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Health apps: a cross-sectional study exploring patient motivations and usage implications

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Abstract

Background Despite the growing availability of health apps, adoption rates remains limited. The motivations behind their use and their impact on patient's empowerment and patient-Healthcare Professional (HCP) relationships remain unclear, yet understanding these factors is crucial for improving adoption, implementation, and sustained use. This study explores these motivations and user experiences, with a focus on empowerment and interactions with HCPs.

Methods An online survey among patient panel members of Amsterdam University Medical Center was conducted. Logistic regression adjusted for socio-demographic variables was used to investigate the motivations potentially influencing health app usage. Patient's empowerment and patient-HCP interaction were addressed through descriptive statistics.

Results Among 133 patients (39.8% female; average age 67.2 ± 9.8 years), 46% used health apps. Movement and Sport (63.9% of users), Vital Functions (47.5%), and Sleep (36.1%) were the most commonly used types. Users considered access to health data more important (OR = 2.7, $p = 0.02$), and were more certain about the usefulness of health apps (OR = 0.26, $p = 0.01$). Non-users were motivated for adoption if the app provides health information (43.1%), access to health data (36.1%), and symptom tracking (27.8%). 60% of the users discussed app-related outcomes with HCPs. Health apps enhanced patients' empowerment by allowing them to maintain an overview of health and supporting active participation in treatment decisions. They also helped gather information before consultations and improved understanding during visits with their HCPs.

Conclusions Health apps usage appears to be positively associated with the perceived importance of health data and confidence in usefulness of health apps. Non-users are more likely to adopt health apps if they provide insights into their health, enable earlier access to personal health data, and help in symptom tracking. HCPs should actively engage individuals who do not use health apps in conversations that emphasize the relevance of such tools to patient care outcomes. Future research should support HCPS in developing implementation strategies, to engage non-users and to encourage health app integration in healthcare practice.

Keywords Digital health solution, Health apps, Patient empowerment, Patient-HCP interaction

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Background

The number of health apps continues to grow, driven by rising demand, technological advancements, and the increasing adoption of digital tools for self-management and care by both patients and healthcare professionals (HCPs) [1, 2]. Health apps are digital applications designed to support various aspects of health management, ranging from promoting wellness to supporting care for chronically ill people [3, 4]. By facilitating easy access to health information, these apps can empower patients to manage their health independently as well as to actively participate in treatment decisions, and prevention [5–7].

Health apps may provide patients a sense of reassurance and autonomy, enabling active engagement in their healthcare journey [8, 9]. Health app usage among patients persists, whether self-initiated or guided by recommendations from HCPs [10, 11]. Patients' use of health apps depends on individual needs, prior experiences, and motivations such as familiarity with digital technology, confidence in the app's effectiveness, and alignment with daily routines and health goals [8]. Some patients perceive health apps as empowering tools that enhance their control over their illness and treatment, improve adherence to medication regimens and reduce the need for frequent clinical visits [9]. Other patients who are more sceptical may find them unnecessary or intrusive due to lack of confidence, privacy concerns, or limited digital skills [8]. A clear understanding of the factors that motivate or hinder health app use is essential for effective implementation and large-scale adoption.

Ensuring widespread use of effective health apps requires addressing diverse user needs and adoption barriers [12]. For instance, individuals with limited digital skills, low health literacy or lower socioeconomic status are at risk of being left out if technology is not tailored to their needs [13, 14]. To promote inclusivity, health apps should be designed to be user-friendly and accessible [15].

The sense of empowerment, or the perceived control over one's health gained through app usage, may be a facilitating factor to app inclusivity [16]. Empowered patients are more likely to actively participate in consultations and shared decision-making, which ultimately leads to achieving better clinical outcomes [3, 17]. Health apps may also improve consultation efficiency [3, 18] by allowing patients to share their concerns faster, potentially reducing unnecessary in-person visits. Contrastingly, health apps may also induce concerns, preconceived ideas or self-diagnosis [19], and misunderstandings or resistance may arise if the patient's pre-consultation insights and expectations do not align with the HCPs' clinical judgment [20]. This could lengthen consultations and alter the dynamics of decision-making [20, 21]. These effects may be more pronounced in video consultations or chat interactions via a health app, where non-verbal cues are less visible or absent [22, 23].

Understanding how users perceive their interactions with HCPs about health apps is critical to effectively integrating these tools into clinical workflows, and improving trust, patient satisfaction and health outcomes. As health apps become increasingly integral to healthcare due to their added value, further research is needed to ensure their effective adoption and use by patients. Therefore, the aim of this exploratory study is to understand patients' motivations for using or not using health apps, and to examine users' perceptions about the extent to which app use contributes to a sense of empowerment and affects interactions with HCPs.

