[56]	A user-centered, learning asthma smartphone application for patients and providers.
Gill, R.K. (2019), Canada.[57]	Feasibility and Acceptability of a Mobile Technology Intervention to Support Post abortion Care (The FACTS Study Phase II) After Surgical Abortion: User-Centered Design.
Giunti, G. (2018), Spain.[58]	More stamina, a gamified mHealth solution for persons with multiple sclerosis: Research through design.
Godinho, R. (2014), Portugal.[59]	Improving accessibility of mobile devices with EasyWrite.
Gould, C. (2020), USA.[60]	Development and Refinement of Educational Materials to Help Older Veterans Use VA Mental Health Mobile Apps.
Green, R. (2015), USA.[61]	Tracking Care in the Emergency Department.
Griffin, L. (2019), USA.[62]	Creating an mHealth app for colorectal cancer screening: User-centered design approach.
Grossman, L. (2018), USA.[63]	Leveraging Patient-Reported Outcomes Using Data Visualization.
Hafiz, P. (2019), Denmark.[64]	The Internet-Based Cognitive Assessment Tool: System Design and Feasibility Study.
Hardy, A. (2018), UK.[65]	How Inclusive, User-Centered Design Research Can Improve Psychological Therapies for Psychosis: Development of SlowMo.
Harte, R. (2017), Ireland.[66]	Human-Centered Design Study: Enhancing the Usability of a Mobile Phone App in an Integrated Falls Risk Detection System for Use by Older Adult Users.
Hartlzer, A. (2016), USA.[67]	Design and feasibility of integrating personalised PRO dashboards into prostate cancer care.
Herschman, J. (2014), Canada.[68]	Development of a smartphone app for adolescents with lupus: a collaborative meeting-based methodology inclusive of a wide range of stakeholders.

End-user population	Innovation type	Design Approach	Study Design
People with Parkinson's disease.	Gait training application.	User-centred design	Mixed Methods
People with asthma.	Mobile app for asthma self-management.	User-centred design	Qualitative
Women who underwent an abortion.	Web-based intervention for post abortion care support.	User-centred design	Mixed Methods
Young adults who have been diagnosed with MS.	M-health solution.	User-centred design	Qualitative
Motor-disabled persons who experience text-entry difficulties when using mobile devices.	Text-entry method for mobile devices.	User-centred approach	Mixed Methods
Older veterans.	Educational material for mobile mental health apps.	User-centred design	Mixed Methods
Emergency department physicians.	Emergency department tracking board.	User-centred design	Qualitative
People at risk for colorectal cancer aged 50 years and above.	M-health screening solution.	User-centred design	Mixed Methods
Patients with heart failure and healthcare providers for heart failure patients.	Data visualization.	User-centred design	Mixed Methods
Patient with unipolar and bipolar disorder.	Web-based cognitive assessment tool.	User-centred design	Mixed Methods
People who fear harm from others.	Digital solution for psychological therapy.	User-centred design	Qualitative
Older adults with fall risk.	Mobile app for fall risk detection.	Human-centred design	Mixed Methods
Patients following prostate cancer treatment.	Patient dashboard.	Human-centred design	Mixed Methods
Adolescents with lupus.	Mobile app for adolescents.	User-centred design	N.A.

Table 1. Continued.

Author (Year), Location	Title
Horsky, J. (2016), USA.[69]	Development of a cognitive framework of patient record summary review in the formative phase of user-centered design.
Huberty, J. (2016), USA.[70]	Development and design of an intervention to improve physical activity in pregnant women using Text4baby.
Isenberg, S. (2018), USA.[71]	An advance care plan decision support video before major surgery: a patient- and family-centred approach.
Johnston, S. (2017), USA.[72]	Designing and Testing a Web-based Interface for Self-Monitoring of Exercise and Symptoms for Older Adults with COPD.
Lan Hing Ting, K. (2020), France.[73]	Examining Usage to Ensure Utility: Co-Design of a Tool for Fall Prevention.
Luna, D. (2017), Argentina.[74]	User-centered design improves the usability of drug-drug interaction alerts: Experimental comparison of interfaces.
Ma, M. (2007), Taiwan.[75]	A new design approach of user-centered design on a personal assistive bathing device for hemiplegia.
Madrigal -Cadavid, J. (2019), Colombia.[76]	Design and development of a mobile app of drug information for people with visual impairment.
Marker, A. (2019), USA.[77]	Iterative development of a web-based intervention for families of young children with type 1 diabetes: DIPPer academy.
Marko-Holguin, M. (2019), USA.[78]	A two-way interactive text messaging application for low-income patients with chronic medical conditions: Design-thinking development approach.
Martin, S. (2018), Ireland.[79]	A qualitative study adopting a user-centered approach to design and validate a brain computer interface for cognitive rehabilitation for people with brain injury.
McGinn, C. (2018), Ireland.[80]	A human-oriented framework for developing assistive service robots.
McMullen, C. (2018), USA.[81]	Designing for impact: identifying stakeholder-driven interventions to support recovery after major cancer surgery.
Melnick, E. (2017), USA.[82]	Patient-Centered Decision Support: Formative Usability Evaluation of Integrated Clinical Decision Support With a Patient Decision Aid for Minor Head Injury in the Emergency Department.
Nunez-Nava, J. (2016), Colombia. [83]	Human-centered development of an online social network for metabolic syndrome management.

End-user population	Innovation type	Design Approach	Study Design
Clinicians.	Patient record summary review.	User-centred design	Qualitative
Pregnant women.	Text messaging.	User-centred design	Mixed Methods
Patients who are preparing for major surgery.	Advance care planning decision support video.	Human-centred design	Mixed Methods
Older adults with COPD.	Web-based interface for self-monitoring of exercise.	User-centred design	Mixed Methods
Older adults with fall risk.	Balance assessment tool.	Human-centred design	Mixed Methods
Physicians.	Drug-drug Interaction alert system.	User-centred design	Mixed Methods
Stroke patients with hemiplegia.	Personal assistive bathing device.	User-centred design	Qualitative
People with visual impairment.	Mobile app for drug information.	User-centred design	Qualitative
Parents with children with type 1 diabetes.	Web-based intervention.	User-centred design	Mixed Methods
Patients with low income and chronic medical conditions.	Interactive text messaging application.	Design thinking	Mixed Methods
People with brain injury.	Brain computer interface.	User-centred design	Qualitative
People with disabilities.	Assistive service robot.	Human-centred design	Qualitative
Patients who recover from major cancer surgery.	Online educational platform for patients.	User-centred design	Qualitative
Emergency department physicians.	Electronic clinical decision support.	User-centred design	Mixed Methods
People with metabolic syndrome.	Online social network.	Human-centred design	Mixed Methods

Table 1. Continued.

Author (Year), Location	Title
Person, B. (2016), Tanzania.[84]	Community co-designed schistosomiasis control interventions for school-aged children in Zanzibar.
Petersen, M. (2017), Denmark.[85]	Development and testing of a mobile application to support diabetes self-management for people with newly diagnosed type 2 diabetes: a design thinking case study.
Ragouzeos, D. (2019), USA.[86]	"Am I OK?" using human centered design to empower rheumatoid arthritis patients through patient reported outcomes.
Ray, J. (2019), USA.[87]	Computerized clinical decision support system for emergency department–initiated buprenorphine for opioid use disorder: User-centered design.
Rothgangel, A. (2017), The Netherlands.[88]	Design and Development of a Telerehabilitation Platform for Patients With Phantom Limb Pain: A User-Centered Approach.
Salmon, M. (2015), Congo.[89]	Alternative ultrasound gel for a sustainable ultrasound program: Application of human centered design.
Schild, S. (2019), Germany.[90]	A digital cognitive aid for anaesthesia to support intraoperative crisis management: Results of the user-centered design process.
Sedlmayr, B. (2019), Germany.[91]	User-centered design of a mobile medication management.
Seeber, L. (2015), Germany.[92]	A Design Thinking Approach to Effective Vaccine Safety Communication.
Sonney, J. (2019), USA. [93]	Applying Human-Centered Design to the Development of an Asthma Essentials Kit for School-Aged Children and Their Parents.
Srinivas, P. (2019), USA.[94]	Context-sensitive ecological momentary assessment: Application of user-centered design for improving user satisfaction and engagement during self-report.
Stevens, A. (2018), The Netherlands.[95]	The development of a patient-specific method for physiotherapy goal setting: a user-centered design.
Taylor, D. (2003), USA.[96]	User-centered development of a Web-based preschool vision screening tool.

End-user population	Innovation type	Design Approach	Study Design
School-aged children.	Intervention to reduce schistosomiasis transmission.	Human-centred design	Qualitative
People with newly diagnosed type 2 diabetes.	Mobile app for newly diagnosed patients with type 2 diabetes.	Design Thinking	Qualitative
Patient with rheumatoid arthritis.	Dashboard to display patient reported outcomes.	Human-centred design	Qualitative
Emergency department physicians.	Computerized clinical decision support system.	User-centred design	Qualitative
Patients with phantom limb pain.	Tele-rehabilitation Platform.	User-centred design	Mixed Methods
Local clinicians who use point of care ultrasound.	Alternative ultrasound gel.	Human-centred design	Mixed Methods
Anaesthesiologists.	Digital cognitive aid for intraoperative crisis management.	User-centred design	Mixed Methods
People that use medication.	Mobile interface for medication management.	User-centred design	Mixed Methods
Parents and babies.	Effective vaccine safety communication.	Design thinking	Qualitative
School-aged children and their parents who deal with asthma management.	Asthma Essential Kit.	Human-centred design	Qualitative
Obese, middle-aged women.	Patients experiences assessment app.	User-centred design	Mixed Methods
Physiotherapists and patients.	A new method for goal setting.	User-centred design	Qualitative
Parents of preschool-aged children with amblyopia.	Web-based vision screening tool.	User-centred design	Mixed Methods

Table 1. Continued.

Author (Year), Location	Title
Timmerman, J. (2016), The Netherlands.[97]	Co-creation of an ICT-supported cancer rehabilitation application for resected lung cancer survivors: design and evaluation.
Tucker Edmonds, B. (2019), USA.[98]	Creation of a Decision Support Tool for Expectant Parents Facing Threatened Periviable Delivery: Application of a User-Centered Design Approach.
van der Weegen, S. (2013), The Netherlands.[99]	The development of a mobile monitoring and feedback tool to stimulate physical activity of people with a chronic disease in primary care: A user-centred design.
Vechakul, J. (2015), USA.[100]	Human-Centered Design as an Approach for Place-Based Innovation in Public Health: A Case Study from Oakland, California.
Vermeulen, J. (2013), The Netherlands.[101]	User-centered development and testing of a monitoring system that provides feedback regarding physical functioning to elderly people.
Vilardaga, R. (2018), USA.[102]	User-centered design of learn to quit, a smoking cessation smartphone app for people with serious mental illness.
Wachtler, C. (2018), Australia.[103]	Development of a mobile clinical prediction tool to estimate future depression severity and guide treatment in primary care: User-centered design.
Willard, S. (2018), The Netherlands.[104]	Development and testing of an online community care platform for frail older adults in the Netherlands: a user-centred design.
Woodard, T. (2018), USA.[105]	The Pathways fertility preservation decision aid website for women with cancer: development and field testing.
Wysocki, T. (2018), USA.[106]	A Web-Based Coping Intervention by and for Parents of Very Young Children With Type 1 Diabetes: User-Centered Design.

End-user population	Innovation type	Design Approach	Study Design
Healthcare professionals and patients with lung cancer survivors.	ICT-supported cancer rehabilitation program.	User-centred design	Mixed Methods
Prospective parents.	Decision support tool.	User-centred design	N.A.
People with chronic disease.	Mobile monitoring and feedback tool.	User-centred design	Qualitative
Citizens of Castlemont neighbourhood.	Novel programs to reduce inequities in infant mortality rates.	Human-centred design	Qualitative
Elderly people.	Mobile interface for a monitoring system.	User-centred development process	Mixed Methods
People with serious mental illness who smoke.	Smoking cessation app.	User-centred design	Mixed Methods
People with depressive symptoms.	App for improvement of treatment allocation for depression.	User-centred design	Qualitative
Frail older adults.	Online community platform.	User-centred design	Mixed Methods
Women cancer survivors.	Decision aid website for young women with cancer.	User-centred design	Mixed Methods
Parents of young children with type 1 diabetes.	Web-based coping resource.	User-centred design	Qualitative

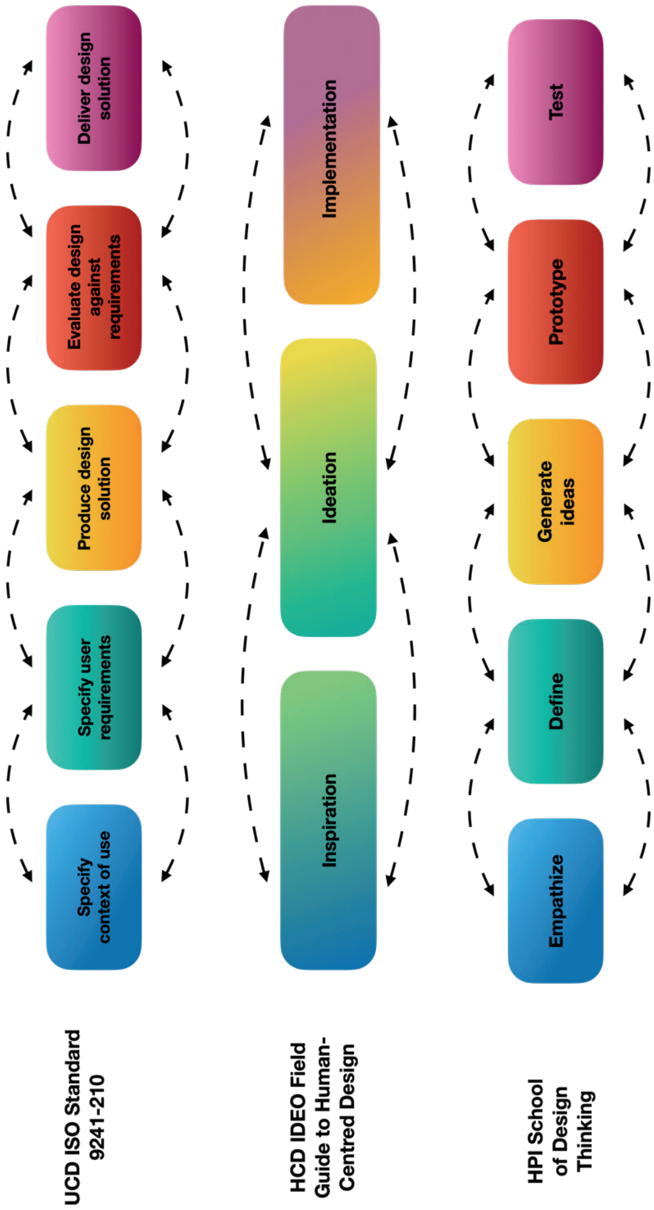

Figure 3. Illustration of human-centred design processes

Of the 82 articles identified, 57 applied a UCD approach, 21 articles used HCD and 4 employed DT. In 14 studies, the concepts of HCD and UCD were referred to interchangeably, of which 9 studies referred to the use of the ISO 9241-210 standard. In the 4 studies that applied DT, the concept was used interchangeably with HCD in all cases. These studies referred to the IDEO Field Guide to Human-Centred Design or the HPI School of Design Thinking Guide as standard. For clarity we will continue to report results of HCD/DT and UCD studies separately in this review.

Design strategies and methods

74 of the studies applied a solution-focused strategy versus 8 that applied a problem-focused strategy to drive the design process. Thus, most of the design studies focused on directly generating solutions or the development of a specific predefined solution. Only a minority employed the design-based methods to define the problem and selectively gather information before proceeding to solution development. Of the 74 studies that applied a solution focus strategy, 55 applied an UCD approach. Of the 8 studies that applied a problem focused strategy, 6 applied an HCD/DT approach. Overall, HCD/DT appears to be the preferred approach for problem driven strategies, while UCD is generally applied for solution-driven ones.

The design processes consisted of several design cycles during which multiple qualitative and/or quantitative methods were used in combination with specific design methods. 47 (57%) of the studies applied a mixed methods approach and 33 (40%) qualitative methodology. A synthesis of the methods used in the different phases of the included studies is presented in table 2 (details about the described design methods can be found in supplement 3.). The first design phase, understanding the context, was often characterized using a limited range of design-based methods. During the second and third phase – problem specification and idea generation – a broader range of design methods was employed in different studies. In the fourth phase – testing of solutions – the range of design methods was reduced again. Some design-based methods are applied in multiple phases of the process, e.g. personas, intervention mapping or the Wizard of Oz technique, but most are uniquely used in one phase.

Table 2. Meta-analysis of applied research and design methods

Design phase	**Qualitative methods**
Understanding the context	· Literature review · Observations · Expert meetings · Delphi technique · Diary studies
Specify the problem or user need	· Focus groups · Interviews · Delphi technique · Contextual inquiry · Observations · Critical incident technique
Generate ideas and design solution(s)	· Observations · Interviews · Focus groups · Literature review

Quantitative methods	Design methods
· Surveys (not specified)	· Storytelling · Metaphors · Persona's · Experience mapping
· Context assessments · Needs assessments · Surveys (not specified)	· Participatory workshop · Persona's · Use case scenario(s) · Decision matrix · MoSCoW method · House of Quality (HoQ) analysis · Goal, Question, Metric (GMQ) Approach · Role play · User journey mapping · Intervention mapping · System mapping · Low functional prototype · Use case diagram
· Usability surveys · Feasibility surveys · Surveys (not specified)	· Brainstorm · Round Robin Concept Ideation · Voting · Round table discussions · Sketching · Visual mind maps · Idea / Concept voting · Storyboarding · User Narratives · Use case scenario(s) · Low functional prototyping · High functional prototyping · Intervention mapping · Heuristic evaluation · Task analysis · SWOT/Competitor analysis · User journey map · Wizard of Oz method · Card sorting · Weekly sprints · Think aloud techniques

Table 2. Continued

Design phase	Qualitative methods
Test solution(s)	· Interviews · Observations · Focus groups · Ecological momentary assessment (EMA)

Overall, qualitative methods or mixed methods were mostly used in the first and last phases of the design process to understand user needs or to evaluate user experiences. In the first phase of the process, qualitative methods such as interviews and observations, as well as literature reviews are commonly employed to understand the problem context. In later stages, the use of methods diverges based on the type of foreseen solution, e.g. digital or non-digital solutions. Quantitative methods were used to either support qualitative findings during the first phase of the process or as an evaluation instrument in later design phases.

