Digital Medicine Tools and the Work of Being a Patient: A Qualitative Investigation of Digital Treatment Burden in Patients With Diabetes

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Abstract

Objective: To understand the contribution of digital medicine tools (eg, continuous glucose monitoring systems, scheduling, and messaging applications) to treatment burden in patients with diabetes.

Patients and Methods: Between October and November 2023, we invited patients with type 1 or type 2 diabetes to participate in semistructured interviews. The interviewees completed the Treatment Burden Questionnaire as they reflected on how digital medicine tools affect their daily routines. A published taxonomy of treatment burden guided the qualitative content analysis of interview transcripts.

Results: In total, 20 patients agreed to participate and completed interviews (aged 21-77 years, 55% female, 60% living with type 2 diabetes). We found 5 categories of tasks related to the use of digital medicine tools that patients had to complete (eg, calibrating continuous glucose monitors), 3 factors that made these tasks burdensome (eg, cost of device replacements), and 2 categories of consequences of burdensome tasks on patient wellbeing (eg, fatigue from device alarms).

Conclusion: Patients identified how digital medicine tools contribute to their treatment burden. The resulting digital burden taxonomy can be used to inform the design, implementation, and prescription of digital medicine tools including support for patients as they normalize them in their lives.

D igital medicine includes an increasing array of technologies and tools including patient portals, virtual visits, continuous glucose monitoring (CGM) systems, automated insulin delivery systems, and online and mobile self-management applications. Over the past decade, these technologies have significantly changed the health management work for people with diabetes and other long-term conditions.[1-4]

Patients living with long-term conditions, such as diabetes, often invest substantial time, energy, and attention to access and use health care and enact on-going self-management tasks.[5-7] These tasks include monitoring blood glucose, making self-management decisions, implementing insulin dosing, food choices, and exercise, and coordinating interactions with the health care system.[8]

The cumulative demands for patient work and the impact of this work on patient's quality of life is often referred to as treatment burden.[9,10] Treatment burden is a growing concern as more patients, at younger ages, receive more diagnoses of incurable and long-term physical and mental health conditions. This is particularly difficult for those living in socioeconomic disadvantage and social isolation.[11] Inaccessible, complicated, and poorly designed and coordinated health care can cause treatment burden, especially as clinicians intensify treatments to bring each separate condition under control.[12-18]

Digital medicine may alleviate the treatment burden by intervening on the factors

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that make care burdensome, streamlining or taking over tasks, or mitigating the impact of these tasks on wellbeing. Use of digital medicine tools, however, may also inadvertently exacerbate the treatment burden.[15,19] Thus, we need a better understanding of how patients access, operate, and normalize these tools into their daily routines and how these affect their treatment burden.[3,13]

Although measures of treatment burden exist,[14,17,20–22] none, to our knowledge, assess the impact of using digital medicine tools on patient self-reported treatment burden. We sought to investigate the experiences patients with diabetes have using digital medicine tools in their care. We focused on the ways in which digital medicine may affect treatment burden. This work represents a first step toward developing a measure of digital treatment burden.

PATIENTS AND METHODS

This qualitative study used individual patient interviews to elicit patient experiences with digital medicine tools and how their use affects patient treatment burden. It was part of a larger study to develop an instrument to assess patient-reported burden of digital medicine. Given the qualitative nature of this work, we report our methods in accordance with the Standards for Reporting Qualitative Research[23] (Supplemental Appendix A, available online at https://www.mcpdigitalhealth.org/).

Participants

Adult (18 years or older) patients with a diagnosis of type 1 or type 2 diabetes and attending the diabetes clinic in the Division of Endocrinology at Mayo Clinic (Rochester, MN) were eligible to participate if they used at least 1 digital medicine tool for diabetes management (eg, glucometer, insulin smartpens, and pumps), were proficient in English, and were able to complete informed consent (ie, had no major functional impairment).

Eligible patients were identified from the daily appointment calendar and approached in-person by study staff. We aimed to achieve a maximum variability sample with a diverse range of participant characteristics (age, gender, type of diabetes, and intensity of use of digital medicine tools) to provide a more comprehensive understanding of different experiences and perspectives in diabetes management. Before each interview, demographic and clinical data for participants were abstracted from the electronic health record. Then, experienced diabetes nurse educators staffing the Diabetes Technology Clinic used a 7-point scale, designed for this study, to rate each patient's intensity of use of digital medicine. To this end, they reviewed the patient's electronic medical chart and identified the digital medicine tools they were using (Supplemental Appendix B, available online at https://www.mcpdigitalhealth.org/).

