

REVIEW

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Barriers and facilitators to patient-to-provider messaging using the COM-B model and theoretical domains framework: a rapid umbrella review

Megan M. MacPherson^{1*} and Shabana Kapadia¹

Abstract

Background Virtual patient-to-provider messaging systems such as text messaging have the potential to improve healthcare access; however, little research has used theory to understand the barriers and facilitators impacting uptake of these systems by patients and healthcare providers. This review uses the Capability-Opportunity-Motivation-Behaviour (COM-B) model and the Theoretical Domains Framework (TDF) to explore barriers and facilitators of patient-to-provider messaging.

Methods A rapid umbrella review method was followed. Medline and CINAHL were searched for review articles that examined patient-to-provider implementation barriers and facilitators by patients or healthcare providers. Two coders extracted implementation barriers and facilitators, and one coder mapped these barriers and facilitators on to the COM-B and TDF.

Results Fifty-nine unique barriers and facilitators were extracted. Regarding healthcare provider oriented barriers and facilitators, the most frequently identified COM-B components included *Reflective Motivation* (identified in 42% of provider barriers and facilitators), *Psychological Capability* (19%) and *Physical Opportunity* (19%) and TDF domains included *Beliefs about Consequences* (identified in 28% of provider barriers and facilitators), *Environmental Context and Resources* (19%), and *Social Influences* (17%). Regarding patient oriented barriers and facilitators, the most frequently identified COM-B components included *Reflective Motivation* (identified in 55% of patient barriers and facilitators), *Psychological Capability* (16%), and *Physical Opportunity* (16%) and TDF domains included *Beliefs about Consequences* (identified in 30% of patient barriers and facilitators), *Environmental Context and Resources* (16%), and *Beliefs about Capabilities* (11%).

Conclusions Both patients and healthcare providers experience barriers to implementing patient-to-provider messaging systems. By conducting a COM-B and TDF-based analysis of the implementation barriers and facilitators, this review highlights several theoretical domains for researchers, healthcare systems, and policy-makers to focus

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on when designing interventions that can effectively target these issues and enhance the impact and reach of virtual messaging systems in the future.

Keywords Telemedicine, Text messaging, Professional-patient relations, Health communication, Communication barriers

Background

With the rapid adoption of virtual healthcare services seen during the COVID-19 pandemic [1–4], and widespread acceptability of mobile devices, there has been a shift towards electronic and mobile health (‘eHealth’ and ‘mHealth’, respectively) solutions to augment traditional in-person healthcare services [5]. For example, adoption of eHealth and mHealth (herein referred to as ‘virtual care’) increased dramatically, with 86% of patients in the province of British Columbia, Canada connecting with their primary care physician virtually between April and September 2020 [6]. To enhance the effectiveness of primary care during COVID-19, primary healthcare providers employed virtual care solutions for remote triage, consultations, monitoring, and prescriptions [7, 8]. The wide-scale adoption and implementation of equitable virtual care services has the potential to improve access to care, reduce risk of disease transmission, reduce tension on healthcare facilities, and support continuity of care [9].

Patient-to-provider messaging is a commonly used virtual care service defined as any virtual messaging system which facilitates written communication between a healthcare provider and their patients. Some examples of patient-to-provider messaging include text messaging, emails, or messaging embedded within smartphone applications. The low overhead costs and time commitments required for patient-to-provider messaging [10–15] has proven useful in supplementing care services and has been shown to improve adherence to health behaviours (e.g., medication adherence, appointment attendance) [16]. Patient-to-provider messaging also has the potential to improve continuity of care by providing patients with ongoing support from healthcare providers remotely [15]. Despite these promises, the sudden shift to virtual care seen during the COVID-19 pandemic has been criticized as it was implemented in haste, and may have inadvertently intensified the marginalization of those already experiencing inequities in healthcare (e.g., older adults, racialized communities, etc.) [17]. Given that virtual care appears here to stay, there is a timely need to generate evidence to inform best practices for developing and delivering equitable, person-centred virtual care via patient-to-provider messaging.

Developing theory-based interventions

One effective approach to generate actionable evidence and support virtual care delivery is by incorporating theory into intervention development. The Behaviour Change Wheel is a comprehensive intervention development framework which includes both the Capability, Opportunity, Motivation, Behaviour (COM-B) model, and the Theoretical Domains Framework (TDF) [18]. The Behaviour Change Wheel has been widely used to guide the development of theory-based interventions for virtual care [19–21]. The COM-B model and TDF (refer to Fig. 1) form the core of the Behaviour Change Wheel (refer to Fig. 2), and are used at the initial stages of intervention development to identify barriers and facilitators which influence a target behaviour [22].

The COM-B model conceptualizes behaviour as part of a system of interacting components including an individual’s *capability* (physical and psychological), *opportunity* (physical and social), and *motivation* (reflective and automatic) [22]. Similarly, the TDF, which is often used alongside with the COM-B model [23, 24], provides a framework of 14 theoretical domains used to explain theoretical constructs considered as determinants of behaviour [25]. The 14 TDF domains map directly onto the COM-B components [25] (see Fig. 1), allowing intervention designers the ability to use the TDF in conjunction with the COM-B. Using an integrated approach allows for the expansion of each component of the COM-B model, providing more detailed insights by incorporating the TDF [26–30]. Using the COM-B and TDF to examine barriers and facilitators to patient-to-provider messaging amongst existing evidence will result in a list of modifiable factors to target; listing such factors can aid designers to create theory-informed interventions, thereby potentially improving the implementation and effectiveness of virtual care services in the future.

