COMMENTARY

Patient-Generated Data as Indicators of Impact of Multidisciplinary and Multi-stakeholder Health Care Systems, in the Age of Personalised Medicine

Paola Zaratin · Per Soelberg Sørensen · Óscar Fernández · Giancarlo Comi

ABSTRACT

Using the case study of the Multiple Sclerosis Care Unit Initiative launched by the European Charcot Foundation, we discuss the need to evaluate the impact of multidisciplinary and multi-stakeholder healthcare systems on patient-reported experience and outcomes for the programming and monitoring of brain and neurodegenerative diseases in Europe and beyond. The multiple sclerosis (MS) case study presented in this paper highlights the role of patient-generated data as indicators of the impact of value-based healthcare (VBHC) for all the different neurological diseases whose prodromal symptoms are the first signs of disease progression and therefore instrumental markers for preventive treatments to preserve brain health. A holistic approach to the treatment of MS plays a crucial role in the inclusion and scientific meaning of the patient's perspective in terms of patient-reported dimension and patient-generated health data (PGHD).

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P. Zaratin (✉)
Scientific Research Department, Italian Multiple Sclerosis Society Foundation, Genoa, Italy
e-mail: paola.zaratin@aism.it

P. Soelberg Sørensen
Danish Multiple Sclerosis Center, Department Of Neurology, Copenhagen University Hospital, Rigshospitalet, Copenhagen, Denmark

P. Soelberg Sørensen
Department Of Clinical Medicine, Faculty Of Health And Medical Science, University Of Copenhagen, Copenhagen, Denmark

Ó. Fernández
Department Of Pharmacology And Pediatry, Faculty Of Medicine, University Of Malaga And Biomedical Research Institute Of Malaga (Ibima), Malaga, Spain

G. Comi
Department of Neurorehabilitation Sciences, Casa di Cura Igea, Milan, Italy

G. Comi
University Vita-Salute San Raffaele, Milan, Italy

△ Adis

Key Summary Points

Background

There is a growing need to advance healthcare in treating brain disorders like multiple sclerosis (MS), because of their high economical and societal impacts on costs and services globally. A tangible solution is to adopt multidisciplinary, multi-stakeholder and mission-oriented organisational models capable of providing optimised care services to prevent the onset and exacerbation of brain diseases. The European Union funded H2020 MULTI-ACT project aims to drive medical research on neurological disorders towards predictive, preventive and personalised medicine by adopting a multi-dimensional impact model and by giving relevance to science "with" and "of" patient input through patient-generated health data (PGHD: patient-reported outcomes measures, patient-reported experience measures and patient preference information).

Aim

The patient perspective, via PGHD, is instrumental in promoting early diagnosis, prevention and treating progression and care of MS, and represents the basis of a renewed concept of value of humanism to healthcare. To this purpose, we present three case studies that aim to help meeting the challenge.

Case studies

The Multiple Sclerosis Care Unit Initiative is using the MULTI-ACT model to set gold standard indicators in the treatment of people with MS. A recent global survey among already identified MS care units has been undertaken to set the current state of the art of MS care and PGHD accessibility worldwide. This has paved the way for the EU-funded MUSICALISE project, which supports a sustainable concept of care and a personalized approach built upon benefits and meaningful impacts for all the stakeholders. At the global level, the global Patient-Reported Outcomes for MS Initiative (PROMS) is a multi-stakeholder and multi-disciplinary initiative, which, since 2019, has involved stakeholders from the different facets of neurology, also including people with MS in a deputy representative body, by a participatory governance to foster the strategic and scientific direction of research to make patient-reported outcomes for MS scientifically meaningful.