Transcripts were reviewed iteratively during data collection, and recruitment continued until the study team determined that little key novel information was emerging with each additional interview, that is, when data saturation was reached.

Interviews

In a private room within the clinic, a trained investigator without previous experience in diabetes care or with diabetes patients (M.A.Z.) conducted semistructured interviews using a guide comprising questions focused on patient experience with digital medicine tools for diabetes management (Supplemental Appendix C, available online at https://www.mcpdigitalhealth.org/).

After eliciting information using open-ended questions, participants completed the Treatment Burden Questionnaire (TBQ), the most commonly used generic measure of treatment burden. The interviewer then asked participants open-ended questions related to the 15 TBQ constructs, for example, daily monitoring.

Survey responses and demographic and clinical data were managed using Research Electronic Data Capture tools hosted at Mayo Clinic (UL1TR002377). Research Electronic Data Capture is a secure, web-based software platform designed to support data capture for research studies.[24,25] Interview audio recordings were transcribed verbatim for analysis.

Data Analysis

Interview transcripts were analyzed using directed content analysis,[26] guided by Tran et al[27] taxonomy of treatment burden. The

process started with the creation of a codebook, which incorporated the treatment burden taxonomy and additional codes derived from reading the interview transcripts. Two researchers (M.A.Z. and S.S.) coded each transcript independently. One researcher (S.S.) has worked in the care of patients with diabetes. Any discrepancies were resolved through discussion to reach consensus. Transcripts were uploaded into NVivo (Lumivero), a computer-assisted qualitative data analysis software, to facilitate queries and discussion.

Survey responses and patient characteristics were analyzed using descriptive statistics where the count and percentage being presented for categorical variables and the mean and standard deviation for continuous variables.

Ethics Considerations
The Mayo Clinic Institutional Review Board (IRB #23-007631) approved all study procedures. All participants gave written informed consent before the interview, ensuring their awareness of the study's purposes, their rights, and the confidential handling of their data.

RESULTS
From September to November 2023, 23 patients were approached and 20 (median age of 53 years, IQR, 37-67 years; 55% female; 12 of 22 living with type 2 diabetes) consented to participate and completed an interview (Table 1). Each interview took an average of 29 minutes. Three patients declined participation owing to time constraints. Seven had care programs of maximal digital intensity. The median TBQ score was 53 (IQR, 21-71). Supplemental Appendix D (available online at https://www.mcpdigitalhealth.org/) reports TBQ item-level scores and TBQ distribution across digital intensity ratings.

Qualitative data are summarized further and presented in Figure[27] using the domains of the treatment burden taxonomy: (1) health care tasks that patients must complete (Table 2); (2) factors that exacerbate the treatment burden (Table 3); and (3) consequences of the health care tasks on patients' wellbeing (Table 4). The figure also notes whether these burden-related issues affect patients at the

TABLE 1. Characteristics of Patients Interviewed	
	Total (N=20)
Age at enrollment, years	
Median (IQR)	53 (37, 67)
Race	
White	16
Black or African American	1
Asian	3
Ethnicity	
Hispanic or Latino	1
No	19
Diabetes type, n	
Type 1 diabetes	8
Type 2 diabetes	12
Diabetes treatment	
Diet and activity	18
Noninsulin medication	9
Insulin use, n	18
Basal-bolus insulin therapy	17
Hypoglycemia in the past 6 mo, n	
No	3
Yes, not severe	15
Yes, severe	2
Health insurance, n	
Public insurance (Medicare, Medicaid)	9
Private	10
No insurance	1
Intensity of digital medicine tools use for self-management, n	
Minimal (1)	4
Low (2,3)	2
Moderate (4,5)	7
Maximal (6,7)	7

point of life, that is, during daily routines, or at the point of care, that is, during direct interactions with health care teams, such as in virtual or in-person clinical appointments or educational sessions.

