Multiple Sclerosis and MyChart Messaging:

A Retrospective Review Evaluating Its Use

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Practice Points

- There is a paucity of research evaluating the use of MyChart messaging or other tethered messaging system equivalents by patients with MS.

- Available data have associated increased morbidity with increased rates of sustained use of patient portal systems, but it remains unclear whether this holds true in patients with MS, especially because increased morbidity in patients with MS may confound rates of tethered messaging utilization for reasons intrinsic to the disease course itself.

- Ultimately, these data could be leveraged to improve patient satisfaction, health outcomes, efficiency, cost, and rates of health care provider burnout and, thus, should be the subject of further research.
Abstract

**Background:** Understanding patterns of MyChart (Epic Systems Corp) messaging has the potential to alter clinical practice. However, because most research evaluating its use has been conducted in limited contexts, utilization patterns in patients with multiple sclerosis (MS) remain unclear. We characterized factors associated with high rates of MyChart messaging in patients with MS.

**Methods:** We performed a retrospective cross-sectional analysis of adult patients in an academic outpatient clinic’s database (N = 439). Inclusion criteria were one or more clinic visits and MS diagnosis. We extracted demographic and disease-specific characteristics and MyChart messaging information.

**Results:** MyChart users in the database totaled 74% (n = 324). MyChart users were more often younger, had shorter duration since diagnosis, had lower Patient-Determined Disease Steps scores, and were more likely to be using high-efficacy disease-modifying therapies than nonusers. Messaging rates were positively correlated with total number of unique medications ($R = 0.17, P = .003$) and negatively correlated with age ($R = -0.11, P = .018$).

**Conclusions:** Although research has implicated arm-hand disability and impaired vision as barriers to patient portal use, these findings suggest the relationship between MS-specific disease burden and MyChart utilization is also a function of underlying medical complexity in capacities beyond physical disability. These data may serve as groundwork for investigation into other disease-specific settings and for quality improvement research to mitigate these high rates in at-risk patients, optimizing provider time investment, clinic productivity, and patient safety and preventing health care provider burnout. *Int J MS Care.*
Introduction

Tethered messaging systems are communication features embedded into the electronic medical record that facilitate patient-provider messaging. These messaging portals enable patients to compose and send messages to their providers electronically at any time; these messages are then reviewed by medical assistants and either answered directly or routed appropriately depending on the message content. One such example is the messaging feature in MyChart (Epic Systems Corp) powered by Epic. In this era where the burden-to-benefit ratio of using tethered messaging systems in health care exchange is still being defined, there is uncertainty regarding patient factors associated with high messaging rates in the electronic medical record, especially as it pertains to patient populations with specific chronic diseases.

These tethered messaging systems confer well-documented benefits for both patients and health care providers, namely, secure, accessible, and asynchronous communication in addition to improved measures of effective care and health care provider productivity.\(^1\)\(^-\)\(^4\) At the same time, these messaging systems introduce unique concerns (eg, nonreimbursed increase in workload) and are naturally limited (eg, insufficient information for clinical decision making).\(^1\)\(^,\)\(^5\)\(^,\)\(^6\) These factors detract from optimal use and compound a situation already akin to contributing to health care practitioner burnout.\(^7\)

Patients with multiple sclerosis (MS) stand to benefit just as much, if not more, from the use of tethered messaging systems as other populations of patients. It has been shown that utilization rates vary by clinical setting type and location as well as by clinic specialty.\(^1\)\(^,\)\(^8\)\(^,\)\(^9\) Most research characterizing tethered messaging utilization patterns exists in the context of family
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medicine practices or a limited subset of chronic disease–specific visits. Although increased morbidity has been associated with higher rates of sustained use of patient portal systems, it remains unclear whether this holds true in patients with MS, especially because increased morbidity in patients with MS may confound rates of tethered messaging utilization for reasons intrinsic to the disease course itself.

To clarify the relationship between chronic disease–specific variables and MyChart messaging use, we characterized factors associated with high rates of MyChart messaging in patients with MS in an academic outpatient setting.

**Methods**

**Patient Selection**

We conducted a retrospective cross-sectional analysis of all patients in an academic MS center database (N = 439). Inclusion criteria were age 18 years or older, one or more documented clinic encounters, and an MS diagnosis. Exclusion criteria were no documented clinic visits at the center and no MS diagnosis.

