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Your Patient Has a New Health App? Start With Its Data Source

Keith E Morse[1,2*], MD, MBA; Jonathan Schremp[2*], MPA; Natalie M Pageler[2,3*], MD, MEd; Jonathan P Palma[2,4*], MD, MS

[1]Department of Pediatrics, Stanford University School of Medicine, Palo Alto, CA, United States

[2]Department of Clinical Informatics, Lucile Packard Children's Hospital, Palo Alto, CA, United States

[3]Division of Pediatric Critical Care Medicine, Department of Pediatrics, Stanford University School of Medicine, Palo Alto, CA, United States

[4]Division of Neonatal and Developmental Medicine, Department of Pediatrics, Stanford University School of Medicine, Palo Alto, CA, United States

[*]all authors contributed equally

Corresponding Author:
Keith E Morse, MD, MBA
Department of Pediatrics
Stanford University School of Medicine
750 Welch Road
Suite 315
Palo Alto, CA, 94304
United States
Phone: 1 650 723 5711
Fax: 1 650 725 8351
Email: kmorse@stanfordchildrens.org

Abstract

Recent regulatory and technological advances have enabled a new era of health apps that are controlled by patients and contain valuable health information. These health apps will be numerous and use novel interfaces that appeal to patients but will likely be unfamiliar to practitioners. We posit that understanding the origin of the health data is the most meaningful and versatile way for physicians to understand and effectively use these apps in patient care. This will allow providers to better support patients and encourage patient engagement in their own care.

With the orange ostrich only a step behind, the purple bear crosses the finish line and wins the first prize. The 9-year-old patient looks up from her smartphone and celebrates by giving her father a high-five. The father explains to her doctor that the game is an app recommended by her weight management clinic and winning the race indicates that she met her health management goals for the previous week. Her avatar, the purple bear, gets faster when she logs her daily activities, including exercise and healthy meals. Following the weight management clinic visits, the girl's weight, blood pressure, and screening laboratory results are downloaded into the app, and the purple bear gets faster when certain goals are met. A *Summary* screen in the app allows the doctor to quickly review the patient's health data.

This hypothetical app illustrates 2 features of a new generation of health apps: First, the outward appearance and functionality are novel. As health app development continues to gain momentum, creative, new apps will more routinely make their way into patient devices and the clinic. Second, the data that drive the app include both patient-entered health information and data downloaded from the clinic's electronic health record (EHR). The availability of these data sources enables app developers to build innovative tools to visualize, monitor, and better utilize the data. It will be incumbent upon providers to acknowledge this new generation of health apps and consider how to incorporate them into clinical practice. The first step in the evaluation of a new app is to understand the source of its health data.

The ability for an app to access patient clinical data from the EHR is the end result of tremendous coordinated efforts between the Centers for Medicare and Medicaid Services (CMS), EHR vendors, and health systems. CMS, via the Promoting Interoperability Program, are incentivizing hospitals to allow patients to view, download, and share their health information from the EHR "using any application of their choice that is configured to meet the technical specifications of the application

programming interface (API)" [1]. APIs are software interfaces that allow 2 apps to communicate—in this case, sharing data between an EHR and a health app. According to the Office of the National Coordinator for Health Information Technology (ONC), 87% of hospitals nationally use EHR platforms that provide these APIs, which are built with an interoperability standard called FHIR (Fast Healthcare Interoperability Resource) [2].

Once enabled by a health care system, these FHIR (pronounced "fire") APIs can be accessed by patient-facing health apps. With the appropriate permission from the patient, these apps can download the patient's Common Clinical Data Set (CCDS), an ONC-defined set of health information that includes data such as patient name, problem list, vital signs, medications, laboratory results, immunizations, and allergies [3].

Quantifying the number of hospitals that have enabled FHIR API capabilities is difficult owing to the lack of a centralized registry. Perhaps the best snapshot comes from an EHR vendor that publishes a list of customers with established FHIR API connections. At present, that list contains approximately 290 organizations, suggesting the broad adoption of FHIR APIs by customers of at least 1 major EHR vendor [4]. Elsewhere, estimates suggest that just under 200 million Americans currently have the option to download their health data [5].

When presented with a health app populated by data from an EHR, providers should keep several factors in mind. First, although FHIR APIs are widely available, they are not universally implemented. If a patient is seen at a facility without functioning FHIR APIs, the data available to the app will be incomplete. Second, patients must connect the app to their health system's FHIR API to download available health information and must continue to initiate additional downloads when new data become available (FHIR does not yet support automatic transmission of updated EHR data). Failure of any of these steps would also result in incomplete retrieval of health information. Finally, in the care of children and other settings involving care

by proxy, it is important that the correct patient's health data are linked to the app (ie, the child's data, not the parent's).

The second sphere of health information is data collected by the patient and entered directly into the health app. This includes information such as logs of meals eaten, headache symptoms, or menses. More sophisticated data capture is possible if an app is paired with a connected health device that logs weight, blood pressure, physical activity, or blood glucose and passively transmits data to the app. Although transferring this health information from an app into the EHR is technically feasible and is being used in select circumstances [6], the clinical workflow and medicolegal complexities (eg, the responsibility of a provider to monitor and respond to the data) of this functionality have delayed its adoption.

Health apps that rely on patient-reported data introduce similar challenges to those of taking an oral medical history in that inaccuracies, unintentional or otherwise, can limit the reliability of the information. This problem is somewhat ameliorated by apps that are digitally connected to home monitoring devices [7]. Even in this case, an error can be introduced through improper use of a connected device (eg, blood pressures obtained from an inappropriately placed blood pressure cuff).

Although health apps with racing zoo animals remain a vision of the future, patient-facing health apps that integrate EHR and patient-generated data to support disease management are here. How these apps will be incorporated into clinical care remains to be seen [8], but the widespread adoption of the FHIR standard and the continued ability of patients to collect their own data encourage novel app development and means providers will increasingly encounter patients using health apps. Physicians need to understand the source of the health information recorded in these apps to assess their relevance and validity. Then, in conjunction with patients and families, providers will be better positioned to identify how to use these apps to best support the health of their patients.

Conflicts of Interest

None declared.

References

1. Centers for Medicare & Medicaid Services. 2018. Medicaid Promoting Interoperability Program Stage 3 Eligible Professionals Objectives and Measures for 2018 Objective 5 of 8. 2018 URL: https://www.cms.gov/Regulations-and-Guidance/Legislation/EHRIncentivePrograms/Downloads/MedicaidEPStage3_2018_Obj5.pdf [accessed 2019-03-27] [WebCite Cache ID 77AnQHVK2]
2. Posnack S, Barker W. The Office of the National Coordinator for Health Information Technology. 2018. Heat Wave: The US in Poised to Catch FHIR in 2019 URL: https://www.healthit.gov/buzz-blog/interoperability/heat-wave-the-u-s-is-poised-to-catch-fhir-in-2019 [accessed 2019-03-26] [WebCite Cache ID 77Anflv61]
3. The Office of the National Coordinator for Health Information Technology. 2015 Edition Common Clinical Data Set (CCDS) Reference Document URL: https://www.healthit.gov/sites/default/files/ccds_reference_document_v1_1.pdf [accessed 2019-03-27] [WebCite Cache ID 77AnsqCG0]
4. Epic FHIR API Endpoints. Epic Systems Corporation URL: https://open.epic.com/MyApps/Endpoints [accessed 2019-03-27] [WebCite Cache ID 77AnvqyCA]
5. @carinalliance. Twitter. 2019 Jan 25. PSA: In the last 12 months, we have gone from zero to more than 197M Americans who have the potential ability to access their clinical data set from a provider who is located in one of the highlighted HRRs

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below. Thanks to the entire team @apple and the @HL7 #FHIR community! URL: https://twitter.com/carinalliance/status/1088903073018376194 [accessed 2019-03-26] [WebCite Cache ID 77Anxud5d]

6. Palma J, Pageler N. Stanford University. 2018. Learning Health System [PowerPoint Slides] URL: https://sites.google.com/view/stanfordbmi208/assignments [accessed 2019-03-27] [WebCite Cache ID 77Ao0FaFr]

7. Bonafide CP, Jamison DT, Foglia EE. The emerging market of smartphone-integrated infant physiologic monitors. J Am Med Assoc 2017 Dec 24;317(4):353-354 [FREE Full text] [doi: 10.1001/jama.2016.19137] [Medline: 28118463]

8. Dameff C, Clay B, Longhurst CA. Personal health records: more promising in the smartphone era? J Am Med Assoc 2019 Jan 29;321(4):339-340. [doi: 10.1001/jama.2018.20434] [Medline: 30633300]

Abbreviations

API: application programming interface
CCDS: Common Clinical Data Set
CMS: Centers for Medicare and Medicaid Services
EHR: electronic health record
FHIR: Fast Healthcare Interoperability Resource
ONC: Office of the National Coordinator for Health Information Technology

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Original Paper

Patient Perspective of Cognitive Symptoms in Major Depressive Disorder: Retrospective Database and Prospective Survey Analyses

Emil Chiauzzi[1], PhD; Jennifer Drahos[1,2], MPH, PhD; Sara Sarkey[3], PhD; Christopher Curran[1], BA; Victor Wang[1], BS; Dapo Tomori[3], MD

[1]PatientsLikeMe, Cambridge, MA, United States

[2]Takeda Pharmaceuticals, Cambridge, MA, United States

[3]Takeda Pharmaceuticals, Deerfield, IL, United States

Corresponding Author:
Emil Chiauzzi, PhD
PatientsLikeMe
160 Second Street
Cambridge, MA, 02142
United States
Phone: 1 617 499 4003
Email: echiauzzi@patientslikeme.com

Abstract

Background: Major depressive disorder (MDD) is a common and burdensome condition. The clinical understanding of MDD is shaped by current research, which lacks insight into the patient perspective.