Health Care Tasks Patients Must Complete
Participants described 5 categories of digital tasks including device maintenance, lifestyle changes, data sharing, administrative burden, and patient education. These tasks included the technical operation of the tools themselves and the effort required to integrate their use into daily routines. Participants reported device maintenance activities they did every day, for example, charging and calibrating devices, as routine yet critical. Less
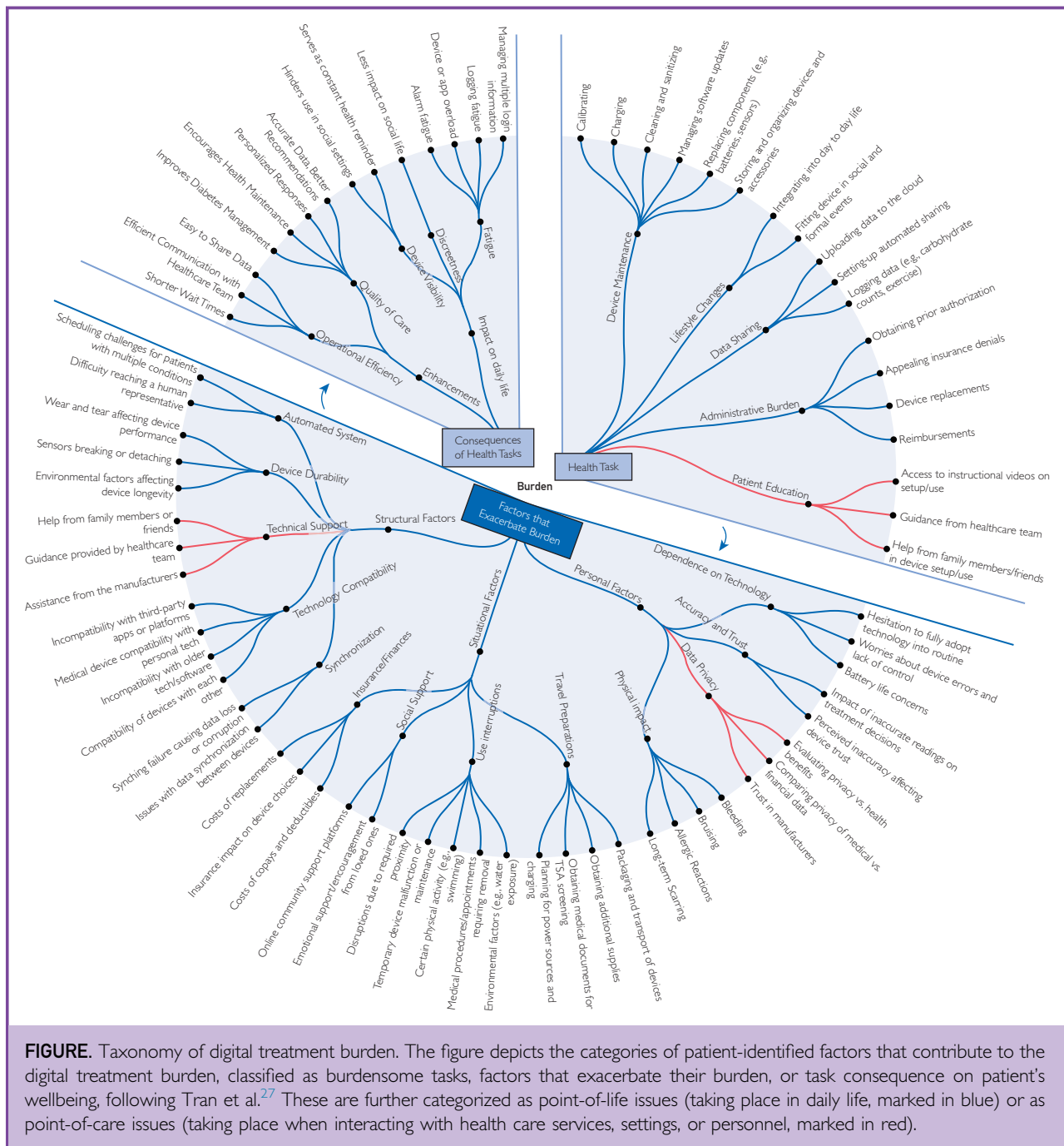
FIGURE. Taxonomy of digital treatment burden. The figure depicts the categories of patient-identified factors that contribute to the digital treatment burden, classified as burdensome tasks, factors that exacerbate their burden, or task consequence on patient's wellbeing, following Tran et al.[27] These are further categorized as point-of-life issues (taking place in daily life, marked in blue) or as point-of-care issues (taking place when interacting with health care services, settings, or personnel, marked in red).

frequent tasks, for example, receiving education on new devices and setting up automated data sharing, were also identified as burdensome, but mostly during their transition to a new device.