End-user involvement

In 6 of the studies (UCD n= 5, HCD/DT n=1) end-users were actively involved beyond the role of a *user*, i.e. as information sources but not active participants in the design process. In 27 (UCD n= 21, HCD/DT n= 6) studies, end-users participated as *tester*, i.e. they were involved in the first and last phases of the design process as testers of the developed solution. In 28 (UCD n= 22, HCT/DT= 6) studies, end-users were involved as *informants*. Here, end-users are involved in various phases of the process and are asked for input on design prototypes, such as sketches and low-fidelity prototypes. Participation as *design partners*, i.e. contribution to all phases and involvement in the decision-making process, was identified in 21 (UCD n= 9, HCD/DT n= 12) studies (Figure 3). While UCD approaches involved end-users primarily in the role of tester (n= 21, 37%) and informant (n= 22, 39%), HCD/DT approaches involved end-users as design partners in 12 (48%) of the studies.

Quantitative methods	Design methods
· Usability surveys · Feasibility surveys · Viability assessments · Ecological momentary assessment (EMA) · Surveys (not specified)	· Low functional prototyping · High functional prototyping · Role play · Story boarding · Card sorting · Simulations · Intervention mapping · Cognitive walkthrough · Brainstorm (general) · Heuristic evaluation · Workflow evaluation · Participatory workshop · Wizard of Oz method · Value vs Effort matrix · Think aloud techniques

Quality assessment of the studies

Using the Mixed Method Appraisal Tool (MMAT), 13 (16%) of the 82 studies included met one or more of the MMAT reporting criteria, based on the study type. The remaining studies had to be rated as unclear on all the MMAT reporting criteria. An overview of the quality assessment results can be found in supplement 4. The biggest limitation to the quality assessment were the lack of uniformity in reporting and the broad extent of the design studies that needed to be captured in limited words for publication. In fact, many of the studies used multiple research and design cycles and generally offered limited details about the applied methodology.

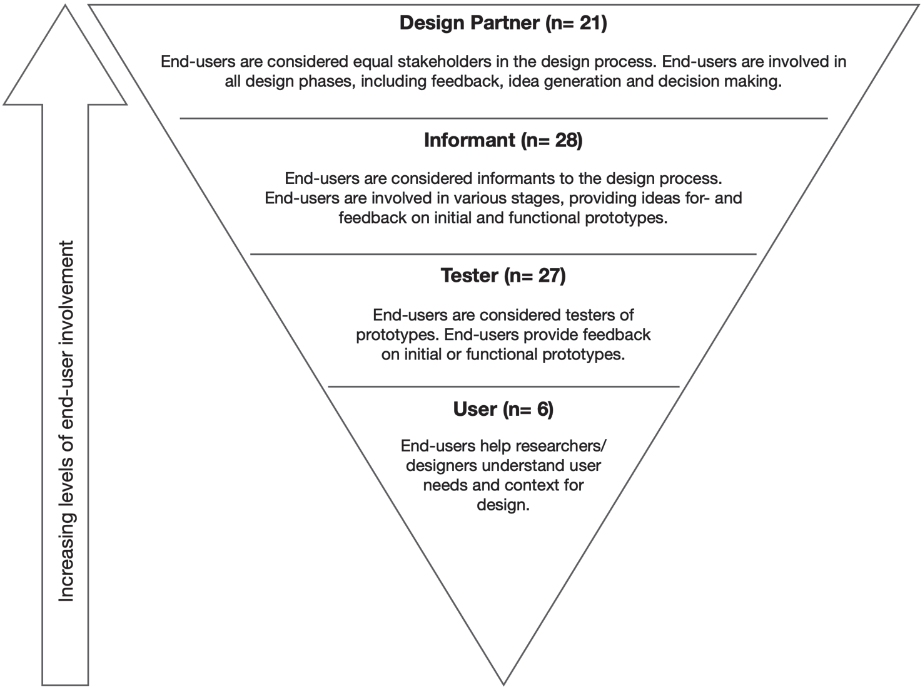

Figure 4. Levels of end-user involvement during human-centred design processes.

Discussion

In this review, we explored how the different human-centred design (HCD) approaches, including design thinking (DT) and user-centred design (UCD), were applied for the development of innovations in health research. Overall, the concepts of HCD/DT and HCD/UCD were used interchangeably in 18 (22%) of the included studies. This applied to all studies that referred to HCD/DT, however, UCD was defined as a stand-alone entity in 48 (84%) of the papers that employed this approach. Most of the studies using HCD/UCD interchangeably referred to the ISO 9241-210 standard. This aligns with the theoretical framework pursued by the studies, i.e., a problem-driven versus solution-driven strategy. DT/HCD-based studies commonly engaged in understanding the underlying problem and focused on a broad range of health/social/medical topics. They often included a focus on human values and a multi-stakeholder or systems perspective. UCD-based approaches, instead, focused primarily on the direct identification of a solution and were mostly used in health technology innovation. They often focused on human factors to increase usability or user friendliness of the solution. The limitations of this functional approach in promoting human interests have been previously described as a potential shortcoming of UCD.[107]

It has been reported that designers who use a problem-driven design strategy produce solutions with the best balance of quality and creativity.[22] However, in this review, 74 (90%) of the included studies used a solution-driven strategy. Although the evaluation of solutions can be used to further define the design problem, this was not an objective of the studies included. Their solution-driven approach generally focused on generating many ideas and solutions, potentially leaving the initial design problem ill-defined and ignoring the relationships between various stakeholders. Healthcare innovation could, however, significantly benefit from problem-driven design processes, especially from a perspective of resource efficiency. Innovation in healthcare is characterized by a development/implementation cost trade-off. Therefore, it is critical that the most impactful innovations be prioritized, based on critical understanding of the underlying problem.[108]

HCD in health research is often perceived as a single unitary method, as emphasized by the reference to a single practitioner guideline in the included studies. In this review, however, we found that the application of HCD entails a wide array of design methods and techniques, that can be used selectively and that are dependent on the specific design case. Design methods diverge from the traditional methods of academic research as they are primarily oriented towards action or solution of defined problems, rather than towards theory and hypotheses building. To date, little is known about their effectiveness according to medical evidence-based standards. The creation of a new product, system, or service to improve health might be considered an outcome from a design perspective but would not be considered a health outcome from a scientific perspective.[13], [14] In the literature a scientific method is described as a strategy to understand the nature of a phenomenon, whereas a design method is a strategy to invent things of value. According to this distinction, science is analytical, and design is constructive, and therefore it is difficult to assess both methods according to the same standard.[20] Yet, according to Frey et al (2006), many of the validation techniques found in medicine could be used for the validation of design methods. For example, where medicine uses animal models and clinical trials to test medical treatments, detailed simulations and controlled field experiments of design methods could be developed for the explicit purpose of evaluating design methodologies.[109]

This logical, empiristic approach towards the evaluation of design methods fits well with e.g. the field of engineering design, which is based on mathematical modelling, since it is mostly appropriate for closed, objective problems that can lead to binary (yes/no) answers. However, HCD approaches often address open, complex problems that involve both objective and subjective elements without a single "correct" answer. For design methods addressing open complex problems, a relativist validation approach that gradually builds confidence in the usefulness of methods can be considered a more appropriate paradigm.[110] A relativist approach to design claims no absolute objectivity for methods or models, but it assumes that a valid method or model is only one of many possible ways of measuring or describing a real situation. In a relativist approach to design methods, validity becomes a matter of practical use and contextual functionality, rather than formal and universal accuracy. Validity of design methods becomes a contextual, semiformal, and conversational process, because establishing models of usefulness is a conversational matter.[111] It is important to note that a relativist approach towards the evaluation of design methods does not antagonize the logical empiristic approach towards the evaluation of scientific research methods used in HCD processes.

There is ongoing demand to develop a 'design science' with systematic and formalised design methods that adhere to the values of the empiristic scientific method: objectivity, rationality and universalism.[112], [113] Scientific design methods have been developed in engineering and computer science, however, there is limited evidence that the systematic use of design practices leads to measurable and reproducible results in health research.[112] Design researchers themselves still debate whether design conforms to a scientific activity or represents an academic discipline with a rigorous culture of its own.[20], [113] As a result, critical appraisal and best practice selections of design methods within health research remain challenging.

In this review the diverse reporting formats challenged our ability to assess the quality of the studies from an evidence-based perspective. While initial guidelines have been proposed to improve reporting of design studies in health research, this is still an area in development.[14] The guidelines by Bazzano et al (2020) represent a first detailed overview of reporting items for health research that include design approaches. Although we acknowledge that this reporting guideline is an important first step towards improving transparency, evaluability, and wider dissemination of design approaches in health research, it is, however, debatable whether the application of these guidelines is feasible in the context of health research manuscripts. The level of detail that the Bazzano guidelines propose, implies that the design research component should be reported as a standalone article, separate from the connected empirical studies. Many of the design studies included in this review offered limited details about their multi-method design cycles, possibly due to the word count limits most scientific journals apply. It would be almost impossible to describe a multi-method design process in adequate detail and report effectively on the research and design outcomes in a single manuscript. Applying the Bazzano guidelines with rigor is likely to result in the reporting of separate design cycles across multiple manuscripts and essential findings for the design process may appear fragmented or be lost among the reports that are published separately.

It could be argued, however, that the separate publication of multiple waves of data collections in design research is preferable for both researchers and reviewers to support the validity, reliability, and reproducibility of design-based health research. Rather than aiming for complex integrated manuscripts, multiple publications would allow researchers to report in more detail on both methods and findings, also allowing for easier critical appraisal and quality assessment by reviewers. Beside traditional research articles, innovative publication formats such as registered reports could be used to submit design research protocols and results which are judged on their methodological robustness, rather than the potential novelty of the findings.[114] To address the issue of potential fragmented data publication, we recommend registering the design research protocols in a research registry. This would allow for systematic referencing to previous design activities, even when results are not published, yet.

Active engagement of stakeholders is one of the key principles of the human-centred design approach. Stakeholders can be defined as: *"individuals, organizations or communities that have a direct interest in the process and outcomes of a project, research or policy endeavour"*.[115] In healthcare innovation the engagement of diverse stakeholders is essential to the development of a shared agenda for responsible innovation and for the co-creation of social value.[116] However, a multi-stakeholder innovation process brings about several challenges. HCD practitioners acknowledge the challenge of equitably including the experience and expertise of all participants in the design process. While the importance of creative interdisciplinary collaborations between various disciplines in healthcare is increasing, it is still a relatively new and complex phenomenon.[117] Each stakeholder brings their own motivations, attitudes, priorities and incentives to the process and such differences will influence the co-creative space and interpersonal interactions. HCD practitioners should reflect critically on the participatory methods that they intend to apply, considering the possible contribution of each participant to the design process to facilitate effective use of their expertise and experiences.[16] This is particularly important when working with vulnerable patient groups or healthcare professionals with limited time to participate in co-design sessions.[118]

An earlier study suggested that HCD processes can rely too much on anecdotal evidence of key stakeholders who might not fully understand what they want and need.[119] A more strategic application of HCD, however, aims at identifying themes that describe people's deeper needs and values, rather than their wishes and desires, and using those themes to inform the creation of innovative strategies and solutions.[120] Field studies with the employment of qualitative methods, such as observations, to study key stakeholders and their activities in their own environment, could offer a valid alternative.[121]

Additionally, it is essential for HCD practitioners to take power dimensions and agency of different stakeholders into account, especially during co-design sessions. To achieve inclusive design processes, intersectional aspects should be considered for stakeholder engagement and methodological choices, such as: gender identity, class, sexuality, geography, age, and disability/ability.[122], [123] Reflective project planning aids and frameworks for involving patients and public in research and design projects should be employed to guarantee meaningful engagement of stakeholders and to facilitate democratic design processes.[124], [125]

Study limitations

At present, the MMAT is the most comprehensive tool available for appraising of multi-method studies.[126] Even though the MMAT is a tool that allows for the critical appraisal of most common types of study designs, the tool seems less appropriate for HCD, DT and UCD due to the inclusion of multiple research and design cycles and often limited word space to describe the applied methodologies and methodological choices in detail. To our knowledge, there is no appropriate tool available yet for critical appraisal of design studies in health research.

In this review, we have only reviewed articles that included studies that described the complete development processes of a health innovation. This criterium might have limited the inclusion of studies that describe the complete process through multiple publications. For example, in a few studies, authors referred to future studies in which they expressed the intention to test a designed solution in an RCT. These studies were not included in the current review. Furthermore, no selection criteria for end-user populations were applied. This might influence the choice for the use of particular design methods as design researchers need to take intersectional aspects into account, as mentioned in the discussion. While this was not a main objective for this review, future research could focus on the application of design methods and their suitable for specific stakeholder populations in healthcare.

Additionally, our search strategy was limited to scientific databases related to biomedical, nursing, and allied health and public health sciences and grey literature was not included. Disciplines that publish design research related to health systems outside this scope have not been considered in our searches. Lastly, the existence of different design methods and models with principles related to HCD and the interchangeable use of these terms in the literature make it challenging to scope and perform a fully systematic search.

Conclusions

A wide variation of design practices and methods such as HCD, DT and UCD are increasingly applied in health research. In our analysis HCD/DT -based projects tended to primarily follow integrated and problem driven approaches whereas UCD-based projects engaged in more functional and solution driven approaches. Most of these design studies used mixed methods approaches, combining qualitative and quantitative research with design methods and frequently referred to the following three design guides: the IDEO Field Guide to Human-Centred Design, the HPI School of Design Thinking Guide and the ISO Standard 9241-210

The increasing use of design-based approaches such as HCD/DT and UCD in health research, subjects them to evaluation according to traditional biomedical standards. However, the analytic approach of the scientific method versus the constructive approach of the design method, impedes an assessment of both methods according to the same standard. To address the validation of design methods, a relativist validation approach that gradually builds confidence in the usefulness of methods could be considered a more appropriate paradigm for design methods, particularly those that are concerned with subjective elements of the design process.

Specific standards for the reporting human-centred design practices within health and biomedical research have been developed in recent years. However, these reporting standards remain challenging to apply for single design research papers due to the extensiveness of multi-method design processes in combination with customary word limits in biomedical publications. Separate publications detailing the multiple waves of data collection in design research might be preferable for both researchers and reviewers to support the validity, reliability, and reproducibility of design-based health research. Additionally, innovative publication formats such as registered reports could be used to submit design research protocols and results which are judged on their methodological robustness, rather than the potential novelty of the findings. Furthermore, future research on HCD approaches in health should focus on the development of an HCD practitioner guideline for stakeholder engagement that takes stakeholder roles, experiences, expertise, agency, and power dimensions into account.

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6

Chapter 6

Gender Aware Parkinson's Care: A design-based study of patient perspectives on gender norms and gender sensitive care

The chapter is based on the following publication:

Göttgens I, Modderkolk L, Vermuë P, Darweesh SKL, Bloem BR, Oertelt-Prigione S. Gender-aware Parkinson's care: a design-based study of patient perspectives on gender norms and gender-sensitive care. EClinicalMedicine. 2023 Oct 17;65:102285. doi: 10.1016/j.eclinm.2023.102285. PMID: 37876997; PMCID: PMC10590864.

Abstract

Background

Gender dimensions are progressively recognised as a relevant social determinant of health in people with Parkinson's disease (PD). However, little is known about the impact of gender norms and stereotypes on illness experiences of men and women with PD and what they consider important focal points for gender-sensitive PD care.

Methods

We conducted two equity-centred design (ECD) sessions on December 7, 2022, and December 8, 2022, at the Radboud University Medical Centre in the Netherlands. This participatory multi-method approach includes patients in the research and design process and was used to explore the impact of gender norms and stereotypes in illness experiences and generate patient-driven recommendations for gender-aware Parkinson's care. Quantitative survey data and design-based data were descriptively analysed, and qualitative focus group discussions were thematically analysed.

Findings

This study included thirteen men and fifteen women with PD in the Netherlands. All participants were of Dutch descent, with a median age of 65.5 years and a median clinical disease duration of 4.2 years. The gendered stereotype that "*people with PD are old men*" affected both men's and women's perception of living with the disease and the perceptions of their social environment. Men described masculine stereotypes related to physical strength and provider roles, while women expressed those related to feminine physical appearance and caregiver roles, influencing their illness experiences. For some, these norms influenced personal behaviours, while for others, they affected experiences through societal attitudes.

Interpretation

Our findings suggested that several gender norms and stereotypes influence the illness experiences of men and women with PD, manifesting at ideological, interpersonal, and internalised levels. Some participants internalised these norms, affecting their coping behaviours, while others encountered them in broader ideological contexts that shaped societal attitudes and interpersonal relationships. To advance gender sensitive PD care, it's essential to explore the impact of gender roles and norms, especially regarding how they might impede coping strategies, care access and utilisation for individuals of diverse gender identities.

Introduction

There is emerging evidence of Parkinson disease (PD) is the fastest growing neurological disorder worldwide. The global number of people with PD is projected to exceed 12 million by 2040.[1] Due to the chronic and progressive nature of PD, the development of interventions that can delay disability and enable people with PD to continue participating in activities and social roles is considered a key priority in PD research.[2]

Gender is progressively recognised as a relevant social determinant of health in people with PD, but its multidimensional operationalisation in biomedical research is challenging.[3] A recent study demonstrated that different gender dimensions, such as gender identity, gendered social norms, roles and relations, have a heterogenous impact on the quality of life of people with PD, emphasising the importance of a precise study of distinct gender dimensions in the context of PD.[4] In fact, previous research has shown that the adherence to traditional gender norms, and their related roles, is a stronger predictor of health outcomes than gender identity, and that norms related to gender influence the illness experiences of people with PD.[4-7]

Gender norms include cultural beliefs and expectations about how people with different gender identities should act and interact with each other, and are part of a gendered socialisation and stereotyping process.[8] Investigating gender norms in healthcare settings, thus, focuses on the presence of social expectations and beliefs attributed to gender that can affect health and health outcomes among particular patient populations. Given the impact of gender norms and expectations on social roles, investigating the particular role of gender norms in illness experiences of people with PD is imperative.[5]

Understanding how gender norms affect health and illness experiences of people with PD is essential for the design of programs and policies that combat harmful norms and improve gender equality in health.[9,10] However, a recent review of health interventions that addressed detrimental gendered norms and stereotypes concluded that longitudinal data on their effectiveness is currently lacking.[11] The review reported that most of the initiatives designed to shift attitudes and behaviours regarding gendered stereotypes and norms rely too much on self-reported survey data that may be subjected to social desirability bias and the use of participant observations and key informant feedback would strengthen evaluations. Accurately capturing the impact of gender norms on health is a complex matter as these social norms are dependent on socio-cultural context, time and place.[12] Surveys used in biomedical research often include proxy measures to investigate how gender norms can affect health but they might lack specificity to capture the full range of gender norms and stereotypes that exists in a particular context and often ask about gender norms in binary terms (men/women), thereby excluding the experiences of people who identify otherwise. The study of these contextual gender norms and stereotypes requires multimethod approaches that enable the investigation of the complex relationship between gender identities, contextual gender norms and roles, and their impact on individual health.[11]

Because much of the existing knowledge regarding gender norms and stereotypes has arisen from research conducted in general population settings, there is a lack of understanding how gender norms and stereotypes unfold within a healthcare context and particularly, whether and how they influence health and care experiences of men and women with PD. Therefore, this study aims to 1) understand the role of stereotypical gender norms in the illness experiences of men and women with PD; and 2) ideate focal points for gender-sensitive PD care from patients' perspectives, using an equity-centred design approach.