Current study

Understanding how barriers and facilitators align with theoretical insights on behaviour change is essential for making system level improvements, healthcare service planning, and policy formulation, all of which may contribute to the sustained use of patient-to-provider messaging within virtual care services. As such, the purpose of this rapid umbrella review is to synthesize barriers and



Fig. 1 Theoretical domains framework depicted in yellow mapped onto the COM-B model depicted in green. TDF domains include: Soc Social influences, Env Environmental context and resources, Id Social/professional role and identity, Bel Cap Beliefs about capabilities, Opt Optimism, Int Intentions, Goals Goals, Bel Cons Beliefs about consequences, Reinf Reinforcement, Em Emotion, Know Knowledge, Cog Cognitive and interpersonal skills, Mem Memory, attention, and decision processes, Beh Reg Behavioural regulation, Phys Physical skills

facilitators to engaging with patient-to-provider messaging using the COM-B model and TDF; this represents the first step towards intervention development according to the Behaviour Change Wheel.

Methods

A rapid umbrella review was conducting following published recommendations [31]. Rapid reviews are a form of knowledge synthesis which accelerates the process of conducting traditional systematic reviews by omitting or streamlining certain steps in the process [32], such as the number of individuals required to screen and extract data. Within the context of virtual care, in which innovations are constantly evolving, rapid reviews are better suited to provide actionable evidence in a more timely manner compared to traditional systematic or scoping reviews [31].

To improve methodological rigour the Preferred Reporting Items for Systematic Reviews and Meta-Analysis

extension for Scoping Reviews (PRISMA-ScR) checklist [33] and the PRISMA flow diagram were used to outline key methodological processes (see Additional file 1 and Fig. 3, respectively). This review was registered on Open Science Framework [34].

Identify the research question

The current umbrella review aims to answer the following questions to inform recommendations for improving patient-to-provider messaging:

- (I) What are patient and healthcare provider barriers and facilitators to engaging with patient-to-provider messaging?
- (II) What COM-B components and TDF domains should be targeted in future patient-to-provider messaging services to improve implementation and uptake?

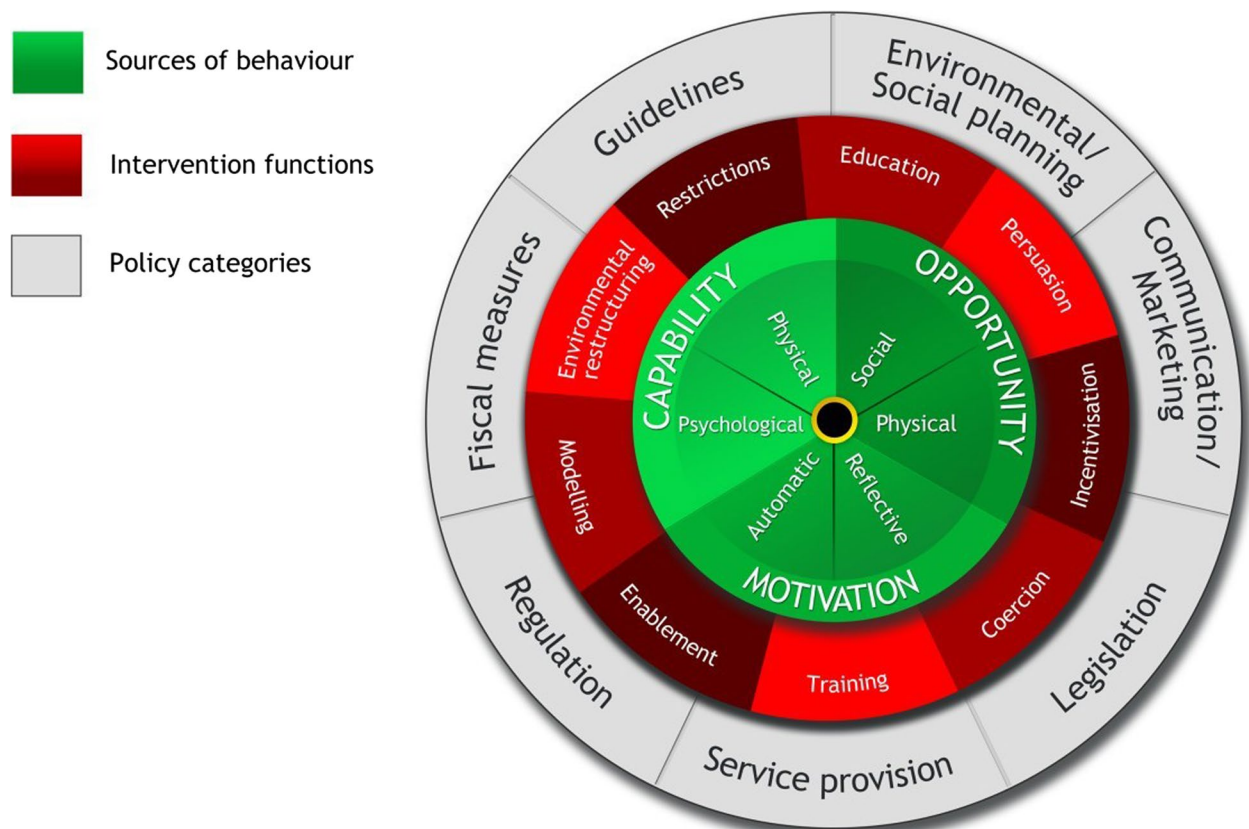


Fig. 2 The Behaviour Change Wheel (reproduced with permission from Michie, Atkins, et al., [18]). Protected by copyright

Identify relevant studies

Medline and CINAHL were searched for studies relating to: (I) patient-to-provider messaging (e.g., MeSH terms “text messaging”, keywords “short messag* service*”, “email”), (II) barriers, facilitators, or best practice (e.g., MeSH terms “communication barriers”, keywords “best practice*”), and (III) review articles. Databases were searched from inception until November 2022. The full search strategy can be found on the published registration [34], and the Medline search strategy can be found in Additional file 2.