Patients reported that maintaining devices had to be integrated into their daily lives. The need for constant calibration, charging, cleaning, and software updates—although seemingly mundane—required reorganization

TABLE 2. Health Care Patient's Must Complete

Health care tasks patients must complete	Details
1.1 Device maintenance	Calibrating
	Charging
	Cleaning and sanitizing
	Managing software updates
	Replacing components (eg, batteries and sensors)
	Storing and organizing devices and accessories
1.2 Lifestyle changes	Integrating the device into day-to-day life
	Fitting the device into social and formal events
1.3 Data management	Uploading data to the cloud
	Setting up automated sharing
	Logging data (eg, carbohydrate counts and exercise)
1.4 Administrative burden	Obtaining prior authorization
	Appealing insurance denials
	Managing device replacements
	Handling reimbursements
1.5 Patient education	Access to instructional videos on setup and use
	Guidance from the health care team
	Help from family members/friends in device setup and use

of personal time and space. One participant explained as follows:

"There is maintenance involved. Every 3 days, you're supposed to change this cartridge and refill the Humalog, the insulin in the cartridge every 4 or 5 days, I would say—3, four, 5 days, and you have to charge the pump. It's a rechargeable battery, which is excellent, but there's maintenance. There's a lot of maintenance that goes on." (a 63-year-old patient with type 2 diabetes and high digital intensity)

These were reported as essential for device reliability and accuracy. Their complexity increased with frequent updates or user-unfriendly interfaces. Participants expressed frustrations, noting:

"Everything moves through the phones, kind of in line, because I know like phones will update. And all of a sudden, it [the continuous glucose monitor or CGM] won't communicate with your phone or something like that, so like kind of keeping those in line. And then, just the number of apps that you have to kind of string together can easily become kind of overwhelming." (a 33-year-old patient, with type 1 diabetes and maximal digital intensity)

Additionally, the administrative burden of using these devices emerged as a stressor. Navigating insurance processes to obtain or replace devices involves extensive paperwork and substantial communication and coordination with administrative personnel from the health care team, insurance companies, and device manufacturers. This multilayered complexity adds considerable strain and detracts from overall care management and quality of life. As 1 patient remarked:

"When my wife puts it on, the needle doesn't go in. Then, we've got to call the insurance company. And then, we have to send the one that doesn't work in. And sometimes, we don't get the Libre [a CGM] like we should, and there's still a glitch. I don't know what's—something with Medicare. Like I had my Libre in previous week and, all of a sudden, I checked my blood sugars, and it said Libre is not functioning. So then, you've got to take it off, and you've got to get another one if you have one." (a 67-year-old patient with type 2 diabetes and moderate digital intensity)

TABLE 3. Factors That Exacerbate Treatment Burden	
Factors that exacerbate treatment burden	Details
2.1 Personal factors	Dependence on technology
	Hesitation to fully integrate technology into daily routines
	Concerns about device errors and lack of control
	Worries regarding battery life
	Accuracy and trust
	Impact of inaccurate readings on treatment decisions
	Perceived inaccuracy affecting trust in the device
	Data privacy
	Evaluating the trade-offs between privacy and health benefits
	Comparisons of the privacy of medical vs financial data
	Trust in manufacturers to protect sensitive information
	Physical impact
	Bleeding
	Bruising
	Allergic reactions
	Long-term scarring from device use
2.2 Situational factors	Travel preparations
	Packaging and transporting the device
	Obtaining additional supplies as needed for the trip
	Securing medical documents for Transportation Security Administration (TSA) screening
	Planning for power sources and charging
	Interruptions that pause use
	Environmental factors, such as water exposure
	Medical procedures or appointments requiring device removal
	Activities incompatible with the device (eg, swimming)
	Temporary device malfunction or maintenance
	Disruptions due to required proximity
	Social support
	Emotional support and encouragement from loved ones
	Support from online community platforms
	Insurance/finances
	Costs of copays and deductibles
	The impact of insurance on device choices
	Costs of replacements
2.3 Structural factors	Synchronization issues
	Problems with data synchronization between devices
	Synchronization fails leading to data loss or corruption
	Technology compatibility
	Compatibility of devices with each other
	Incompatibility with older technologies or software
	Medical device compatibility with personal technology
	Incompatibility with third-party apps or platforms
	Technical support
	Assistance from device manufacturers
	Guidance provided by health care teams
	Help from family members or friends
	Device durability
	Environmental factors affecting device longevity
	Sensors breaking or detaching
	Wear and tear impacting device performance
	Automated system challenges
	Difficulty reaching a human representative
	Scheduling challenges for patients with multiple conditions