Methods

Equity-centred design approach

This design-based study was embedded in the PRIME-NL Study, a large cohort study in the Netherlands focused on PRoactive and Integrated Management and Empowerment in Parkinson's Disease.[13] An equity-centred design approach inspired by Raz and Clifford (2017) was used to guide the research and design process, focusing on the first three phases of the process, including the notice and reflect phase. (figure 1).[14]

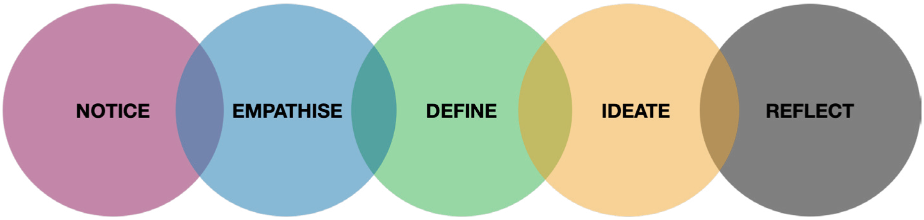

Figure 1. Adapted Equity-centred design framework from Raz et al (2017), as applied in this study.

Equity-centred design builds on the human-centred design framework by incorporating intentional reflectivity and acknowledge power, identity, and context in which the design process takes place. Participatory design sessions were organised for men and women separately and on two different days; one workshop day for men with PD and one workshop day for women with PD (for details, see Supplement 1). The reporting is guided by the guidelines for reporting health research involving design, by Bazzano et al (2020) (Supplement 2) and by the SAGER guidelines.[15,16]

Ethics statement

This study has been assessed by the Ethical Board of the Radboud University Medical Centre (METC Oost-Nederland, file number 2022-15954). All participants signed an informed consent at the start of the workshop.

Theoretical framework for Gender Norms and Gender Stereotypes

The Theory of Normative Social Behaviour (TNSB) will be used to elucidate *when*, *how*, and *which* gender related norms affect health behaviours among men and women with PD. The TNSB states that perceived descriptive and injunctive norms may impact behavioural intention, which in turn may impact personal behaviour. Descriptive norms refer to individuals´ beliefs about the prevalence of a behaviour (e.g., most women with PD I know, worry about their physical appearance). Injunctive norms refer to the extent to which individuals perceive that influential others or important referents expect them to behave in a certain way and context, and by implication, social sanctions will be incurred if they don't comply (e.g. women with PD should work on their physical appearance to remain 'lady-like').[17] Hence, as people embody several social roles and identities, it is possible for individuals to believe that certain social peers engage in a behaviour (e.g. people with PD) and simultaneously believe that another groups of social peers (e.g. colleagues) would disapprove of their enacting that behaviour. Therefore, motivations for complying with descriptive gender norms depend on (a) how strong the influence of a certain gender norm is perceived in a particular context (descriptive norms) *and* (b) the importance of the social reference group in an individuals' embodied identity (injunctive norms). A schematic model of the TNSB is presented in figure 2.

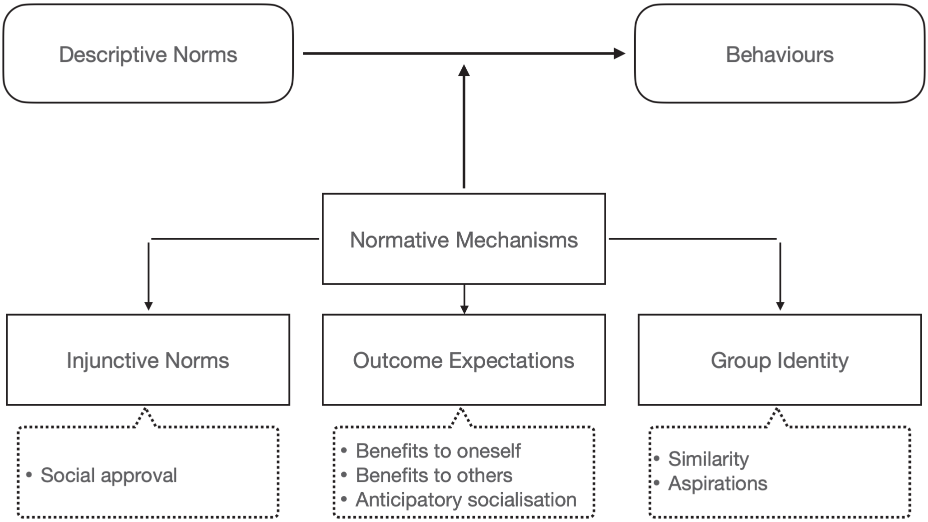

Figure 2. Components of the Theory of Normative Social Behaviour, Rimal et al (2005)

For this study, we applied the definition of gender norms by Cislaghi et al (2020), who describe gender norms as '*social rules and expectations that define acceptable and appropriate actions, roles and behaviours for women and men in a given group or society*'.[18] Gender-based stereotypes are '*generalised assumptions regarding common traits, roles and behaviours based on a person´s gender identity or expression*' and are informed by gender-based expectations.[11] Whilst gender stereotypes inform our assumptions about another person, gender norms govern the expected and accepted behaviours.

Sample

In November 2022, self-reported men and women with PD were recruited through the PRIME-NL Gender Study in the Netherlands.[4,13] The PRIME-NL Gender Study included a sample of 307 people with PD (127 women and 180 men). People were eligible to participate when they met the following criteria: aged 18 years or older; diagnosed with Parkinson's disease or Parkinsonism; absence of serious cognitive and/or communication impairment; able and willing to participate in a participatory design workshop of 4.5-5 hours (including breaks). Men and women who had previously participated in the PRIME-NL Gender Study and who had indicated an interest to participate in follow-up studies, received an email invitation to participate in the design workshop. In total, 263 participants indicated interest in follow-up studies and received an invitation to participate. The PRIME-NL Gender Study already included a purposive and relatively homogeneous sample of participants with relevant characteristics for this study. Therefore, a convenience sampling method was used with a maximum recruitment goal of N = 40 (20 men and 20 women). For each design session, we intended to include a minimum of 12 participants. Guest et al (2020) determined that approximately 12 participants would be needed to reach higher levels of saturation in qualitative interviews.[19]

All individuals who indicated to be willing and able to participate in the design workshop received an email confirmation with further information about the workshop objectives, program, and facilitation team. The workshop facilitators (LM, PV, and IG) had no therapeutic relations with the participants and all participants were offered travel reimbursements.

Procedure and data collection

Empathise (Phase 1): Understanding gender stereotypes and norms in illness experiences.

The aim of this first phase was to understand the role of gender stereotypes and norms in health and illness experiences of men and women with PD and *how* they impact these experiences.

Pre-workshop surveys

A week prior to the design session, participants received a pre-workshop survey.
The Hoffman Gender Scale was used to assess Gender Self-Confidence (GSC) among participants; the degree to which a person beliefs that they meet their personal standards for femininity/masculinity, which is considered a component of gender identity (supplement 3).[20] The survey measures two domains of GSC: Gender Self-Definition, which refers to how salient gender is to one's individual identity (7-items,

e.g. *"When I am asked to describe myself, being female/male is one of the first things I think of")* and Gender Self-Acceptance, which refers to how comfortable a person feels as a member of their gender category (7-items, e.g. *"I am confident in my femininity/masculinity")*. Each item is scored on a 6-point Likert-scale (1 = strongly disagree to 6 = strongly agree). The mean of all item scores is calculated for each subscale score. The scale has not been validated in a Dutch population; however, this was not deemed a limitation as its function in this study was primarily the establishment of congruent focus groups. Higher scores on the Gender Self-Definition subscale correspond to attributing a greater deal of importance to femininity/masculinity as part of their identity. Higher scores on the Gender Self-Acceptance scale correspond to more acceptance of themselves as female/male without necessarily strongly defining themselves in terms of their notions of femininity/masculinity. The survey is presented in an A (for women) or B (for men) format and includes binary gender congruent statements related to identifying as a woman/being feminine and man/being masculine. The survey contains a final open question which allows participants to define for themselves what the term femininity (for women) or masculinity (for men) means to them. This measure was used as proxy to assess how strongly committed participants were to their gender identity (higher or lower GSC).

The Nijmegen Gender Awareness in Medicine Scale (N-GAMS) was included to assess the degree to which participants are sensitive towards the role of gender in medical care (supplement 4).[21] The N-GAMS includes three subscales: 1) gender sensitivity and 2) gender role ideology towards doctors and 3) gender role ideology towards patients. The gender sensitivity subscale (12-items) consisted of attitudinal statements about gender concerns in healthcare (e.g., *"Do you think that addressing differences between men and women creates equity in healthcare?")*. The gender role ideology towards doctors and patients' subscales assesses the degree to which participants agree with gender stereotypical attitudes towards doctors (7-items, e.g., *"Male physicians put too much emphasis on technical aspects of medicine compared to female physicians")* and patients (11-items, e.g., *"Women more frequently than men want to discuss problems with physicians that do not belong in the consultation room")*. All items were measured on a 5-point Likert scale (1 = strongly disagree to 5 = strongly agree). This scale was developed and validated in the Netherlands. Notably, the N-GAMS has not previously been applied in patient populations and has mainly been used to measure attitudes among medical students and physicians. However, as the survey includes general statements with regards to gender-sensitive healthcare and generic stereotypical statements in healthcare settings with regards to gender role ideology, the N-GAMS could be considered a valuable instrument to also assess attitudes among patients towards the topic of gender in medical care.

Lastly, with two single item question, participants were asked to respond to the following questions and statement: "*Do you have previous experience with the topic of gender sensitive medicine for men and women with PD, or have you thought about this topic prior to this workshop?*" (Yes/No) and "*I think it is important that there be more differentiation between men and women in PD research and care.*" (1 = Strongly disagree, 5 = Strongly agree).

Focus Group Discussions
During the morning program of the design sessions, we conducted focus group discussions (FGDs) using a standardised semi-structured interview guide with open-ended questions. On the first workshop day, we conducted 2 simultaneous FGDs with men with PD and on the second workshop day 2 FGDs with women with PD on the second day. Participants numbers were split equally and allocated to a focus group based on their GSC scores, with one focus group consisting of participants with lower GSC scores and one focus group with higher GSC scores. The objective of the interviews was to explore and identify gender norms or stereotypes that impact illness experiences of men and women with Parkinson's Disease. We hypothesised that gender norms or stereotypes would be more salient in the experiences of participants with higher GSC scores compared to those with lower GSC scores. IG, LM and PV developed the interview guide, which was discussed with SOP (Supplement 5). The FGDs were performed simultaneously by LM and PV and observed by IG. The interviews were audio-taped and lasted 75-90 minutes.

Define (Phase 2): Individual focal points for gender-aware PD care.

Participants were individually guided through 3 self-reflective design-based methods to evoke individual insights towards relevant objectives for gender-aware PD care: 1) Reverse Thinking, 2) Word-Concept Association and 3) Download the Learnings.[22] The purpose of Reverse Thinking was to prompt ideas about '*how gender-sensitive care for people with PD would look like if we designed it completely wrong*'. The Word-Concept Association was meant to elicit individual associations with gender-specific care for men or women with PD and the Download the Learnings exercise was intended to create a personal description for gender-sensitive PD care and when this becomes most relevant for the individual participant. The duration of this phase lasted 20-25 minutes.

Ideate (Phase 3): Formulate key recommendations for gender-sensitive PD care research.

The objective of this final design phase was to cumulate the learnings of phase 1 and 2 to formulate recommendations for gender-sensitive PD care. In subgroups of 3-4 people, participants shared their learnings from Phase 2 and were encouraged to listen for common themes and discuss differences. Subsequently, collective insight statements were created, answering the following prompt: *"For us, care for men/women with Parkinson means paying attention to [……] This is especially important when [……]"*. Lastly, each group was asked to reflect on recommendation for future research into gender-sensitive care for men and women with PD. Each subgroup was invited to present their collective insights during the plenary closing of the workshop. The duration of this phase lasted 60-75 minutes.

Notice and Reflect (Phase 4): Research team and reflexivity.

The notice and reflect phases are ongoing and throughout the design and research process. In this study, we operationalised these phases through reflective discussions prior to- and directly after the workshop among the facilitation team (IG, LM, PV). The intention of these phases is to encourage self-awareness and introspection among the facilitation team members about potential biases and assumptions that can influence the research process. For example, the facilitation team was aware that it consisted of 3 female team members and facilitated both the women's design session and the men's design session. Furthermore, the preliminary workshop program was discussed with SKLD, neurologist-in-training, to ensure a workshop program, methods and location that were accommodating towards the potential cognitive and physical challenges of people with PD. As a result, we introduced self-reflective exercises in phase 2 of the workshop and included frequent breaks to lower the stress that can be triggering through prolonged cognitive- and interactive group work for people with PD. To accommodate participants with PD related handwriting challenges, we opted for larger papers and digital typing options instead of the typical 'post-it notes', which are often used in design sessions. After the workshop, the facilitation team completed an online evaluation reflecting on the workshop program, process and discussed the outcomes with specific focus on principles of inclusive and equity centred design.[23] The evaluation questions can be found in Supplement 6. These types of reflections are an integral part of the equity-centred design process and of the '*notice and reflect*' phase in particular.

Data analysis

Statistical analysis

Pre-workshop surveys

Descriptive statistics were performed on the demographic data of the participants, the Hoffman Gender Scale, and the Nijmegen Gender Awareness in Medicine Scale. Differences between men and women in demographic data and the survey scale scores were compared using the Kruskal–Wallis rank sum test or the Fisher exact test. Missing responses were removed during analyses. Data was analysed with the use of R Studio (version 4.1.3).

Qualitative analysis

Phase 1: Focus group interviews

The interviews were audio-recorded and professionally transcribed ad verbatim. To explore which gender stereotypes and gender norms are made relevant by participants, a reflexive thematic analysis was applied to the two FGDs with men and the two FGDs with women seperately.[24] Themes were compared for within-group similarities and differences between the higher and lower GSC subgroups regarding experiences with gender norms and stereotypes in their illness experiences. Additionally, we applied the TNSB to analyse at which level of social manifestation gender norms and stereotypes were experienced by men and women with PD. For this, the social manifestation levels as described by the equity-centred design guide were used: 1) ideological level (descriptive norms), 2) interpersonal level (descriptive/injunctive norms) and 3) internalised level (injunctive/self-stereotyping norms).[23] The analyses were guided by the following questions: *"Which gender norms or stereotypes are present in the illness experiences of people with PD?"* and *"At which level(s) of systemic social structures do these gender norms or stereotypes occur?"*. First, the text was read and re-read to familiarise the researchers with the data. Secondly, open coding was applied by LM and IG to identify meaningful text units related to the research question. Data was coded with the use of ATLAS.ti (version 22.0.11). In this stage, the text that explicitly addressed gender norms or stereotypes in illness experiences were separated from the text for further analyses. Codes were discussed and categorised according to similarities and differences in content. An iterative process of identifying and defining gender norms and stereotypes was performed. Lastly, LM and IG analysed and labelled each gender norm and stereotype on the level(s) of social manifestation in which they were mentioned by participants.

Phase 2: Self-reflective methods

For this paper, the results from the Word-Concept Association (WCA) method and the Downloaded learning are presented. The self-reflective prompting exercises were recorded in written notes. The WCA methods was translated with the use of Deepl.com and visualised using Word Clouds, generated by ATLAS.ti. Word Clouds are a graphical ranking system, i.e., the more a word is mentioned by the participants, the larger it will be visualised in the Word Cloud. The data from the Downloaded Learnings methods were descriptively analysed. An overview of the self-reflective methods can be found in supplement 7. The Reverse Thinking method was translated with the use of Deepl.com and the results can be found in supplement 9.

Phase 3: Collective insight statements and care research recommendations

The collective insight statements and research recommendations were video recorded during the plenary presentations, recorded in written notes and descriptively analysed. Preliminary findings of the focus group interviews, and a summary of the collective Phase 3 outcomes were shared with participants one week after the participatory design sessions to provide an opportunity for participant feedback and reflections on the workshop.

Results

Participant Characteristics

Overall, 21 men with PD and 18 women with PD registered for the workshops, of which eight men and three women cancelled their participation before or on the day of the workshop. Reasons for cancellations were related to not feeling well enough to travel, not having enough energy to join the workshop or the emergence of other commitments. In total, 28 people participated in the two workshops: one workshop with 13 men and one with 15 women. All participants' sex assigned at birth was congruent with their gender identity, leading to a study cohort of only cisgender individuals. The median (IQR) age of the participants was 64.2 (7.8) years, and all participants were of Dutch descent. Most participants lived together with a partner or family (96%) and 29% had paid employment. Participants had a median disease duration of 4.9 (2.4) years; notably, with women having a significantly longer median duration (5.9 (2.7) years) compared to men (3.7 (1.4) years) (p = 0.016). Table 1 shows the demographical and clinical characteristics of the study population.