INTRODUCTION

The increasing prevalence of chronic brain and neurodegenerative diseases and the rapid aging of the population [1, 2] pose unprecedented challenges to health systems worldwide. It is increasingly recognized that optimal care can no longer involve just responding to problems but also adopting a proactive approach aimed at identifying early warning signs that could anticipate the progression of more debilitating (and costly) problems [3]. To provide better healthcare services able to meet this challenge, sustainable and outcome-oriented health research and care systems must be redesigned by leveraging new mission-driven, multi-stakeholder and multidisciplinary organizational models that ensure a long-term social and economic

return on investment [4]. The crucial levers to accelerate this transformation are the promotion of health "with" and "of" patient (and citizen) input from research to care. Most of the healthcare models proposed for chronic diseases that announce a patient-centred approach do not measure their impact on patients' experience and outcomes. The active involvement of the patient with a chronic condition affecting a variable proportion of the life is not only an obvious social need, but it may also bring a very important scientific contribution in unmasking symptoms as markers for preserving brain health strategy [5]. There is an increasing demand for a shift towards predictive, preventive and personalised medicine [6, 7], and enabling science "with" and "of" patient input can play a vital role in achieving this. Our definition of this new science comes from the Responsible Research Innovation European Horizon 2020-funded MULTI-ACT project [8], and integrating this new science in multidisciplinary healthcare systems is considered strategic for the future European Brain research and care agenda [9]. The power of science with patient input relies on an innovative framework for engaging patients while the science of patient input is founded on patient-generated health data (PGHD) [4, 10]. The innovative concept of PGHD includes three main dimensions: patient-reported outcome measures (PROMs), i.e. their perception of their health experience while living with disease; patient-reported experience measures (PREMs), i.e. their perception of their experience during treatment/while receiving care; and patient preference information (PPI), i.e. their preferences and acceptability for innovative health interventions, including digital devices for data collected via passive monitoring. Therefore, capturing the experiences and preferences of people living with the disease, also through active and passive digital monitoring systems, and making it scientifically meaningful by and for the other stakeholders, will enable the holistic approach needed to develop preventive, predictive toward brain health [11] and personalized treatments for neurodegenerative diseases.