Factors That Exacerbate the Treatment Burden

Factors that participants reported as exacerbating burden were categorized into personal, situational, and structural factors, highlighting the multilevel challenges that can intensify patient burden.

Under personal factors, individuals reported the impact of perceived accuracy and trust in the devices and of inaccurate readings on treatment decisions. This often stemmed from previous experiences with devices that were inaccurate, leading to diminished trust and making dependence on technology more challenging. Interestingly, data privacy was less of a concern, as participants placed a greater value on the health benefits of using the devices than on preventing privacy loss. As one participant said,

"I probably don't think about it as much as I should. There's a lot of personal information that goes on them, like my birthdate and my full name and a bunch of stuff that could be used and could probably be hacked. But at this point, it's a useful enough tool that I just don't let myself think about it." (a 31-year-old patient with type 2 diabetes and moderate digital intensity)

The second category, situational factors, involves circumstances that vary by context. For instance, travel preparations exacerbated the burden for some participants by requiring management of the logistics for transporting devices, securing additional supplies, and maintaining device functionality through power sources. For instance, 1 participant noted,

"You have to make sure you've got enough strips, certainly. And when we travel, I have an average. I know, on average, how long an insulin pen will last me. So, I know if I need to take 3 pens, or do I need to take 6 pens because we're gone for 3 weeks." (a 71-year-old patient with type 3 diabetes and low digital intensity).

"And what I find—the only thing I find tremendously limiting is, with travel, how long can those pens be

unrefrigerated because, obviously, once you take them out of the refrigerator, your Novolog flex-pens are only good for 30 days. So, you really are kind of limited when you're going to be gone for 30 days unless I have a pharmacy that I can get more meds from and readily available. And if we're in Europe, that's not happening. Well, it probably would happen if I had to make it happen, but it's not like I can just go to Walgreens and say, "Could you refill my prescription?" (a 71-year-old patient with type 3 diabetes and low digital intensity).

Environmental factors and the need for temporary removal of devices during certain activities or at imaging appointments disrupt continuous use and force unwanted replacement of components that cannot be reused contributing to financial strains and administrative burden. Patients reported needing to fill out paperwork for device replacement or pay out-of-pocket to maintain continuous monitoring. One patient highlighted the direct financial impact of having a CGM stating, "I have to pay $200 every 6 months out of pocket." (a 41-year-old patient with type 1 diabetes and moderate digital intensity).

Finally, structural factors related to the technical and logistical aspects of device management were also identified. Issues such as synchronization problems between devices, incompatibility with older technologies or software, and difficulties in obtaining support from device manufacturers pose significant barriers. Durability concerns, such as sensors breaking or devices wearing out, affect long-term usability and reliability. Automated customer service systems add another layer of complexity, particularly because they make it harder to reach a human representative for problem-solving.

"The only thing I thought about was dealing with Medicare, which is impossible. I couldn't get them to answer the phone. That's the challenge of Medicare because, generally, if I can get somebody on the phone, I can resolve it." (a 75-year-old patient with type 2 diabetes and moderate digital intensity)

TABLE 4. Consequences of the Health Care Tasks on Patients	
Consequences of the health care tasks on patients	Details
3.1 Enhancements in patient care and lifestyle	
	Operational efficiency
	Reduced wait times
	Efficient communication with health care teams
	Easy to share data
	Quality of care
	Improved diabetes management
	Encouragement of health maintenance
	Personalized responses
	More accurate data collection, resulting in better health care recommendations
3.2 Impact on professional, social, family life, and leisure activities	
	Device visibility
	Hinders use in social settings
	Serves as a constant health reminder
	Discrete management
	Less impact on social life
	Fatigue
	Alarm fatigue
	Overload from managing multiple devices or applications
	Logging fatigue
	The burden of managing multiple login details