Pre-workshop survey results

Results of the two single item questions showed that most participants had no previous knowledge or experiences with the topic of '*gender sensitive care for men and women with PD*' (85%) and had a slightly positive attitude towards the importance of gender sensitivity in PD care (3.8 (0.9) on a 1-5 range). The mean (SD) Gender Self Confidence score of the participants was 4.1 ((1.1) on a 1-6 range), indicating that the degree to which participants met their own standards for masculinity (for men) and femininity (for women) was moderately strong. Participants' definitions of masculinity or femininity can be found in Supplement 8. Furthermore, participants considered their masculinity or femininity as a moderately strong component of their overall identity (3.9 (1.3) on a 1-6 range). The results of the N-GAMS showed that the attitude of the participants towards gender-related concerns in healthcare was slightly positive (3.8 (0.5) on a 1-5 range), with women having a more positive attitude towards gender-related concern in healthcare (4.1 (0.5) compared to men (3.5 (0.4). Furthermore, participants had a neutral attitude about gender stereotypes towards doctors (2.7 (0.5) on a 1-5 range) and slightly disagreed with gender stereotypes towards patients (2.3 (0.4) on a 1-5 range), with men having a more neutral Gender Role Ideology towards patients (2.5 (0.4)) compared to women (2.2 (0.4)). Two women did not complete the single items question regarding previous knowledge or experiences with the topic and one woman did not complete the N-GAMS. Their responses are not included in pre-workshop survey results presented in table 2.

Table 1. Demographical and clinical characteristics of the participants

Characteristic	**Overall (N=28)**	**Men (n=13)**	**Women (n=15)**
Age (Median in years (IQR))	64.2 (7.8)	64.9 (6.5)	63.5 (8.9)
Disease duration (Median in years (IQR))	4.9 (2.4)	3.7 (1.4)	5.9 (2.7)
Hoehn & Yahr Score[25] (stage) (n(%))			
Unilateral involvement only (1)	15 (54)	7 (54)	8 (53)
Mild bilateral involvement (2)	8 (29)	4 (31)	4 (27)
Moderate bilateral disease (3)	4 (14)	2 (15)	2 (13)
Severe disability, but still able to stand and walk (4)	0 (0)	0 (0)	0 (0)
Wheelchair bound (5)	1 (3.6)	0 (0)	1 (6.7)
Ethnicity (n(%))			
Dutch	28 (100)	13 (100)	15 (100)
Education level* (n(%))			
Lower education	2 (7.1)	1 (7.7)	1 (6.7)
Medium education	6 (21)	3 (23)	3 (20)
Higher education	20 (71)	9 (69)	11 (73)
Living situation (n(%))			
Alone	1 (3.6)	0 (0)	1 (6.7)
With partner or family	27 (96)	13 (100)	14 (93)
Facilitated care	0 (0)	0 (0)	0 (0)
Working status (n(%))			
Working	8 (29)	3 (23)	5 (33)
Not working	20 (71)	10 (77)	10 (67)

* For education levels, the following categorization is used: Lower education (None, Primary education, VMBO, MAVO), Medium education (HAVO, VWO, MBO), Higher education (HBO, University, PhD)

Phase 1: Focus group discussion results.

Several gender related stereotypes were expressed by the participants on a different level of social manifestation. Overall, the most prominent gender-related stereotype mentioned by both men and women with PD was the idea related to "*People with PD are old men*". This stereotypical idea is disease ('Parkinson's'), age ('old') and gender identity ('men') specific and often impacts the prospects of living with the disease and affects the experiences of stigma in people of different ages and particularly women. Some men and women also expressed stereotypical ideas related to dealing with difficulties in daily life, where coping through excessive drinking is considered more acceptable for men, whereas compulsive shopping was more acceptable for women. We found no distinct differences in experiences with gender norms or stereotypes between the higher GSC groups and the lower GSC groups, indicating that these themes are not necessarily related to how strongly participants identified with- and were committed to their masculinity or femininity. Table 3 provides an overview of the gender stereotypes and norms mentioned by the participants, in order of prevalence, reflecting the relative saturation level of each item across the focus groups.

Table 2. Pre-workshop survey results of the participants

Domain	Overall (N=28)	Men (n=13)	Women (n=15)
Previous topic knowledge or experience (No) (n (%))	22 (85)	12 (92)	10 (77)
Importance of Gender Sensitivity in PD score (Mean (SD))	3.8 (0.9)	3.7 (0.8)	3.9 (1.0)
Hoffmans' Gender Self-Confidence Score (Mean (SD))	4.1 (1.1)	3.9 (0.8)	4.2 (1.3)
Gender self-definition	3.9 (1.3)	3.7 (1.0)	4.0 (1.5)
Gender self-acceptance	4.3 (1.1)	4.2 (0.8)	4.4 (1.2)
N-GAMS Gender Sensitivity score ((Mean (SD)*	3.8 (0.5)	3.5 (0.4)	4.1 (0.5)
N-GAMS Gender Role Ideology towards Doctors score (Mean (SD))	2.7 (0.5)	2.7 (0.4)	2.6 (0.6)
N-GAMS Gender Role Ideology towards Patients score (Mean (SD))*	2.3 (0.4)	2.5 (0.4)	2.2 (0.4)

* $p < 0.05$ indicates statistical significance

Among the men with PD, there was an internalised sense of gendered stereotypes related to *"Men should be strong"*. Men should have the ability to be independent, be physically and mentally strong and perform well in sports and sexually. PD motor- and nonmotor symptoms impact these abilities, resulting in feelings of loss of control, confidence, and independence. At multiple levels, men expressed a general idea related to *"Men should suppress their emotions"*, describing situations in which men should control their emotions, particularly in the context of crying. Men expressed the importance of asking (follow-up) questions because they often felt less inclined to share emotionally loaded experiences due to discomfort and unfamiliarity. This need is dependent on personal openness and willingness to share and experienced level of social support. The idea of *"men are the providers"* was related to men's perceived responsibility as providers for their family and not becoming dependent on their (female) partner.

Table 3. Gender stereotypes in illness experiences of men and women with PD

Gender Stereotype or Norm	**Expressed by men/ women**	**Level(s) of social manifestation**	**Exemplar Quotes**
People with PD are old men	Men and Women	Ideological / Interpersonal	*"I couldn't identify well with the diagnosis at all,[...] I saw an eighty-year-old man who was walking with difficulty. So, I thought, how can I have it? And that still causes a little bit of yes, not being able to identify with the fact that I also have it. And that it is completely normal for women to get it too, of course."* [Woman] *"When they said to me 'you have Parkinson's', then you already have an image that is this old, deficient man who walks all bent over and indeed can't do anything anymore and has to sit in a chair. That's ultimately, that's kind of your vision of the future."* [Man] *"It is also because it is confirmed over and over again. Other people, including girlfriends, say to you "hey, how can that be, that's an old man's disease. And well, then you have to explain it, and it's actually very strange to have to explain it. So yeah, then I feel like I'm one zero behind or something and then I get the feeling it's not about me."* [Woman] *"When I tell someone for the first time, they say, but you're not that old yet. I do think that's a stereotypical comment. That it's really an old age disease and that you're already....* *SP1* So you must be an older man?* *SPR* Yes.* *SPR Who shakes a lot"* [Men]

Table 3. Continued

Gender Stereotype or Norm	**Expressed by men/ women**	**Level(s) of social manifestation**	**Exemplar Quotes**
Men should suppress their emotions	Men	Internalise / Interpersonal	*"There might be something masculine about that too, if we're talking about gender, which we men, we're not …* *SPR We don't cry as easily no.* *SPR Finding that more uncomfortable than maybe a woman or something."* [Men] *"I have a female specialist. Well, she knows how to get me to shed a tear […] But then she continues to ask me questions like that and then I get embarrassed, tears come like that. But would that [specialist] be man, I think, I'd be even more embarrassed.* *SPR Or would he not ask those question?* *SPR Asking those same question.* *SPR No, or would that man, that male doctor not have asked that question?"* [Men]
Men should be strong	Men	Internalised	*"I was always a pretty confident person and I'm a lot less so now. And also, when you see yourself move sometimes in the mirror, you think, you are so crooked, you know. That shows a lot less masculinity than it used to. And I sometimes have trouble with that."* [Man] *But what I notice is that I have trouble that my masculinity, we can talk about that in a moment, what that means exactly, that's being tinkered with, that's being nagged at, so to speak. So, performing in mountain biking, performing in all kinds of other sports yes, you notice that is going to be less. And I find that very difficult. The feeling of being a man and wanting to perform in being strong, being powerful.* [Man]

Table 3. Continued

Gender Stereotype or Norm	Expressed by men/ women	Level(s) of social manifestation	Exemplar Quotes
Men are the providers	Men	Ideological / Interpersonal / Internalised	*"All my life, I was raised as a Marine, a professional Marine, from a Reformed family. So that's a stamp on your worldview. And yes, I was brought up that as a man that you have things taken care of, that the household has adequate resources to run. And my father had ten slogans, one of them was you can't be afraid, you have to take the bull by the horns. And you try to do that. And then morally you get something and that's going to hinder you. Then you become dependent on your wife, I have a wonderful wife it's not about that. But I don't want to be dependent on her. I say you're married to me as a guy, but not 's a caregiver. And I find that very annoying."* [Man] *"And I think we are all still from the generation when there is a fairly old-fashioned male-female hierarchy in the home anyway. One does this and the other does that. But with us too, it's going to change.* *My wife is also quite old-fashioned, so she keeps pushing everything off, like you arrange it. So that will be quite a challenge in future."* [Man]
Men with addictions drink more, women go shopping.	Men and Women	Ideological	*"I fortunately don't have a problem with alcohol myself, but I do know of the necessary men who indeed if they have a problem then they drink more.* *SPI Yes, is expressions of addiction you say there is something male about that?* *SPR Well, addiction not so much, but maybe the manifestation. The stereotype is that we grab the alcohol more and a woman goes to the store more so to speak. "*[Man] *"Yes, the disinhibition in men is more likely to be in sex and in women somewhere else, in expressing feelings, or not expressing them at all, or a little bit snarky.* *SPR Disinhibition is just a little bit different?* *SPR Yes.* *SPR Yes, the expression is different."* [Women]

Table 3. Continued

Gender Stereotype or Norm	Expressed by men/ women	Level(s) of social manifestation	Exemplar Quotes
Women are the family carers	Women	Ideological / Interpersonal/ Internalised	*"What I also notice with couples with Parkinson's, everyone thinks it's very normal when a woman takes care of a man with Parkinson's. But that they find it very special when a man takes care of his wife with Parkinson's, then suddenly that is a hero. For that woman, that's normal."* [Woman] *"But the husband was sick and then he could also immediately do almost nothing. But when a woman is ill, you stay at home and take care of things. And then they are told by the doctor 'well it won't be so bad, because she is still hanging up the laundry'. While you say you can't move your arm.* *SPR You should see how I hang the laundry, you know like that.* *SPR So what else do you have to say.* *SPR So you have to conceal things sometimes too.* *SPR Yes that won't be too bad.* *SPR Yeah right.* *SPR Can you still run your household? I said of man you don't want to know how I do it, but you do it.* *SPR You can hardly say no because indeed you do.* *SPR Then it must be not too bad."* [Women]
Women should look friendly	Women	Ideological	*"Women are supposed to look a little more friendly.* *SPR And they do feeling supporting gestures and with their face too. And if you don´t do that then they think you´re uninterested.* *SPR Yes, because you're such a dragon, such a bitch or such a nasty woman.* *SPR And with a man that doesn't happen, or he was drunk, but not that he's a nasty man. "* *SPR I have to think about Prince Claus, of course that was someone you saw a lot in public. That wasn't one of those stereotypes about I thought 'hey, what an unsympathetic man'. That was more of 'oh my, you can tell by looking at him that he has Parkinson's.'* *SPR That's kind of accepted that's Parkinson's, but with the women it takes longer for that understanding of it. Initially she's cranky."* [Women]

Table 3. Continued

Gender Stereotype or Norm	Expressed by men/ women	Level(s) of social manifestation	Exemplar Quotes
Women physicians should be emphatic	Women	Ideological / Interpersonal	*I notice with doctors and health care providers; some are more empathetic than others. And when I tell of the experience with two neurologists, they think the empathetic doctor was the woman and the non-empathetic doctor was the man. But it was exactly the other way around. So the stereotypes are there too …* *I also think maybe as a woman you appreciate more if a man is empathetic to you and a woman you expect it maybe more. Yes, I don't know, if I look at myself then yes, I do appreciate that yes.* *SPR Then if that woman as a doctor is not empathetic, I think it's almost worse.* *SPR That's what you say too, yes that you actually expect it.* *SPR I find that so bad that I don't go there anymore."* [Women]
Men should be good sexual partners	Men	Ideological	*"But I think then, that's also something I just heard, performing, it also belongs to 'sexual performing' in quotation marks. Not that I experience it that way, but that is also something that is very important for men often and for men in general. That you are good at sex so to speak."* [Man]

*SPI = Interviewer, SPR = Respondent(s)

Among the women with PD, the gendered stereotype of "*Women are the family carers*" was related to the normalisation of women being the household- and informal caretakers. Women indicated that the performance of these roles can mask difficulties with PD-related symptoms observed by others due to their continued participation in these activities and social roles. Women described themselves as adaptive by having various compensation strategies to juggle the challenge of performing multiple social roles whereas it was generally viewed that men would ask for- and receive help sooner. The belief that "*Women should look friendly*" was related to how changes in body language, posture, and facial expressions due to PD symptoms resulted in stigmatising experiences for some women, as women are often socially expected to be more emotionally and nonverbally expressive. One group of women also expressed the stereotypical idea that "*women physicians should be empathic*" and that women physicians might face stronger social criticism, also by their own gender peers, when they are not considered 'empathic enough'.

Phase 2: Self-reflective methods

Word-Concept Associations

The findings of the word-concept association show that women relate care for women with PD with interpersonal traits such being listened to and taken seriously with attention towards balancing the different social roles' women fulfil in their lives. Clinical associations focused on attention towards the impact of hormonal changes and differences in medication dosage and treatment responses (figure 3).

Figure 3. Word-Concept Association: Care for women with Parkinson's disease

For men, the word-concept associations present attention towards dealing with changes and difficulties in expressing emotions, and a focus towards self-management and self-reliance. Also, associations were made with men's roles as husbands and fathers, feelings of shame and loss of confidence and physical abilities (figure 4).

Downloaded Learnings

Results of the Downloaded Learnings exercise showed a variety of focal points for gender-aware PD care as described by the participants. Both men and women described a, more sex-linked, focus on potential differences in side effects of PD medication and optimal dosage for men and women. An attention towards personality and life changes and dealing with- and listening to the emotional experience of living with PD were also prominent topics for both genders. Men described a difficulty between balancing a 'do not complain and carry your emotions' attitude while also feeling relieved when they were able to express their emotional experiences. Women mentioned a call towards challenging the stereotypical image of ‘the person with Parkinson’ due to its strong gendered association with ‘an old man’s disease’ and the need to move beyond the stereotype for a more accurate representation of the diversity of people who have the disease.

Figure 4. Word-Concept Association: Care for men with Parkinson’s disease

Phase 3: Collective insight statements and care research recommendations

Results of the small group discussion among men revealed an eminent focus of gender-sensitive PD care for the psychosocial experiences of men with PD related to their self-image, self-confidence, and self-reliance. This includes attention to personality and cognitive changes. Men stressed the relatively strong focus on monitoring and treating the physical aspects of Parkinson’s but the lack of attention to emotional well-being, particularly in the period after diagnosis, and coping with increased emotionality and mood disturbances. Additionally, changes in sexual experiences, both physically and emotionally, require more attention. Preferably these topics are discussed initially in their direct or relevant social environment with partners and close friends, but men stated the importance to address these topics in clinical practice as well.

The small group discussions among women identified a need for gender-sensitive PD care with more attention towards emotional well-being of women with PD and a focus on (re)enforcing self-agency and equivalence in the patient-physician relationship. Women stressed the importance of attention to women in different life stages (related to age) and life situations (e.g., active (single) parenting role, caregiver for partner, working professional) that might require different levels of flexibility in care demand and supply. Furthermore, the women expressed the need for more knowledge regarding the impact of hormonal influences on PD progression and treatment. An overview of the formulated care and research recommendations for future gender-sensitive care research for people with PD is included below (table 4).

Table 4. Gender-sensitive PD care and research recommendations

Care & Research Recommendations	
1.	Create more balance between physiological and psychosocial skills and expertise within multidisciplinary care teams for people with PD.
2.	Investigations into emotional- experiences, changes, challenges and growth among men and women with PD.
3.	Investigation into care needs among men and women with PD in different life stages and circumstances (life-course perspectives).
4.	Create more awareness regarding gender stereotypes and prejudices when formulating research questions and analysing research data, to avoid reproduction of restrictive gender biases.
5.	Continued investigation into men-specific and women-specific issues by more explicitly exploring and addressing them during medical consultations and research.
6.	Proactively discuss social role changes with men and women that are affected by the progression of PD symptoms.
7.	Continued efforts for structural research into similarities and differences in biological sex characteristics and social-cultural gender dimensions in diagnostics, treatment, therapy and care for men and women with PD.

Discussion

In this multi-method design-based study, we explored patient perspectives on gender norms and gender-sensitive care. Most participants had no previous knowledge or experience with the topic of '*gender sensitive PD care*' and had a positive attitude towards investigating and addressing gender related concerns in healthcare. Participants considered their masculinity (for men) and femininity (for women) as a moderately strong component of their identity and overall, participants did not hold strong gender stereotypical attitudes towards male and female patients and physicians. Furthermore, we found that there are shared and distinct gendered stereotypes and norms that influence illness experiences of men and women with PD. Most prominently, the general perception that '*People with PD are old men*' impacts both men and women's own initial perception of living with the disease and the perception of their social environment. Attention towards personality changes, dealing with- and listening to emotional experiences of living with PD were prominent topics for both men and women, although their interpretations differed. Men described their experiences with prevalent gendered stereotypes related to '*men should be strong*', '*men should suppress their emotions*' and '*men are providers*'. Women described experiences with stereotypes related to '*women are family carers*' and '*women should look friendly*'.

The results from the self-reflections revealed that women associated '*gender-sensitive care for women with PD*' with a focus on interpersonal aspects related to the patient-healthcare provider relationships such as being listened to and attention towards the different social roles women fulfil in their lives. Men tended to associate '*gender-sensitive care for men with PD*' more with attention towards intrapersonal aspects such as self-regulation, management, and reliance. Both men and women expressed a need for more attention towards emotional wellbeing. This is particularly important in the period after diagnosis when people with PD are learning to cope with increased emotionality due to PD symptoms and disease progression and the impact of PD treatment on social role changes. Participants expressed a need for emotional support with a focus on (re)enforcing self-agency.