THE CASE STUDY OF MULTIPLE SCLEROSIS CARE UNIT

Multiple sclerosis (MS) is a chronic lifelong neurological disease that begins in young adulthood with diverse symptoms and variable evolution, affecting 2.8 million people worldwide. MS care involves a complex blend of health and social care and expertise. Consequently, it necessitates a high degree of coordination to guarantee continuity of care and to fulfil specific, and always evolving, patients' needs as much as possible. In this context, the development of MS Care Units (MSCUs) which gathers a multidisciplinary team of MS-experts in a single place, has progressively emerged, with the aim of providing seamless, efficient and personalized care to people with MS. In 2018, the European Charcot Foundation launched the MS Care Unit Initiative [12] highlighting the necessity of an organisational structure of an MSCU to lead the way for personalised treatments. To ensure the MSCU Initiative achieves its vision, a governance based on the MULTI-ACT model was established. The MULTI-ACT validated approach aims to allow for effective cooperation between all relevant stakeholders in the MSCU model, and includes tools and guidelines for the governance, the stakeholder engagement, and the impact assessment of the initiative, and foresees patients as key stakeholders. As part of this process, the MSCU Initiative has defined its mission as follows: "The MS Care Unit is a patient-centred initiative that aims to provide the highest possible leading-edge interdisciplinary care model for people with and affected by MS, while advancing research to prove its cost-effectiveness for society (sustainability)." At the current stage, MSCU has identified the following categories of relevant stakeholders: patients, patients' organizations, citizens and civil society organizations, payers and purchasers, healthcare providers and industry companies. Based on its call to action, the selected stakeholders have been engaged to set or refine the agenda that the MSCU Initiative aims to achieve. In defining the priorities of the initiative, the plurality of stakeholders' interests
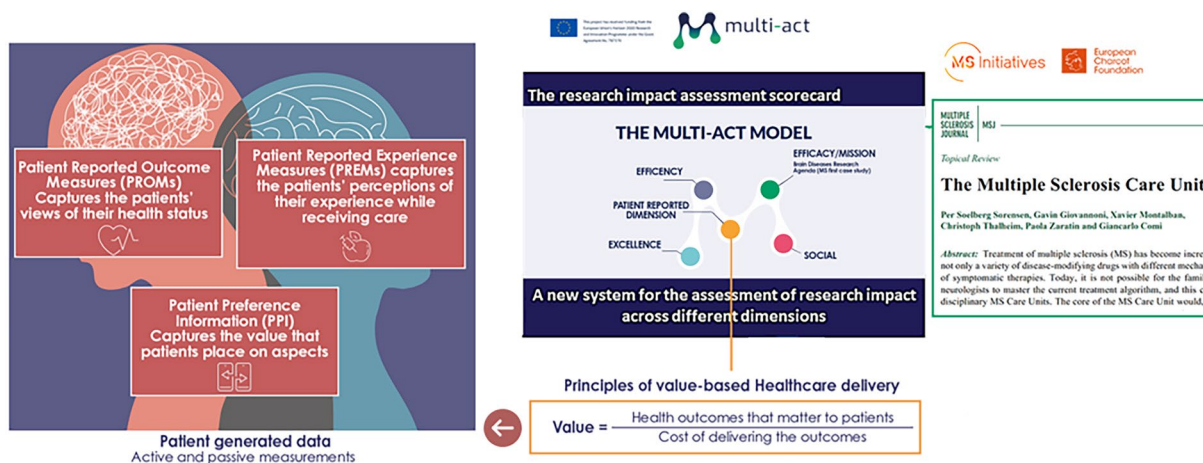
Fig. 1 Measuring patient-reported dimension impact of Multiple Sclerosis Care Units via patient-generated health data
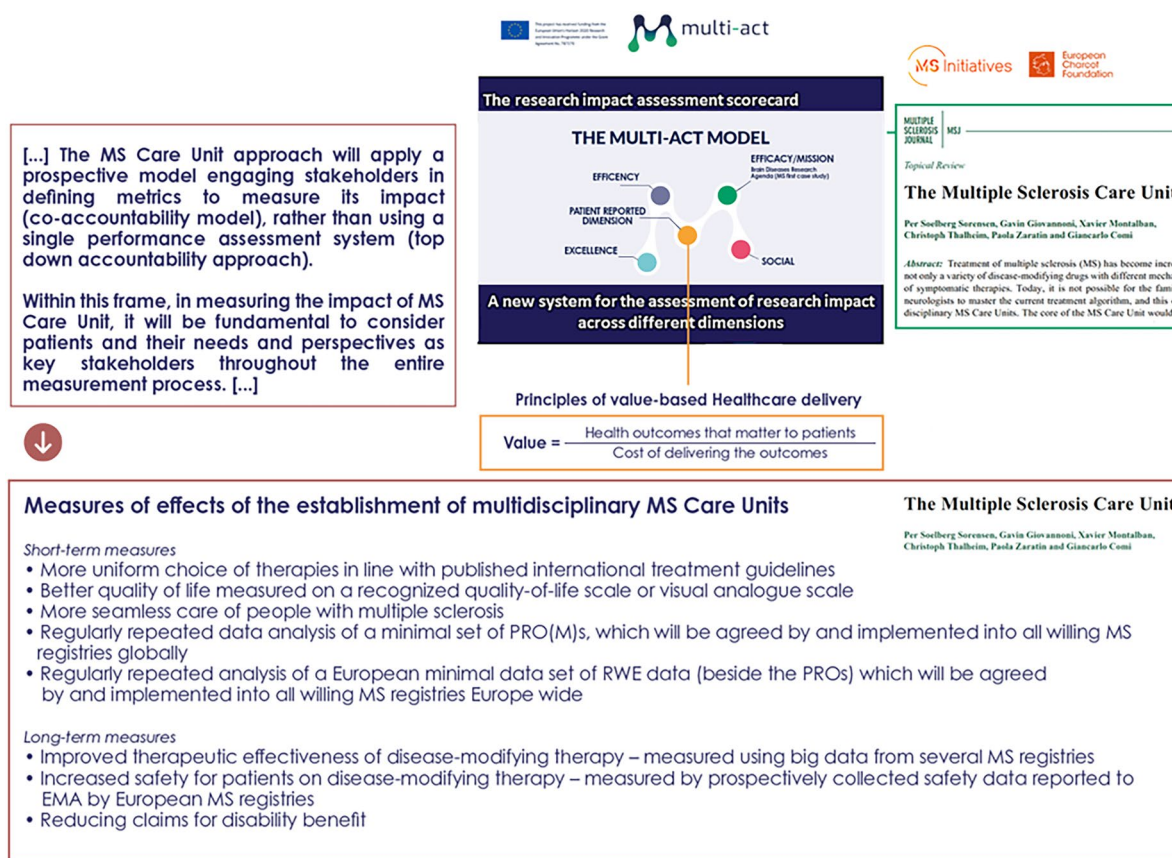