**Study Site and Approvals**
Patients in this study were seen at an academic MS center in Tampa, Florida. The University of South Florida’s institutional review board approved this study. All the patients consented to participation in the MS clinic database.

**Data Collected**

The study included all MyChart messaging activity from August 2015 through August 2019. Extracted information included age, sex, time since MS diagnosis, current disease-modifying therapy (DMT), Patient-Determined Disease Steps (PDDS) score, total number of unique prescription medications, MyChart subscription status, time since first MyChart message, and total number of MyChart messages.

We categorized each MyChart message into one of five categories: nonurgent medical question, prescription question, test results question, visit follow-up question, and medication refill request. Included messages were all part of conversations that were patient-initiated, and each patient-authored message was included as a distinct data point. Included messages were those that occurred between provider (ie, physician, physician assistant, or advanced registered nurse practitioner) and patient. Excluded messages were those that were visit follow-up questionnaires, direct patient responses to provider-initiated questions, and patient responses consisting of “thank you” or variations thereof, such as “you’re the best.” We provide detailed definitions of the study variables in Table S1, which is published in the online version of this article at ijmsc.org.
A PDDS score can range from 0 to 8, with 0 being normal and 8 being bedridden as noted by the patient. A lower score on the PDDS indicates less disability.11

Statistical Analysis

Data were analyzed using a statistical software program (SAS version 9.4; SAS Institute Inc). Descriptive statistics were used for demographic and MyChart use level data (users vs nonusers). Analysis by independent t test was used to compare the significance of the difference between groups over the specified variables. Pearson correlations were used to determine any associations between characteristic variables and MyChart use levels. A significance level of $P < .01$ was used to indicate significance due to multiple comparisons.

Data Availability Statement

Anonymized data will be shared by request from any qualified investigator for purposes of replicating procedures and results.

Results

There were 439 unique patients in the center’s database. Of these, 324 (74%) were subscribed to MyChart accounts and 314 (72%) sent at least one message through the MyChart portal. The mean ± SD patient age was 51.4 ± 13.1 years. There were 104 male patients (24%)
and 335 female patients (76%). The mean ± SD PDDS score was 2.0 ± 2.4. A total of 327 patients (74%) were taking some form of DMT or other off-label medication (Table 1).

On average, MyChart subscribers were younger (mean ± SD age: 50.1 ± 12.6 years vs 55.0 ± 13.7 years, \(P < .001\)), had lower mean ± SD PDDS scores (2.8 ± 2.3 vs 3.5 ± 2.5, \(P = .0107\)), and were diagnosed more recently (mean ± SD: 11.9 ± 8.3 years vs 15.8 ± 10.8 years, \(P = .0013\)). There was no difference between MyChart subscribers and nonsubscribers for number of unique medications (Table 1).

Annually, MyChart users had a mean ± SD of 8.5 ± 10.6 messages and a median of 5.16 (range, 0-84) messages. Based on this annual average data, the top 15% of the MyChart users were sending a minimum of one message per week. In descending order of mean ± SD number of messages per patient, message categories were nonurgent medical questions (9.9 ± 18.2), prescription questions (4.0 ± 6.4), refill requests (2.0 ± 3.6), test results questions (1.8 ± 4.3), and visit follow-up questions (1.4 ± 2.4).

There was a significant difference in current DMT use between MyChart users and nonusers \(\left(\chi^2_{1,323} = 6.7, P = .009\right)\). MyChart users were more likely to be taking a high-efficacy DMT (alemtuzumab, natalizumab, ocrelizumab) (Table 1). Total number of MyChart messages was correlated with the total number of unique medications \((R = 0.17, P < .001)\) and negatively correlated with age \((R = −0.11, P = .018)\). There were no significant associations between total number of MyChart messages and PDDS score or time since diagnosis (Table 2).

**Discussion**
In this retrospective observational study of MyChart messaging among patients with MS, we identified significant demographic and disease-specific differences between users and nonusers of this messaging system as well as demographic and disease-specific variables accounting for increased messaging rates. In doing so, we highlight the importance of disease-specific investigation in evaluation of tethered messaging systems.