Recommendations for gender-sensitive PD care and research included fostering awareness among researchers and healthcare providers about gender stereotypes to avoid the reproduction of gender biases as well as the encouragement to proactively address social role changes due to the progression of PD related symptoms. For healthcare providers, this begins with acknowledging the emotional toll that social role changes can have on patients and understanding feelings of frustration, loss and anxiety related to changes in the ability to perform certain roles. This includes reflection on your own, perhaps unconscious, assumptions regarding gender norms and roles and how these might influence (medical) social interactions. Also, it is important to assess the specific challenges in peoples' personal and professional roles to tailor their individual treatment plans and provide education about how disease progression can lead to changes in motor functions, energy levels, emotionality, and cognitive abilities. This can contribute to an understanding that these changes are a result of underlying neurodegenerative processes and not personal failing.[26] Furthermore, discussing adaptive strategies, assistive technologies and mobile aids that can help people with PD to continue to engage in their desired social roles with modifications in behaviours, routines, and environments. Researchers are encouraged to integrate gender-sensitivity training and collaborations with advocacy groups focused on gender equity in healthcare to enhance the recognition of gender stereotypes and understanding of the impact of undesirable social biases on patient outcomes.

The stereotype of *'People with PD are old men'*, while well supported, is the most common representation of PD since the sketch by Sir. William Richard Gowers MD in 1886.[27] Although this image is still accurate for some people with PD, it does not represent the vast variations among people with PD we know today. As a result, particularly younger and middle-aged women can face poor public understanding and experience an unnecessary explanatory burden to counter this stereotypical perception.[6] We therefore echo the calls for a broader and more accurate view of Parkinson's through the use of diverse imaging and inclusive research participation.[28–31] While acknowledging that no single image can adequately reflect the diversity in background, phenotypes, and experiences in PD, it is important that images, both in public and in medical teachings, are consistent with the advances in Parkinson's research and encourage discussion about how Parkinson's is represented.

In this study we found gender norms and stereotypes on multiple levels of social manifestation in illness experiences of men and women with PD. Among men, the gender norms related to '*men should be strong*' and '*men should suppress their emotions*', were most strongly internalised and are therefore more likely to act as prosocial self-regulators. Research suggests that, although men and women tend to have similar emotional reactivity and fluctuations, men are more likely than women to suppress emotional expression in certain situations.[32,33] A recent study reported greater gender role flexibility in women compared to men, which refers to the capacity to contextually switch between self-perceived masculine and feminine behaviours. Men experienced more negative affectivity, such as increased anxiety, self-criticism and feelings of depression when 'code switching' gender roles.[34] The collective insight statement of men in our study that calls for more psychosocial support and coping with changes in their self-image, self-confidence, and self-reliance require care approaches that are sensitive towards these gender normative constrains regarding the expression of emotional experiences. Particularly those that are considered stereotypically feminine and gender role inconsistent for men (e.g. fear, sadness, embarrassment, shame or guilt).[35] It is well known that maladaptive emotional regulation increases psychological stress, exacerbates motor symptoms and result in poorer health outcomes in PD.[36] Especially for men who consider their masculinity a strong component of their overall identity and define their masculinity in traditional, hegemonic, terms, emotional disclosure can be challenging. These restrictive masculine norms and self-stereotyping behaviours are illustrative of a gendered pathways to health that can limit men's access to and utilisation of psychosocial PD care.

It is important to note that masculinities demonstrate a wide range in patterns of practice and a generalisation about emotionality and men would be misleading. Focusing on masculinity risks being overly focused on problems associated with 'negative' masculinity and may neglect to focus on adaptive traits and the normalisation of emotional experiences.[37] Gender transformative approaches to improve emotional health and wellbeing of men with PD require not only changes in personal narratives but also in media representations, healthcare discourses and care services that normalise mental health, integrate role modelling and leverage adaptive gender norms and value systems.[18,38] This is particularly relevant in a strong national gender equality discourse in which women's emancipation promotes non-traditional role changes for women and dynamic feminine stereotypes, whereas the transgression of men into social roles that are generally considered communal or feminine progresses much slower and traditional masculine norms seem much more resistant to change.[39-41] It is important for researchers, clinician and policy-makers in healthcare to recognise that cultivating dynamic and less restrictive masculinities, normalising mental health and acknowledging the diverse ways in which men may construct gender ideals, *is* psychosocial health promotion for men with, and without, PD.[10,37,42,43]

Gender norms related to '*women as family carers*' were most strongly internalised among the women in our study. Norms related to '*women should look friendly*' were largely experienced by women as ideological, descriptive norms. A recent study into emotional cues in expressive behaviours of men and women with PD found that, to conform to gendered social expectations, women with PD may experience more pressure to express sociable behaviours such as more smiling and laughing during conversations. This study suggested that these socially desired behaviours can be misunderstood by observers, even healthcare professionals, and mask negative emotional experiences of women with PD, particularly when smiling and laughing is expressed with less conversational engagement.[44] These findings in line with the remarks of women in our study that the performance of certain social roles, such as active family care and household duties, can mask experienced difficulties with PD-related symptoms observed by others. Subsequently, this can lead to inaccurate evaluations of emotional and physical well-being of women with PD, intensify feelings of not being listened to or taken seriously and could explain why the women in this study described their need for- and use of more adaptive coping strategies compared to men. These examples are illustrations of a gendered pathway to health that can hamper women's access to care and therefore increased awareness of these gendered performances and potential biases is needed among healthcare professionals. This could be assisted with active listening skills and additional probing during medical consultations to assess emotional and physical experiences of women with PD in a more detailed way.[45] We support the 'call to arms' described by Subramanian et al (2022) that management of PD needs to be customised to include the unique stages and roles of women's lifes.[46]

A strength of this study is the in-depth line of inquiry through our multimethod approach. For this present study, we applied an equity-centred design (ECD) approach that incorporates intentional reflectivity and that acknowledges power, identity and context in which the design process takes place.[14,23] This multi-method participatory process includes patients in the research and design process and aims towards a practical translation of generated knowledge and insights. In a collaborative process, people with PD and health researchers worked together using cultural inquiry to understand patients lived gendered experiences, creative thinking to stimulate diverse perspectives and prioritise ideas related to gender aware PD care. It is useful to note that, in contrast to more traditional hypothesis-driven biomedical research, the design-based approach we employed in this study centres on understanding complex real-world contexts, aiming not to prove or reject hypotheses, but to comprehensively explore multifaceted issues and generate patient-driven recommendations through an iterative process of problem identification and solution co-creation.

To our knowledge, there are still few design-based health research studies that directly address gender inequities that impact health and illness experiences.[47–50] While human-centred design methodologies, such as the ECD approach used in this study, are often perceived as a single standardised method, their application, in fact, entails a wide array of qualitative, quantitative and design methods or techniques that can and should be used selectively, dependent on the specific research context.[51] ECD practitioners in health research should carefully select the participatory methods they deploy, with sensitivity towards capturing the unique insights and capabilities of each participant in the design process and stay attuned to the power dynamics and agency of varying stakeholders during co-design sessions. Using an ECD approach can support the development of care interventions that increase gender equity in PD care. When men, women and gender diverse people with PD are encouraged to use the power of their own lived experiences to identify and discuss gender-related experiences and ideate priorities for gender-sensitive PD care, community members are purposefully involved as co-designers with the goal of formulating and innovating solutions relevant to their needs. This intentional engagement of patient communities is especially important when it comes to improving the knowledge base around PD, which is still based largely on the experiences of a relatively homogeneous population from European Caucasian descent.[29,52] To foster genuinely inclusive design research processes, using reflective tools and frameworks, such as ECD, can ensure that a participatory process is not just tokenistic but genuinely meaningful.

It should be noted that the sample in this study is not necessarily representative of the broader Parkinson's population in the Netherlands. Participants had generally received higher education, experienced mild to moderate disease disability and were not as ethnically diverse as the general Dutch population. Homogeneous sampling is employed when the objective is an in-depth exploration of the experiences of a particular group by minimising group differences; this approach could therefore be viewed as a strength for this study. Nonetheless, there are increasing demands to emphasise greater diversity and inclusion in Parkinson's research overall.[29] It remains to be investigated whether the same pattern of results appears when studies are conducted that include individuals with more advanced stages of disease progression and with distinct social identities that might adhere to- and practice different gender norms and stereotypes.[6] The promotion of an intersectional gender approach that emphasises the intersectionality of gender with other contextual aspects of identity, such as ethnicity, socioeconomic status, sexual orientation, and age, is needed to better understand and address the unique healthcare challenges faced by men and women with PD from different social backgrounds.

Furthermore, investigations could be even more robust if researchers considered the added layer of complexity brought by disease-specific symptoms that intensify during the disease journey. For example, researchers could consider how contextual gender norms related to caregiving can become more or less salient with disease progression and shape the quality of life of both men and women with PD and their caregivers.[53] Or when one considers that depression, common in Parkinson's disease, combined with its potential gendered manifestations can play an important role in help-seeking behaviours and may hold particular significance for people with PD that endorse traditional masculine gender norms.[54,55] Such intricate interplays necessitate more nuanced research approaches, that can shed light on the compounded influences of social identity, gender norms, and disease-specific symptomatology. Herein, contextualisation should be prioritised over broad generalisation, as these considerations steer away from a one-size-fits-all paradigm and towards precision medicine.[3,56,57] Recognising these nuanced interactions will ensure more tailored and effective health interventions.

When designing health interventions that support changes in attitudes and behaviours related to rigid gender norms and stereotypes, a recent review concluded that design studies that involved groups with mixed gender identities were generally lower in quality than those working with single gender identity groups.[11] Furthermore, this study stated the importance of dismantling and avoiding the reinforcement of rigid gender stereotypes during participatory sessions in which they are being addressed. During the participatory sessions in our study, the single gender identity groups were effective in avoiding the reinforcement of rigid norms and stereotypes due to the different perspectives that were shared within the men and women groups. This offered an exchange of diverse within-group experiences that contributed to an atmosphere of '*talking about*' rather than '*talking from*' norms and stereotypes. The general average Gender Self-Confidence score of the participants might also have contributed to this atmosphere. Although participants were allocated to the focus groups based on their Hoffman Gender Scale score, the within-group score distribution was relatively low, with few significant extremes. When people do not strongly associate their sense of self with masculinities or femininities, their perceptions and behaviours are less likely to be strongly regulated by cognitive '*gender schemas*': the extent to which participants consider gender an important frame of reference and inclination to regulate their perception and behaviours through self-stereotyping.[58,59] It might therefore be easier to '*talk about*' gendered experiences because personal experiences are less processed and evaluated through the lens of normative gendered practices. We recommend further investigation into the moderating effects of the perceived salience of individual gender identity on the performance of gender norms and their impact on health outcomes for people with PD.

Besides the investigation of gender norms and stereotypes in personal illness experiences, it is equally important the investigate the gendered social systems that reproduce these experiences to ultimately address broader harmful social gender norms.[60] For qualitative researchers studying gender stereotypes and norms, there is serious potential for a 'catch-22' situation when we are not aware of the '*talking about*' versus '*talking from*' social dynamics. In attempts to address gender biases in health, e.g., by making gender stereotypes explicit during focus group discussions, a mutual reinforcing effect can occur in which gender stereotypes are not only activated to '*talk about*', but also become reinforced when participants '*take on*' stereotypical roles that reproduce rather than deconstruct the gender biases researchers aim to address. When qualitative research results are then anecdotally reported without noticing this distinction in the social dynamics of the research context, researchers risk reproducing these gender biases as inevitabilities in patient experiences, rather than as social constructions within patient experiences. Consequently, researchers can, unconsciously, contribute to maintaining perceived gender norms through health research rather than reflecting critically on them. We consider substantial theoretical grounding in gender studies, strong listening and prompting skills of facilitators as key in supporting the investigation of gender as a social construct in health and illness experiences. Furthermore, including an instrument to measure how strongly participants associate themselves or internalise the gender dimensions under investigation, can support participatory workshop preparations.

Supplements

Supplement 1. Overview and description of the included design phases and methods.

Included phases of the equity-centred design process, applied methods and objectives

Phase	Description
Empathy	The EMPATHY phase of the process is focused on understanding the experiences, emotions and motivations of men and women with Parkinson's disease (PD). In this phase we aim to uncover gender stereotypes and gender norms that men and women with PD experience in their daily lives and how PD impacts these stereotypes or norms and vice versa.
Define	The DEFINE phase of the process if focused on developing a point of view about the needs of men and women with PD with regards to gender-aware PD care. During this stage of the process, data from the first phase will inform the design challenge: "How might clinical care for men and women with Parkinson's Disease become more gender aware?"
Ideate	The IDEATE phase of the process is focused on the generation of as many solutions to the design question(s) as possible. Once many solutions have been generated, participants will select and prioritize key ideas that could move forward to prototyping.
Notice & Reflect	The NOTICE & REFLECT phase of the process is ongoing and transparent throughout the design process. It allows the research team to take time to focus and reflect on actions, emotions, insights and impacts as researcher and as humans. This phase activates cultural and social emotional awareness within and among the research team before entering the empathy phase, to allow an authentic human-centred design practice

Applied methods	Methodological objective
Hoffman Gender Scale. Nijmegen Gender Awareness Scale Focus Group Discussions	To assess how strongly committed participants were to their gender identity to allocate participants to FGD subgroup (higher vs lower committed). To assess the degree to with participants were sensitive towards the role of gender in medical care as a baseline awareness measure towards the topic. To explore and identify gender norms or stereotypes present in illness experiences of men and women with PD.
Reverse/Inverted Thinking Word-Concept Association Download the Learning	Warm-up exercise towards insights by flipping the logic of ideation and stoke creativity. To cluster perceptions and prioritize design features and concepts. To formulate individual key learnings, impressions, and experiences.
Collective insight statements	To share individual learnings and make them part of the collective groups' knowledge base to brainstorm recommendations for the design question: '*how might we design gender aware PD care?*'
Reflective discussions Post-workshop evaluation	To cultivate awareness among the facilitation team regarding the sensitivity of the topic, workshop design and research context. To deliberately centre principles of inclusion and equity centred design and think about their role and relevance during the participatory design session and the data analyses.

Supplement 2: Recommended elements for reporting of global health research that has used design

Item	Paper section	Topic/descriptor
1	Title and abstract	Title should indicate that the study included a design approach. Abstract summarises the salient components, including background, statement of problem, approach/methods, findings, results and conclusion.
2	Introduction/ background	Overview of the background to the topic, what has been done in the area already and rationale for using design. Description of the initial research question or health problem that the design-based work aimed to address.
3	Methods/approach	Reporting of the approach, tools or processes that were used for the research; who was involved (both researchers and participants); when and where research was conducted; how data were reviewed, analysed and synthesised; and iteration.
4	Results/findings from design research and activities	Summary of findings from design activities. Explanation of what was finally designed and what the associated decision-making points were, and (if available) impact. Report on any secondary or ancillary results.
5	Discussion	Reflection on the incorporation of design to this research topic, including but not limited to strengths, limitations and contribution.
6	Conclusion	Implications of this work for the larger fields of health and design, and any next steps.
7	Other	Ethical considerations, relevant acknowledgements of conflict of interest, funding, and contributorship of authors, designers, stakeholders and participants.

Bazzano AN, Yan SD, Martin J, et alImproving the reporting of health research involving design: a proposed guidelineBMJ Global Health 2020;5:e002248.

Supplement 3. The Hoffman Gender Scale

Hoffman Gender Scale: Measurement for Gender Self Confidence	
Subscale	GSD = Gender Self-Definition subscale (how salient gender is to individual identity) GSA = Gender Self-Acceptance subscale (how comfortable a person is as a member of his/her gender) Rating 1 = sterk mee oneens, 6 = sterk mee eens)
GSD1	Als aan mij gevraagd wordt om mezelf te beschrijven, is man-zijn/vrouw-zijn een van de eerste dingen waar ik aan denk.
GSA1	Ik ben zelfverzekerd in mijn mannelijkheid/vrouwelijkheid.
GSA2	Ik voldoe aan mijn persoonlijke standaard voor mannelijkheid/vrouwelijkheid.
GSD2	Mijn perceptie van mijzelf is positief geassocieerd met mijn biologisch geslacht.
GSA3	Ik voel me zeker in mijn mannelijkheid/vrouwelijkheid.
GSD3	Ik definieer mijzelf grotendeels in termen van mijn mannelijkheid/vrouwelijkheid.
GSD4	Mijn identiteit is sterk verbonden met mijn mannelijkheid/vrouwelijkheid.
GSA4	Ik heb veel waardering voor mijzelf als man/vrouw.
GSD5	Man-zijn/vrouw-zijn is een cruciaal onderdeel van hoe ik mezelf zie.
GSA5	Ik ben blij met mijzelf als man/vrouw
GSA6	Ik voel me erg op mijn gemak als man/vrouw
GSD6	Mannelijkheid/vrouwelijkheid is een belangrijk aspect van mijn zelfbeeld.
GSA7	Mijn gevoel van mezelf als man/vrouw is positief
GSD7	Man-zijn/Vrouw-zijn draagt voor een groot deel bij aan mijn gevoel van zelfvertrouwen.
Open Question	Wat verstaat u onder mannelijkheid/vrouwelijk?

For English version, see: Hoffman, R.M. & Borders, L. & Hattie, John. (2000). Reconceptualising femininity and masculinity: From gender roles to gender self-confidence. Journal of Social Behaviour and Personality. 15. 475-503.