Fig. 2 The application of the MULTI-ACT model to establish the Multiple Sclerosis Care Unit gold standard [11]

has been considered according to the MULTI-ACT model. Conventional metrics related to the excellence dimension are integrated with new measures related to the economic and financial dimension (efficiency) and to the social dimension contributing to achieving MSCU mission success. The patient-reported dimension has been prioritized by all the stakeholders to be applied transversally throughout the four dimensions of the MULTI-ACT model as a tool for enabling the Science of Patient Input (Fig. 1). Value-based healthcare (VBHC) focuses on the value of PGHD and is achieved by ensuring resources already available are managed to realise the best possible individual and population health outcomes.

PROMs are commonly used in VBHC programmes but they have yet to demonstrate their full potential in a VBHC context [13]. Within this framework, by applying the multidimensional impact assessment model of the MULTI-ACT project, the MSCU Initiative has launched a global survey (https://charcot-ms.org/files/Multiple-Sclerosis-Care-Units_a-progress-report.pdf) based on a previously developed protocol [14]. The aim of the MSCU questionnaire is to establish a more equitable access to expert treatment for people with MS in MS clinics by using, among others, PHGD indicators. The MSCU survey runs on the MULTI-ACT Digital Toolbox [15] administered by the Italian Multiple Sclerosis Foundation. The completion of the MSCU survey, which is still ongoing, represents the initial phase of a process preparatory to the understanding of the compliance status regarding the MSCU gold standard among the different bodies actively involved in healthcare and the validation of VBHC indicators to apply to those organizations participating in the survey (Fig. 2).

In line with the MULTI-ACT model, engaging patients as key stakeholders will enable us to measure the impact of care on outcomes that matter most to them (Science of Patient Input) and to all the other stakeholders, thus making health research and care more sustainable. PGHD included in the MULTI-ACT Master Scorecard [16] are increasingly instrumental in making stakeholders co-accountable for patient engagement in brain condition research and care. In particular, PROMs can provide important insights into the 'hidden' parts of MS [17, 18] and help to uncover the complexity of the disease evolution.

The use of PROMs can be more challenging for some brain diseases, considering that patients may be older, fragile, with comorbidities, and often have cognitive or communication impairments. On the other hand, Parkinson's, MS, dementia and diseases with an elevated individual and socio-economic burden may benefit a lot from patient-based active feedback. Moreover, digital technology has the potential to bring passive measures of the individual's perception and feelings to the point of research and
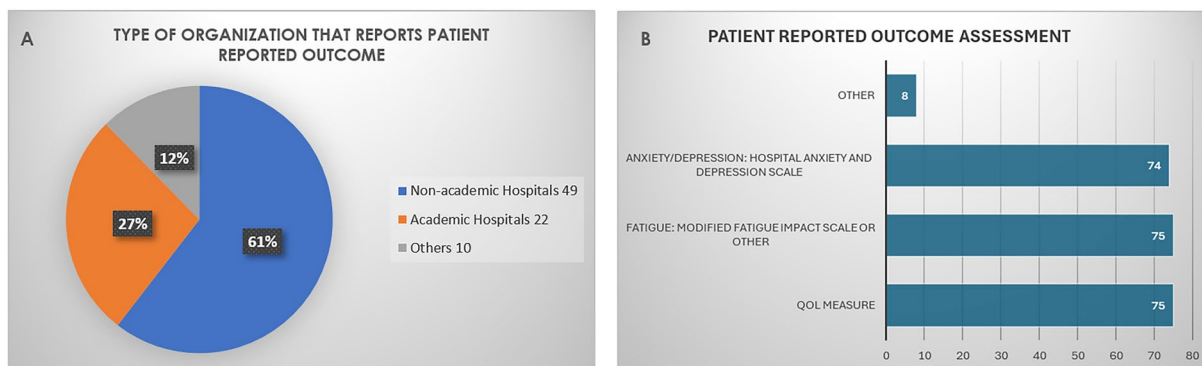
Fig. 3 **A** Preliminary overview of the average responders that declared to collect patient-reported outcomes in their registries replying to the Multiple Sclerosis Care Unit survey; **B** preliminary results of the type of patient-reported outcomes mostly collected within the Multiple Sclerosis Care Unit survey