Eligibility criteria

For inclusion criteria as it related to the Population, Intervention, Comparator groups, and Outcomes (PICO), see Table 1. To improve the timeliness of this review, articles were limited to review type articles (including any type of review article; e.g., narrative, rapid, scoping, systematic, qualitative, scans, etc.). Conference proceedings, newspaper articles, dissertations, and non-peer review articles were excluded. To be included, review articles had to refer to the use of patient-to-provider messaging in the context of

healthcare. No limits on date of publication, geographical location, or research setting (e.g., lab, community, hospital) were imposed. Only studies published in English were included.

Study screening and selection

All studies obtained from the search were uploaded into the systematic review software Covidence (Veritas Health Innovation Ltd., Melbourne, Australia) for processing. Removal of duplicate studies was completed automatically within Covidence. Following this, one author (MM) completed title and abstract screening. Full-text screening was performed by two authors (MM and SK). First, a sample of five records was screened independently by both authors to determine the degree of consistency in individual assessment, which subsequently yielded 100% agreement. Due to the high levels of agreement, the remaining full-texts were screened by a single reviewer for inclusion to improve the timeliness of this review.

Charting and extracting the data

A custom data extraction form was developed to characterize general study information (author, title, year of

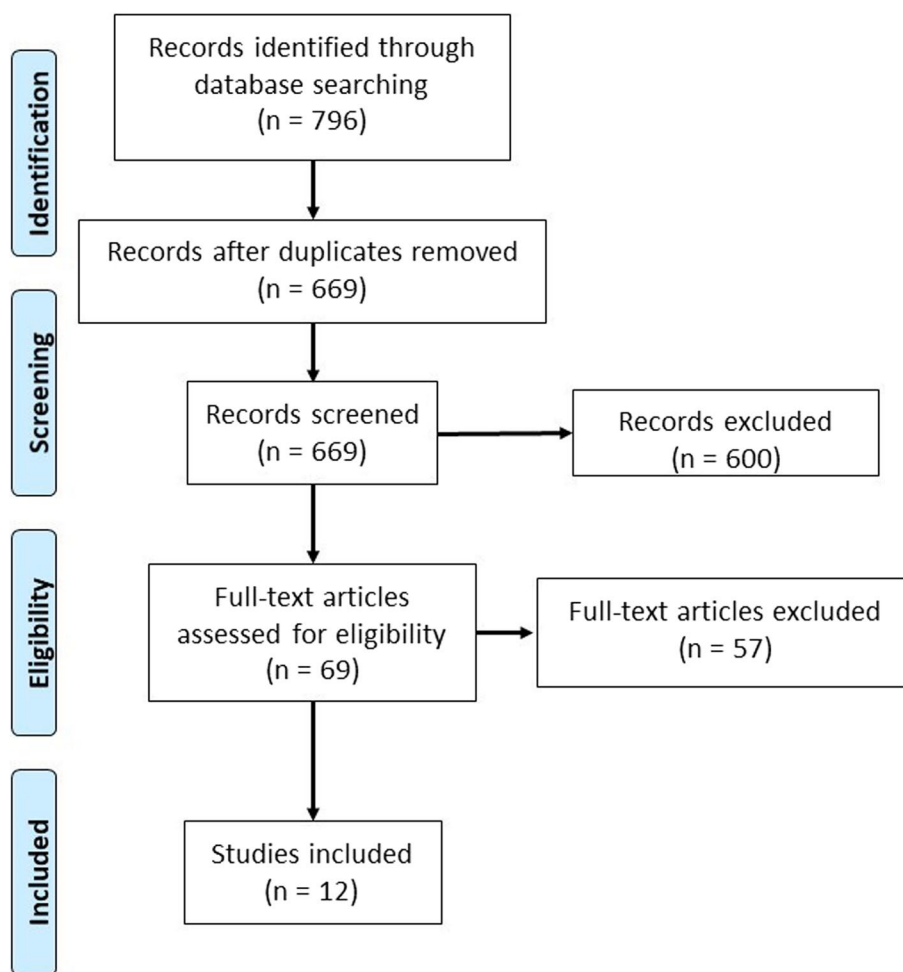


Fig. 3 PRISMA flow diagram

publication, review location, review type); participant information (gender, sex, age, ethnicity, race, health status); and a description of the patient-to-provider messaging system assessed (type of virtual messaging, barriers, facilitators). Two reviewers independently extracted data from half of the articles with 20% checked by both reviewers.

Protocol deviations

While the published registration states that quality evaluation/risk of bias was not going to be assessed, review authors felt that contextualizing the rapid review within the quality of evidence would benefit readers and healthcare authorities wishing to utilize this information in their decision making; therefore, a risk of bias

Table 1 Inclusion and exclusion criteria

PICO	Inclusion	Exclusion
Population	Human patients and/or healthcare providers	Non-human participants
Intervention	Patient-to-provider messaging (as a sole intervention, or provided in addition to other in-person or virtual services). Patient-to-provider message includes any virtual written communication between healthcare provider and patients	Virtual care services which do not specify the use of patient-to-provider messaging, in-person care delivery without the inclusion of patient-provider messaging, peer-support messaging, provider-to-provider messaging
Comparator	A comparator group is not necessary for this review	N/A
Outcomes	Reviews had to discuss best practices, barriers, or facilitators to engaging in patient-provider messaging in a healthcare setting	Reviews which identify that patient-to-provider messaging is used but provide no further information/recommendations on best-practice, barriers, or facilitators

was completed by both authors using the Assessment of Multiple Systematic Reviews (AMSTAR) 2 tool [35]. This tool evaluates the quality of review articles by answering 16 items. Five items (4, 9, 11, 12, and 15) are considered “critical” domains. Study quality was defined as high (none or 1 non-critical weakness), moderate (>1 non-critical weakness), low (1 critical weakness), and critically low (>1 critical weakness). Further, to increase the generalizability of results, one author (MM) used the TDF and COM-B to code all extracted barriers/facilitators according to the 14 TDF domains and 6 COM-B components.