Supplement 4. The Nijmegen Gender Awareness in Medicine Scale

Nijmegen Gender Awareness Scale	
Subscale	Gender Sensitivity: In hoeverre bent u het eens met de onderstaande stellingen (1 = helemaal mee oneens, 5 = helemaal mee eens)
GS1_R	Artsen moeten alleen rekening houden met biologische verschillen tussen mannen en vrouwen.
GS2_R	Bij niet-geslachtsgebonden aandoeningen is het geboortegeslacht van de patiënt niet belangrijk.
GS3_R	Een arts moet zich zoveel mogelijk beperken tot medische aspecten van klachten van mannen en vrouwen.
GS4_R	Verschillen tussen mannelijke en vrouwelijke artsen zijn te klein om relevant te kunnen zijn.
GS5_R	Juist omdat mannen en vrouwen verschillend zijn moeten artsen iedereen op dezelfde wijze behandelen.
GS6_R	Artsen die rekening houden met geslachtsverschillen houden zich niet met de belangrijke zaken bezig.
GS7_R	In de communicatie met patiënten maakt het voor een arts niet uit of het mannen of vrouwen zijn.
GS8_R	In de communicatie met patiënten maak het voor de arts niet uit of de arts zelf een man of een vrouw is.
GS9_R	Verschillen tussen mannelijke en vrouwelijke patiënten zijn zo klein dat artsen er nauwelijks rekening mee kunnen houden.
GS10_R	Rekening houden met verschillen tussen mannen en vrouwen veroorzaakt ongelijkheid in de gezondheidszorg.
GS11_R	Het is niet nodig om rekening te houden met verschillen in de wijze waarop mannen en vrouwen hun gezondheidsklachten presenteren.
GS12	Kennis over geslachtsverschillen in ziekte en gezondheid bij artsen verhoogd de kwaliteit in de gezondheidszorg.
Subscale	Gender role ideology towards patients: Bent u van mening dat (1 = helemaal mee oneens, 5 = helemaal mee eens)
GRIP1	Mannelijke patiënten de werkwijze van artsen beter begrijpen dan vrouwelijke patiënten.
GRIP2	Vrouwelijke patiënten onnodig veel van artsen vragen vergelijken met mannelijke patiënten.
GRIP3	Vrouwen vaker dan mannen met de arts problemen willen bespreken die niet thuishoren in de spreekkamer.
GRIP4	Vrouwen te veel emotionele steun van artsen verwachten.
GRIP5	Mannelijke patiënten minder veeleisend zijn dan vrouwelijke patiënten.
GRIP6	Vrouwen meer gebruik maken van de gezondheidzorg dan werkelijk nodig is.
GRP7	Mannelijke niet naar een arts gaan voor onschuldige gezondheidsproblemen.

Supplement 4. Continued

Nijmegen Gender Awareness Scale	
GRIP8	Medisch onverklaarbare aandoeningen bij vrouwen ontstaan doordat zij teveel zeuren over gezondheid.
GRIP9	Vrouwelijke patiënten over hun gezondheid klagen omdat ze meer aandacht nodig hebben dan mannelijke patiënten.
GRIP10	Het gemakkelijker is om oorzaken te vinden van klachten bij mannen omdat mannen gewoon zeggen waar het op staat.
GRIP11	Mannen vaker dan vrouwen een beroep doen op de gezondheidszorg met problemen die zij hadden moeten voorkomen.
Subscale	Gender role ideology towards doctors: Bent u van mening dat (1= helemaal mee oneens, 5 = helemaal mee eens)
GRID1	Mannelijke artsen te veel nadruk leggen op technische aspecten van de geneeskunde vergeleken met vrouwelijke artsen.
GRID2	Vrouwelijke artsen vergelijken met mannelijke artsen hun consulten te veel laten uitlopen.
GRID3	Mannelijke artsen efficiënter zijn dan vrouwelijke artsen
GRD4	Vrouwelijke artsen empathische zijn dan mannelijke artsen
GRID5	Vrouwelijke artsen onnodig veel rekening houden met de belevingswereld van de patiënt.
GRID6	Mannelijke artsen zijn gehaaster in hun werk vergeleken met vrouwelijke artsen.
GRID7	Vrouwelijke artsen emotioneel meer betrokken zijn bij hun patiënten dan mannelijke artsen.

For English version, see: Verdonk, Petra & Benschop, Yvonne & Haes, Y. & Lagro-Janssen, Antoinette. (2008). Medical students' gender awareness: construction of the Nijmegen Gender Awareness In Medicine Scale (N-GAMS). Sex Roles. 58. 222-234.

Supplement 5. Interview Guide Focus Group Discussions

Domains	Topic
Gender Identity	• Can you talk a little about the perspectives and ideas you grew up with regarding being male/female? How do you view it now as an adult? • What do terms like "masculinity" and "femininity" mean to you? • How would you describe your own gender identity? Is your being male or female an important part of your identity? • Do you consider yourself a 'traditional' man/woman? What does this mean to you? • Are there specific activities that are an important expression of your being male or female? What role does Parkinson's disease play in this for you?
Gender Norms and Stereotypes	• In your opinion, what is the general perception of men/women with Parkinson's? • In your opinion, are there any stereotypical images or ideas about men/women with Parkinson's? Do you recognize yourself in these images, why/why not? • Are there certain social expectations in your environment that you as a man/woman should meet according to others? Who are those 'others'? • How do you deal with these expectations? Does Parkinson's disease play a role in this for you? Is it hindering or helpful?
Gender Sensitive Care	• What do you think of when you think of "gender sensitive care for people with Parkinson's"? • What do you think of when you think of more sensitive care for men/women with Parkinson's?

Supplement 6. Post-Workshop Evaluation Questions for facilitators

	Post-workshop reflective questions
1	Based on your own observations, (briefly and intuitively) formulate an answer to the primary research question?
2	Based on your own observations, (briefly and intuitively) formulate an answer to the primary design question?
3	Was the focus group method an effective method to explore gender norms in illness experiences of men and women with PD?
4	Optional: Which methods might be (even) more effective to explore gender norms in illness experiences? How might we explore them more effectively (=more informatively)?
5	Was the structured brainstorm an effective method to explore concepts for gender-sensitive care for men and women with PD?
6	Optional: Which methods might be (even) more effective to explore concepts for gender-sensitive PD care? How might we explore them more effectively (=more informatively)?

Supplement 6. Continued

	Post-workshop reflective questions
	Equity Centred Design - Notion & Reflect Phase Reflect on the following principles and think about their role and relevance during the workshop and upcoming data analyses. **Principles of Inclusive and Equity Centred Design:** Recognize Exclusion Checking personal biases, including those around disabilities and related limitations, to avoid conscious or unconscious exclusionary decisions. Learn from Diversity Letting research insights be driven by the unique perspectives of diverse individuals and the way they adapt to experiences not originally designed for them. Solve for One, Extend to Many Focusing on what's universally important to all humans and understanding the power of solving along the continuum of permanent disabilities to temporary disabilities (e.g., broken arm) to situational impairments (e.g., loud crowd affecting your hearing). Design at Margins Building for marginalised communities who are most hurt by oppression, and bringing them into the design process. Start with Self Recognizing personal mental models, including how biases and assumptions impact solution design on both a conscious and unconscious level. Cede Power Providing power to underrepresented individuals that are brought into the design process, and making it a safe space for speaking truth to injustices. Make the Invisible Visible Recognizing, explicitly calling out, and actively challenging hegemonic practices that have historically advantaged dominant groups over marginalised groups. Speak to the Future Finding new language to complement the design of a new, equitable future, such as defining an innovation as an increase in equity and reduction of racism.
7	What social demographics should we be aware of in our study population? Who might we be excluding?
8	How could identities within our team (have) influence(d) or impact(ed) data collection and data analysis decisions? What do we need to be aware of moving forward towards the data analysis?
9	During data analysis: How can we ensure we are focussing on an actual need or question that this community has, rather than one we may be incorrectly perceiving they have (implicit/explicit biases)?
10	During data analysis: How can we ensure we are focussing on an actual need or question that this community has, rather than one we may be incorrectly perceiving they have (implicit/explicit biases)?

Supplement 7. Operationalisation of the self-reflective methods

Method	Operationalisation
Reverse Thinking	How would ‘gender sensitive care’ for people with Parkinson’s look like if we would design it completely wrong?
Word-Concept Association	Write down words that you associate with “care for women/men with Parkinson’s”.
Downloaded Learning	Finish these sentences: For me, care for women/men with Parkinson’s means paying attention to:........(so that/because)......... Attention to this care is (mainly) important/relevant when:....

Supplement 8. Pre-workshop survey | Hoffman Gender Scale | Open Question | Participants' definitions of masculinity and femininity.

What do you understand by 'masculinity'?*

#	Response
1	Being part of society, regardless of whether you are male or female
2	The influence of my hormones determines my behaviour and will not be influenced by concepts such as "Masculinity", which is relative. How can I know what I would feel with a higher testosterone level or oestrogen?
3	Role distributions between male and females
4	That you are assertive and know what you stand for
5	Tough question. Not being able to get pregnant.
6	Less emotional, more rational, loves women, physically stronger, together with woman a good couple
7	That I was born a man
8	The fact, that I have an outward appearance of a man....
9	Radiate that you are full of self-confidence
10	Still to be determined
11	Masculinity for me is being self-reliant, tough, and strong. Strong in muscular strength but also in decisiveness and decisiveness. Masculinity for me is also being sexually active, not showing too many emotions and being successful in your work.
12	Showing male behaviour
13	Primarily related to sex. Other traits, in my view, are more related to the personality
14	Biological characteristics of the male
15	So called here, all this feels like a very old-fashioned proposition: the man strong, tough, not faint, leading. I have seen that for a very long time: man -woman=equal. Being a man is a given, but being human is the basis.
16	Healthy attention to female beauty!
17	Cannot be said in three words
18	Biologically determined and society-influenced set of behavioural characteristics
19	Stand by what you say or do. A man a man, a word a word! Straightforward and in most cases do not step aside. Warning once should be enough. Respect all women and treat them the same. Don't participate in gossip etc. Take care of those you love.
20	Strongly inquisitive, protective, gallant, camaraderie.

*Responses of male participants.

What do you understand by 'femininity'?*

#	Response
1	The physique, the actions, the ideas, the solutions, the thinking, the appearance, the organization, the strength, the structuring
2	The female sex, motherhood, feminine appearance, caring,
3	Difficult question - but is about empathy, caring, being confident in what I do. Being proud of my children, doing my part for a living, male characteristics are also part of me, winning.
4	Femininity for me consists of motherliness, gentleness, empathy, seeing connections, seeing interests of different groups or family members. Being able to connect and behave that way. Not being submissive but being strong. Setting boundaries. Being attractive, seductive if desired, authentic.
5	Empathy, sensitivity, emotional
6	Sex Motherhood Softness
7	Just being yourself and radiating that
8	A combination of purely biological, external, and genetic set of differences from men and, in addition, cultural and social expectations regarding being a woman. I struggled a lot with the above questions. I see myself as human, I am a woman and was very happy to become a mother but don't feel particularly feminine and am not much about it. Although I find it very annoying when I notice that I or other women are disadvantaged by being a woman.
9	That you appreciate who you are and what you put out.
10	Characteristics and behaviours and roles that typically belong to women such as choosing clothes and professions and behaving in a dependent (vulnerable) manner, among others.
11	I feel completely female because of how I look. How people respond to me. I just can't imagine how to feel like a man. I'm just a woman. And feel very comfortable under that.
12	Caring, independence, cleverness combined with inner beauty, versatility, justice and being sensitive.
13	By that I mean that we as women are allowed to have children. That we are given curves and more extras to distinguish us from men.
14	Caring and compassionate....

*Responses of female participants.

Supplement 9. Self-reflective methods | Reverse Thinking Results

Gender identity category	How would 'gender sensitive care' for people with Parkinson's look like if we would design it completely wrong?
Men	• Assuming that all men are equal. No longer paying attention to issues that are important in men. • Not asking questions. Making assumptions. • Anything that goes too fast and creates stress; giving the impression of being in a hurry. • Not taking into account differences between men and women; differences in interest and also differences in age due to the presence of children. • Probably achieve less effect and also coping will be less good. The influence of social influence will be decisive. • Assume dependency. Think in terms of problems. Especially dwell on the progression of Parkinson's disease. Not naming your own contribution to the conversation/ coping with Parkinson's disease. Avoiding certain topics, such as work/hobby/volunteer work/sports/emotions/sexuality. Not naming any resources. • No approach. Falling back on past approaches? No examination of medication. • No attention to social problems, no attention to addiction. • No attention to feelings and emotions. No attention to sexual limitations. No attention to performance/sports. No attention to attention, actual attention to anxiety(s). • Risk of wrong treatment. For example, in cardiology, for a very long time there was no distinction between men and women. Result is wrong treatment of cardiac issues in women. Wrong interpretation of symptoms and thus treatment of Parkinson's disease. • No attention to the emotional aspect and no attention to the importance of exercise (walking, cycling, fitness). • Possibly then a (healthcare) model is created in which only sex (biological) is distinguished. I consider this risk quite high because no other classification with corresponding relevant research data is known. By the way, this need not be COMPLETELY wrong. • Care would then not take into account my 'being a man'. 'Parkinson's' is different for everyone, so all-encompassing care will/cannot suffice.

Supplement 9. Continued

Gender identity category	How would ‘gender sensitive care’ for people with Parkinson’s look like if we would design it completely wrong?
Women	• I expect that wrong medication will be prescribed and there will be many more complaints among women. • More self-neglect, informal care. • Maybe the way it is now? If it does matter it goes wrong (now). If it doesn't matter, it doesn't matter and nothing changes in health care providers. Caregivers probably work more randomly if they are not aware of possible gender influences. • Assuming that care for men with P also applies to women. Not taking into account differences such as hormone changes. No other advice to women in terms of lifestyle, medication, nutrition, in relation to being a woman. Offering male-oriented care to women and assuming that women react the same way to medication etc. Not listening to the specific complaints of the woman. "I don't have an answer" and not being referred for woman specific questions. • Not taking into account the difference between men and women This should not be static, it is not black and white. • Using stereotypes to e.g. approach women only empathetically, to educate men only cognitively. Caregivers know what is good for the patient - don't check in, don't consider grief, communicate from negativity "just enjoy the opportunities you still have". • Women not being "read" properly and therefore receiving less/no proper counselling. Perhaps an anti-neurology movement arises against levodopa or other medications making the "followers" worse off. The relationship "thinking for yourself" is punished -- not good. Women are not taught, actively thinking and feeling -- not good for them. Transition -- important. Changes not being included. • Not listening to the women or man affected, applying male research findings 1-1 to women, no understanding of hormones + Parkinson’s, no consideration of transition/child desire, no attention to female sexuality, treating emotions as female. • Working in health care from stereotypical thoughts. Not questioning complaints and symptoms. Sticking to a non-holistic attitude towards patients (leads to less stereotyping??). I myself was treated by 4 specialties but no one had a total overview except myself. As a result, I tried very hard to put complaints in a broader perspective. Medicine is too much divided into specialties, possibly a disadvantage for the Parkinson's patient -- a Parkinson's specialty. • I assume that this concern can never develop completely wrong. If it did that would be solvable through communication. Caregivers can also learn from others in consultation and conclude from that to work with new methods.

Supplement 9. Continued

Gender identity category	How would 'gender sensitive care' for people with Parkinson's look like if we would design it completely wrong?
Women (Continued)	• Assessing/questioning men and women the same way. Making assumptions. Not asking experts by experience. Not involving immediate family. Fixed / procedure-driven investigations (not being open to conflicting (gender) perceptions). Not listening. Subordinating. • Prescribing medication according to a fixed protocol starting too high instead of building up slowly. Generic explanation of illness with too few solutions about other treatment options. What health care providers do: stigmatize, trivialize, medicate too quickly. Do not: ask questions, be empathetic, present alternatives, emphasize the importance of exercise and daring to ask for help. Point. • Then they start filling in for you what would be good. I am no longer taken seriously and assumptions are made that are not helpful. For me then the right medication does not apply. They start being authoritarian and then I become recalcitrant and then I languish behind the geraniums. • Then women would not get the chance to develop their image regarding their illness. • Little/no attention to emotion: what does the diagnosis do to you, what does the disease do to you. Insensitive handling of input on patient complaints. Not seeing women as equal. Quickly naming complaints as nagging or exaggerated. Cooler approach to the patient.

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7

Chapter 7

Moving beyond gender identity: the need for contextualisation in gender-sensitive medical research

This chapter is based on the following publication:

Göttgens I, Oertelt-Prigione S. Moving beyond gender identity: the need for contextualization in gender-sensitive medical research. Lancet Reg Health Eur. 2022 Nov 25;24:100548. doi: 10.1016/j.lanepe.2022.100548. PMID: 36643661; PMCID: PMC9832263.

Moving beyond gender identity: the need for contextualization in gender-sensitive medical research.

Gender is progressively recognized as a relevant social determinant of health in the field of biomedicine. In fact, a growing number of funding agencies and medical journals are requesting sex- and gender-sensitive analyses in applications and submissions.[1] However, these mandates frequently lack methodological clarity about how sex or gender should be analysed in practice. Consequently, the biomedical field still heavily focuses on the impact of sex on health and disease, and gender is oftentimes operationalized as a somewhat fuzzy construct. Regardless of calls for the standardization of sex- and gender-related terminology there is currently no methodological gold standard.[2]

The operationalization of gender should aim at addressing its different dimensions. Research currently distinguishes between - at least - gender identity (e.g. being a woman, a man, non-binary), gender expression (i.e. how do I present my body and identity to the world) gender roles and norms (i.e. societal constructs that lead to shared ideas about what constitutes e.g. masculinity and femininity) and gender relations (the impact of gender on e.g. power dynamics in relationships). These dimensions explain the inherent challenge of representing a sociocultural construct such as gender within the biomedical context, where research mostly relies on quantitative methodology.

In recent years, operationalization in biomedicine has primarily focused on the inclusion of gender identity alongside biological sex assigned at birth in large cohort studies (two-step method), although some combined instruments are being developed.[3,4] The clinical utility of these novel approaches remains to be established. Even a multi-layered approach, disentangling the contribution of different gender dimensions towards quality of life[5,6] represent only a first step towards an appropriate operationalization of gender in biomedicine and its translation into clinical action. Indeed, many of the currently available questionnaires in the field of health[7] focus on abstract and culturally-primed variables related to gender, such as household task divisions, or traits related to 'masculinities and femininities'. The results identified with these questionnaires fall short of direct clinical actionability and oftentimes highlight the trickle-down effect of societal inequities on health.

Gender is one element in a complex adaptive social system and its immutable quantification across time and place might be potentially impossible. In fact, social interactions and relationships are not fixed and gender-related variables constantly evolve; 'what matters' emerges in a particular real-world situation. Clinical research, however, is mostly based on cause and effect modeling.[8] This positivistic and reductionist approach can hinder the identification of dynamic interactions and contextual gendered social practices that impact individual health. In complex systems, the question driving scientific inquiry should not be "what is the effect size and is it statistically significant once other variables have been controlled for?" but rather "does this intervention contribute, along with other factors, to the desirable outcome?".[9] This requires a methodology that includes in-depth, mixed-methods case studies that can act as concrete, context-dependent examples. It includes ethnographic narratives that focus on interconnectedness of multiple factors that come together as a whole from different perspectives.[10]

To avoid the reduction of gender sensitive research in clinical settings to the sole disaggregation of data based on gender identities, multimethod approaches in real-world social settings are needed. These approaches can enable the investigation of interrelationships between gender identities, contextual gender norms and roles and their impact on individual health, as well as their interaction with intersecting social factors such as age, sexual orientation, ethnicity, and socio-economic status. Rather than using gender identity as proxy for an intricate social process, a complexity-informed approach to gender will allow to focus on when, how and for whom gender becomes a relevant social factor that influences health outcomes.