care, facilitating PROMs, and more in general, PGHD collection [19].

Building on the EU MULTI-ACT best practice, two other related international initiatives have been launched to tackle the challenges: the Global Patient-Reported Outcomes for Multiple Sclerosis Initiative (PROMS) [20] and the European project MUSICALISE [21], co-funded by the European Union under the Transforming Health Care Systems (THCS) programme.

THE GLOBAL PATIENT-REPORTED OUTCOMES FOR MULTIPLE SCLEROSIS INITIATIVE (PROMS) EXPERIENCE

The Global PROMS initiative is a multi-stakeholder and multidisciplinary initiative, launched in 2019 and jointly led by the European Charcot Foundation and the Multiple Sclerosis International Federation (MSIF) with the Italian MS Society acting as leading agency for and behalf of the global MSIF movement. It comprises more than 60 experts from neurological, clinical, industrial, pharmaceutical, academic, and patients' organisations and the regulatory field, together with a dedicated body composed of patients' representatives as per the MULTI-ACT governance model. The mission of this frontier initiative is to provide scientific content of validity to the patient's dimension in order to provide a set of common tools based on PGHD useful for identifying early disease onset. Therefore, last year, a questionnaire [22] designed by and for people with MS was launched worldwide in seven languages with the aim of capturing, and then prioritizing, the most significant outcomes, thus paving the way for the design of new patient-driven PROMs.

The existing and available PROMs are mainly used as secondary outcomes in clinical trials and no standardized protocols for their use in clinical practice exist. The integration of PROMs in MS care holds great promise for enhancing patient-centred care and VBHC. However, their use in clinical trials and clinical practice has been quite limited because they have been considered subjective and lacking some fundamental qualities for a valid outcome measurement. In fact (Fig. 3), the majority of PROMs commonly collected in registries and highlighted
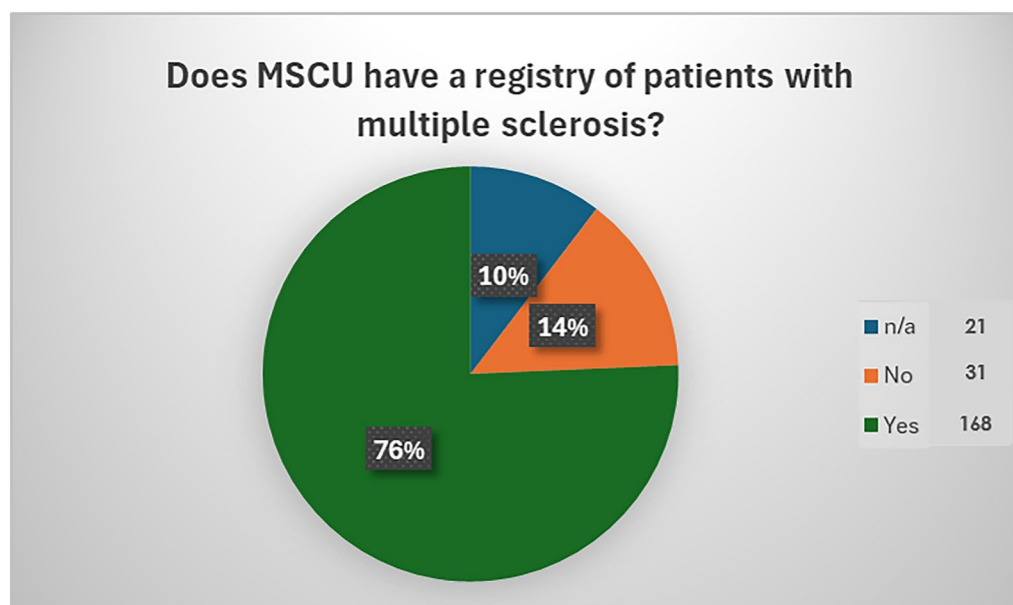
Fig. 4 Preliminary overview of the distribution of multiple sclerosis registries within the Multiple Sclerosis Care Unit respondents to the survey