Objective: This two-part study aimed to generate data from PatientsLikeMe, an online patient network, on the perception of cognitive symptoms and their prioritization in MDD.

Methods: A retrospective data analysis (study 1) was used to analyze data from the PatientsLikeMe community with self-reported MDD. Information on patient demographics, comorbidities, self-rated severity of MDD, treatment effectiveness, and specific symptoms of MDD was analyzed. A prospective electronic survey (study 2) was emailed to longstanding and recently active members of the PatientsLikeMe MDD community. Study 1 analysis informed the objectives of the study 2 survey, which were to determine symptom perception and prioritization, cognitive symptoms of MDD, residual symptoms, and medication effectiveness.

Results: In study 1 (N=17,166), cognitive symptoms were frequently reported, including "severe" difficulty in concentrating (28%). Difficulty in concentrating was reported even among patients with no/mild depression (80%) and those who considered their treatment successful (17%). In study 2 (N=2525), 23% (118/508) of patients cited cognitive symptoms as a treatment priority. Cognitive symptoms correlated with depression severity, including difficulty in making decisions, concentrating, and thinking clearly (r_s=0.32, 0.36, and 0.34, respectively). Cognitive symptoms interfered with meaningful relationships and daily life tasks and had a profound impact on patients' ability to work and recover from depression.

Conclusions: Patients acknowledge that cognitive dysfunction in MDD limits their ability to recover fully and return to a normal level of social and occupational functioning. Further clinical understanding and characterization of MDD for symptom prioritization and relapse risk due to residual cognitive impairment are required to help patients return to normal cognitive function and aid their overall recovery.

KEYWORDS

Introduction

Major depressive disorder (MDD) is a common disorder, with the lifetime prevalence estimated to be just over 16% in the United States [1]. MDD is also a burdensome condition: It is the third-leading global cause of disability according to the World Health Organization [2]. The epidemiology of MDD is affected by a number of factors. In addition, its lifetime prevalence is higher in high-income (14.6%) than in low-to-middle income (11.1%) countries [3]. In addition, women typically have a much higher risk of MDD than men (odds ratio, 1.6-2.7 in developed countries), and a substantial proportion of patients receiving treatment for MDD have chronic recurrent illnesses alongside their depressive symptoms [3].

Understanding patients' views on the burden and trajectory of symptoms and the extent to which different symptoms affect daily life is a necessary step toward addressing the most troublesome symptoms of MDD in ways that improve patients' abilities to meet their personal and occupational goals [4]. Ultimately, the aim of obtaining patient insights into MDD is not only to improve treatment and recovery but also to ensure optimal treatment of MDD in order to benefit society.

Mood disturbance, problems with concentration/attention, and physical symptoms are core criteria used to diagnose MDD [5]. Impairment in cognitive function, in particular, those related to executive function, concentration, learning, and memory, is well recognized in MDD [6,7]; indeed, cognitive symptoms appear to be a core feature of the disorder [8] and a key mediator of functional impairment [9,10]. Even after other depressive symptoms are abated, unresolved cognitive deficits can lead to continued social, functional, and occupational disabilities [11]. In addition, persistent cognitive symptoms have been associated with an increased risk of relapse [12]. At present, there is no consensus among clinicians on the most-appropriate tools for assessing cognitive function in MDD. In addition, current cognitive evaluation methods lack the patient perspective and require more formal neuropsychological assessment [10,13,14]. Patients' views on the significance and effects of cognitive symptoms are therefore important in order to fully understand the subjective experience of MDD and the role of these symptoms in the disorder.

A lack of shared decision-making behaviors has been highlighted in depression care [15], and many health care providers (HCPs) find the structured assessment of depression burdensome [16]. Collectively, these issues may limit the ability of HCPs to fully account for the patient experience of MDD and tailor care to the needs of individuals. Considering the potentially different perspectives of patient and provider assessments of disease experience and burden in MDD (ie, disease severity, disease improvement, and symptom prioritization) [4,17-19], it is important to evaluate patients' perspectives on their own disorder. This approach emphasizes the importance of gaining patient insights on particular symptoms of the disorder to optimize patient care. To further understand patients' perspectives, we performed Patient Insights and Voice on Major Depressive Disorder Treatment and Symptom Perception (PIVOT) studies using the PatientsLikeMe [20] online patient research network.

PatientsLikeMe is an online patient research network that provides a forum for sharing real-world health experiences to improve patient outcomes, allows patients to track their own conditions, and gathers crowdsourced data that can be used for disease research. PatientsLikeMe has approximately 30,000 patients with self-reported major depression and is a source of both qualitative and quantitative patient-reported data and perspectives about disease symptoms, treatments, and comorbidities. Patient engagement and data donations enable PatientsLikeMe researchers to invite members to participate in research projects that may be valuable to the patients based on their self-reported data. Here, we report the results of two PIVOT studies that examine data from subsets of the PatientsLikeMe MDD community. These two studies were designed to analyze existing platform data on patients' perceptions of MDD symptoms, with a focus on cognitive symptoms and medication effectiveness (study 1: retrospective database analysis) and ways patients understand and prioritize symptoms of depression (study 2: prospective survey). Study 1 analyzed a wide array of data, which were used to determine the exploratory research questions to be addressed in study 2 and enable construction of the survey. Thus, this report primarily focuses on the outcomes of study 2.

Methods

Ethical Approval

All data were provided voluntarily by patients, and PatientsLikeMe was granted exemption from ethical approval by the New England Institutional Review Board (exemption number 15-349; September 24, 2015).

Study 1: Retrospective Database Analysis

Data Collection

Members of PatientsLikeMe provide demographic information such as age, race, educational status, health insurance coverage, and location to help match demographically similar patients. They also identify primary and comorbid medical conditions from among more than 2500 conditions in the system or enter a new condition. Patients can complete a list of their symptoms and rate the current severity of symptoms (none/mild/moderate/severe), both of which can be updated over time. In addition, patients are invited to rate the effectiveness of treatments, including prescription and over-the-counter medications. These treatment evaluations also include treatment burden, adverse effects, adherence, and cost. Furthermore, the PatientsLikeMe platform database collects free-text entries, in which members provide qualitative, narrative information. Individuals were not required to complete all fields in the PatientsLikeMe system for their data to be included in this database analysis.

In the retrospective database analysis, data were examined from the entire PatientsLikeMe community of patients who reported having MDD ("the total MDD community"). This community comprised 17,166 individuals as of June 1, 2015. Patients who

selected MDD among their conditions in the PatientsLikeMe system were prompted to provide feedback on specific symptoms, including depressed mood, fatigue, insomnia, inability to experience pleasure (anhedonia), low self-esteem, lack of motivation, and problems with concentration.

Data Analysis

All patients were included in the analysis irrespective of whether they had missing data. In cases where data were incomplete, the total frequency of respondents (n) was used and the missing data were not imputed.

Demographics, clinical characteristics, and treatment covariates of interest are presented using descriptive statistics. Continuous variables are described using the number of observations, including mean and SD, for nonnormally distributed data. Categorical variables were described using frequency and percentage (n, %) or relative percentage of values in each category. Data were analyzed using STATA, version 13.0 (StataCorp LP, College Station, TX) and RStudio, version 0.99.902 (RStudio, Inc, Boston, MA).

Study 2: Prospective Survey Questionnaire

Survey Design

The custom survey was developed by all authors using information obtained during the study 1 analysis and was written in a way that was understandable to individuals with an average Flesch–Kincaid [21] reading grade of 7.5. The survey (Multimedia Appendix 1) included items comprising demographic information and patient characteristics (six items); medication history (three items); patient experience of depression in brief (three items); the patient health questionnaire (PHQ-8) depression scale (eight items), which is an adaptation of the clinically used PHQ-9 scale [22] that omits one item relating to suicidal thoughts and is a commonly used and accepted brief screening measure of depression [23]; patient prioritization of depressive symptoms (seven items); patient experience of memory, thinking, and concentration (seven items); patient-reported cognitive function using an adapted version of the perceived deficits questionnaire (PDQ-5), which is a cognitive function severity scale ranging from 0 to 20 (0=low perceived impairment) [24] and has been validated in patients with major depression [25], and using patient perception of cognitive symptoms and depressive relapse (11 items in total); and seeking advice and life adjustments (four items).