A complexity-led approach to gender in biomedicine should focus on how people are 'doing gender' and when and how this impacts individual care needs. It starts with close reading of patients' narratives to understand how gendered aspects arise in individual experiences of illness (case studies) and through narrative reviews. It involves a deconstruction of gender into observable variables that become meaningful in a particular context; from individual mores, community customs, to institutional mechanisms where aspects of gender become conjunctively relevant as a determinant of health. It is based on emergent causality where multiple aspects of gender interact for a particular health outcome, but none can be argued to have a fixed 'effect size'. Incorporating complexity theory into the study of gender and health will not only contribute to a more nuanced understanding of the construct of gender but can also help to overcome the reproduction of ingrained preconceptions and stereotypes that stand in the way of equitable and personalized care for all.

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Part 3

Discussion and summary

Chapter 8

General discussion and future perspectives

This chapter addresses the methodological considerations and practical implications of the work presented in this thesis.

Key findings

Chapter 2 provides a rapid review of the impact of sex and gender on Parkinson's disease (PD). It emphasizes the need for multidisciplinary care and highlights examples where sex- and gender-related differences have been reported. The chapter also calls for a clear definition and operationalization of gender as a multidimensional construct in PD research. **Chapter 3** focused on the impact of different gender dimensions on the health-related quality of life (HRQoL) of people with PD. The study showed that gender identity did not significantly affect overall HRQoL, but an androgynous gender role and higher engagement in household tasks were associated with a better HRQoL. This highlights the importance of precise measures for distinct gender dimensions to inform targeted gender-sensitive interventions. In **Chapter 4**, a qualitative study explored how gender identity and associated social roles impacted the subjective illness experiences of people with PD. While most participants did not consider gender-related aspects highly salient, once probed, several stereotypical views were described related to visibility of PD, coping with emotional experiences, help-seeking behaviours, social role patterns, and physical appearances. Preferences for the gender identity of healthcare providers are also discussed, with participants expressing preferences for women providers which were related to the practice of attributed feminine traits during consultations and physical examinations.

Chapter 5 reviewed the use of human-centred design (HCD) methodologies in health innovation. HCD approaches prioritize patients' lived experiences and engage them in the research and design process. The chapter provides an overview of currently applied methodologies and HCD guidelines. Building on the HCD review, **Chapter 6** describes a novel design-based study that investigated the role of gender norms and stereotypes in the illness experiences of men and women with PD. The study found that gendered stereotypes, such as the perception of PD as an old men's disease, impacted both men's and women's individuals' experiences. Recommendations for gender-aware PD care focus on addressing restrictive gender norms and stereotypes in different life stages and patient-provider relationships.

Chapter 7 proposes the use of multimethod approaches, including qualitative, quantitative, and design-based methods, to investigate the multiple dimensions of gender in PD research. It suggests moving beyond solely relying on self-reported gender identity and instead exploring the interrelationships between gender identities, contextual gender norms and roles, and their impact on health outcomes. The chapter advocates for an ethnographic inquiry followed by hypothesis formulation and quantitative testing.

In summary, these chapters highlight the importance of considering gender as a multidimensional social construct in PD research. They emphasize the need for precise gender measures, contextual understanding of gender dimensions, and the use of multimethod approaches to capture nuanced insights into the impact of gender on health outcomes and illness experiences in PD.

Gender-sensitive PD research could further develop by focusing on how people are 'doing gender' and when and how this impacts individual health and care needs of people with PD. Integrating social theory in the study of gender in the field of PD is essential as it provides a framework for analysing how social structures related to gender shape health outcomes of people with PD, thereby contributing to more conceptual clarity, analytical consistency and comparability of gender sensitive PD research.

Methodological considerations and limitations

The work presented in this thesis provided new insights into the study of gender in PD research. I have used different study designs and methods to investigate the impact of gender in PD ranging from literature reviews, survey-based inquiries, individual in-depth and focus group interviews and design-based explorations. A multiphase investigation with different methods is a useful way to obtain different but complementary data on the same topic. However, there are several methodological considerations and limitations that should be considered when interpreting the findings of this thesis.

External validity of the findings

As gender-related aspects are based on social processes, some of the findings could be generalizable to other patient populations with (and without) chronic neurological condition, such as (self-)stereotyping behaviours that affect coping with emotional experiences and help seeking behaviours. Previous studies have suggested that, in general, men who adhere to traditional masculine norms related to 'toughness' are more likely to discourage themselves for help-seeking when emotionally distressed through self-stereotyping.[1,2] Some of the women who participated in the studies presented in this thesis experienced that performing certain feminine gender roles related to 'household and caring tasks' and 'social organizing' could mask their difficulties with PD related symptoms observed by others, including healthcare professionals, and can contribute to feelings of invisibility and not being taken seriously when communicating experienced difficulties with PD. These examples might be illustrative of general forms of benevolent sexism that rewards men and women for the performance of 'positive' stereotypical gender roles while undermining their capacity to effectively assert agency over their own health.[3]

While these findings can be viewed as general reflections of the impact of social gender norms in illness experiences, they are also reflections of the impact of disease specific symptom presentations that highlight particular gender norms in illness experiences of people with PD. For example, masculine norms related to 'toughness' are potentially stronger social regulators for some men when their physical functioning is increasingly impaired by the progression of PD. Also, a contributor to the feeling of invisibility among women with PD was related to the disease specific stereotype of 'people with PD are old men'. These examples illustrate that while the impact of gender roles and norms on illness experiences are reflections of broader societal social structures, particular gender norms and roles can become highlighted in illness experiences by disease-specific disabilities and stereotypes. This interpretation would limit the generalizability of some findings to other chronic neurological conditions yet should encourage the replication of these studies among different patient populations.

Furthermore, the samples included in the studies were relatively homogeneous, with men and women with PD from exclusively Dutch descent, in heterosexual relationships and with an average age of 66 years. Therefore, the findings from these studies cannot be generalized to populations with different generational and cultural backgrounds. Distinguishing between people with PD with different sociocultural and generational backgrounds and sexual orientations is tremendously important given the contextual experiences of gender-related performances in various domains such as family, social and work life and during medical encounters.[4,5]

Studying gender in medicine with different study designs

This thesis employed a triangulation of study designs to explore the role of gender and its situated performances in illness experiences of people with PD. In this section, I discuss the use of these study designs and considerations for the operationalization of gender dimensions.

Quantitative study design

For the survey study described in **Chapter 3**, a literature review was performed to identify state-of-the-art options for operationalizing the gender dimensions: gender identity, gender roles and gender relations. The inclusion of multiple gender dimensions allows an analysis in which the identity categories of 'women', 'men' and 'gender-diverse people' can be considered as heterogeneous categories with within-groups differences. However, using existing questionnaires or variables to operationalize, for example, gender roles means that what is considered 'masculine' or 'feminine' is predefined. In Chapter 3 I included the Bem Sex Role Inventory (BSRI), which is currently still the most widely used measure for gender roles. However, the BSRI was validated in 1974 among U.S. students from a private University.[6] As cultural ideas about gender evolve over time due to generational differences in views and attitudes towards gender, it is important that these measures are critically screened for fit across content, context, culture and contemporality.

Additionally, using existing gender measures regarding roles and norms risks reproducing stereotypical views and undesirable biases related to gender. It requires a conscious effort on the part of the researchers to avoid essentialist conclusions that perpetuate these stereotypes and reinforce stigmatization of participants who do not conform to traditional gender roles. Employing a multidimensional approach to gender acknowledges the complex and diverse nature of gender and helps to contextualize research findings by enabling analyses for both between group and within group similarities and differences. For this purpose, integrating social theory in analysis on how gender is situationally performed and using inclusive language in scientific writing is essential. Integrating social theory grounds gender-related findings in a solid foundation of knowledge about 'gender as a performative act' and supports consistent reasoning by being more explicit about the underlying principles, concepts and assumptions that guide the interpretation of research results. Inclusive language recognizes individuals as human beings first rather defining them by characteristics or traits (e.g. "women who endorse traditional feminine traits" in instead of "feminine women" or "people with Parkinson's disease" instead of "Parkinson's patients").[7] Inclusive language is more precise and informative, conveys respect, dignity and empathy towards research participants, and is a powerful way to avoid the reproduction of stereotypes and promote equity in scholarly communications. This is also particularly relevant for bias mitigation in the increasing use and development of artificial intelligence and machine learning in medicine that is modelled on word embeddings in available medical scientific publications.[8,9]

Additionally, in **Chapter 3**, I performed a backwards regression analysis to deconstruct the masculinity and femininity scores of the participants to investigate which gendered characteristics were specifically contributing to better HRQoL of people with PD. Results of this backwards regression showed that 'de-gendered' characteristics such as 'Athletic', 'Assertive', 'Self-sufficient' and 'Happy' were specific contributors to better overall HRQoL. These characteristics could potentially be used as more direct predictors of HRQoL rather than as components of a specific gender role. This raises questions about the usefulness of the construct's 'masculinity' and 'femininity' in medical research, operationalized as a set of psychological characteristics. However, while the singular underlying characteristics that are associated with masculinity and femininity can be useful to understand the direct relation between specific psychological traits and health outcomes regardless of gender, they do not capture the complex ways in which gender roles operate in society at large and shape people's social positions and experiences. In other words, when we deconstruct the constructs of 'masculinity' and 'femininity' into their singular underlying components, we are no longer examining masculine or feminine gender roles because those concepts are then stripped of their combined cultural meaning. An appropriate measure for gender roles should reflect contextual societal norms and expectations about gender roles and informs research *whether* these constructs as social positions and experiences influences health outcomes.

The reality is that very few quantitative analyses of the impact of gender norms and roles on health outcomes are available because direct measures of gender norms are absent in standard survey data.[10] However, several studies have showed that the impact of gender norms on health outcomes can be assessed by creating proxy measures for norms in existing data, for example Ballering et al (2020).[11,12] It is important to emphasize that a central premise of gender-sensitive research in medicine is to focus on gendered social positions and experiences rather than on decontextualized 'risky' identities or behaviours, and to analyse *if, when* and *how* these gendered identities, roles and relations as social positions and experiences become contextual risk factors for health.

Qualitative study design

In **Chapter 4** I used a qualitative approach to unravel *when* and *how* gender identities, roles and relations become relevant in illness experiences and care preferences of people with PD. This study posed challenges about how to investigate 'doing gender' in interview studies because the interview setting is an occasion in which both the interviewer and the interviewee actively and primarily engage in a process of meaning making *about* the concept of 'doing gender' rather than observing the actual performances in real-world settings. A previous review on 'doing gender' reported that numerous studies cite the use of the concept, yet, the vast majority did so in ways that did not reflect the concept's intellectual roots in ethnomethodology and the study of social practices.[13] The authors argue that interviews are less appropriate for accessing the situated practices that characterizes the 'doing of gender' because they provide little information about what people actually do in interaction with others and the routine ways in which gender is accomplished. Nentwhich et al (2013) state that: "*if gender is not seen as a fixed category that can be defined prior to the research conducted, the actual practices of constructing or performing that identity must be analysed. Instead of taken women and men at face value, researchers must be careful not to reify everyday taken for granted assumptions about gender but to critically investigate how they actually come into being.*"[14] From this theoretical perspective, being a 'man' or a 'woman' is the outcome of a social process rather than the starting point and I acknowledge that by making participants' gender identity explicit in the interviews as a starting point for the investigation does not reflect the intellectual roots of the original concept of 'doing gender'.

However, Nentwhich et al. also argued that theoretical concepts are never only informed by static theory but also shaped by their practical application in empirical research.[14] In studying 'doing gender' it has become equally important to understand people's own evaluation of 'doing gender' as a personal practice, besides investigating its social structural foundation; to investigate what counts as 'masculine' or 'feminine' and in which circumstances it is accentuated for individuals in their daily lives. Because one cannot assume e.g. that what is considered 'feminine' in society at large, will also be defined as 'feminine' in a personal and/or disease related context. The results of **Chapter 4** showed that most participants did not evaluate gender as strongly salient towards their illness experiences. However, when prompted, several participants described stereotypical views about gender as related to the visibility of PD, coping with emotional experiences, help seeking behaviours, social role patterns and physical appearances. Future research could, for example, further unravel the social structures behind these stereotypical views, whether there are subgroups of men or women for whom these are more of less impactful in coping with PD and under which circumstances they might affect access to PD care. Based on the typology of 'doing gender' developed by Nentwhich, studying 'doing gender' in a medical context can focus on several themes.[14] An adapted overview of guiding questions for gender-sensitive medical research using qualitative designs is presented in Table 1.

Design-based study design

In **Chapter 6** I used a design-based approach to further investigate the impact of gender norms and stereotypes on illness experiences of men and women with PD and to co-develop focal points of gender-sensitive PD care from patients' perspectives. As described in **Chapter 5**, design-based research approaches centre implementation as an outcome and allows researchers to create and test interventions in real-world settings while simultaneously collecting and analysing multimethod data in a rigorous and systematic manner. In social medical studies, such as gender medicine studies, they are particularly useful because they allow researchers to address and explore complex sociocultural factors that influence health by actively engaging target populations throughout the design process. The participatory approach facilitates a better understanding regarding the perspectives, needs and experiences of people with different gender identities who are affected by PD or other health conditions. Furthermore, it helps to build trust and facilitate the uptake and implementation of interventions in real-world settings. Design-based research approaches are also well-suited to address issues of equity and inequality by explicitly considering the needs and experiences of marginalized or underrepresented groups. Although the study in **Chapter 6** only included the first 'understanding' and 'ideation' cycles of the design process, future studies can build on these outcomes for the development of targeted gender-sensitive interventions of PD care.

Table 1. Modified from Nentwhich et al (2013) Typology for the study of 'doing gender' with adapted guiding questions for medical and PD research.

Relevant themes for 'doing gender' in medical research	**Exemplar questions for research design and analysis**
Structures	Why is it that we define certain health(care) related roles or behaviours as gendered/masculine/feminine? What kinds of social structures (e.g. attitudes, roles, norms, positions, or policies) can we identify in medical data and health research that legitimize a phenomenon as being gendered? How does this affect health outcomes in patient populations or patient-physician encounters? In what ways do (implicit) gendered norms and expectations impact the development and implementation of treatments policies?
Hierarchies	How are masculinities and femininities respectively made relevant in health related or medical settings? How are differences between gender identities and masculine and feminine gender norms created in a hierarchical way in healthcare or medical settings? How do gender norms impact the utilisation of non-pharmacological interventions for PD, such as exercise and physical therapy?
Identity	How is the gender identity of patients or healthcare professionals made relevant in research data? How does this differ across different medical contexts? How do gendered social roles and activities influence the quality of life of men, women, and gender diverse people with PD? How do gender identity-based expectations and stereotypes around disability and illness impact experiences of people with PD?
Flexible and context specific	What is the specific understanding of gender/masculinity/femininity in illness experiences of patients? How does this differ across other context in the health and medical field? How do gender norms and stereotypes related to caregiving roles influence the informal care management of people with PD? How do these effects differ between the gender identities of the caregiver and care recipient?
Gradually relevant and subverted	How are gender differences emphasized, downplayed, or subverted in health related or medical settings? In what ways are gender norms or stereotypes utilised in patient-provider interactions? How do gendered expectations or biases of healthcare providers influence treatment decision making for Parkinson's in women versus men? How do (sexed or) gendered assumptions about Parkinson's disease influence the design and implementation of medical studies and how does this impact our understanding of the disease?

A recent study highlighted the importance of adding more gender awareness in design-based studies in healthcare.[15] The author argued that there is a lack of understanding and awareness of gender in design research and how gender norms and stereotypes can impact the development, use and perception of products, systems and services that are designed with these methodologies. Particularly in the design of health interventions, culturally established gender norms can either be reproduced or deconstructed. A recent systematic review on *'disrupting gender norms in health systems'* emphasized the need to systematically identify and address restrictive gender norms that lead to gender inequalities in health systems.[16] Only four of the 76 included studies used a clinic-based gender transformative approach that effectively challenged and addressed restrictive gender norms and showed significant health impact.[17] These interventions were primarily focused on the empowerment of women and girls. This review reported that, due to the historical legacy of gender-based inequalities, the health consequences fall most heavily on women, especially poor women. However, restrictive gender norms and stereotypes undermine the health and wellbeing of women, men *and* gender minorities and effective promotion of gender equality in health required the engagement of actors of all gender identities.[10]

Moreover, the review concluded that the data did not support a particular gender transformative intervention as a 'silver bullet' that will work in all contexts. Gender norms and inequalities are highly contextual and rather than seeking to make gendered interventions universally generalizable, design researchers should recognize the value of their contextual nature and identify program elements that could work alone or in combination, depending on the context and intended health outcomes. Stewart et al. (2020) identified effective strategies to challenge and address gendered norms and stereotypes in the design of health interventions, such as increasing knowledge of gendered norms and stereotypes, addressing multiple dimensions of gender during the design process, co-designing interventions with participants of the target population and cultivating agents of change and role models.[18]

Implications for future research

An intersectional gender approach

While it is already a challenging endeavour to capture the full range of gender-related variables that may be relevant to health outcomes and illness experiences of people with PD, gender dimensions are additionally informed by other intersecting social identities, such as ethnicity, sexual orientation, and socio-economic status. From this perspective, social categories of ‘women’ and ‘men’ are not considered homogeneous, mutually exclusive, and collectively exhaustive groups and there can be large within-group variations, depending on the research context. This intersectional nature of social identities can further complicate efforts to operationalize gender in (bio)medical research because intersectionality can create unique health risks and disparities that may not be apparent if gender dimensions are analysed in isolation. However complex, an intersectional gender approach in (bio)medicine can help to better understand how different social identities and associated normative practices intersect to create unique personal experiences of health and disease. An intersectional gender approach takes gender identity as an entry point for a more complex analysis that recognizes the interconnectedness of these multiple social identities and includes a critical lens towards the ways how power hierarchies operate at the individual, institutional and societal levels. The recognition of power dynamics in this approach is essential to understand how health disparities develop and affect different populations and to avoid the treatment of social identities themselves as being inherently ‘risky’ rather than as proxies for social positions and experiences.