by the preliminary results of the MSCU survey, are mainly clinician-driven measures and scales: of the 81 respondents who declared to collect PROMs in their registries, only 8 specified that they collect PROMs different from quality of life aspects, such as fatigue and mood. Therefore, by combining this previous investigation with the available information stored in hospital databases and data collected within registries across the globe, the PROMS initiative has recently started an international task force team of experts aimed at conducting a comprehensive global landscape analysis of disease-related registries and databases to identify potential value-based healthcare indicators that would encourage policy makers to use PROMs in decision-making processes in healthcare. Foremost, the results from the MSCU survey of people with MS will drive the selection of current PROMs included in the registries (Fig. 4) that are able to measure dominant domains and their interdependences as indicated by patients.

The relevance of this work, which considers MS, but can also be applied to other neurological disorders, relies on the chance to generate consensus on the use of PGHD. Therefore, the results of the MSCU network analysis will serve as a testing environment where the efficacy of the use of batteries of measures reflecting the patients' expectations can be evaluated. This will move in parallel with the role played by the digital tools used to penetrate the patients' daily life and monitoring of the disease progression. Furthermore, the digitalisation of the medical field accompanied by the self-improving systems assisted by artificial intelligence is going to play a crucial role in the treatment of patients, as it may develop a more intrusive way to capture patient perspectives [23]. An eHealth catalogue containing disease-specific tools at different developmental stages has been developed by the PROMS Initiative and is always in evolution [24]. The adoption of a digital approach risks worsening the already known differences between regions and countries in the provision of social and health services. Therefore, a national definition of Essential Levels of Digital Technology Access needs to be developed, which guarantees that digital opportunities are accessible everywhere and not only in the social

and health services of the richest countries and regions in Europe and beyond. This raises the issue of the possible dehumanization of care services that can be managed if the patient sees a renewed value of humanisation capable of evaluating and measuring the patient's perspective on new technologies. PPI will be instrumental in meeting the above challenge and the core indicator of the MSCU model.

EUROPEAN EFFORTS TO THE MS CARE UNIT PROJECT: THE MUSICALISE PROJECT FUNDED BY THE TRANSFORMING HEALTH CARE SYSTEMS PROGRAM

At a European level, the MULTI-ACT model will be adopted also by the MUSICALISE project (MUltiple Sclerosis, how to Instigate Care integration across nationaL contexts via patIentS Engagement?, THCS23HF_00145). This European project represents an even more extended translation of the MSCU initiative. MUSICALISE, over its 36 months, will develop MSCUs that will be relevant and definable in different contexts to better satisfy the needs of all the stakeholders (patients, healthcare providers, policy makers) and ensure integrated care. With a strong focus on the integration of patient perspectives, this THCS project offers a sustainable concept of care and a personalized approach, built upon the benefits and meaningful impacts of all the stakeholders. Together with other EU projects [25], MUSICALISE will provide healthcare authorities and policy makers' access to VBHC strategies supporting the transformation towards a renewed concept of humanism from research to care.

CONCLUSION

In the era of preventive and personalized medicine, the central role of the person living with the disease in the definition of indicators of the impact of value-based healthcare clearly emerges, including the key role in unmasking

symptoms as markers for preserving brain health. Using different case studies we have highlighted the use of the MULTI-ACT governance model of science "with" and "of" patient input to enable the used of patient-generated health data as indicators of impact from research to care. The same approach could be transferred to other brain and neurodegenerative diseases in Europe and beyond.

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Declarations

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