Longstanding (n=288; rated depressed mood at least six times during membership and active within the last 30 months) and recently active (n=3112; active within the last 90 days) members of the "total MDD community" were individually invited to participate in the PIVOT survey (total of 3400). Members were invited to participate via private message through the PatientsLikeMe platform. The private message contained research patient information and links to accept or decline the invitation to participate in the study.

Patients who accepted the invitation were directed to the electronic survey. To maximize participation, an email reminder was sent to users who did not accept or decline the survey invitation within 3 days. An email reminder was also sent to users who partially completed the survey within 3 days of their last survey data entry. The patient flow is shown in Figure 1. Only those who completed at least half of the survey were included in the analysis sample (N=525). Patients were not compensated for their participation.

Data Analysis

Similar to study 1, the total frequency of survey respondents (n) was used, and missing data were not imputed. Data analysis of the prospective survey questionnaire was performed in line with that reported for the retrospective database analysis in study 1. Response rates were calculated using the checklist for reporting results of the internet e-survey criteria [26]. Severity levels on the PHQ-8 depression scale were scored according to Centers for Disease Control and Prevention guidelines (none = 0-4; mild = 5-9; moderate = 10-14; moderately severe = 15-19; and severe = 20-24) [23]. If data were missing for any question, the PHQ-8 score was deemed to be missing. The Spearman rank correlation was used to measure the degree of association between cognitive symptoms and depressive severity. Some demographic information that was not directly requested in the survey was taken from the PatientsLikeMe platform database and included the country of origin and comorbidities. Survey data were reported in cases where both platform and survey data were available.

Open-response questions were reviewed and analyzed for themes. Commonly reported themes were assigned a unique code, and the frequencies of codes were counted. Participants responding with multiple themes per question were counted for each theme reported; thus, the themes were not mutually exclusive by participant and question.

Figure 1. Study 2 patient flow for prospective PIVOT survey in patients with MDD. *Number of unique users who opened one or more survey invitations or reminder emails. PIVOT: Patient Insights and Voice on Major Depressive Disorder Treatment and Symptom Perception.
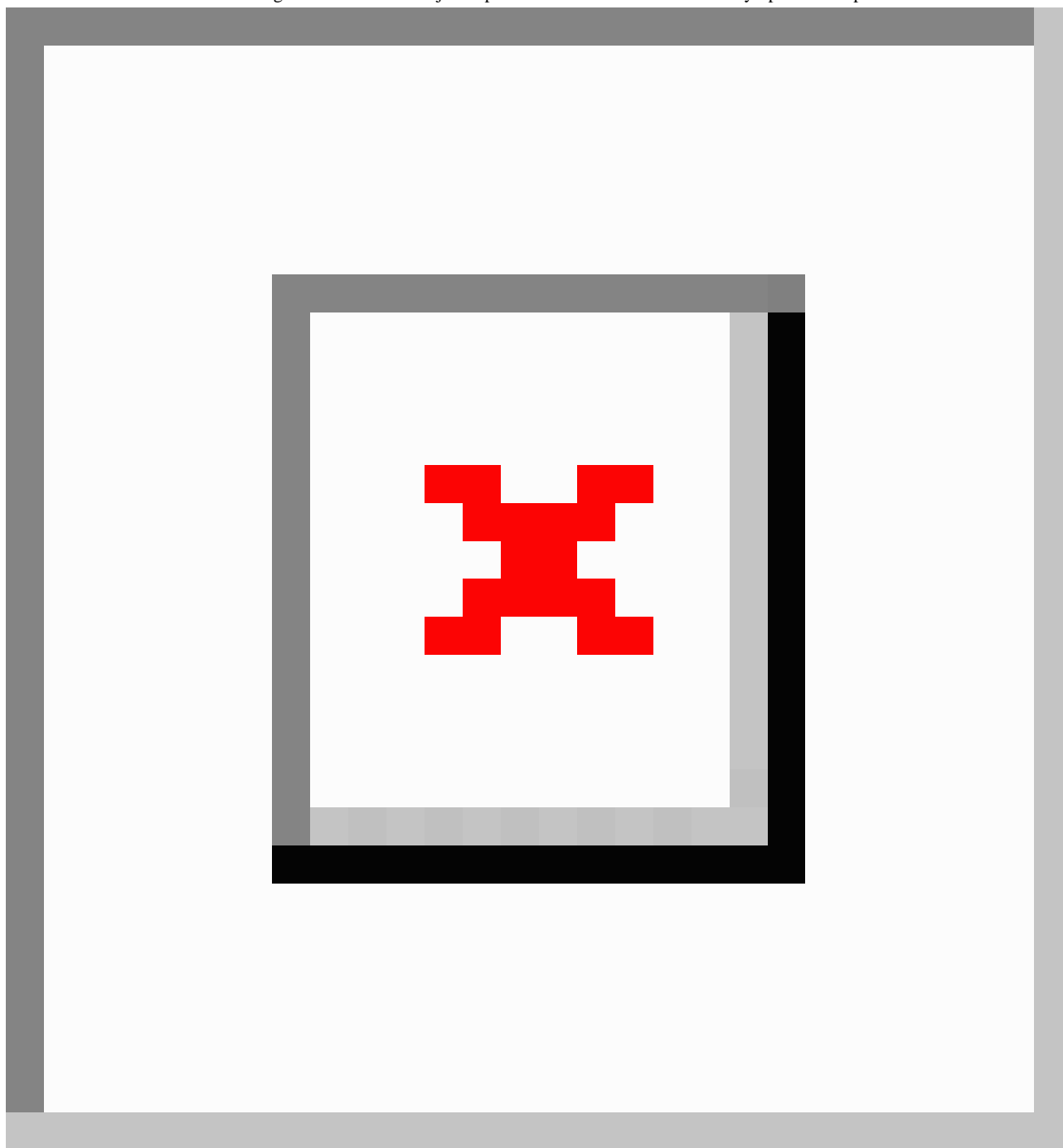
Results

Study 1

Patients

The "total MDD community" comprised 17,166 individuals. The majority were women (77%); were white (89%); lived in the United States (75%); and had at least some college education, an undergraduate degree, or a professional degree (80%; Table 1). The MDD characteristics of this population are shown in Table 1. Overall, 78% of individuals reported that they had, at some point, received treatment for MDD. In addition, 65% indicated the current severity of their depressed mood as moderate/severe (compared with 25% reporting mild and 10% reporting no depressed mood). These patients reported a wide variety of comorbidities, particularly anxiety disorders and dysthymia.

Perception and Impact of Cognitive Symptoms

Of the total, 38% of patients with data in the system (2255/5998) reported severe lack of motivation and 28% (2889/10,372) reported severe difficulty in concentrating. Among patients with severe depression, those reporting severe difficulty in concentrating were approximately five-fold more in number than those reporting no/mild depressive symptoms (Figure 2). Notably, persistent difficulty in concentration was common in all severities of depression and reported by as many as 80% of

patients, even in the absence of depressed mood, or with self-described "mild" depression (Figure 2).

The results of the retrospective database analysis also revealed that across 12 of the most frequently reported medications, only approximately 20% of patient reports (n=3095) indicated major effectiveness of the antidepressant treatment. Of the patients who considered themselves successfully treated, 24% (124/521) and 17% (149/859) still experienced a severe lack of motivation and difficulty in concentration, respectively.

Table 1. Demographic characteristics and comorbid conditions in the total PatientsLikeMe major depressive disorder community (study 1). Percentages are based on the number of available cases for each question.

Variable	Patients with major depressive disorder (N=17,166)
Country, n (%)	
United States	10,349 (75)
United Kingdom	1203 (9)
Canada	701 (5)
Australia	525 (4)
Other	948 (7)
Sex (female), n (%)	12,072 (77)
Age (years), mean (SD)	40.5 (13.1)
Age at first diagnosis (years), mean (SD)	28.1 (11.7)
Race, n (%)	
White	6648 (89)
Black	202 (3)
Other	642 (9)
Prefer to skip	N/A[a]
Education, n (%)	
Less than high school	370 (6)
High school graduate	860 (13)
Some college	2935 (45)
Undergraduate degree	1450 (22)
Graduate degree	860 (13)
Prefer to skip	N/A[a]
Treatment[b], n (%)	13,367 (78)
Current depressed mood severity, n (%)	
Mild	1964 (25)
Moderate/severe	5024 (65)
None	802 (10)
Comorbidities, n (%)	
Generalized anxiety disorder	7881 (46)
Panic disorder	4582 (27)
Posttraumatic stress disorder	4344 (25)
Persistent depressive disorder (dysthymia)	4139 (24)
Social anxiety disorder	4116 (24)
Fibromyalgia	3501 (20)
Tobacco addiction	2940 (17)
Obsessive compulsive disorder	2612 (15)
Eating disorder	2297 (13)
Attention deficit/hyperactivity disorder	2272 (13)
Phobic disorder	2089 (12)
Alcohol addiction	1659 (10)
Drug addiction	1588 (9)
Bipolar disorder	1479 (9)

[a]N/A: not applicable ("prefer to skip" was not an option within the PatientsLikeMe platform).

[b]Number of individuals who had ever received treatment (treatment predominantly refers to medication, but also includes nonpharmacologic treatments such as psychotherapy).