For example, a recent study across US Parkinson’s Disease Centres of Excellence found that African American and Hispanic patients with PD seem to be at increased risk of cognitive impairment, reported a lower quality of life and were less likely to be prescribed anti-depressant medications compared to White non-Hispanic patients.[19] This study emphasized the need for additional research to better understand reasons for treatment and outcome differences in underrepresented populations. An intersectional gender approach could further investigate how the intersection of ethnicity with gender affect access to healthcare, disease management and quality of life between and within different populations of people with PD.

West and Fenstermaker (1995) extended their methodological perspective from ‘doing gender’ to ‘doing difference’ to expand their understanding of how gender, ethnicity and class operate simultaneously with one another.[20] They defined this process as “*relations between people and institutional practices that create and maintain social hierarchies and power relations*”. By using a critical lens towards gender, ethnicity and class-based power relations in intersectional gender research, historical and systemic factors such as undesirable discrimination and biases can be explored. These efforts are important when we aim to prioritize cultural competence in PD researcher and care providers by understanding how social inequalities are produced and reproduced and how they affect health outcomes of people with PD. More precise and nuanced investigations into the role of intersectional gender on health and health outcomes as part of gender equity initiatives is not only a matter of social justice and rights. It is crucial for producing high quality research and providing effective care to patients. Some exemplar research questions for intersectional gender studies in PD with different methodological approaches are presented in Figure 1.

Implication for medical education, clinical practice, and policy makers

To study gender in medicine is to become curious about what is generally considered as 'normal' and 'normative' in 'doing gender' and to become aware of and question its underlying assumptions. This requires the development of cultural competence among healthcare professionals, researchers, and policy makers to cultivate sensitivity towards the social structures that shape people's lived experiences and that can become harmful towards their health. Initially, this means building awareness of the social and demographic structures that shape the perspectives of healthcare professionals, researchers, and policy makers themselves; the lenses through which we analyse our daily observations. Lenses through which we evaluate others in their 'similarities' and 'differences' compared to our own experiences and, hence, the perspective and attitudes we might, (un)consciously, be biased towards.

Cognitive biases and heuristics, which include learned ideas about gender and gendered expectations, are shortcuts that allow us to interact meaningfully with other people without having to exhaust our insufficient attention resources.[21] Information about gender has perceptual primacy in the way we frame and see the world, and this cognitive social categorization process is an inevitable part of our perceptual experience.[21,22] First, recognizing that social categorization is something human beings do is a first step to engage in a process of uncovering 'doing gender' as normative performances in personal and professional practices. Second, acknowledging that these cognitive heuristics and biases inform medical and health-related decision making encourages the training of healthcare professionals and medical students in reflective reasoning. Reflective reasoning can counteract the impact of undesirable biases of healthcare professionals themselves and helps to flags harmful (self)stereotyping behaviours in patients and constraining social roles and positions during medical consultations.[23] This gender awareness is a prerequisite for the integration of gender sensitivity in medicine.[24] It holds a promise for gender transformative care practices that go beyond acknowledging similarities and differences between men and women in specific disease populations, and aims to actively challenge and transform gender norms and stereotypes that can lead to inequitable treatment and health outcomes of people, with and without, PD.

Lastly, I contextualize a remarks of West and Zimmerman (1987) that is it important for gender-sensitive researchers and practitioners in the field of (bio)medicine to recognize that the analytical distinction between institutional and interpersonal spheres does not pose an either/or choice when it comes to the question of effective gender-sensitive or even gender-transformative interventions in medicine.[25] Reconceptualizing gender in medicine is not simply a responsibility of individuals, whether researchers, patients, healthcare professionals or policy makers, but as an integral part of a dynamic sociocultural order it implies new perspectives on the entire network of gender relations in healthcare and medicine; how people act and interact on the basis of sex categories, how this is produced and reproduced in social situations related to health and medicine and which social control mechanisms or institutional policies sustain it.

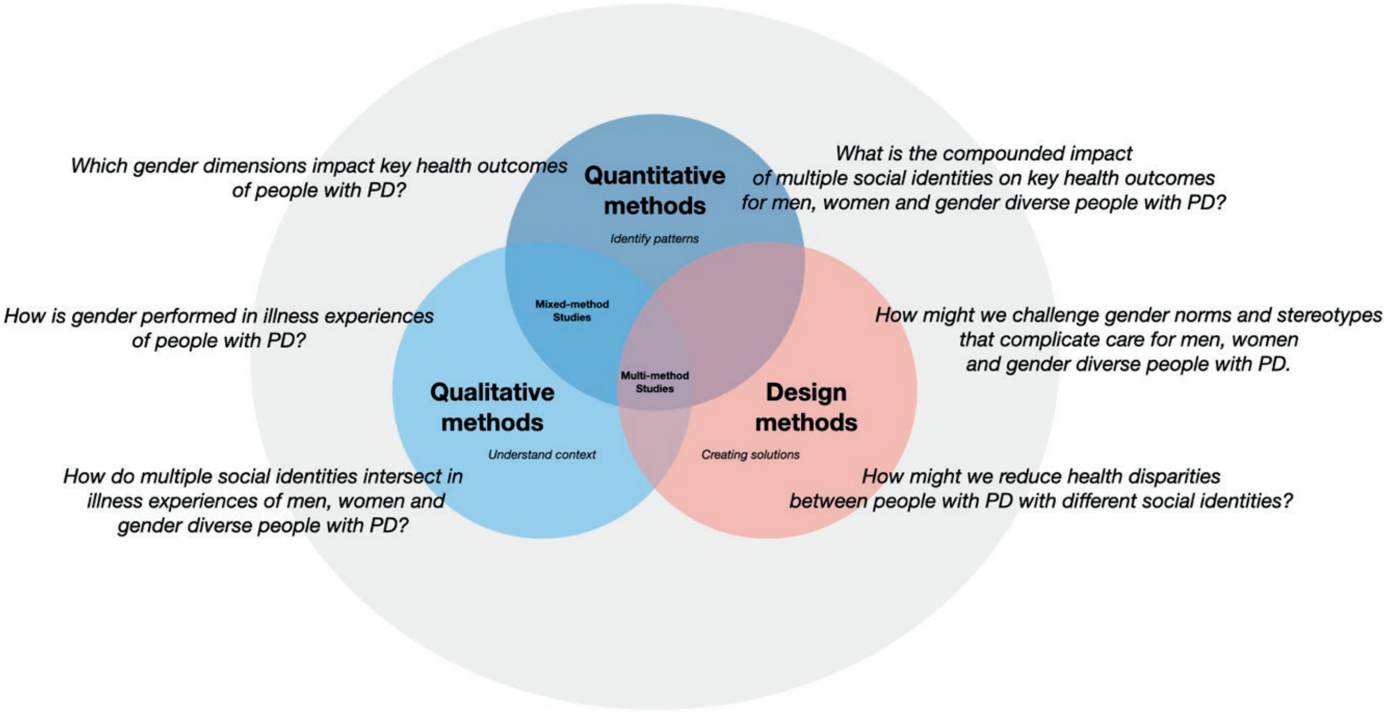

Figure 1. Illustrative questions for intersectional gender in PD research using different methodological approaches.

Conclusion

In this chapter, I have highlighted the importance of deconstructing the concept 'gender' into several dimensions to study its impact on health outcomes and illness experiences of people with PD more accurately and to investigate how people are 'doing gender' rather than approaching gender as a unidimensional and static variable in medical research. In general, gender norms and stereotypes associated with gender identities appear to affect illness experiences and health related quality of life of people with PD more strongly than solely their gender identity. Gender norms and stereotypes can become salient in illness experiences due to disease related symptoms such as loss of physical strength and postural stability, changes in physical appearances and increased emotionality and their associations with masculinities and femininities. These motor and non-motor symptoms and their associations with masculinities and femininities are not necessarily limited to people with PD and further research is encouraged to investigate the impact of disease specific symptoms, their associations with contextual gender norms and relations that might complicate care for people with and without PD.

Employing multiple methodological approaches allows for a better understanding of the complex ways in which gender dimensions influence health outcomes and illness experiences, and I have provided my perspective on how the main findings of this thesis may fit into the larger context of gender studies and person-centred care. I expect that, in the coming years, the study of gender in medicine and in different patient populations will continue to increase, which will facilitate the unravelling of the contextual relevance of gender-related aspects and its intersection with other social factors in relation to health and health outcomes. Consequently, these studies will accelerate the development of contextual care practices for patient population in general, and people with PD in particular, and the training of cultural competence in healthcare providers. Furthermore, they will enable the development of more targeted interventions that challenge intersectional gender norms and stereotypes that contribute to health inequalities between people with different gender identities. Ultimately, such interventions should aim to improve health outcomes and reduce health disparities by recognizing and addressing the impact of intersectional gender dimensions, in conjunction with and separate from, sex characteristics on health and disease.

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9

Chapter 9

Summary (English)

Summary (English)

Context, rationale, and overall approach

In **Chapter 1**, I outline the context of the research included in this thesis, address the knowledge gaps in the investigation of gender in medical research and in Parkinson's Disease (PD) in particular, and present a multimethod approach to address these gaps. Overall, the aim of this thesis was to explore the impact of gender and its multiple dimensions in the context of PD.

Understanding the impact of gender on health outcomes and illness experiences

In **Chapter 2**, I provided a rapid overview of the current knowledge base regarding the impact of sex and gender on the management of care for people with PD. In **Chapter 3**, I quantitatively assessed the impact of multiple gender dimensions on health-related quality of life among people with PD. And in **Chapter 4,** I explored the subjective impact of gender dimensions on the illness experiences of people with PD using a qualitative approach.

Advancing the study of gender in medical research

In **Chapter 5**, I explored how multi-method human centred design approaches are used in health research and innovation, and I integrated these findings into a novel design-based study (**Chapter 6**). In this study, I explored patients' perspectives on the impact of gender norms and stereotypes in PD illness experiences and co-created focal points for gender-sensitive PD care. Based on the insights gained from these studies, I emphasized in **Chapter 7** the need for contextualisation of gender in medical research.

Integration of the key findings

In **Chapter 8**, I discussed the main findings of this thesis and the methodological considerations for the study of gender in PD research and in a broader medical research context. Implications for future research, medical education and clinical practice were addressed as well.

Key Points

- Conceptual clarity and critical usage of the terms ‘sex’ and ‘gender’ is needed in PD research (and other medical domains) to make research findings more actionable, comparable, and replicable. (**Chapter 1**)
- Addressing multiple dimensions of gender in PD research is important to understand their singular and interactional effect on key health outcomes. (**Chapter 2**)
- Distinct gender dimensions can impact health-related quality of life differently among people with PD. (**Chapter 3**)
- Although every person has a gender identity, the relevance people with PD attribute to gender in their illness experiences varies. Descriptive norms and stereotypes related to gender identity appear to be more relevant. (**Chapter 4**)
- The influence of social gender norms and stereotypes in illness experiences can be exacerbated by disease specific impairments, such as social expectations regarding physical appearances in women and physical strength in men. (**Chapter 6**)
- Gender identities are often used as proxies for biological sex characteristics in medical research, rather than as constructs that requires in-depth and contextual investigations grounded in social theory. (**Chapter 7**)
- It is important for gender sensitive PD research to include social theory to further study the impact of ‘doing gender’. This will advance the study of gender in PD beyond the sole disaggregation of data based on gender identities. (**Chapter 8**)

10

Chapter 10

Dutch Summary | Nederlandse samenvatting

Dutch Summary | Nederlandse samenvatting

Context, motivatie en algemene aanpak

In **hoofdstuk 1** schetste ik de context van het onderzoek in dit proefschrift, ging ik in op de hiaten in de kennis over gender in medisch onderzoek en bij de ziekte van Parkinson (ZvP) in het bijzonder, en presenteerde ik een stapsgewijze methodologische benadering om deze kennis hiaten aan te pakken. Het hoofddoel van dit proefschrift is het onderzoeken van de impact van gender en de verschillende dimensies ervan in de context van de ZvP.

Inzicht in de invloed van gender op gezondheidsuitkomsten en ziekte-ervaringen

In **hoofdstuk 2** gaf ik een beknopt overzicht van de huidige kennisbasis met betrekking tot de impact van sekse en gender op de zorg voor mensen met de ZvP. In **hoofdstuk 3** heb ik de impact van meerdere genderdimensies op gezondheid gerelateerde kwaliteit van leven bij mensen met de ZvP kwantitatief bestudeerd. En in **hoofdstuk 4** heb ik vervolgens de subjectieve impact van genderdimensies op de ziekte-ervaringen van mensen met de ZvP onderzocht met behulp van een kwalitatieve benadering.

De studie van gender in medisch onderzoek bevorderen

In **hoofdstuk 5** onderzocht ik hoe human-centered design benaderingen worden gebruikt in gezondheidsonderzoek en innovatie en integreerde ik deze bevindingen in een originele design-based studie (**hoofdstuk 6**). In deze studie onderzocht ik de perspectieven van patiënten op de impact van gendernormen en -stereotypen in PD-ziekte-ervaringen en co-creëerde we aandachtspunten voor gender sensitieve PD-zorg. Op basis van de inzichten uit deze studies benadrukte ik in **hoofdstuk 7** de noodzaak van contextualiseren van gender in medisch onderzoek.

Integratie van de belangrijkste bevindingen

In **hoofdstuk 8** besprak ik de belangrijkste bevindingen van dit proefschrift en de methodologische overwegingen voor de studie van gender in PD-onderzoek, en in een algemene medische onderzoek context. Implicaties voor toekomstig onderzoek, medisch onderwijs en klinische praktijk kwamen aan bod.

Kernpunten

- Conceptuele helderheid en kritisch gebruik van de termen “sekse”, “geslacht” en “gender” zijn nodig in Parkinson onderzoek om onderzoeksresultaten beter vergelijkbaar en reproduceerbaar te maken. (**Hoofdstuk 1**)
- Het integreren van meerdere dimensies van gender in Parkinson onderzoek is belangrijk hun afzonderlijke en interactieve effect op belangrijke gezondheidsuitkomsten beter te begrijpen. (**Hoofdstuk 2**)
- Verschillende gender dimensies kunnen een verschillend effect hebben op de kwaliteit van leven bij mensen met de ZvP. (**Hoofdstuk 3**)
- Hoewel ieder mens een genderidentiteit heeft, verschilt het belang dat mensen met de ZvP aan hun gender identiteit toekennen in hun ziekte-ervaringen. Sociale gendernormen en stereotypen met betrekking tot genderidentiteit lijken relevanter te zijn. (**Hoofdstuk 4**)
- De invloed van sociale gendernormen en stereotypen in ziekte-ervaringen kan worden versterkt door ziekte specifieke beperkingen, zoals sociale verwachtingen ten aanzien van fysieke verschijning bij vrouwen en fysieke kracht bij mannen. (**Hoofdstuk 6**)
- Genderidentiteiten worden in medisch onderzoek vaak gebruikt als proxy voor biologische geslachtskenmerken, in plaats van als constructen die contextueel onderzoek vereisen dat is gebaseerd op sociale theorie. (**Hoofdstuk 7**)
- Het is belangrijk voor gender sensitief Parkinson onderzoek om sociale theorie te integreren om de impact van genderdimensies verder te bestuderen. Dit zal de studie van gender in Parkinson onderzoek verder brengen dan het louter het uitsplitsen van onderzoeksgegevens op basis van gender-identiteiten. (**Hoofdstuk 8**)

Addendum

Addendum 1

Research Data Management

Research Data Management

Ethics and privacy

This thesis is based on the results of medical-scientific research with human participants. The studies described in Chapter 3, 4 and 6 were not subject to the Medical Research Involving Human Subjects Acts (WMO). The medical ethical review committee 'METC Oost-Nederland' reviewed the study protocols (file numbers: 2019–5618, 2020-6643, 2022-15954). Informed consent was obtained from research participants prior to inclusion in the studies. Technical and organization measures were followed to safeguard the availability and confidentiality of the data, such as the use of secure data storage, access authorization and pseudonymization of the data.

Data collection and storage

The data for Chapter 3, 4 and 6 was collected through electronic surveys using CASTOR EDC, audio interviews and participatory design sessions. The pseudoanonymized survey data was exported from CASTOR EDC to a secure server of the Radboudumc department and were only accessible by members of the research team working at the Radboudumc. Survey data was analysed using R.Studio. Interview data was audio recorded and professionally transcribed verbatim and anonymously. Qualitative and design data was stored on a secure server of the Radboudumc and were only accessible by members of the research team. Qualitative and design data was analysed using Atlas.ti. Hardcopies of informed consent forms are archived at the department.

Availability of the data

All studies in this thesis are published open access. The data will be archived for 10 years after termination of the study. Reusing pseudonymized survey data for future research can be made available upon request under restricted access. Interview data is only accessible for reuse after renewed permission by the participants.


A

Addendum 2

List of Publications

Articles published in this thesis

Göttgens I, van Halteren AD, de Vries NM, Meinders MJ, Ben-Shlomo Y, Bloem BR, Darweesh SKL, Oertelt-Prigione S. The Impact of Sex and Gender on the Multidisciplinary Management of Care for Persons With Parkinson's Disease. Front Neurol. 2020 Sep 18;11:576121. doi: 10.3389/fneur.2020.576121. PMID: 33071952; PMCID: PMC7530641.

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Addendum 3

Acknowledgement

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Addendum 4

About the author

About the author

Irene Göttgens was born in Nijmegen, the Netherlands, on November 6, 1986. After obtaining her propaedeutic in Applied Psychology in Tilburg in 2005, she moved to Amsterdam to study Health Sciences at the Free University (VU) Amsterdam. During her studies she participated in multiple extracurricular activities, including the Health Sciences VU Study Association board. She was a board member of Enactus-VU and later a board member of Enactus the Netherlands alumni association. She spent multiple summers as part of the Humans of Health trainer team, which facilitated the educational program for the Healthcare Leadership Summer school. She conducted her master research thesis on 'leadership skills of surgical residents in the operating room' at the VU Medical Centre in Amsterdam and received her master's degree in 2012. From 2013 to 2018 she worked as a consultant and project coordinator for several health innovation initiatives at the Radboud University Medical Centre in Nijmegen. In 2019 she started her career as a scientific researcher and started her PhD project in 2020 under the supervision of prof. dr. Sabine Oertelt-Prigione, prof. dr. Bas Bloem and dr. Sirwan Darweesh, resulting in this thesis.

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