



Review article

The influence of patient portals on users' decision making is insufficiently investigated: A systematic methodological review

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ABSTRACT

Background: Patient portals are considered valuable conduits for supporting patients' self-management. However, it is unknown why they often fail to impact on health care processes and outcomes. This may be due to a scarcity of robust studies focusing on the steps that are required to induce improvement: users need to effectively interact with the portal (step 1) in order to receive information (step 2), which might influence their decision-making (step 3). We aimed to explore this potential knowledge gap by investigating to what extent each step has been investigated for patient portals, and explore the methodological approaches used.

Methods: We performed a systematic literature review using Coiera's information value chain as a guiding theoretical framework. We searched MEDLINE and Scopus by combining terms related to patient portals and evaluation methodologies. Two reviewers selected relevant papers through duplicate screening, and one extracted data from the included papers.

Results: We included 115 articles. The large majority ($n = 104$) evaluated aspects related to interaction with patient portals (step 1). Usage was most often assessed ($n = 61$), mainly by analysing system interaction data ($n = 50$), with most authors considering participants as active users if they logged in at least once. Overall usability ($n = 57$) was commonly assessed through non-validated questionnaires ($n = 44$). Step 2 (information received) was investigated in 58 studies, primarily by analysing interaction data to evaluate usage of specific system functionalities ($n = 34$). Eleven studies explicitly assessed the influence of patient portals on patients' and clinicians' decisions (step 3).

Conclusions: Whereas interaction with patient portals has been extensively studied, their influence on users' decision-making remains under-investigated. Methodological approaches to evaluating usage and usability of portals showed room for improvement. To unlock the potential of patient portals, more (robust) research should focus on better understanding the complex process of how portals lead to improved health and care.

1. Introduction

Patient portals are information systems that provide individuals with access to their health records [1–5]. Further, they support basic activities such as recording symptoms, communication with healthcare providers, or booking appointments online [6]. Many patient portals target people living with chronic conditions, including asthma, cancer, diabetes, and multiple sclerosis [7,8].

Patient portals are seen as a key route to engage patients in care

[9–14], and as a valuable conduit to support them with self-managing their health and conditions [7,14,15]. This may explain their increasing availability [16,17], with previous studies reporting high levels of user satisfaction [6,18,19]. Yet, despite their rising popularity and potential, there is no strong evidence for the positive effect of patient portals on health care processes and outcomes [20–24].

The reasons for patient portals' lack of impact are currently poorly understood [20,21]. To address this, others have advocated that evaluations should take into account the complex processes whereby

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health information systems—in our case: patient portals—may lead to improvement [25,26]. Coiera proposed in his ‘information value chain’ [26] that for a system to have impact, users first need to effectively interact with it (step 1) in order to receive information (step 2), which might then influence their decision-making (step 3). In favourable conditions, this could lead to improved care processes (step 4) and, ultimately, better health outcomes (step 5). This implies that, to understand why a system fails to induce change in step 4 and 5, we need to focus more on investigating steps 1–3.

Many studies in patient portals so far have focused on steps 4 and 5: several systematic review evaluated the effect of patient portals on care processes and health outcomes [20–24]. For example, de Lusignan et al. [22] included 143 studies in their systematic review to investigate the effect of patient portals on provision, quality and safety of healthcare, while also appraising the quality of these studies. Giardina et al. [21] included 20 randomized controlled trials and seven observational studies to explore the impact of patient portals on effectiveness, efficiency, timeliness, patient-centeredness, and equity. Another review focused on the effect on chronic conditions outcomes and identified 27 studies [17]. In contrast, there seems to be a knowledge gap for steps 1–3 in the context of patients portals, with only one realist review [27] focusing on identifying factors related to patients’ engagement with the system which—among other things—included usage and usability.

Therefore, as this potential gap in knowledge might conceal some of the reasons for the current lack of impact of patient portals, our study aimed to investigate to what extent steps 1–3 have been investigated for patient portals. To achieve this, we systematically reviewed the literature to identify studies that evaluated usage, usability and effect on decision-making of patient portals. We describe which specific aspects these studies evaluated and report on the methodological approaches they employed in order to provide further insight into how extensively Coiera’s Information Value chain Steps 1–3 were investigated. We anticipate that our review will provide pointers for Health Informatics research by revealing aspects of patient portals that warrant further studies.