Figure 2. Study 1 self-reported concentration difficulties in patients with major depressive disorder.
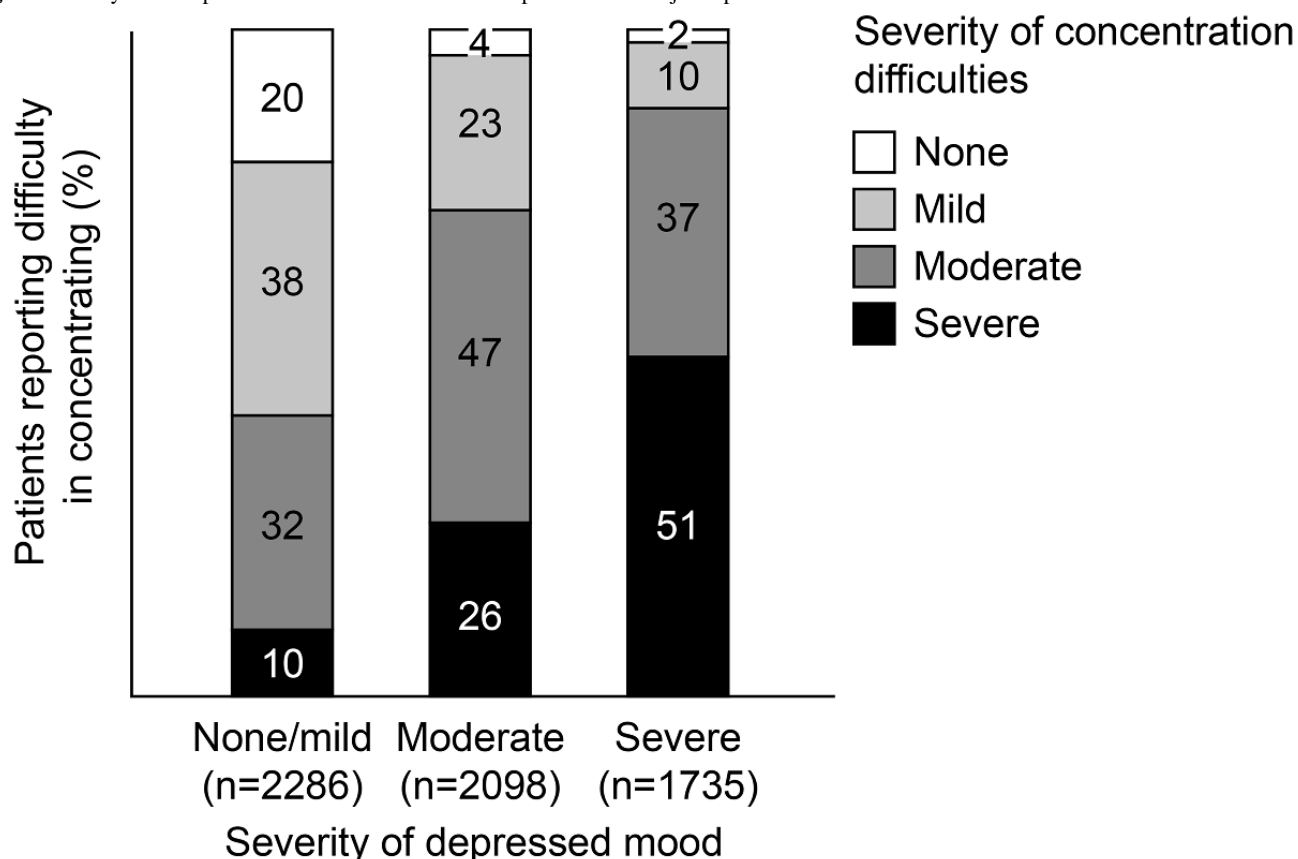
Use of Study 1 Results for Development of the Study 2 Survey

The study 1 results highlighted three key topics to be included in the study 2 survey questionnaire: patient prioritization of symptoms, patient perception of cognitive symptoms of depression, and patient perception of residual symptoms and medication effectiveness.

Regarding patient prioritization of symptoms, patients reported lack of motivation and problems in concentrating as their most severe symptoms while experiencing a severely depressed mood. For some patients, these suggested mood and cognitive symptoms could be a higher priority for symptom resolution than physical symptoms (eg, fatigue and muscle tension). Therefore, the first key objective for study 2 was to understand how patients prioritize resolution of symptoms and how they define their own depression.

With regard to patient perception of cognitive symptoms of depression, study 1 results indicated that the majority of patients suffered some level of impairment in concentration, even when they reported no or mildly depressed mood. However, no data were available to assess other domains of cognition symptoms, such as executive function, attention, and memory; therefore,

the second key objective of study 2 was to understand patient perceptions of cognitive symptoms related to depression, of these symptoms on their disorder, their daily life, and as symptoms independent of mood symptomatology.

Study 1 also suggested that many patients experienced residual symptoms when receiving a treatment that was perceived to be effective, including severe lack of motivation and problems concentrating. However, PatientsLikeMe data do not distinguish between residual symptoms of depression and treatment-related side effects. Thus, study 2 aimed to identify residual symptoms that were most important to patients, expectations of symptom resolution, and factors that influence perception of medication efficacy.

Study 2

Patients

The questionnaire survey sample included 525 members with MDD. Survey respondents had demographic characteristics similar to those of the "total PatientsLikeMe MDD community" (Table 2). As in study 1, the majority of participants were women (74%), white (87%), and living in the United States (95%), and 90% had at least some college education, undergraduate degree, or graduate degree.

Table 2. Demographic characteristics and comorbid conditions in major depressive disorder survey participants (study 2). Percentages are based on the number of available cases for each question.

Variable	Major depressive disorder survey participants (N=525)
Country, n (%)[a]	
United States	499 (95)
United Kingdom	8 (2)
Canada	10 (2)
Australia	2 (0)
Other	6 (1)
Sex (female), n (%)	368 (74)
Age (years), mean (SD)	49.0 (12.9)
Age at first diagnosis (years), mean (SD)	29.8 (12.9)
Race, n (%)	
White	432 (87)
Black	15 (3)
Other	42 (8)
Prefer to skip	9 (2)
Education, n (%)	
Less than high school	7 (1)
High school graduate	42 (8)
Some college	217 (44)
Undergraduate degree	134 (27)
Graduate degree	92 (18)
Prefer to skip	6 (1)
PHQ-8[b] score, mean (SD)	23 (6.0)
PHQ-8 (score), n (%)	
None (0-4)	0 (0)
Mild (5-9)	9 (2)
Moderate (10-14)	47 (9)
Moderately severe (15-19)	103 (20)
Severe (20-24)	354 (67)
Missing[c]	12 (2)
Currently taking a medication, n (%)	437 (87)
Number of lifetime depression episodes, n (%)	
1 episode	10 (2)
2–3 episodes	47 (9)
4–5 episodes	43 (8)
>5 episodes	374 (71)
I don't know/I prefer to skip	51 (10)
Current symptom status, n (%)	
Current episode <3 months/symptoms not better	60 (11)
Current episode >3 months/symptoms not better	172 (33)
Current episode >3 months/symptoms better	127 (24)
No current episode/occurred in the past	127 (24)

Variable	Major depressive disorder survey participants (N=525)
Other	22 (4)
I don't know/I prefer to skip	17 (3)
Comorbidities[d] , n (%)	
Generalized anxiety disorder	252 (48)
Posttraumatic stress disorder	224 (43)
Panic disorder	138 (26)
Fibromyalgia	137 (26)
Persistent depressive disorder (dysthymia)	99 (19)
Hypertension	69 (13)
Hypothyroidism	65 (12)
Traumatic brain injury	62 (12)
Gastroesophageal reflux disease	61 (12)
Migraine	57 (11)
Irritable bowel syndrome	55 (10)
Bipolar disorder	54 (10)
Asthma	53 (10)
Social anxiety disorder	51 (10)
Osteoarthritis	51 (10)

[a]Values reflect answers reported by patients on their PatientsLikeMe profile. Country of origin was not asked directly in the survey.

[b]PHQ-8: patient health questionnaire (8-item).

[c]In accordance with PHQ-8 scoring guidelines, patients with one or more missing item score did not receive a total score.

[d]Values reflect answers reported by patients on their PatientsLikeMe profile.

The characteristics of survey participants are shown in Table 2. PHQ-8 scores indicated moderate (9%), moderately severe (20%), and severe (67%) rates of depression, with a mean score of 23 (SD 6.0). A total of 44% of participants reported a current episode with continued symptoms. In addition, 71% of patients reported at least five past depressive episodes, and 87% reported currently taking medications for MDD. In total, according to data from the PatientsLikeMe platform database, 79% of the survey participants (416/525) reported more than three comorbid conditions—most commonly, generalized anxiety disorder, posttraumatic stress disorder, panic disorder, and dysthymia. The most-common nonpsychological conditions were fibromyalgia, hypertension, hypothyroidism, and gastroesophageal reflux disease.