Methods

Study design

This survey study involved patients participating in the digital patient panel of Amsterdam University Medical Center (Amsterdam UMC) in the Netherlands. Members were patients, visitors, or neighbours of the hospital, sharing their opinions on various subjects through periodical digital questionnaires (5–12 times a year). Participation was voluntary, members received no reimbursement and could opt out any time. The panel includes 858 members, all aged 16 years and older. Inclusion in the panel requires the ability to interact with digital platforms, such as responding to email invitations and completing online surveys. All members receiving the periodic survey were concurrently invited to participate in the study. Out of the 401 respondents (46.7%) who completed the questionnaire on healthcare digitalization, 210 (52.4%) expressed their willingness for participation.

Data collection

To be eligible, respondents had to be Amsterdam UMC patient panel members, Dutch-proficient, ≥ 18 years, and patients at Amsterdam UMC. Members who are visitors or neighbours were excluded. An online survey was sent in November 2023 to all patients who consented to participate. All participants provided informed consent (e-consent) prior to participation. The survey was available for two months with reminders sent after one month and shortly before the deadline.

Given the absence of validated instruments that adequately capture our specific constructs, motivations for health app use, perceived empowerment, and patient-HCP interaction, we developed a tailored questionnaire to address these gaps in existing measurement tools. The survey distinguished between users and non-users and was developed based on existing literature on factors influencing health app adoption, patient empowerment, engagement with health apps, and the patient-HCP

relationship [1, 24]. The Technology Acceptance Model was used for understanding behaviours and attitudes of health app users [25]. Patient-HCP interaction questions were based on the Patient-Doctor relationship questionnaire (PDRQ-9) [26], and a shared decision making questionnaire (SDM-Q-9) was used to inspire items related to patient empowerment [27]. The survey was revised and finalised in three rounds involving the co-authors (medical doctor, implementation expert, medical specialist, anthropologist, and an expert in medical communication) [12] (Appendix A). In the final round, four patients provided feedback on the survey; their responses were excluded from the final dataset. Questions assessed characteristics such as age, gender, level of education, health literacy, digital literacy, and chronic diseases. Subsequently, participants' use of health apps, whether an HCP had ever recommended their use to them, and their motivations for using or not using such apps were inquired. The majority of questions employed 5-point Likert scales, ranging from 'strongly disagree' to 'strongly agree,' or offered multiple-choice response options (Appendix B).

Users were questioned about the types of apps they use (diet, exercise, vital functions, sleep, menstruation, chronic disease, medication reminders, health information, mental health, other). For each type of app, participants were asked about: (1) frequency of use (2), the source that promoted initial use (e.g. HCP, general practitioner, social media, family member) (3), their goals for using the app, (4) whether app-generated information had been discussed with a HCP (5), whether the app's results or recommendations had been discussed with a HCP, and (6) if not, whether they would be interested in doing so. Users were asked to report their agreement with statements about patient empowerment and patient-HCP interaction, such as feeling more engaged in health decisions when using app-provided data in conversations with their HCP. One open-ended question invited patients to share additional comments.

Non-users were questioned if they would be willing to use a health app and for what purposes, based on the same types of health apps presented to users. Participants were asked under what conditions they might use a health app, with options like recommendations from their health insurer, a friend, or a celebrity, amongst others.

Ethical consent

The Medical Ethical Committee of Amsterdam UMC provided approval. As this study was not subject to the Human Subjects Act, no further approval was required (METC 2023.0681). The research was conducted in accordance with the Declaration of Helsinki.

Data analysis

Data were analysed using R (version 4.4.1; R Core Team, 2013) [28]. Participants who completed less than 5% of the survey were excluded. Differences in average age and distribution of gender and educational level between users and non-users were assessed through Wilcoxon and chi-square tests. Logistic regression analysis assessed the association between potential motivations for using (or not-using) health apps and actual health app usage, adjusted for age, gender and education. "Education" was recoded into two categories: (1) lower education (primary and secondary education) and (2) higher education (pre-university and higher education). Participants who did not report their age, gender, or level of education as well as the one non-binary participant were excluded from this analysis. Multicollinearity and data sparsity were evaluated assessing distributions, variance inflation factors, and pairwise correlations. After excluding potentially problematic variables, a full regression model was fitted to the data. In addition, further data-driven variable selection was performed using the Lasso regression method with regularization parameter optimized through cross-validation [29]. Results of the Lasso regression were used to choose the subset of regressors retained in the "reduced regression model". The Akaike information criterion (AIC) was used to assess the goodness of fit of the two models. Aspects comprising patient empowerment and patient-HCP interaction were addressed through descriptive statistics. A Sankey diagram was produced for visualization of patterns related to the discussions of health app outcomes with HCPs. Chi-square tests were used assessing the motivations for usage. The open-ended question and 'Other' response text fields were qualitatively analysed to identify emergent themes and their frequency within the sample.