Results

After de-duplication, the search resulted in 796 records. Of these, 69 were included for full-text review, resulting in a total of 12 included review articles (see Fig. 3). Reviews were conducted primarily in the United States [36–38], Canada [39, 40], and the United Kingdom [41, 42], with remaining reviews conducted in Australia [43], China [44], Denmark [45], Germany [46], and New Zealand [47]. Reviews were published from 2009 until 2022, with the majority (92%) published in the past 10 years.

From the 12 included reviews, five (42%) were scoping reviews [37–39, 44, 46], four (33%) were systematic reviews [36, 40, 41, 43], two (17%) were narrative reviews [42, 45], and one (8%) was an integrative literature review [47]. Reviews included studies targeting both patient/caregiver and healthcare provider perspectives across a variety of patient populations (older adults, patients in rural settings, and those with HIV, diabetes, cancer, or overweight and obesity). Only four reviews (33%) summarized demographic information beyond the patient condition being treated [36, 38, 43, 44], none of which provided information on participant race, ethnicity, culture, or socio-economic status.

Patient-to-provider messages were sent via multiple modalities including text messaging, social media, emails, and web-messaging. Barriers and facilitators to implementing or engaging with patient-to-provider messaging were identified in 10 studies (83%), one study outlined facilitators only, and one outlined barriers only. A total of 59 unique barriers and facilitators were identified; see Table 2 for specific barriers and facilitators identified for patients, and Table 3 for barriers and facilitators identified for healthcare providers.

Barriers

Of the 27 unique barriers identified amongst both populations, 21 (78%) were oriented towards the healthcare provider or clinical practice (e.g., addition of technology results in healthcare providers having to add “tech support” to their scope of practice), and 19 (70%) were

oriented towards the patient (e.g., digital health literacy). Interestingly, from this list of 27 barriers, a total of 13 (48%) were coded as being oriented towards both the patient and provider (e.g., blurring of boundaries in the relationship).

Across studies, the most frequent barriers extracted were related to privacy and confidentiality (reported in $n=7$ reviews; 58%; TDF=*Environmental Context and Resources* and *Beliefs about Consequences*; COM-B=*Physical Opportunity* and *Reflective Motivation*), technical problems ($n=3$; 25%; TDF=*Knowledge* and *Environmental Context and Resources*; COM-B=*Psychological Capability* and *Physical Opportunity*), disparities in internet access ($n=3$; 25%; TDF=*Environmental Context and Resources*; COM-B=*Physical Opportunity*), affordability of technology for patient and clinician/practice ($n=3$; 25%; TDF=*Environmental Context and Resources*; COM-B=*Physical Opportunity*), perceived increase in clinician workload ($n=3$; 25%; TDF=*Beliefs about Consequences*; COM-B=*Reflective Motivation*), and a lack of clinician training ($n=3$; 25%; TDF=*Skills, Knowledge, and Environmental Context and Resources*; COM-B=*Physical Capability, Psychological Capability, and Physical Opportunity*).

Provider barriers

The most frequently coded TDF domains relating to barriers for healthcare providers engaging with patient-to-provider messaging were *Environmental Context and Resources* ($n=5$ out of 21 provider-oriented barriers; 24%), *Beliefs about Consequences* ($n=5$; 24%), *Knowledge* ($n=3$; 14%), and *Social or Professional Role and Identity* ($n=3$; 14%). See Table 4 for information on all domains.

Regarding the COM-B, *Motivation* was the most the most frequently identified components for healthcare provider barriers ($n=9$; 43% barriers identified within the sub domain *Reflective Motivation*; $n=0$; 0% *Automatic motivation*), followed by *Opportunity* ($n=5$; 24% *Physical Opportunity*, $n=2$; 10% *Social Opportunity*), then *Capability* ($n=4$; 19% *Psychological Capability*, $n=1$; 5% *Physical Capability*).

Patient barriers

The most frequently coded TDF domains relating to barriers for patients engaging with patient-to-provider messaging were *Environmental Context and Resources* ($n=5$ out of 19 patient-oriented barriers; 26%), and *Beliefs about Consequences* ($n=5$; 26%). See Table 4 for information on all domains.

Regarding the COM-B, *Motivation* was the most the most frequently identified category for patient barriers ($n=11$; 58% barriers identified within the sub domain

Table 2 Patient-oriented barriers and facilitators to patient-to-provider messaging implementation