Perception of Symptoms

When patients were asked whether they were able to tell if individual symptoms were improving, 73% of patients (383/525) agreed that they could distinguish between different symptoms of their depression and discern improvements in individual symptoms. In addition, although 72% of respondents (364/508) stated that the symptoms they most wanted to "go away or control" were mood and physical symptoms (depressed mood, anhedonia, anxiety, fatigue, insomnia, muscle tension, feelings of guilt or inadequacy, and low self-esteem), 23% (118/508)

cited that the most important symptoms were cognitive symptoms (difficulty staying motivated, difficulty staying focused on goals, concentration problems, short-term memory problems, inability to make decisions, and attention problems).

Effects of Cognitive Symptoms on Daily Functioning

Overall, 83% of respondents (433/523) reported speaking with their doctor about cognitive problems, and when asked to describe the experience (via free-text responses), 73% of the respondents (172/237) reported that they had received advice or treatment. The mean PDQ-5 score of respondents was 13.2 (SD 4.2), with 31% of respondents (165/525) scoring a higher level of perceived cognitive impairment (scores of 16-20).

Most patients attributed their cognitive difficulties to a combination of factors, including MDD (82%, 432/524) and other health (eg, fibromyalgia and Parkinson disease; 74%, 390/524) and life (eg, stress; 84%, 439/524) factors; only 6% (30/524) attributed these symptoms solely to MDD.

Many patients reported cognitive symptoms other than those recorded in the PDQ-5. The cognitive symptoms that were most strongly correlated with severity of depression, as measured by the PHQ-8, were difficulty making decisions, concentrating, and thinking clearly (Spearman rank correlation coefficients [r_s] of 0.32, 0.36, and 0.34, respectively; Figure 3).

Figure 3. Self-reported cognitive symptoms among survey respondents with major depressive disorder in study 2, and correlation with severity of depression (N=525).
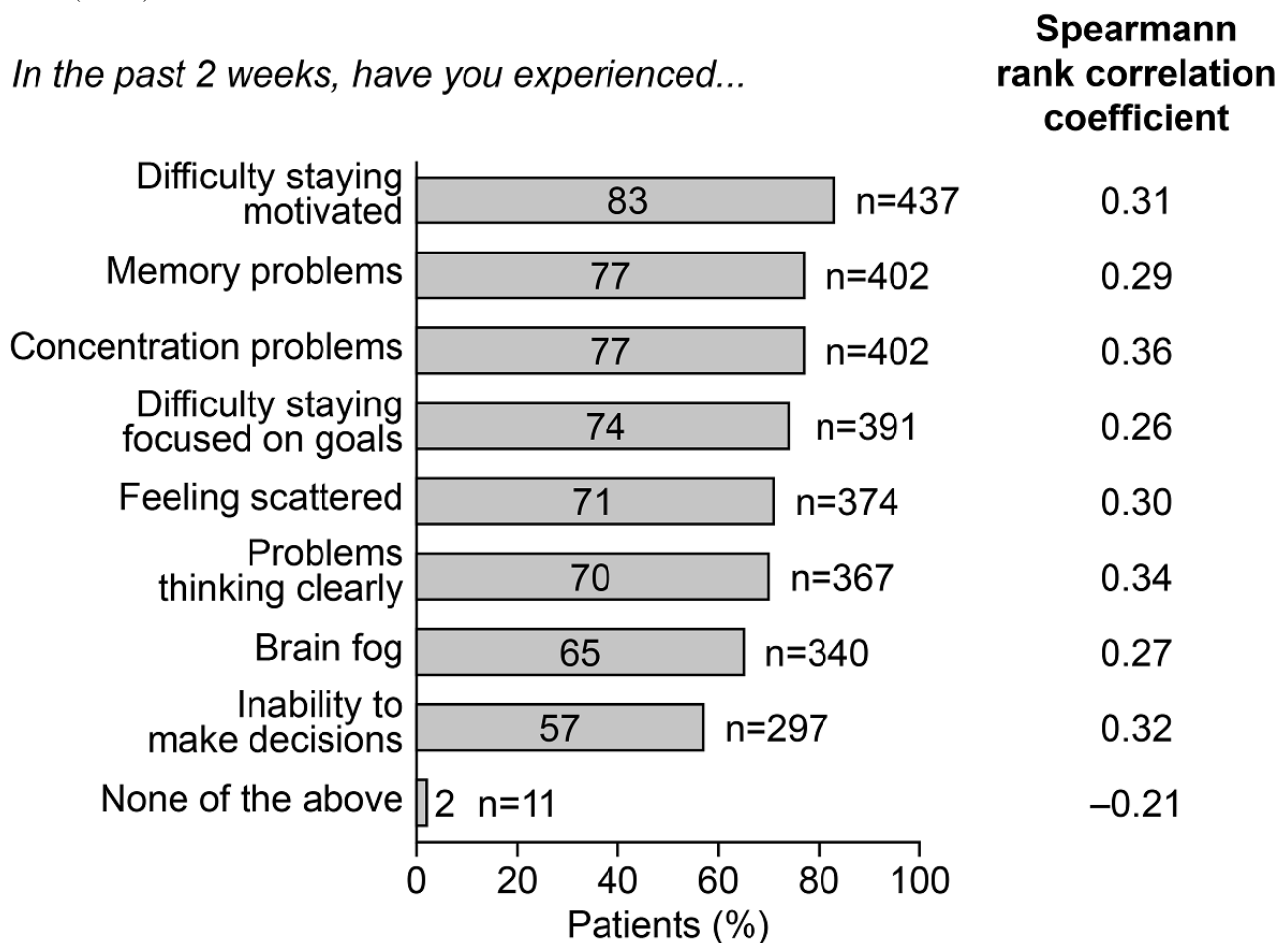
When asked to select three symptoms with the most negative impact, depressed mood was the most frequently reported symptom to have a negative impact on family and social relationships (39%, 196/509) and fatigue had the most negative impact on social and leisure activities (43%, 219/510). Problems with memory, motivation, and concentration/attention also interfered with these aspects of life. In all, 66% of respondents stated that cognitive difficulties interfered with their ability to have meaningful relationships, and 69% reported that cognitive difficulties impaired their ability to maintain the household (Figure 4). More than half the patients reported that memory, thought, and concentration difficulties reduced their ability to handle household finances (54%), plan and serve meals (53%), and take care of themselves (54%; Figure 4a). When asked to provide free-text responses about how cognitive symptoms impacted them in any way that was not previously asked, common response themes among the respondents included interference with work/school (34%), disrupted relationships (28%), personal issues (27%), and communication problems (12%; Figure 4a).

Cognitive difficulties also had a profoundly negative impact on patients' ability to work. In all, 35% of respondents cited poor concentration as one of the three symptoms with the most negative impact on occupational ability, compared with only 22% who cited symptoms of depressed mood (Multimedia Appendix 2). In total, 65% of respondents (341/525) reported that memory, thought, and concentration difficulties interfered with their ability to work effectively. A total of 48% of patients had stopped working completely as a result of the disability caused by these symptoms, and only a minority were employed full time (18%, 88/498) or part time (8%, 41/498).

In the free-text responses, patients commonly used the terms "brain fog," "memory," and "remember" when describing their cognitive symptoms. Free-text analysis revealed themes of feeling paralyzed, debilitated, and frustrated by symptoms:
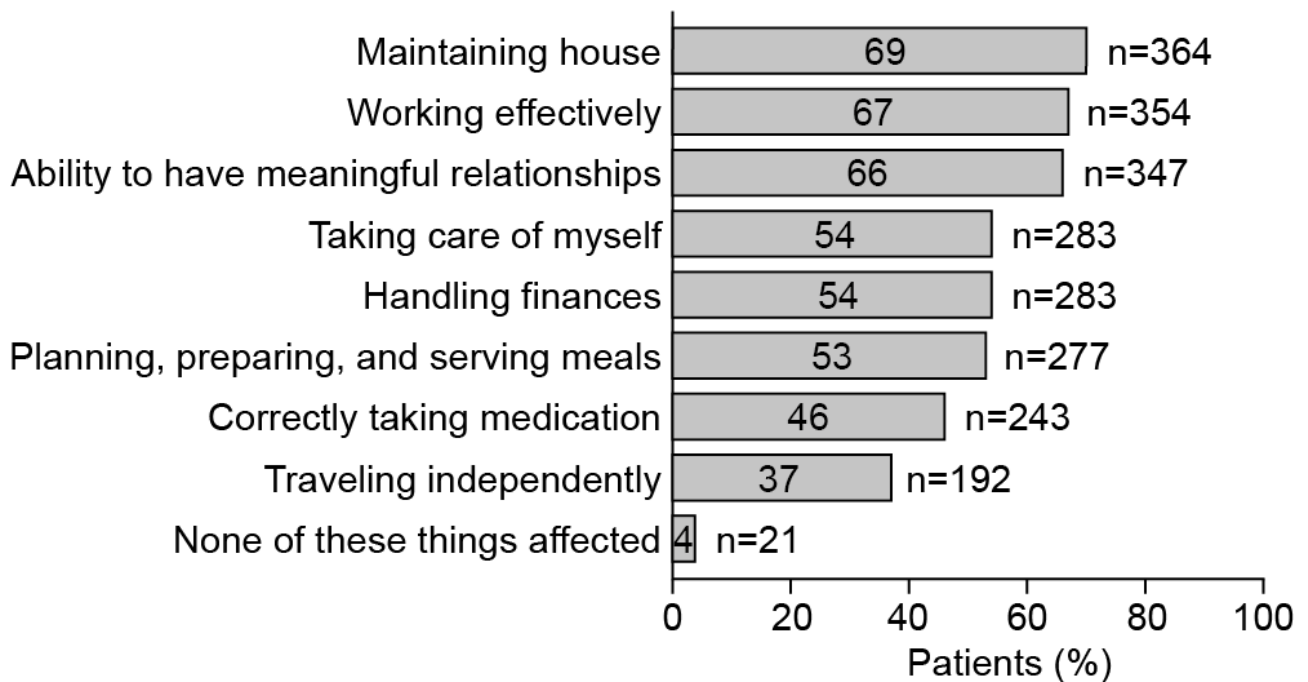
> *When I am unable to concentrate I do not do anything well. It affects my job performance...I fall behind in all the things I need to do at work and in my personal life which triggers more depression and other negative emotions.*