Results

The survey was sent to 210 members from the Amsterdam UMC patient panel and was returned by $n = 153$ (response rate 73%). Twenty individuals were excluded from the dataset: those identified as visitors or neighbours of Amsterdam UMC ($n = 14$), one patient under the age of 18, and five participants for completing less than 5% of the questionnaire, resulting in a final sample of $N = 133$. Among the 133 respondents, 45.9% ($n = 61$) reported using health apps (Table 1).

Motivations for app use

The most commonly used types of health apps were Movement and Sport (63.9%), Vital functions (47.5%), and Sleep (36.1%), while the least used were mental health (6.6%) and Menstruation (0%) (Supplementary file C). No participants reported using health apps primarily for menstruation-related purposes; therefore, this

Table 1 Baseline demographics of health app users versus non-users (*N* = 133)

Characteristic	*N* (%)	Health app users *n* = 61	Non health app users *n* = 72
Age (years), mean ± SD*	133	65.2 ± 9.2	69.2 ± 10.4
	N (%)	*N* (%)	*N* (%)
Gender			
Male	79 (59.4)	37 (46.8)	42 (53.2)
Female	53 (39.8)	23 (43.4)	30 (56.6)
Non-binary	1 (0.8)	1 (100.0)	0 (0.0)
Educational level †			
Primary	2 (1.5)	0 (0.0)	2 (100.0)
Pre-vocational secondary education	18 (13.5)	8 (44.4)	10 (55.6)
Secondary vocational education	18 (13.5)	7 (38.9)	11 (61.1)
Senior general secondary education	13 (9.8)	4 (30.8)	9 (69.2)
Pre-university	2 (1.5)	1 (50.0)	1 (50.0)
Higher vocational education	55 (41.4)	27 (49.1)	28 (50.9)
Academic education	24 (18.0)	14 (58.3)	10 (41.7)
Prefer not to say	1 (0.8)	0 (0.0)	1 (100.0)
Presence of chronic disease			
Diabetes	28 (21.1)	14 (50.0)	14 (50.0)
Hypertension	57 (42.9)	33 (57.9)	24 (42.1)
Lung condition*	44 (33.1)	19 (43.2)	25 (56.8)
Heart and blood vessels	63 (47.4)	31 (49.2)	32 (50.8)
Neurological	15 (11.3)	8 (53.3)	7 (46.7)
Renal/Endocrine	14 (10.5)	8 (57.1)	6 (42.9)
Musculoskeletal	22 (16.5)	7 (31.8)	15 (68.2)
Hematologic/Oncologic	13 (9.8)	7 (53.8)	6 (46.2)
Gastrointestinal	9 (6.8)	5 (55.6)	4 (44.4)
Inflammatory/auto-immune	8 (6.0)	2 (25.0)	6 (75.0)
Use computer or laptop	117 (88.0)	53 (45.3)	64 (54.7)
A few times a day	69 (51.9)	31 (44.9)	38 (55.1)
Once a day	14 (10.5)	9 (64.3)	5 (35.7)
Few times a week	20 (15.0)	8 (40.0)	12 (60.0)
Once a week	6 (4.5)	1 (16.7)	5 (83.3)
< Once a week	8 (6.0)	4 (50.0)	4 (50.0)
Use smartphone or tablet	128 (96.2)	60 (46.9)	68 (53.1)
A few times a day	128 (96.2)	60 (46.9)	68 (53.1)
Wearable use	32 (24.1)	27 (84.4)	5 (15.6)
A few times a day	23 (17.3)	19 (82.6)	4 (17.4)
Once a day	4 (3.0)	3 (75.0)	1 (25.0)
Few times a week	2 (1.5)	2 (100.0)	0 (0.0)
< Once a week	3 (2.3)	3 (100.0)	0 (0.0)
Overall health, median [IQR][a]	133 (100.0)	3.00 [2.00–3.00]	3.00 [3.00–4.00]
Difficulty filling in medical forms	133 (100.0)	4.00 [3.00–4.00]	3.00 [3.00–4.00]
Digital literacy, median [IQR][a]			
Dexterity computer or laptop, median [IQR]	117 (88.0)	3.00 [2.00–4.00]	3.00 [2.00–3.00]
Dexterity smartphone or tablet, median [IQR]	128 (96.2)	3.00 [3.00–4.00]	3.00 [2.00–3.00]