TDF Domain ^a	COM-B Domain	Theme—Barriers	Theme—Facilitators
Skills	Physical Capability	<ul style="list-style-type: none"> • Patients may lack manual dexterity, visual acuity, or reflexes to use a mobile device to communicate 	<ul style="list-style-type: none"> • None identified
Knowledge	Psychological Capability	<ul style="list-style-type: none"> • Patient literacy level 	<ul style="list-style-type: none"> • Message content (with detailed information regarding patient care, that uses graphical data) can improve patient knowledge
Behavioural regulation	Psychological Capability	<ul style="list-style-type: none"> • None identified 	<ul style="list-style-type: none"> • Virtual messaging systems providing rapid feedback (automated via the device or by a provider) allow patients to make timely modifications to their management
Memory, Attention, and Decision Processes	Psychological Capability	<ul style="list-style-type: none"> • Simple errors when writing a message may result in ambiguity and inaccurate content 	<ul style="list-style-type: none"> • Having a written record aids recall • Increased access to healthcare providers can assist patients in decision-making • Easier to remember and communicate health questions in writing (no distractions like when speaking to their provider)
Social or professional role and identity	Reflective Motivation	<ul style="list-style-type: none"> • Blurring of the boundaries in the relationship^b 	<ul style="list-style-type: none"> • Levelling out of power imbalances • Patients now have a role as “agenda setters” resulting in greater autonomy and empowerment
Beliefs about capabilities	Reflective Motivation	<ul style="list-style-type: none"> • Asynchronous nature makes building a trusting relationship difficult^b • When providers make grammatical mistakes in their messaging, it reduces patient confidence in their capabilities as clinicians 	<ul style="list-style-type: none"> • Patients feel empowered to ask questions they would not have otherwise felt comfortable asking • Increased access to healthcare provider improves patient-provider relationship^b • Informal nature of messaging can strengthen patient-provider relationship^b
Beliefs about consequences	Reflective Motivation	<ul style="list-style-type: none"> • Privacy and confidentiality with sharing information via technology • Some patients fear their message will be misunderstood by their clinician • Patients feel they are not receiving adequate care if their provider does not use the gathered data to provide tailored feedback or if responses are too general • Virtual messaging not appropriate to receive information on urgent issues • Unable to communicate using visual cues making it difficult to recognize misunderstandings 	<ul style="list-style-type: none"> • Belief that virtual messaging can allow for more detailed informational exchanges • Communicating virtually increases access and convenience (i.e., can send/receive messages at any time and refer back to them when needed; reach isolated or stigmatized populations) • Improves patient access to information • Patients no longer feel like a burden to providers, wasting their time • Patients and caregivers feel more connected to, and looked after by the provider • Ability to share data and receive advice from home reduces travel to clinic visits • Increased feelings of personal connection • Increased connection decreases psychological distress among caregivers
Intentions	Reflective Motivation	<ul style="list-style-type: none"> • Patients not motivated to use messaging (do not want to engage in manual data entry) • Patients may feel that technology is too intrusive 	<ul style="list-style-type: none"> • None identified
Optimism	Reflective Motivation	<ul style="list-style-type: none"> • Lack of confidence with technology among patients and/or caregivers 	<ul style="list-style-type: none"> • None identified

Table 2 (continued)

TDF Domain ^a	COM-B Domain	Theme—Barriers	Theme—Facilitators
Reinforcement	Automatic Motivation	<ul style="list-style-type: none"> • None identified 	<ul style="list-style-type: none"> • Message content (reminders and motivational messages to reinforce behaviours are preferred by some patients) • Having “virtual physician” who is with you all the time (even asynchronously) can increase accountability
Emotion	Automatic Motivation	<ul style="list-style-type: none"> • None identified 	<ul style="list-style-type: none"> • Patients don't feel as though they are a burden to their provider, wasting their providers time with irrelevant questions, or otherwise stressing their provider
Environmental context and resources	Physical Opportunity	<ul style="list-style-type: none"> • Lack of time • Lack of resources (i.e., infrastructure, equipment, access to internet or mobile phones) • Affordability of technology • Physical set-up for mobile devices (small text, small buttons, narrow scroll bars) • Technical issues with devices 	<ul style="list-style-type: none"> • Provision of informational resources which can be sent and read at any time • No tight time constraints to share information (compared to in-person visits)
Social influences	Social Opportunity	<ul style="list-style-type: none"> • None identified 	<ul style="list-style-type: none"> • Increased access to healthcare provider improves patient-provider relationship^b • Informal nature of messaging can strengthen patient-provider relationship^b

TDF Theoretical Domains Framework

^a No barriers or facilitators were coded to TDF domain Goals

^b Any barriers or facilitators relating to the therapeutic relationship between patient and provider was coded within Social Influence

Table 3 Provider-oriented barriers and facilitators to patient-to-provider messaging implementation

TDF Domain ^a	COM-B Domain	Theme—Barriers	Theme—Facilitators
Skills	Physical Capability	<ul style="list-style-type: none"> Lack of provider training^b 	<ul style="list-style-type: none"> None identified
Knowledge	Psychological Capability	<ul style="list-style-type: none"> Lack of provider training^b Lack of direction in policy guidelines Lack of institutional and professional guidelines 	<ul style="list-style-type: none"> Providers can better share detailed information regarding patient care Providers can use graphical data for interpreting data and identifying trends
Memory, Attention, and Decision Processes	Psychological Capability	<ul style="list-style-type: none"> Simple errors when writing a message may result in ambiguity and inaccurate content 	<ul style="list-style-type: none"> Having a written record aids recall
Social or professional role and identity	Reflective Motivation	<ul style="list-style-type: none"> Patient-to-provider messaging is not currently seen as part of the provider's professional role, making it a challenge for providers to adopt into their professional practice "Tech support" is not within the scope of healthcare providers practice Blurring of the boundaries in the relationship 	<ul style="list-style-type: none"> None identified
Beliefs about capabilities	Reflective Motivation	<ul style="list-style-type: none"> Asynchronous nature makes building a trusting relationship difficult^c 	<ul style="list-style-type: none"> Providers are better able to manage their time (answer patient requests at their own convenience vs interrupting their activities at unpredictable times for phone conversations)
Beliefs about consequences	Reflective Motivation	<ul style="list-style-type: none"> Burden on provider (i.e., increased workload, responsibility) Privacy and confidentiality issues (concerns about who is reading/answering messages intended for a patient) Virtual messaging not appropriate to share urgent issues Unable to communicate using visual cues making it difficult to recognize misunderstandings Unable to provide instant feedback 	<ul style="list-style-type: none"> Flexibility of access (i.e., messages can be sent at a suitable time where convenient) Increased convenience Virtual messaging can allow for more detailed informational exchanges Decreased provider burden (i.e., improves efficiency and productivity; self-documenting nature of messages decreases charting time) Reduced clinic costs
Environmental context and resources	Physical Opportunity	<ul style="list-style-type: none"> Lack of clinician training^b Lack of time Lack of resources (i.e., infrastructure, equipment, access to internet or mobile phones) Affordability of technology Technical issues with devices 	<ul style="list-style-type: none"> Increased accessibility of niche education/training for rural healthcare providers Providers have more time to contemplate their answers
Social influences	Social Opportunity	<ul style="list-style-type: none"> Asynchronous nature makes building a trusting relationship difficult^c Blurring of boundaries in the relationship^c 	<ul style="list-style-type: none"> Increased access to healthcare provider improves patient-provider relationship Providers have increased time to consult with colleagues and provide more considered responses Informal nature of messaging can strengthen patient-provider relationship Can help in establishing and maintaining rapport with the patient