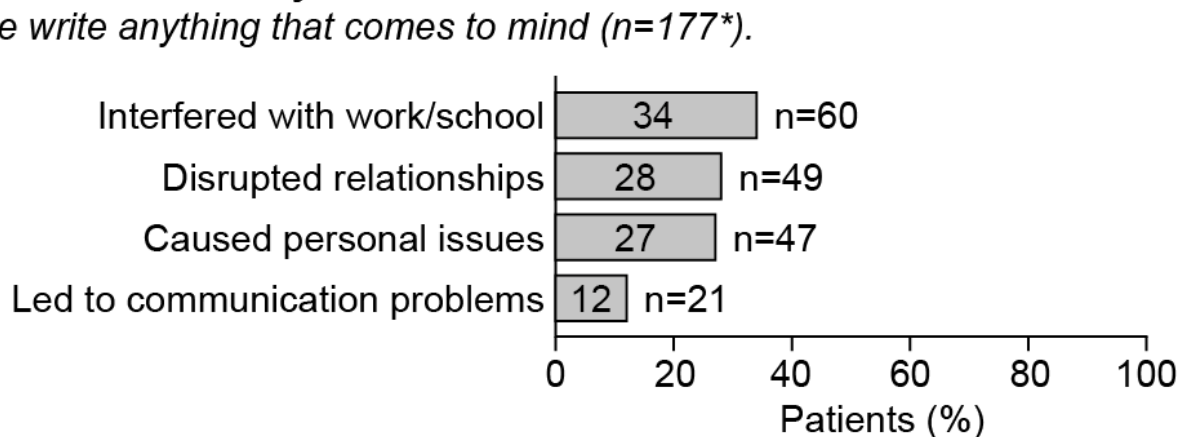> *...being indecisive is like mental paralysis.*

> *I feel like other symptoms would be easier to manage if I could stay focused.*

Figure 4. Effects of cognitive symptoms on social functioning among survey respondents in study 2. *Categories are not exclusive; a category is counted each time it is mentioned by the respondent.

a) *Have problems with memory, thought, or concentration interfered with your current daily life in these ways? (n=525)*

Category	%	n
Maintaining house	69	n=364
Working effectively	67	n=354
Ability to have meaningful relationships	66	n=347
Taking care of myself	54	n=283
Handling finances	54	n=283
Planning, preparing, and serving meals	53	n=277
Correctly taking medication	46	n=243
Traveling independently	37	n=192
None of these things affected	4	n=21

Patients (%)

b) *Have problems with memory, thought, or concentration **interfered with your current life in ways we have not asked**?*
Please write anything that comes to mind (n=177).*

Category	%	n
Interfered with work/school	34	n=60
Disrupted relationships	28	n=49
Caused personal issues	27	n=47
Led to communication problems	12	n=21

Patients (%)

Cognition and Recovery From Major Depressive Disorder

Patients reported that cognitive symptoms "often" or "almost always" interfered with their ability to recover fully from depression (24% [125/525] and 19% [98/525] respondents, respectively), prevent relapse (22% [116/525] and 16% [84/525], respectively), and participate actively in treatment (15% [78/525] and 8% [43/525], respectively). Therefore, patients recognized cognitive difficulties as a distinct entity from other symptoms of depression.

Most patients reported multiple lifestyle adjustments to try to overcome the challenges posed by their cognitive symptoms. These included using reminders (eg, electronic organizer, checklists, and sticky notes; 85%, 439/516), organizing their living space (49%, 255/516), and taking public transportation instead of driving themselves (15%, 79/516). Patients stated that relief from emotional symptoms (91%; 454/501 respondents) and relief from cognitive symptoms (75%, 378/501) were "very important" in treatment decisions; in addition, a number of patients reported relief from emotional symptoms (7%, 37/501) and cognitive symptoms (19%, 96/501) as "somewhat important." However, 61% of respondents (319/525) considered antidepressant treatment successful as long as their most troublesome symptoms improved. Overall, 9% of the respondents (46/501) stated that "the need to think more clearly" was the main priority in selecting antidepressant treatment, compared with 17% (85/501) who cited low rates of side effects and 13% (64/501) who were guided primarily by HCP recommendations.

Discussion

Principal Findings

Our study results suggest that patients with MDD recognize improvement in individual symptoms of depression and can discern how changes in different symptom domains affect various aspects of their lives. Although many patients were aware of their cognitive difficulties, not all patients attributed them to MDD.

Although most participants in the PIVOT survey (study 2) reported improvement in mood and physical symptoms as their primary treatment goal, almost a quarter prioritized cognitive symptoms as those they most wanted to "go away or control." However, 61% of respondents in study 2 also stated that they would consider antidepressant treatments successful if they saw improvements in their most troublesome symptoms. This finding may be indicative of a discrepancy between the high prioritization of resolution of cognitive symptoms by patients and the perception that their treatment is working even when these symptoms persist. Therefore, both HCPs and patients need to know that cognitive symptoms are a core feature of MDD and that successful treatment of MDD should equate to not only improvements in mood, but also to recovery from all aspects of the disorder. HCPs should be aware of the link between residual symptoms (including cognitive symptoms) and the increased risk of relapse [12]. Moreover, it may be beneficial for HCPs to further address medical comorbidities in MDD, such as sleep deprivation, which are known to negatively affect cognitive performance and might contribute to improved patient outcomes [10].

Although the majority of respondents in study 2 had talked to their HCP about cognitive problems at some point and many received advice or treatment, patients reported that cognitive difficulties persisted. On the PDQ-5, a measure of perceived cognitive dysfunction severity, 31% of patients scored in the highest quintile, with a mean PDQ score of 13.2 (SD 4.2). These patient-reported findings support the empirical evidence, suggesting that although conventional antidepressants mitigate deficits in certain cognitive domains in a proportion of patients [8], outstanding deficits in executive functioning [27-29] often persist even after the depressive symptoms have remitted [30-33]. However, evidence for which cognitive domains remain impaired after antidepressant treatment is inconsistent [27,29,34]. This inconsistent finding emphasizes that identification and treatment of cognitive symptoms are important unmet clinical needs among patients with MDD, including those whose depressive symptoms have remitted, and highlights the need for HCP and patient education on identification, treatment, and follow-up of cognitive symptoms in MDD.

In the PIVOT studies, cognitive difficulties had far-reaching effects on multiple aspects of patients' lives. Patients recognized that cognitive symptoms, distinct from depressed mood, disrupted their relationships, ability to carry out household duties, and ability to hold down a job or work full-time. Patient-reported data from the present study support those from a post hoc analysis from the International Mood Disorders Collaborative Project, which reported that workplace

performance variability is explained by subjective measures of cognitive symptoms to a greater extent than by total depression symptom severity [35].

A notable proportion of respondents indicated that cognitive symptoms interfered with work ability; therefore, it would be valuable to increase awareness about the effects of cognitive difficulties on work ability, even following remission of depressive symptoms, among HCPs and payers. The well-being of patients with cognitive symptoms in MDD should be considered by providing workplace interventions, including work modification and support programs, exposure-based work reintegration plans, and problem-solving therapy. Such interventions, when implemented alongside clinical intervention, were found to reduce sick leave among employees with depressive disorders in the medium term (4 to 12 months) [36].

Beyond functioning at work, the potential negative effects of cognitive dysfunction on social and family relationships cannot be minimized. At least two-thirds of respondents reported difficulties in maintaining meaningful relationships, but other limitations may have indirect effects on relationships. For example, more than half of the respondents reported difficulties maintaining the household, managing finances, taking care of oneself, and preparing meals. One would expect that these difficulties place additional burden on caregivers. Because these activities involve attention, planning, and decision making, cognitive functions such as executive functioning, attention capacity, and memory have been implicated [37]. However, additional research is needed to determine the causal pathway between cognitive dysfunction and psychosocial deficits in major depression.