All results are given in number (percentage) unless indicated otherwise

SD standard deviation

[a]Responses were rated on a 5-point Likert scale, with higher scores indicating better overall health, greater difficulty, or higher digital dexterity, depending on the item

*such as asthma, bronchitis and emphysema

*Wilcoxon test*p*-value=0.027

†Educational degree are equivalents to Dutch degrees. For the regression analysis, the division between low and high education was used

Table 2 Motivations associated with use or non-use of health apps, divided by users and non-users ($N = 133$)

	Users ($n = 61$)	Non-users ($n = 72$)
	n **(%)**	***n*** **(%)**
Motivations for not using health apps		
I do not want to pay for the health app	38 (62.3)	31 (43.1)
I am concerned about my privacy	16 (26.2)	24 (33.3)
I do not want to be reminded that I am ill	5 (8.2)	10 (13.9)
I do not have the right digital tools	0 (0.0)	4 (5.6)
I am not sure if health apps are useful	**7 (11.5)***	**29 (40.3)**
I find health apps too complicated to use	1 (1.6)	5 (6.9)
I prefer going to the hospital	14 (23.0)	22 (30.6)
It causes me stress	4 (6.6)	10 (13.9)
Motivations for using health apps	*n* (%)	*n* (%)
I feel that an app can help me to better adhere to treatment	**22 (36.1)**	**11 (15.3)**
The healthcare professional can intervene earlier when values deviate	32 (52.5)	30 (41.7)
I think it makes communication in the consultation room easier	25 (41.0)	21 (29.2)
A health app can remind me to take my medication	**24 (39.3)**	**11 (15.3)**
A health app can provide me with information about my health	**37 (60.7)**	**31 (43.1)**
A health app can help me quit a habit (such as smoking)	1 (1.6)	2 (2.8)
A health app can help me track my symptoms	**27 (44.3)**	**20 (27.8)**
A health app can improve my health	**13 (21.3)**	**6 (8.3)**
I can access my health data (such as sleep, blood pressure)	**39 (63.9)**	**26 (36.1)**
I can better prepare for an appointment with my HCP	28 (45.9)	23 (31.9)
I have no intention of ever using a health app	**0.0 (0.0)**	**11 (15.3)**

HCP Health Care Professional

*Results presented in bold are statistically significant ($p<0.05$)

Table 3 Results of the logistic regression model assessing the association between motivations for (not) using health apps and health apps usage (yes/no)

Motivation	Estimate	SE	*p*-value
Intercept	1.639	1.787	0.359
I feel that I can adhere to a treatment better with an app	0.596	0.524	0.255
A health app can remind me to take my medication	0.704	0.515	0.172
I can monitor data about my health*†	**0.985**	**0.411**	**0.017**
I do not want to pay for a health app	0.399	0.424	0.347
I do not know if health apps are useful	**−1.350**	**0.514**	**0.009**
Age	−0.037	0.026	0.148

Akaike Information Criterion (AIC of the reduced model: 157.77, AIC of the extended model: 169.71)

SE standard error

*Results presented in bold are statistically significant ($p<0.05$)

†(such as sleep, blood pressure, etc.)

category was excluded from further analysis. The majority of users reported daily usage, with the highest usage reported for Medication reminders (81.3%), and Sleep (63.6%) and the lowest for Medical information (27.8%). The most common way of initiating app use was by independent discovery via app platforms, especially for Movement and Sport apps (61.5%). Recommendations from HCPs were less frequently mentioned as a reason for health app usage (24.7%), though apps for Medical information were most likely to be recommended by an HCP (27.8%). Users primarily used apps to improve their health or gain more knowledge about their health condition, with the latter goal being particularly prevalent for apps aimed at Medical information (50.0%), Chronic disease management (50.0%), and Vital functions (44.8%).

Overall, users reported higher agreement with all motivational factors compared to non-users (Table 2). Significant differences ($p<0.05$) were found between users and non-users for the following motivations. Users are less unsure about app usefulness (40.3% versus 11.5%) than non-users, and users feel that they can better adhere to treatment (36.1% versus 15.3%). Moreover, compared to non-users, users feel more often that apps can remind them to take their medication (39.3% versus 15.3%), provide information about their health (21.3% versus 8.3%), track their symptoms (44.3% versus 27.8%), improve their health (21.3% versus 8.3%) and provide access to health data (63.9% versus 36.1%).