2. Materials and methods

We followed the PRISMA statement [28] to design and report our systematic review, where applicable.

2.1. Theoretical framework

We used Coiera’s ‘information value chain’ as the theoretical framework [26] to guide our study selection and data synthesis. This theoretical framework was especially suitable for our study because it conceptualizes in five steps how the use of a health information system of any type might lead to a change in health outcomes [26]. Also, a main feature of the information value chain relevant to our study aim is that each step can be evaluated and quantified on its own, with positive results in one step increasing the likelihood of obtaining improvements in the next steps.

If we apply Coiera’s framework to patient portals, the chain starts with patients interacting with the system (step 1), which for example can be evaluated in terms of usability or usage (e.g. if and how often patients logged into the system). From some interactions, patients will receive information from the system (step 2). The amount and type of information received will depend on which patient portal functionalities patients accessed. This could be, for example, viewing a medication or problem lists, or laboratory results. Where the portal functionality allows patients to record information such as symptoms, the quantity and accuracy of data logged into the system can be evaluated. Step 3 will then focus on whether this information led to patients and clinicians making or changing a decision. For example, patients could decide to contact their healthcare provider if they are

worried about an out-of-range laboratory result, or notify their general practitioner of an incorrect medication entry in their health record. At the same time, information recorded by patients through the portal might lead to a clinician requesting an extra laboratory test, or updating the medication list. In both cases, one can count the number of decisions that changed and evaluate their appropriateness. Ultimately, these decisions may alter the process of care (step 4), such as a change in utilisation of the health care resources, patient activation or medication prescriptions. In some cases, such changes will lead to better health outcomes (step 5), such as improvements in blood sugar control or quality of life.

In our review we focused on identifying studies that evaluated aspects of patient portals related to the first three steps of Coiera’s information value chain (i.e. interaction with the system, receipt of information, and influence on decision making) [26].

2.2. Search strategy

In compliance with guidance from the Cochrane collaboration [29], we searched MEDLINE via Ovid [30] and Scopus [31] for articles in English using both words in title, abstract, or keywords as well as standardized indexing terms. We combined terms referring to patient portals with terms pertaining to evaluations of system usage; usability and decision-making that reflected Coiera’s information value chain steps 1–3; Supplementary file A contains the search syntax for both databases. The searches were performed on the 18th of July 2016; without limits on year of publication.

2.2.1. Selection of relevant studies

The inclusion criteria for our review spanned across four areas:

- Type of system; We included studies that evaluated a patient portal, following the definition of patient portals from Irizarry et al. [27]. This included systems that were either “tethered” or “untethered” to an Electronic Health Record (EHR), as well as prototypes or mock-ups of patient portals. We focused on systems that gave users access to (part of) their medical records (e.g. laboratory test results, medications or problem lists), allowed them to enter health data, or share it with healthcare professionals. We excluded systems that only provided patients with educational material, or online booking or secure messaging functionalities. Included studies could focus on a specific system or more than one system at the same time.
- Target population; We were interested in studies that had patients, carers, or healthy volunteers from the general population as the study sample, as they are the people most commonly targeted by patient portals.
- Aspects evaluated; We included articles that reported findings on patient portal use, i.e. related to the first three steps of Coiera’s information value chain [26], obtained from experiments in controlled laboratory settings, as well as from field studies in a real world context. We excluded studies that only evaluated the intention to use patient portals. We also excluded studies solely reporting on the impact on care processes or health outcomes (steps 4 and 5 from Coiera’s information value chain) as such studies and their methodological quality have been already investigated in previous systematic reviews [20–24].
- Publication type; We were interested in systematic reviews or original articles in English. We included full papers published in conference proceedings, while excluding conference abstracts. Narrative reviews, editorials, view point papers and grey literature were also excluded.

After removing duplicates from the MEDLINE and Scopus searches, the principal reviewer (PF) independently screened the titles and abstracts of all studies, whereas two others (PB; SvdV) each did half. For studies considered potentially relevant, we retrieved the full papers to

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