Many patients reported that cognitive symptoms "often" or "almost always" interfered with their ability to fully recover from depression; thus, HCPs need to be able to evaluate the potential of residual cognitive symptoms to trigger future relapses of MDD and be aware of the more sensitive assessment of cognition at all phases of the depression cycle. Overall, a marked proportion of patients cited relief from cognitive symptoms as an important factor when deciding on a treatment for MDD. This finding implies that treatments for MDD that improve cognitive functioning may be preferred by patients over options that do not address this aspect of the disorder. Several new or repurposed medications that target cognitive symptoms may help address this need, including vortioxetine, lisdexamfetamine, and erythropoietin [31]; however, the long-term benefits of such MDD treatments in cognitive function remain to be fully elucidated [38].

Overall, HCPs may want to adopt a rehabilitation approach for the assessment and treatment of cognitive symptoms in MDD and utilize cognitive remediation in addition to occupational therapies. Since cognitive symptoms are increasingly recognized as a factor that can impair recovery from MDD and maintain psychosocial and workplace disability, even after MDD remittance [9,33], some experts recommend that "cognitive remission" and "functional recovery" be added as treatment goals for MDD [39,40].

Limitations

There are some limitations to this study that should be noted. The majority of participants in this study were white, educated women from the United States who had insurance coverage, which is higher than the rates of women and white patients reported in a previous national study of depressive symptoms (58.1% women and 73.4% white patients) [41]. This inequality in demographics may therefore limit generalizability. However, it should also be noted that some attributes such as the mean age and age at first episode were similar to those reported in previous studies [42]. In addition, owing to the self-selected nature of the PatientsLikeMe patient population and the lack of an independent validation of diagnosis and cognitive impairment, it is not possible to confirm that patients represented in the PatientsLikeMe platform and survey data were indeed diagnosed with MDD. However, participants who participated in the survey completed the PHQ-8 depression scale, and almost 87% were found to have moderately severe or severe levels of depression. Finally, the study design did not allow an independent assessment to determine whether participants were experiencing actual cognitive performance difficulties. Previous studies have found that subjective impressions and objective performance in cognition do not correlate with each other [43] and may reflect the negative cognitive bias central to MDD [10]. Therefore, it is possible that patients' self-reports may not have mirrored their cognitive reality. Moreover, previous studies have found that subjective reports of cognitive dysfunction correlate with depression symptoms [43].

Further studies are needed to evaluate the consequences of residual cognitive symptoms after remission of depression and identify appropriate treatments. It is important for future studies to evaluate patient perceptions of cognitive function along with objective longitudinal measurement through the cycle of depression and to investigate the effect of medications and cognitive remediation on the course and treatment outcomes of depression.

Conclusions

The PIVOT studies provide an understanding of how symptoms of and recovery from MDD are conceptualized by patients. An analysis of the PatientsLikeMe database responses indicated that cognitive symptoms were frequently reported, and many patients with no/mild depression still reported difficulty in concentrating. These difficulties were also reported among patients who considered their treatment successful. In the prospective survey, most patients reported the ability to discern improvements in individual MDD symptoms. Cognitive symptoms correlated with depression severity, and patients acknowledged that cognitive symptoms did not necessarily improve with treatment. These symptoms interfered with meaningful relationships and daily life tasks and impacted work and recovery from depression. Our studies identified the need for measures to further characterize the nature and impact of cognitive symptoms in MDD and a commitment to integrate cognitive function into the assessment and management of MDD. Further understanding and management of cognitive issues of MDD will be beneficial for patients and may improve overall recovery.

Authors' Contributions

EC was involved with conceptualization of the studies, development of the survey, interpretation of the data, and organization and preparation of the manuscript. JD was involved in conceptualization of the studies, development of the survey, analysis and interpretation of the data, and creation of tables and charts. CC was involved with data collection and analysis, preparation of tables and figures, data reporting in the manuscript, and review of the manuscript. VW was involved in conducting the studies, data analysis, and manuscript review. SS and DT made substantial contributions to the conception and design of the studies and were involved in the interpretation of data. All authors were involved in drafting the manuscript and revising it critically for important intellectual content. All authors have read and approved the final manuscript to be published and agree to be accountable for all aspects of the work. Authors had full control of the content of this manuscript.

Conflicts of Interest

EC, CC, and VW are employed by PatientsLikeMe. The PatientsLikeMe Research Team has received research funding, including conference support and consulting fees, from AbbVie, Acorda, Actelion, Alexion, Amgen, AstraZeneca, Avanir, Biogen, Boehringer Ingelheim, Celgene, EMD, Genentech, Genzyme, Janssen, Johnson & Johnson, Merck, Neuraltus, Novartis, Otsuka, Pfizer, Sanofi, Takeda, and UCB. JD was an employee of PatientsLikeMe during this study. JD is currently employed by the Global Outcomes and Research team at Takeda Pharmaceuticals; this work does not overlap with that of the group contributing to this study. SS is an employee of Takeda Pharmaceuticals. DT was an employee of Takeda Pharmaceuticals during this study. DT is currently employed by Roche Pharmaceuticals.

Multimedia Appendix 1
Full PIVOT study survey. PIVOT: Patient Insights and Voice on Major Depressive Disorder Treatment and Symptom Perception.
[PDF File (Adobe PDF File), 68KB - jopm_v11i2e11167_app1.pdf]

Multimedia Appendix 2
Effect of cognitive and mood disturbance symptoms on ability to work among survey respondents in study 2.
[PDF File (Adobe PDF File), 117KB - jopm_v11i2e11167_app2.pdf]

References

1. Kessler RC, Berglund P, Demler O, Jin R, Koretz D, Merikangas KR, et al. The epidemiology of major depressive disorder: results from the National Comorbidity Survey Replication (NCS-R). JAMA 2003 Jun 18;289(23):3095-3105. [doi: 10.1001/jama.289.23.3095] [Medline: 12813115]
2. The Global Burden of Disease: 2004 Update. Geneva, Switzerland: World Health Organization; 2008.
3. Kessler RC, Bromet EJ. The epidemiology of depression across cultures. Annu Rev Public Health 2013;34:119-138 [FREE Full text] [doi: 10.1146/annurev-publhealth-031912-114409] [Medline: 23514317]
4. Demyttenaere K, Donneau A, Albert A, Ansseau M, Constant E, van Heeringen K. What is important in being cured from depression? Discordance between physicians and patients (1). J Affect Disord 2015 Mar 15;174:390-396. [doi: 10.1016/j.jad.2014.12.004] [Medline: 25545606]
5. American Psychiatric Association: Depressive disorders: DSM-5® selections. Diagnostic and Statistical Manual of Mental Disorders Fifth Edition. Arlington, VA: American Psychiatric Publishing; 2015.
6. Murrough JW, Iacoviello B, Neumeister A, Charney DS, Iosifescu DV. Cognitive dysfunction in depression: neurocircuitry and new therapeutic strategies. Neurobiol Learn Mem 2011 Nov;96(4):553-563. [doi: 10.1016/j.nlm.2011.06.006] [Medline: 21704176]
7. Hasselbalch BJ, Knorr U, Hasselbalch SG, Gade A, Kessing LV. Cognitive deficits in the remitted state of unipolar depressive disorder. Neuropsychology 2012 Sep;26(5):642-651. [doi: 10.1037/a0029301] [Medline: 22823136]
8. Rosenblat JD, Kakar R, McIntyre RS. The Cognitive Effects of Antidepressants in Major Depressive Disorder: A Systematic Review and Meta-Analysis of Randomized Clinical Trials. Int J Neuropsychopharmacol 2015 Jul 25;19(2) [FREE Full text] [doi: 10.1093/ijnp/pyv082] [Medline: 26209859]
9. McIntyre RS, Cha DS, Soczynska JK, Woldeyohannes HO, Gallaugher LA, Kudlow P, et al. Cognitive deficits and functional outcomes in major depressive disorder: determinants, substrates, and treatment interventions. Depress Anxiety 2013 Jun;30(6):515-527. [doi: 10.1002/da.22063] [Medline: 23468126]
10. Lam RW, Kennedy SH, Mclntyre RS, Khullar A. Cognitive dysfunction in major depressive disorder: effects on psychosocial functioning and implications for treatment. Can J Psychiatry 2014 Dec;59(12):649-654 [FREE Full text] [doi: 10.1177/070674371405901206] [Medline: 25702365]
11. Hammar A, Ardal G. Cognitive functioning in major depression--a summary. Front Hum Neurosci 2009;3:26 [FREE Full text] [doi: 10.3389/neuro.09.026.2009] [Medline: 19826496]
12. Gonda X, Pompili M, Serafini G, Carvalho AF, Rihmer Z, Dome P. The role of cognitive dysfunction in the symptoms and remission from depression. Ann Gen Psychiatry 2015;14:27 [FREE Full text] [doi: 10.1186/s12991-015-0068-9] [Medline: 26396586]
13. El HE, Samp J, Rémuzat C, Auray J, Lamure M, Aballéa S, et al. Difference of perceptions and evaluation of cognitive dysfunction in major depressive disorder patients across psychiatrists internationally. Ther Adv Psychopharmacol 2014 Feb;4(1):22-29 [FREE Full text] [doi: 10.1177/2045125313507946] [Medline: 24490027]
14. Russo M, Mahon K, Burdick KE. Measuring cognitive function in MDD: emerging assessment tools. Depress Anxiety 2015 Apr;32(4):262-269 [FREE Full text] [doi: 10.1002/da.22297] [Medline: 25421437]
15. Young HN, Bell RA, Epstein RM, Feldman MD, Kravitz RL. Physicians' shared decision-making behaviors in depression care. Arch Intern Med 2008 Jul 14;168(13):1404-1408 [FREE Full text] [doi: 10.1001/archinte.168.13.1404] [Medline: 18625920]
16. Henke RM, Chou AF, Chanin JC, Zides AB, Scholle SH. Physician attitude toward depression care interventions: implications for implementation of quality improvement initiatives. Implement Sci 2008 Sep 30;3:40 [FREE Full text] [doi: 10.1186/1748-5908-3-40] [Medline: 18826646]
17. Demyttenaere K, Desaiah D, Petit C, Croenlein J, Brecht S. Patient-assessed versus physician-assessed disease severity and outcome in patients with nonspecific pain associated with major depressive disorder. Prim Care Companion J Clin Psychiatry 2009;11(1):8-15 [FREE Full text] [Medline: 19333404]
18. Marando F, Gualberti G, Costanzo AM, di Luzio Paparatti U, Franzetti M, Ammassari A, et al. Discrepancies between physician's perception of depression in HIV patients and self-reported CES-D-20 assessment: the DHIVA study. AIDS Care 2016;28(2):147-159 [FREE Full text] [doi: 10.1080/09540121.2015.1080794] [Medline: 26461177]