Out of 133 respondents, 44 (33%) answered the open-ended question. Of these, 23% (10/44) expressed concerns about privacy, reliability, and the risk of increased stress due to app use, 7% (3/44) worried about the impact of monitoring on mental well-being, and 7% (3/44) felt HCPs do not take app-generated data seriously.

The following regressors were included in the "reduce regression model": "I feel that I can adhere to a treatment better with an app", "A health app can remind me to take my medication", "I can monitor data about my health", "I do not want to pay for a health app", "I do not know if health apps are useful", and age (Table 3). This model highlighted a positive association between health app usage and having access to health data (OR = 2.68, p-value = 0.017) and a negative association between using health apps and being unsure about their usefulness (OR = 0.26, p-value = 0.009).

HCP discussion of health app outcomes by category

Over half of the users (60.0%) discussed outcomes with their HCP, especially when using apps for Chronic diseases (100.0%) or Vital functions (62.1%), while more than one third of the time (38.1%), outcomes were not

discussed (Fig. 1). Frequency of discussions varied, with most users discussing app outcomes occasionally (Supplementary file C). Apps regarding Vital functions, Movement and sport, and Sleep were the most frequently discussed with HCPs, by respectively 18 (30.0%), 15 (25%) and 11 (18.3%) of the users. Of those who were unsure or unaware that they could discuss app use with their HCP, 17.6% reported that they would like to, 47.5% indicated they might be open to it, and 25.0% stated they did not wish to share app outcomes.

Patient empowerment and HCP-patient interaction

Users perceived health apps to aid them in empowerment (score ≥ 3 on Likert scale 1–5) by: Providing an overview of their health, setting goals, participating in decisions, making choices surrounding treatment, indicating what is important during conversations or treatment, becoming engaged in their own care, support in making choices, and confidence in own health (Table 4). Regarding the patient-HCP interaction, users reported health apps to aid (score ≥ 3) in: Gathering information before discussing their health with their HCP, understanding