"You don't get anybody to talk to a human being. You just have to sit there and wait until they answer, if they answer" (a 75-year-old patient with type 2 diabetes and moderate digital intensity)

Consequences of the Health Care Tasks on Patients

Consequences to wellbeing were categorized into enhancements to patient care and lifestyle (as both operational efficiencies and quality of care) and impact on professional, social, family life, and leisure activities.

In terms of operational efficiencies, patients experienced reduced wait times when using the patient portal to schedule appointments or to communicate with their care team. Data sharing was noted as easier owing to the automation systems. Participants also described how digital medicine tools improved the quality of care, mostly attributed to the effects of more complete self-monitoring contributing to maintaining their health. A patient noted, "Well, I have a new pump, and so far, so good with that. It's better than its predecessor. It affords me a lot more

opportunities to keep control of the diabetes." (a 77-year-old patient with type 1 diabetes and maximal digital intensity).

They also reported on the effects of using digital medicine tools on personal and social life. Using medical devices in social settings affected social interactions and acted as a constant reminder of one's health condition, impacting mental wellbeing. A participant noted,

"I mean the pump. I'm looking at it. I have to think about it from the morning I wake up until the time I go to sleep, so that's quite a burden. And yet, it's like nothing compared with not being here, so I feel like it just reminds me every day about what's going on" (a 63-year-old patient with type 2 diabetes and high digital intensity).

Conversely, CGMs reporting real-time blood glucose levels to smart watches or mobile phones or using mobile applications to control insulin administration via pumps enabled discrete self-management. This minimized their impact on social interactions and allowed patients to engage more naturally

and, in some instances, without having to shift their focus to or keep it on their health conditions. Additionally, patients reported alarm fatigue from frequent alerts, overload from managing multiple devices or applications, logging fatigue fueled by repeated demands for data entry, and the burden of managing multiple login details, all of which contribute to the overall stress associated with disease management. A patient remarked,

"[a diet app] gives you like micros and macros, and it's looking at all kinds of k-cals and i-cals, and I mean it's very helpful, and it's very sophisticated—fats, energy, protein, net carbs, and then also breaks down into some vitamins, which is helpful. It just takes just more time to find it, log it, to put it in. And if I'm out to lunch with some friends, or we're out to dinner, or I'm thinking of—I'm looking much more for convenience." (a 63-year-old patient with type 2 diabetes and maximal digital intensity)

There is cyclical and multiple interplay between categories: a task leads to an exacerbating factor, which results in a consequence that in turn amplifies the burden. A substantial portion of this digital burden takes place within daily routines (Figure).

DISCUSSION

This study explored how patients with diabetes experience digital medicine tools in their daily care routines and their impact on treatment burden. Participants described a range of digital-related tasks, from device maintenance to navigating insurance processes to afford them, which contribute to their overall treatment burden. The integration of these tools into daily life requires substantial effort that can overwhelm patients, particularly when dealing with multiple applications, badly designed interfaces, and frequent device updates.

The findings of this study have direct implications for diabetes care practices. Digital medicine tools are increasingly being integrated into diabetes management to improve glycemic control and promote self-management.[2,28-30] However, our results suggest that although these tools may offer benefits, they also impose significant demands on patients, particularly those managing comorbidities or complex treatment regimens. Health care professionals should be aware of the cumulative burden these tools may place on patients, especially in terms of device maintenance, technical troubleshooting, and managing digital health data. Once aware, clinicians could assess the digital workload of their patients and work collaboratively to streamline the use of digital tools, ensuring that they enhance, rather than complicate, patient care and patient lives.

The taxonomy of digital treatment burden calls for a model of care that anticipates and mitigates the cascading effects of each branch in Figure, aiming to disrupt the accrual of burden and alleviate the overall burden on patients. For instance, the task of calibrating a glucose monitoring device—an everyday health care task—is foundational. If the device yields an inaccurate reading, it may initially seem like a temporary device malfunction (a situational factor). However, repeated instances of inaccuracy can lead to a loss of trust in the device, turning it into a personal factor as it undermines the patient's confidence in the technology and challenges their willingness to rely on it. This interplay between health care tasks and factors that exacerbate burden can have profound consequences, such as anxiety or imperfect fidelity to treatment plans, which may reduce quality of life and then exacerbate treatment burden.