Rates of MyChart messaging subscription at our center are similar to those of other university-based settings, with more than 70% of patients with active patient portal accounts. Multiple studies have shown that the age range of these patients tends to be somewhere within 36 to 69 years but generally mirrors the patient population of the clinic. In the present cohort, MyChart subscribers were, on average, younger, and messaging rates were negatively correlated with age. Although the clinical relevance of the absolute difference between these ages is likely inconsequential because the age gap is not meaningfully large enough to account for differences in technological access or aptitude, it does suggest that a general trend exists. In addition to being younger, those who used MyChart also had lower PDDS scores. Previous studies assessing this at other MS centers demonstrated similar results. Those who were younger and had less disability were more likely to use an electronic messaging portal. Although PDDS scores were associated with MyChart subscription status, they were not significantly associated with messaging rates. Patients who generally tend to account for the most messages in patient portals are white and female, although in the present population of patients with MS, there was no difference between messaging rates for male and female patients.

Total number of medications served as an additional surrogate for a patient’s overall morbidity by MS but also by other comorbidities. In the present study, as total number of
medications increased, total number of MyChart messages also increased, although this did not have bearing on MyChart user status. This finding is congruent with that of a previously published study, which identified a similar variable’s relationship with overall patient portal use in patients with MS. This suggests that increased overall disease burden (ie, including a patient’s comorbidities) is a predictor of increased messaging rates.

MyChart users were more likely than nonusers to be receiving a high-efficacy DMT. This is consistent with what was reported by a similar study, which found higher messaging rates among those being treated with second-line therapy compared with those receiving first-line therapy or no treatment. This variable, unlike PDDS score and total number of medications, is more likely a direct reflection of disease severity and indirectly reflects disease morbidity. This variable may be influenced by the logistical implications of DMT administration, need for DMT-specific monitoring, and tolerability of the DMT, all of which may contribute to higher rates of messaging.

In the present cohort, most messages were categorized as nonurgent medical questions and prescription questions, and fewer messages were categorized as refill requests, test results, or visit follow-up questions. These findings are similar to those reported previously in which the most common message subjects were for medication adverse effects and prescription refills or requests. Nonurgent medical questions likely account for the greatest number of messages because this message category is the most encompassing.

These data serve as the groundwork for potential process improvement initiatives in the outpatient clinical setting. Application of the demographic and disease-specific variables associated with MyChart subscription and increased messaging rates may enable providers and
clinic staff to identify high users among patients early on. Once identified, in-clinic measures may be constructed to mitigate the anticipated MyChart messaging utilization rate to optimize the tethered messaging system for both the patient and the health care provider. These potential in-clinic measures should be the subject of subsequent research endeavors and may include modified patient intake, health care provider checklists, and patient education. Further research would need to corroborate the effect on patient satisfaction and health care–associated outcomes, health care provider time investment and burnout, and overall clinic productivity and resource optimization such as changes in telephone call rates. Finally, as many of the pertinent outcomes we mention are unique to the epidemiology and disease course of MS, this study can also serve as the groundwork for similar investigations in other disease-specific settings.

There were several limitations to this study. The messages captured in the nonurgent medical questions category were broad. This makes it difficult to determine whether any specific realm of medical questioning was more likely in this population and, in turn, difficult to identify a target for intervention. In addition, the message categories did not provide a sense of whether high-volume MyChart messaging utilization is secondary to factors intrinsic to the disease process or to MyChart messaging misuse; thus, it would be helpful to determine the criteria for appropriate and inappropriate messages. Last, this research was a single-center study; additional investigation is needed to assess for any regional differences in the findings described.

In conclusion, electronic medical record systems have improved health care delivery overall, but their implementation, especially concerning secure messaging systems such as MyChart messaging, has also presented unique challenges. The present study, which assessed MyChart subscription status and messaging utilization at an academic outpatient MS clinic,
showed that most patients use MyChart, and younger age and higher total number of unique prescription medications were associated with increased messaging rates. The burden-to-benefit ratio of these secure messaging systems is still being defined. Further understanding of the factors that influence MyChart use could be leveraged in many ways, including to improve patient satisfaction, health outcomes, efficiency, cost, and rates of health care provider burnout.