TDF Theoretical Domains Framework

^a No barriers or facilitators were coded to TDF domain *Goals, Behavioural regulation, Intentions, Reinforcement, Emotion, or Optimism*

^b A general lack of training was always coded under Skills AND Knowledge AND Environmental Context and Resources

^c Any barriers or facilitators relating to the therapeutic relationship between patient and provider was coded within Social Influence

Reflective Motivation; $n=0$; 0% *Automatic motivation*), followed by *Opportunity* ($n=5$; 26% *Physical Opportunity*, $n=0$; 0% *Social Opportunity*), then *Capability* ($n=2$; 11% *Psychological Capability*, $n=1$; 5% *Physical Capability*).

Facilitators

Of the 32 unique facilitators identified, 15 (47%) were oriented towards the healthcare provider or clinical practice, and 25 (78%) towards the patient. Interestingly, from this list of 32 facilitators, a total of 8 (25%) were

Table 4 Number of barriers and facilitators per TDF domain for healthcare providers and patients

TDF Domain	Healthcare Provider		Patient	
	Barriers	Facilitators	Barriers	Facilitators
Knowledge	3	2	1	1
Skills	1	0	1	0
Social/Professional Role Identity	3	0	1	2
Beliefs about Capabilities	1	1	2	3
Beliefs about Consequences	5	5	5	8
Optimism	0	0	1	0
Reinforcement	0	0	0	2
Intentions	0	0	2	0
Goals	0	0	0	0
Memory, Attention, and Decision Processes	1	1	1	3
Environmental Context and Resources	5	2	5	2
Social Influences	2	4	0	2
Emotion	0	0	0	1
Behavioural Regulation	0	0	0	1
Total	21	15	19	25

coded as being oriented towards both the patient and provider.

Across studies, the most frequent facilitators identified were related to patients feeling empowered to ask questions via virtual messaging that they may otherwise not have asked ($n=4$; 33%; TDF = *Beliefs about Capabilities*, *Social or Professional Roles and Identity*; COM-B = *Reflective Motivation*), improved access to information ($n=3$; 25%; TDF = *Beliefs about Consequences*; COM-B = *Reflective Motivation*), having a written record aids recall ($n=3$; 25%; TDF = *Memory, Attention, and Decision Processes*; COM-B = *Psychological Capability*), and reduced travel time ($n=3$; 25%; TDF = *Beliefs about Consequences*; COM-B = *Reflective Motivation*).

Provider facilitators

The most frequently identified TDF domains relating to facilitators for healthcare providers engaging with patient-to-provider messaging were *Beliefs about Consequences* ($n=5$ out of 15 provider-oriented facilitators; 33%), and *Social Influences* ($n=4$; 27%). See Table 4 for information on all domains.

Regarding the COM-B, *Motivation* ($n=6$; 40% barriers identified within the sub domain *Reflective Motivation*; $n=0$; 0% *Automatic motivation*) and *Opportunity* ($n=2$; 13% *Physical Opportunity*, $n=4$; 27% *Social Opportunity*) were the most the most frequently identified COM-B components for healthcare provider facilitators, followed by *Capability* ($n=3$; 20% *Psychological Capability*, $n=0$; 0% *Physical Capability*).

Patient facilitators

The most frequently identified TDF domains relating to facilitators for patients engaging with patient-to-provider messaging were *Beliefs about Consequences* ($n=8$ out of 25 patient-oriented facilitators; 32%), *Beliefs about Capabilities* ($n=3$; 12%), and *Memory, Attention, and Decision Processes* ($n=3$; 12%). See Table 4 for information on all domains.

Regarding the COM-B, *Motivation* was the most the most frequently identified category for patient facilitators ($n=13$; 52% barriers identified within the sub domain *Reflective Motivation*; $n=3$; 12% *Automatic motivation*), followed by *Capability* ($n=5$; 20% *Psychological Capability*, $n=0$; 0% *Physical Capability*), and then *Opportunity* ($n=2$; 8% *Physical Opportunity*, $n=2$; 8% *Social Opportunity*).

Study quality

From the 12 included reviews, none were of high quality, 3 were moderate, 8 were low, and 1 was of critically low quality (Additional file 3 shows the AMSTAR 2 evaluation for all included reviews). All, or nearly all, of the included reviews reported on: all PICO components within the research question (item 1), literature search (item 4), details on included studies (item 8), and discussion of heterogeneity in results (item 14). None, or nearly none, of the included reviews reported on: a priori protocol (item 2), risk of bias assessment (item 9), information on funding sources (item 10), and accounting for risk of bias in interpretation (item 13).

Discussion

The development and implementation of patient-to-provider messaging is paramount to providing a cost-efficient, sustainable, and accessible form of text-based virtual care. With that said, various barriers and facilitators exist towards its adoption and effectiveness. The current rapid umbrella review represents the first systematic analysis and integration of barriers and facilitators associated with patient-to-provider messaging using the TDF and COM-B model. While use of the TDF or COM-B model to synthesize research literature is a relatively new concept [48], both have previously guided data analysis in other reviews focused on health behaviours and interventions [49–51].

This review provides valuable insights into the factors affecting healthcare providers and patients when using virtual messaging services, and highlights that both encounter numerous barriers and facilitators to implementing and engaging with patient-to-provider messaging. Further, the barriers and facilitators identified in this review span all COM-B components and all TDF domains (except for *Goals*); the most commonly identified COM-B category was *Reflective Motivation* which was identified in 39 out of the 59 unique barriers and facilitators (66%). Of the 39 barriers which fell within *Reflective Motivation*, the majority were further specified as *Beliefs about Consequences* using the TDF (23/39; 60%).