Similarly, situational factors like the need to remove a disposable sensor during a magnetic resonance imaging scan could temporarily disconnect a patient from their monitoring system, leaving them vulnerable and anxious. In turn, the need for the patient to use a new sensor could contribute to financial stress (consequences), which could lead to further exacerbation of the burden as patients might need to pay out-of-pocket costs for another device. On another front, structural factors such as a device's poor durability could lead to frequent replacements. This presents not only an administrative burden but also consequences affecting a patient's professional life, demanding time off work for device troubleshooting and replacement. Such disruptions could lead to professional setbacks and

social isolation, thus intensifying the overall treatment burden management.

Previous studies have primarily focused on cost-effectiveness, adherence facilitation, economic implications, and health outcomes of digital devices.[4,6,31-35] Other studies have examined the barriers and facilitators to digital health technology usage. Safi et al[36] found that patients' positive attitudes toward technology usage were influenced by trust in health care, system ease of use, medical condition severity, and data security concerns. Although our findings are similar, our participants were much less concerned about the security of their health information, highlighting how digital burden may vary across care contexts. Although we assessed patients' digital use intensity, additional insights may derive from understanding patients' capacity to handle the workload imposed by prescription of digital interventions. Graeber et al[37] cited low effort, minimal disruptions, and strong health care support as key to adopting digital medicine. Oikonomidi et al[38] found that treatment burden, data security, and dehumanization of care with digital technologies contributed to the intrusiveness and acceptability of digital monitoring tools. Our findings corroborate these requirements; furthermore, patients desire technology to lighten their workload.

Beyond clinical practice, this study also has potential implications for health policy. As digital medicine becomes more integrated into diabetes care, policymakers need to consider how the design, cost, and accessibility of digital tools impact patient care.[32,39,40] Payers should be mindful of how coverage policies can either mitigate or exacerbate the burden associated with digital health devices and their replacements. This could be accomplished by simplifying administrative procedures to obtain, repair, and replace tools and provide reimbursement for personnel dedicated to support patients in their use in practice. Policies that support the affordability and accessibility of these tools, as well as provide for seamless and secure integration into patients' lives, are critical for ensuring equitable care.

There are limitations to this work. Our data come from patients with diabetes seen in a tertiary medical center; their digital burden may not reflect the experiences of other groups, such as those with socioeconomic disadvantages, in rural areas, or in underresourced health care settings. Additionally, our study focused only on the patient's experience. Interviews revealed that multiple parties—health care professionals, technology developers, insurance providers, caretakers, and family members—are involved in patients' digital medicine use. Understanding these perspectives and actions could enhance our comprehension of digital treatment burden.

Our findings contribute empirical findings to the evolving literature supporting a theory of treatment burden.[21] To date, this literature has not made any explicit predictions about digital burden. Subsequent research needs to connect this literature, for example, noting how caregivers and health care staff support the adoption of digital health by navigating administrative, technical, and access barriers, as predicted by May et al.[10] In turn, theory and empirical evidence, such as this study, should influence digital medicine tool design. For example, taking advantage of user-centered design principles can help technology developers alleviate some of the structural factors that exacerbate the treatment burden and thus contribute to minimally disruptive digital care.[20]

CONCLUSION

Our study highlights the dual nature of digital medicine in diabetes care: although they can offer benefits in streamlining the work of being a patient, their use also introduces new work and new demands on time and attention that could worsen treatment burden. Tailoring these tools, during their design, implementation, prescription, and maintenance, to better fit patients' needs and minimize their burden can lead to more successful integration into daily care routines and ultimately improve patient outcomes and quality of life.

POTENTIAL COMPETING INTERESTS

Revolution. The other authors report no competing interests.

ETHICS STATEMENT

SUPPLEMENTAL ONLINE MATERIAL

Supplemental material can be found online at https://www.mcpdigitalhealth.org/. Supplemental material attached to journal articles has not been edited, and the authors take responsibility for the accuracy of all data.

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