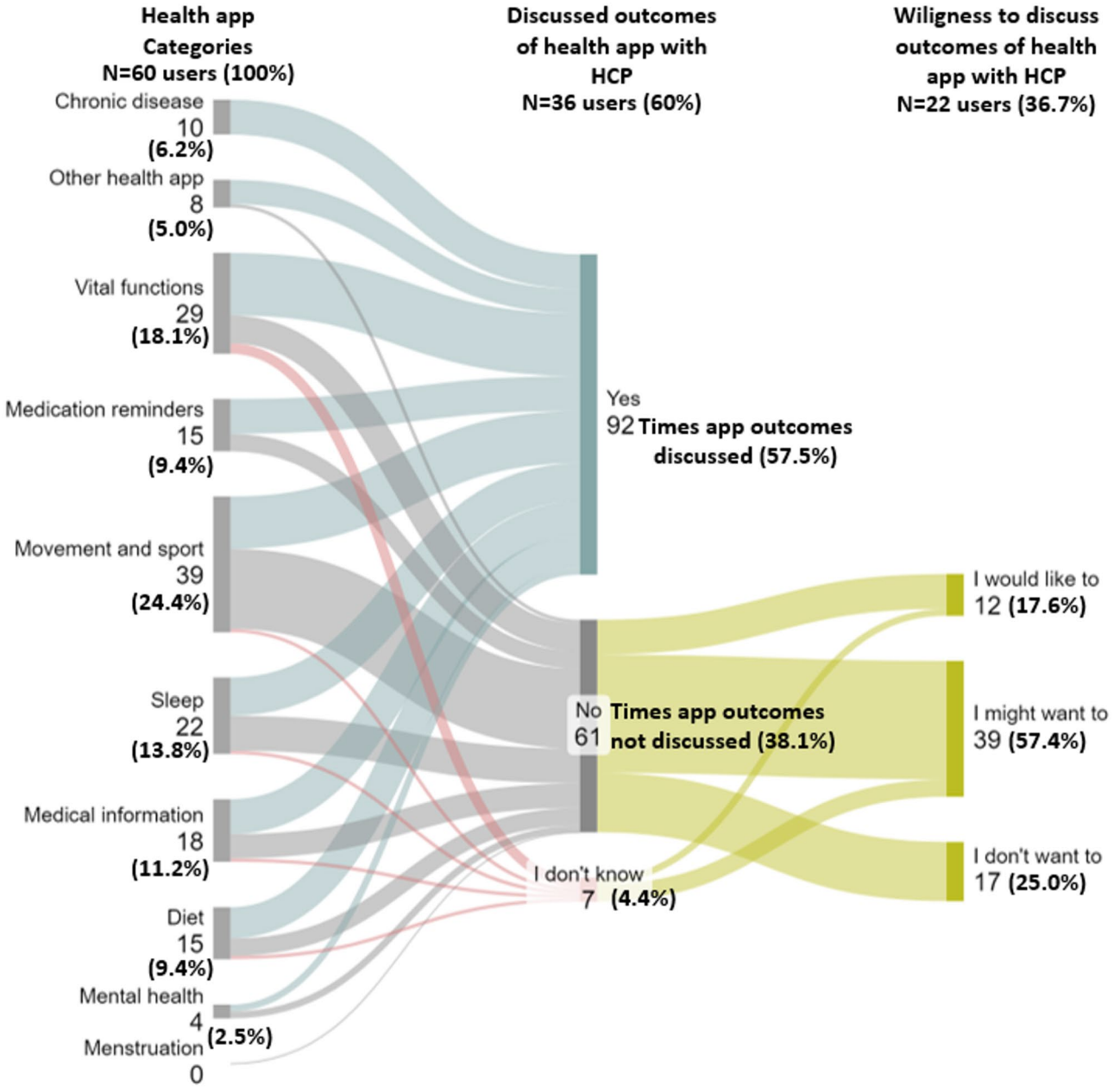

Fig. 1 Sankey diagram visualizing the relationship between different categories of health apps, users' discussions of health app information and outcomes with HCPs, and their willingness to discuss health app outcomes with HCPs in the future

Table 4 Experiences of health app users regarding sense of empowerment and patient-HCP relationship ($n=57$)

Item	Mean*	SD	NA (%)
Patient empowerment			
Using a health app has given me a better overview of my health.	3.7	1.3	4 (7.0)
Using health apps helps me set goals for myself.	3.7	1.3	4 (7.0)
Using health apps, I feel that I can better participate in decisions regarding my treatment.	3.4	1.6	7 (12.3)
Using health apps makes me feel better informed about the choices surrounding my treatment.	3.4	1.6	8 (14.0)
By using health apps, I find it easier to indicate what is important to me in conversations about my treatment.	3.4	1.7	7 (12.3)
The use of health apps has helped me become more engaged in my care.	3.3	1.5	4 (7.0)
Using health apps makes me feel more supported in making choices about my treatment.	3.3	1.7	8 (14.0)
Using health apps has given me more confidence in my own health.	3.1	1.7	6 (10.5)
Using a health app makes me feel like I have more control over my illness.	2.9	1.8	5 (8.8)
Patient-HCP interaction			
I like gathering information about my health via the app before discussing it with my HCP.	4.0	1.2	8 (14.0)
Using a health app helps me better understand the information from my HCP during appointments.	3.5	1.7	11 (19.3)
By using health apps, I feel that my opinion is taken into account more in discussions with my HCP about my treatment.	3.0	1.9	9 (15.8)
Since I started using a health app, I have more regular contact with my HCP.	2.8	2.1	13 (22.8)
The use of health apps has strengthened my trust in my HCP.	2.8	1.9	10 (17.5)
Since I started using a health app, my conversations with my HCP have improved.	2.7	1.5	14 (24.6)

Four users did not answer these statements

HCP Healthcare Professional, *NA* Not Applicable, *SD* Standard Deviation

*Items are all rated on a Likert scale 1-5 (1:Completely disagree to 5: Completely agree)

information from their HCP better during appointments, and having their opinion more taken into account during treatment.

Discussion

Despite the great potential and benefits of health apps, their adoption remains challenging. The findings indicate patients' interest in incorporating app-derived data into clinical discussions with their HCP. Health apps empower patients by enabling goal setting and health monitoring. In the context of patient-HCP interactions, they assist in gathering information prior to consultations, enhance understanding of information provided by HCPs, and help patients feel more valued in the decision-making process. Additionally, adherence-related motivations, such as medication reminders and treatment adherence support were significantly more relevant for users than for non-users. This suggests that while non-users acknowledge certain benefits of health apps, they may not yet see their full potential for self-management. A perceived lack of relevance could be attributed to non-users having different diseases with fewer self-management needs. However, this is unlikely given the similar disease distribution between users and non-users in our sample.