Barriers

The results of this review indicate that barriers to patient-to-provider messaging are almost evenly distributed within the literature between healthcare providers (8/27 barriers oriented towards providers alone; 30%) and patients (6/27 barriers oriented towards patients alone; 22%), with 13 out of 27 barriers (48%) affecting both groups. Barriers oriented towards healthcare providers were primarily found within the TDF domains *Environmental Context and Resources*, *Beliefs about Consequences*, *Knowledge*, and *Social or Professional Role and Identity*, and COM-B components of *Reflective Motivation*, *Physical Opportunity*, and *Psychological Capability*. These provider barriers focused on aspects such as the addition of technology to their scope of practice, perceived increases in workload, and a lack of training. Patient-oriented barriers were primarily found within the TDF domains *Environmental Context and Resources* and *Beliefs about Consequences*, and the COM-B components of *Reflective Motivation* and *Physical Opportunity*. These patient barriers highlight the importance of addressing issues such as digital health literacy and disparities in internet access. Notably, privacy and confidentiality emerged as a prominent barrier across studies for both healthcare providers and patients, emphasizing the significance of ensuring data security and privacy safeguards in patient-to-provider messaging.

Facilitators

Results demonstrate a higher proportion of facilitators oriented towards patients (17/32 barriers oriented towards patients alone; 53%) compared to healthcare providers (7 barriers oriented towards providers alone; 22%), with only 8 out of 32 barriers (25%) spanning both groups. For healthcare providers, the TDF domains *Beliefs about Consequences* and *Social Influences* and COM-B components *Reflective Motivation* and *Social Opportunity* were the most frequently identified facilitators. The asynchronous nature of messaging allows healthcare providers to consult with colleagues and provide more considered responses, thereby allowing them the opportunity to prioritize the content of their messages to build and maintaining rapport with their patients. Contrary to the experiences noted as barriers, providers reported a perceived decrease in workload once patient-to-provider messaging was integrated into their clinical practice. This finding suggests that highlighting the potential benefits of improved efficiency and productivity through messaging could enhance provider motivation to adopt messaging practices.

Patient related facilitators were primarily found within the TDF domains *Beliefs about Consequences*, *Beliefs about Capabilities*, and *Memory, Attention, and Decision Processes*, and COM-B components of *Reflective motivation*, and *Psychological Capability*. These patient facilitators emphasized patients feeling empowered to ask questions, improved access to information, the aid of written records in recall, and reduced travel time. The findings suggest that patient-to-provider messaging has the potential to enhance patient engagement, information accessibility, and convenience, thereby enabling patients to play a more active role in their healthcare.

An interesting finding from this review is the potential impact of patient-to-provider messaging on the therapeutic relationship, as indicated by barriers and facilitators from both healthcare providers and patients. Patients reported feeling more comfortable sharing sensitive information through messaging, which they otherwise might not feel comfortable discussing in person. Additionally, the asynchronous nature of messaging allows patients to ask relevant questions at their convenience. However, providers expressed concerns about the informal nature of messaging and its potential to blur the patient-provider relationship. These results appear to underscore the importance of maintaining appropriate boundaries and ensuring clear communication channels within text-based patient-to-provider messaging.

Developing patient-to-provider messaging interventions to target barriers and facilitators

The current analysis of barriers and facilitators using the COM-B model and TDF provides a “behavioural diagnosis” of potentially modifiable factors which enables a target behaviour to occur, and can be linked to intervention functions and behaviour change techniques through the guidance of the Behaviour Change Wheel [18]. By using the COM-B model, TDF, and associated intervention functions linked by the Behaviour Change Wheel, future researchers can develop and implement theory-based solutions to address barriers and promote facilitators identified within this review. Specifically, using the Behaviour Change Wheel, the most commonly identified TDF domains and COM-B components correspond to the following intervention functions: *Training, Restriction, Environmental Restructuring, Enablement, Education, Persuasion, and Modelling* [18]. For an example of how the Behaviour Change Wheel can be used in conjunction with the COM-B model and TDF for intervention design, see Fig. 4. Additionally, for example policy and clinical solutions for the top identified barriers in this review, see Table 5.

Strengths and limitations

While the primary strength of this review is the use of the COM-B model and the TDF to categorize provider- and patient-level barriers and facilitators influencing the implementation of virtual care identified in previous research on patient-to-provider messaging, it is important to also recognize its limitations. In conducting this umbrella review, a rapid review methodology was used which streamlines the systematic review process while also potentially introducing bias into specific review steps. For example, a limited number of databases were searched, and inclusion was limited to English language

review articles. By limiting to only review type articles, the authors did not have access to the raw data from each article within eligible reviews; therefore only barriers and facilitators that were reported within the review articles could be extracted and coded, and findings may not encompass the full range of factors influencing implementation of patient-to-provider virtual messaging. Further, the majority of screening and data extraction, and the entirety of the TDF coding was completed by a single author to expedite the review process. Future research should consider a formal systematic review that includes patient-to-provider messaging from other article types to provide more comprehensive and generalizable findings.

Most of the included reviews were assessed as having low confidence (Additional file 3). Specifically, many reviews lacked an a priori study protocol, and a quality assessment of included studies. Another important limitation for this work is the lack of demographic reporting within the included reviews. Only four of the twelve included reviews summarized demographic information beyond the patient condition being treated, and none provided information on participant race, ethnicity, culture, or socio-economic status. Such important factors are likely to influence barriers and facilitators for implementing and engaging with patient-to-provider virtual messaging and limit generalizability of these results. Future research should prioritize collecting and reporting on demographic information to identify any differences in barriers and facilitators of patient-to-provider virtual messaging experienced by different populations so that potential differences in the perception of barriers and facilitators of patient-to-provider virtual messaging can be identified and addressed.