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Table 1. Demographic and disease-specific variables for MyChart subscribers and nonsubscribers

| Variable                        | Total (N = 439) | Subscribers (n = 324) | Nonsubscribers (n = 115) | P value |
|---------------------------------|-----------------|-----------------------|--------------------------|---------|
| Age, y                          | 51.4 ± 13.1     | 50.1 ± 12.6           | 55.0 ± 13.7              | <.001a  |
| Sex                             |                 |                       |                          |         |
| Female                          | 335 (76)        | 257                   | 78                       | NA      |
| Male                            | 104 (24)        | 67                    | 37                       |         |
| PDDS score                      | 2.0 ± 2.4       | 2.8 ± 2.3             | 3.5 ± 2.5                | .0107a  |
| Time since diagnosis, y         | NA              | 11.9 ± 8.3            | 15.8 ± 10.8              | .0013a  |
| No. of unique medications       | NA              | 10 ± 5.6              | 10.2 ± 5.2               | .72a    |
| DMT                             |                 |                       |                          |         |
| Alemtuzumab                     | 9 (2.1)         | 9                     | 0                        |         |
| Dimethyl fumarate               | 55 (12.5)       | 40                    | 15                       |         |
| Fingolimod                      | 18 (4.1)        | 16                    | 2                        |         |
| Glatiramer acetate              | 51 (11.6)       | 31                    | 20                       |         |
| Interferon beta-1a              | 32 (7.3)        | 23                    | 9                        |         |
| Interferon beta-1b              | 7 (1.6)         | 2                     | 5                        |         |
| Natalizumab                     | 37 (8.4)        | 34                    | 3                        |         |
| Ocrelizumab                     | 73 (16.6)       | 58                    | 15                       |         |
| Teriflunomide                   | 34 (7.8)        | 23                    | 11                       |         |
| Otherb                          | 11 (2.5)        | 7                     | 4                        |         |
| None                            | 112 (25.5)      | 71                    | 41                       |         |
| High-efficacy DMTc              | 119 (27.1)      | 101                   | 18                       | .009d   |

Note: Data are given as mean ± SD, number (percentage), or number.

Abbreviations: DMT, disease-modifying therapy; NA, not applicable; PDDS, Patient-Determined Disease Steps.

a Independent t test.

b Rituximab, azathioprine, pulse solumedrol, siponimod, secukinumab, or cladribine; for one patient, data were missing.

c Includes alemtuzumab, natalizumab, and ocrelizumab.

d $\chi^2_{1,323} = 6.7$. 
Table 2. Association between total MyChart messages by disease-specific variables

(Pearson correlation coefficient)

| Variable                        | R     | P value |
|---------------------------------|-------|---------|
| PDDS score                      | 0.068 | .15     |
| Age (y)                         | -0.11 | .018    |
| Time since diagnosis (y)        | -0.087| .07     |
| Total unique medications (no.)  | 0.17  | <.001   |

Abbreviation: PDDS, Patient-Determined Disease Steps.
Table S1. Detailed definitions of study variables

| Variable                                      | Definition                                                                                                                                 |
|-----------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|
| Time since diagnosis                          | Defined as number of years since MS diagnosis. This was determined by direct documentation in the clinic notes; if information was not available in the clinic notes recorded in Epic, the information was obtained from clinic notes documented in USF’s electronic medical record prior to Epic. |
| Total number of unique prescription medications | Defined as all documented medications, excluding generic multivitamins and other supplements such as turmeric, fish oil, garlic, cinnamon, milk thistle, and cranberry. |
| Patient-Determined Disease Steps (PDDS)       | PDDS scores range from 0-8, 0 being normal and 8 being bedridden as noted by the patient. A lower score on the PDDS indicates less disability. |
| Time since first MyChart message              | Determined using the difference between the end-date of the chart review (8/18/2019) and the date of the earliest recorded MyChart message with USF MS Clinic. |
| Annual messaging rates                         | Determined using the number of MyChart messages and time since first MyChart message (see above)                                          |
| Message classification: “Nonurgent medical questions” | Included those regarding symptoms, clinical relevance of MS or MS therapy in the context of activities or other medical interventions, medical history updates from other specialties, requests for MS Clinic staff-to-patient phone calls, clinic scheduling, doctor’s note (disability, FMLA, handicap permit, jury duty exemption, etc.), and casual conversation. |
| Message classification: “Prescription questions” | Included those regarding medication administration, prior authorization, pharmacy questions, infusion center logistics, and prescription requests for assistive devices. |
| Message classification: “Test results questions” | Included those regarding clinical implication of lab or imaging results, expected result date, and inter-facility communication of lab results. |
| Message classification: “Visit follow-up questions” | Included those regarding a specific topic referenced in clinic, if/when lab work or imaging should be done in reference to next visit, and billing concerns. |
| Message classification: “Medication refill requests” | Included those written out in a patient message and those requested directly through the MyChart refill option. |

Abbreviations: FMLA, Family and Medical Leave Act; MS, multiple sclerosis; PDDS, Patient-Determined Disease Steps.