Non-users were found to not perceive health apps as useful in comparison to users, which directly relates to the perceived usefulness of the Technology Acceptance Model (TAM). Perceived usefulness refers to the extent to which an individual believes that a technology enhances their performance [25]. It is a key driver of technology adoption, as it significantly influences the behavioral intention to use [30]. The absence of perceived usefulness among non-users may suggest a misalignment between current app functionalities and users' actual needs [31], indicating a missed opportunity in aligning design and communication strategies with user expectations. Interestingly, 15.3% of non-users stated they had no intention of ever using a health app, suggesting a low behavioral intention, which, according to TAM, is a key predictor of actual technology adoption. This highlights a group whose motivations first need to be identified to understand their reluctance and potential engagement strategies. In terms of perceived usefulness, non-users indicated that they would consider using apps if they helped with gaining insights into their health, enabling HCPs to intervene more quickly in response to abnormal values, and accessing their personal health data. These are aspects that could be given attention in the promotion of health apps.

Other factors described in the literature, such as the duration of the disease, social influence and trust also play a role in motivation for health app use [30, 32], which should be considered when developing tailored implementation strategies to persuade non-users of the utility of health apps. Targeted communication strategies could emphasize app benefits, such as enabling timely medical intervention, while trust-building measures, like transparent data privacy policies or HCP endorsements, could address concerns about reliability and security. All patients using a health app for their chronic disease discussed outcomes with their HCP, suggesting their use and discussion has found its way into chronic care, as evidenced by their application in the treatment of conditions such as diabetes and hypertension [33, 34]. Understanding the factors that enabled successful health app integration in chronic care could provide valuable

insights for other areas of healthcare such as rehabilitation after surgery [35].

In this study, half of the patients reported discussing app-derived information and outcomes with their HCPs. For apps prescribed by the HCP, it is beneficial to inquire about the information and health outcomes generated by these apps, as they are perceived as complementary tools supporting medical practice, and facilitating follow-up care [36, 37]. Patient-initiated apps pose a challenge, as HCPs must actively inquire about app usage and data. HCPs may experience uncertainty in integrating patient-generated data into clinical decision-making, particularly when patients come to consultations with their own interpretations of health data [38, 39]. Additionally, the evidence base for health apps is often unclear, even for those prescribed by HCPs, because current studies lack concrete evaluation [11, 40]. Integrating patient-initiated apps into clinical practice is challenging, as it depends on both the patient's willingness to share information and the HCP's ability to effectively incorporate data into medical decision-making [41]. This is consistent with our findings, showing that some users were unwilling to share the outcomes with their HCPs. For both HCP-prescribed and patient-initiated health apps, the most important consideration was that the generated data help address the patient's healthcare needs. To address this, targeted training is needed to equip HCPs with the appropriate communication strategies to engage in patient conversations about the use of health apps and its relevance in personalized care.

Users in our study perceive health apps as empowering, particularly in terms of gaining insight into their health, setting goals, and shared decision making. Traditionally, HCPs were the primary source of medical information and decision-making, but self-monitoring empowers patients with greater control over their health data [42, 43]. While increased autonomy can lead to greater self-reliance, it also challenges traditional patient-provider roles, altering the dynamic of healthcare interactions [21].

Among users, more than one-third do not currently share the data from these apps with their HCPs. While patients value tracking their health data, they often hesitate to share app-derived data with HCPs [41, 44]. Concerns include the perceived relevance of the data, uncertainty about their HCP's interest and a lack of effective communication discussing health app usage [45, 46]. Further research could explore conversations with a diverse patient sample using an observational study design to identify effective communication strategies for integrating health apps into clinical consultations.

Strengths and limitations

A key strength of this study is the inclusion of perspectives from health app users and non-users, providing a comprehensive understanding of motivations for health app adoption. Evaluation of health apps often focuses exclusively on individuals who actively use them, introducing selection bias and neglecting the perspectives of those who are hesitant or unwilling to engage with health apps [47]. A dual perspective is essential for understanding accessibility and the broader applicability and scalability of health apps across diverse patient groups. Beyond assessing motivations for health app usage, our study explored the implications of app use for patient empowerment and the dynamics of the patient–HCP interaction.

A limitation of the current study is its focus on broad health app categories rather than disease-specific apps, which may not fully capture the nuances that affect adoption and use within particular patient populations. National data from the Netherlands indicate that approximately 35% of the Dutch population has limited health literacy and lower educational attainment [48]. Participants were recruited from the Amsterdam UMC's patient panel, comprising individuals with diverse chronic conditions and app usage patterns. However, patients participating in a panel are likely to differ from those who do not: They may be more engaged in their care, have better access to resources, or be overrepresented in certain demographic groups (better health literacy, socioeconomic status, or educational level) [49, 50]. These factors may limit the representativeness of the sample, particularly with respect to digital literacy and the inclusion of both users and non-users of health apps, and may therefore reduce the generalizability of the findings beyond this academic hospital setting. Consequently, the results should be interpreted within the context of this specific, digitally probably more engaged patient group. Lastly, although our questionnaire was designed based on existing literature to ensure relevance to our research objectives, we used a self-developed questionnaire rather than validated instruments, which may limit the reliability and generalizability of our findings. To optimize measurement precision and reduce cognitive burden, we used standardized 5-point Likert scales, which have been shown to produce more reliable responses than shorter or longer scales [51].