19. McGrady A, Lynch DJ, Nagel RW, Tamburrino M. Coherence between physician diagnosis and patient self reports of anxiety and depression in primary care. J Nerv Ment Dis 2010 Jun;198(6):420-424. [doi: 10.1097/NMD.0b013e3181e084ce] [Medline: 20531120]

20. Patientslikeme. URL: https://www.patientslikeme.com/?format=html [accessed 2019-01-22] [WebCite Cache ID 75cdEqgPW]

21. Kincaid JP, Fishburne RP, Rogers RL, Chissom BS. Derivation of New Readability Formulas: (automated Readability Index, Fog Count and Flesch Reading Ease Formula) for Navy Enlisted Personnel. Memphis, US: Chief of Naval Technical Training; 1975:1-48.

22. Kroenke K, Spitzer RL, Williams JB. The PHQ-9: validity of a brief depression severity measure. J Gen Intern Med 2001 Sep;16(9):606-613 [FREE Full text] [Medline: 11556941]

23. Kroenke K, Strine TW, Spitzer RL, Williams JBW, Berry JT, Mokdad AH. The PHQ-8 as a measure of current depression in the general population. J Affect Disord 2009 Apr;114(1-3):163-173. [doi: 10.1016/j.jad.2008.06.026] [Medline: 18752852]

24. Ritvo P, Fischer J, Miller D, Andrews H, Paty D. Multiple Sclerosis Quality of Life Inventory: A User's Manual. New York, NY: National Multiple Sclerosis Society; 1997. Self-reported cognitive dysfunction: Perceived deficits questionnaire (PDQ) URL: https://www.nationalmssociety.org/NationalMSSociety/media/MSNationalFiles/Brochures/MSQLI_-A-User-s-Manual.pdf [accessed 2019-01-09] [WebCite Cache ID 75IYjZ8YL]

25. Lam R, Saragoussi D, Danchenko N, Rive B, Lamy F, Brevig T. Psychometric Validation of Perceived Deficits Questionnaire – Depression (PDQ-D) in Patients with Major Depressive Disorder (MDD). Value in Health 2013 Nov;16(7):A330. [doi: 10.1016/j.jval.2013.08.046]

26. Eysenbach G. Improving the quality of Web surveys: the Checklist for Reporting Results of Internet E-Surveys (CHERRIES). J Med Internet Res 2004 Sep 29;6(3):e34 [FREE Full text] [doi: 10.2196/jmir.6.3.e34] [Medline: 15471760]

27. Douglas KM, Porter RJ. Longitudinal assessment of neuropsychological function in major depression. Aust N Z J Psychiatry 2009 Dec;43(12):1105-1117. [doi: 10.3109/00048670903279887] [Medline: 20001409]

28. Snyder HR. Major depressive disorder is associated with broad impairments on neuropsychological measures of executive function: a meta-analysis and review. Psychol Bull 2013 Jan;139(1):81-132 [FREE Full text] [doi: 10.1037/a0028727] [Medline: 22642228]

29. Huang CL. Residual Cognitive Deficit in Adults with Depression who Recovered after 6-month Treatment: Stable versus State-Dependent Markers. J Clin Med Res 2009 Oct;1(4):202-206 [FREE Full text] [doi: 10.4021/jocmr2009.10.1266] [Medline: 22461869]

30. Stotland NL. Recovery from depression. Psychiatr Clin North Am 2012 Mar;35(1):37-49. [doi: 10.1016/j.psc.2011.11.007] [Medline: 22370489]

31. Bortolato B, Miskowiak KW, Köhler CA, Maes M, Fernandes BS, Berk M, et al. Cognitive remission: a novel objective for the treatment of major depression? BMC Med 2016 Jan 22;14:9 [FREE Full text] [doi: 10.1186/s12916-016-0560-3] [Medline: 26801406]

32. Hammar A, Sørensen L, Ardal G, Oedegaard KJ, Kroken R, Roness A, et al. Enduring cognitive dysfunction in unipolar major depression: a test-retest study using the Stroop paradigm. Scand J Psychol 2010 Aug;51(4):304-308. [doi: 10.1111/j.1467-9450.2009.00765.x] [Medline: 20042028]

33. Woo YS, Rosenblat JD, Kakar R, Bahk W, McIntyre RS. Cognitive Deficits as a Mediator of Poor Occupational Function in Remitted Major Depressive Disorder Patients. Clin Psychopharmacol Neurosci 2016 Feb 29;14(1):1-16 [FREE Full text] [doi: 10.9758/cpn.2016.14.1.1] [Medline: 26792035]

34. Biringer E, Mykletun A, Sundet K, Kroken R, Stordal KI, Lund A. A longitudinal analysis of neurocognitive function in unipolar depression. J Clin Exp Neuropsychol 2007 Nov;29(8):879-891. [doi: 10.1080/13803390601147686] [Medline: 17852600]

35. McIntyre RS, Soczynska JZ, Woldeyohannes HO, Alsuwaidan MT, Cha DS, Carvalho AF, et al. The impact of cognitive impairment on perceived workforce performance: results from the International Mood Disorders Collaborative Project. Compr Psychiatry 2015 Jan;56:279-282. [doi: 10.1016/j.comppsych.2014.08.051] [Medline: 25439523]

36. Nieuwenhuijsen K, Faber B, Verbeek JH, Neumeyer-Gromen A, Hees HL, Verhoeven AC, et al. Interventions to improve return to work in depressed people. Cochrane Database Syst Rev 2014 Dec 03(12):CD006237. [doi: 10.1002/14651858.CD006237.pub3] [Medline: 25470301]

37. Cambridge OR, Knight MJ, Mills N, Baune BT. The clinical relationship between cognitive impairment and psychosocial functioning in major depressive disorder: A systematic review. Psychiatry Res 2018 Nov;269:157-171. [doi: 10.1016/j.psychres.2018.08.033] [Medline: 30149273]

38. Porter RJ, Douglas K, Jordan J, Bowie CR, Roiser J, Malhi GS. Psychological treatments for cognitive dysfunction in major depressive disorder: current evidence and perspectives. CNS Neurol Disord Drug Targets 2014;13(10):1677-1692. [Medline: 25470388]

39. McIntyre RS. Using measurement strategies to identify and monitor residual symptoms. J Clin Psychiatry 2013;74 Suppl 2:14-18 [FREE Full text] [doi: 10.4088/JCP.12084su1c.03] [Medline: 24191973]

40. Trivedi MH, Greer TL. Cognitive dysfunction in unipolar depression: implications for treatment. J Affect Disord 2014 Jan;152-154:19-27. [doi: 10.1016/j.jad.2013.09.012] [Medline: 24215896]

41.   Martin LA, Neighbors HW, Griffith DM. The experience of symptoms of depression in men vs women: analysis of the National Comorbidity Survey Replication. JAMA Psychiatry 2013 Oct;70(10):1100-1106. [Medline: 23986338]

42.   Kessler RC, Birnbaum H, Bromet E, Hwang I, Sampson N, Shahly V. Age differences in major depression: results from the National Comorbidity Survey Replication (NCS-R). Psychol Med 2010 Feb;40(2):225-237 [FREE Full text] [doi: 10.1017/S0033291709990213] [Medline: 19531277]

43.   Srisurapanont M, Suttajit S, Eurviriyanukul K, Varnado P. Discrepancy between objective and subjective cognition in adults with major depressive disorder. Sci Rep 2017 Jun 20;7(1):3901 [FREE Full text] [doi: 10.1038/s41598-017-04353-w] [Medline: 28634383]

Abbreviations

HCP: health care providers
MDD: major depressive disorder
PDQ: perceived deficits questionnaire
PHQ: patient health questionnaire
PIVOT: Patient Insights and Voice on Major Depressive Disorder Treatment and Symptom Perception

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