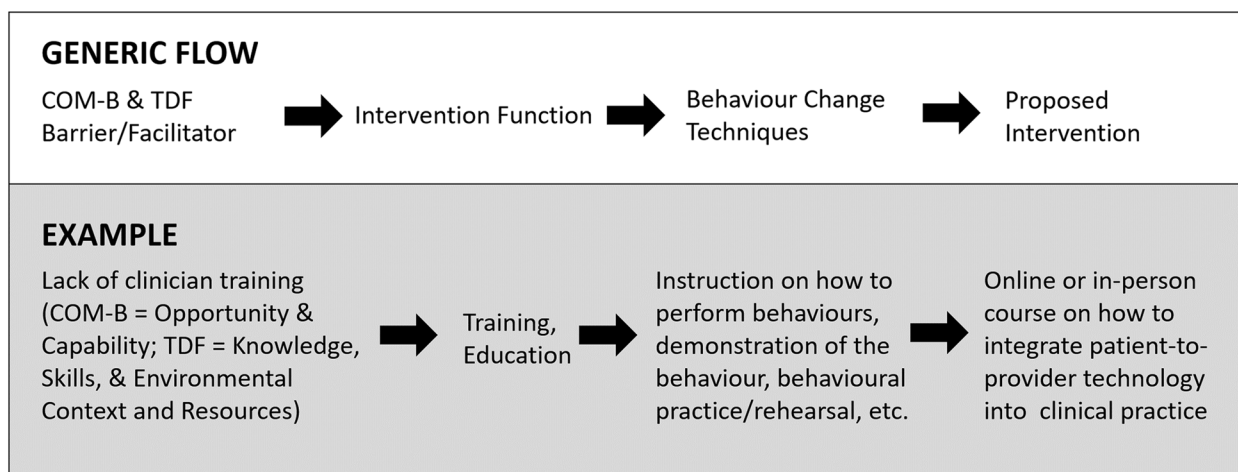


Fig. 4 Simplified depiction of Behaviour Change Wheel flow with worked example

Table 5 Top barriers and example policy and clinical solutions identified using the behaviour change wheel

COM-B Components	TDF Domain ^a	Barrier	Example Policy	Example Clinical Practice
Physical Opportunity, and Reflective Motivation	Environmental Context and Resources, Beliefs about Consequences	Privacy and confidentiality	Development of guidelines or procedures to ensure patient data is secure and protected when using digital messaging platforms (IF ^b = enablement)	Ensure that patients are fully informed of the privacy risks and benefits of messaging before they opt-in to these services (IF = education)
Psychological Capability, and Physical Opportunity	Knowledge, Environmental Context and Resources	Technical problems		Implement user-friendly messaging platforms that are easy to navigate and have a low learning curve for both patients and clinicians (IF = environmental restructuring)
Physical Opportunity	Environmental Context and Resources	Disparities in internet access and affordability of technology	Development of policies or initiatives to provide technology to underserved populations, subsidies for technology purchases, and improvement to internet infrastructure (IF = environmental restructuring). Policies that provide financial incentives for healthcare providers and practices to invest in tech infrastructure (IF = incentivization)	Provide training and technical support to patients and providers to troubleshoot common technical problems (IF = education, training)
Reflective Motivation	Beliefs about Consequences	Perceived increase in clinician workload	Create and implement policies which integrate patient-provider messaging into clinical workflows (IF = environmental restructuring). Policies to incentivize providers to use messaging platforms in their workflows (IF = incentivization)	Healthcare providers can ensure that any patient-to-provider messaging systems implemented in their clinical practice are accessible to all their patients (i.e., using text messaging that is not reliant on internet capabilities) (IF = environmental restructuring)
Physical Opportunity	Environmental Context and Resources, Skills, Knowledge	Lack of clinician training	Policies to ensure that healthcare providers are trained to use patient-provider messaging effectively, efficiently, and safely (IF = training)	Create campaigns which emphasize how virtual messaging services can improve efficiencies and decrease provider burden while positively benefiting patients (IF = persuasion and education). Provide administrative support to providers to help manage their workload (IF = enablement)

^a TDF theoretical domains framework

^b IF intervention function

Conclusions

This rapid umbrella review provides insights into the barriers and facilitators to implementing patient-to-provider messaging services (e.g., text messaging) within healthcare settings. Barriers and facilitators were primarily associated with the COM-B components *Reflective Motivation*, *Psychological Capability*, and *Physical Opportunity* and TDF domains *Beliefs about Consequences*, *Environmental Contexts and Resources*, *Social Influences*, and *Beliefs about Capabilities*. Using a COM-B model and TDF-based analysis, this review offers a theoretical foundation for researchers, healthcare systems, and policy-makers to design interventions that can effectively target potential implementation issues thus enhancing the impact and accessibility of patient-to-provider messaging systems in the future.

Abbreviations

AMSTAR	A Measurement Tool to Assess systematic Reviews
BCT	Behaviour Change Technique
BCW	Behaviour Change Wheel
COM-B	Capability, Opportunity, Motivation, Behaviour model for behaviour change
eHealth	Electronic health
IF	Intervention functions
mHealth	Mobile health
PICO	Population, intervention, comparator group, outcomes
TDF	Theoretical Domains Framework

Supplementary Information

The online version contains supplementary material available at <https://doi.org/10.1186/s44247-023-00033-0>.

Additional file 1. Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) Checklist.

Additional file 2. MEDLINE Search Strategy.

Additional file 3. AMSTAR ratings for all included reviews.

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Authors' contributions

MM was responsible for all aspects of this review. SK was responsible for data collection and analyses. All authors read and approved the final manuscript.

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Availability of data and materials

The datasets used and analysed during the current study are available from the corresponding author on reasonable request.

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Ethics approval and consent to participate

Not applicable.

Consent for publication

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Competing interests

The authors declare no competing interests.

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