Implications for practice

For successful implementation, it is essential to explore how to motivate HCPs and patients alike to engage with app-generated health data. Beyond perceived usefulness, practical barriers such as workflow integration, time constraints, and limited digital competencies must be addressed. Additional implementation strategies

could include the formal inclusion and endorsement of validated health apps within hospital policies, as well as institution-wide campaigns aimed at promoting their adoption among both HCPs and patients. Furthermore, integrating data generated by these recognized health apps into the electronic health record may facilitate greater utilization of such data by HCPs in clinical decision-making. To support HCPs in adopting health apps, a multifaceted approach is needed. First, integrating digital health literacy into medical education, both at undergraduate and postgraduate levels, can equip future professionals with the skills to navigate, interpret, and apply patient-generated data. For practicing HCPs, training can foster familiarity with relevant health apps and build confidence in their clinical utility. In addition, healthcare organizations could foster a culture of digital innovation, e.g., by designating digital health champions, incentivizing app use through alignment with quality indicators, and offering institutional support for digital technology adoption. Emerging models such as reverse mentorship may also help bridge the digital skills gap: digitally fluent junior HCPs can mentor more experienced colleagues in navigating new technologies, fostering intergenerational learning and accelerating digital integration into routine care.

For both patients and HCPs, the focus should not solely be on assessing existing users but also on developing and evaluating targeted interventions aimed at increasing acceptance among hesitant individuals, particularly those who could derive the greatest benefit from health app use. Addressing these gaps will contribute to more inclusive design. To ensure that health apps align with the needs and expectations of diverse patient populations, it is essential to involve end-users early in the development process through co-design [52]. Engaging patients, caregivers, and HCPs before the start of app development helps identify varying user needs, preferences, and potential barriers to adoption. Following initial implementation, health apps should undergo iterative evaluation to assess how well they meet users' needs in practice. Standardized instruments, such as the 'Experienced Usability and Satisfaction with digital health solutions in a home Setting´ (GEMS) questionnaire, can support this process by capturing user satisfaction, perceived usefulness, and usability through visual feedback mechanisms such as thermometers [53]. Structured evaluations provide actionable insights into the app's current performance and highlight areas for improvement. Lastly, patient involvement remains key: enabling patients to discuss app-derived insights during consultations can enhance relevance and shared understanding. Together they (patients and HCPs) can explore their relevance in a medical setting, while HCPs can help patients navigate the benefits and limitations of apps, considering the limited evidence and varying quality.

Conclusion

Health app usage was associated with the importance attached to health data and confidence in health apps' usefulness. Non-users most likely adopt health apps if these provide health insights, allow HCPs to intervene quickly when needed, and offer access to personal health data. HCPs should actively support non-users by initiating discussions on health app use and highlight its relevance to patient care. To maximize benefits, users should be encouraged to engage in clinical discussions, ensuring app derived data contributes to addressing their healthcare needs. Further research could explore conversations about health app use in a more diverse patient population through observational studies. To support health app adoption, HCPs, policymakers, and educators must provide clear leadership in integrating these tools into patient care, establishing them as a standard component of patient-HCP interactions.

Abbreviation

HCP Healthcare professional

Supplementary Information

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Supplementary Material 1.

Supplementary Material 2.

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Authors' contributions

SJO: Conceptualization, methodology, data curation, formal analysis, writing original draft, editing. MP: Formal analysis, writing original draft, writing – editing. MS: Conceptualization, methodology, writing – review and editing. SAN: Supervision, writing – review and editing. JJM: Conceptualization, methodology, supervision, writing – review and editing. EMAS: Conceptualization, methodology, supervision, writing – review and editing.

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Data availability

The datasets generated and/or analysed during the current study are not publicly available due to privacy restrictions, but are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate

The Medical Ethical Committee of Amsterdam UMC provided approval. As this study was not subject to the Human Subjects Act, no further approval was required (METC 2023.0681). The research was conducted in accordance with the Declaration of Helsinki. All participants provided informed consent (e-consent) prior to participation.

Competing interests
The authors declare no competing interests.

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