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Patient Portals: Objectives, Acceptance, and Effects on Health Outcome - A Scoping Review of Reviews

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Abstract. Patient portals provide patients access to their electronic health record and other functions as secure messaging. For over a decade, more and more patient portals are developed for various settings. The aim of this scoping review of reviews is to systematically search the literature for existing reviews to provide an overview of patient portals' objectives, acceptance and effects on outcome. We followed the PRISMA Statement and its extension for scoping reviews, and searched for articles published in 2011 – 2021. The 19 included articles were considerably heterogeneous concentrating on health outcome or patient portal facilitators and barriers.

Keywords. patient portal, electronic health record, personal health record, systematic review

1. Introduction

With the effect of the "Krankenhauszukunftsgesetz" (KHZG) hospitals shall receive a digital update including sponsoring for emergency capacities and digital infrastructure. One of these elements are patient portals[1]. Patient portals provide several functions for patients to access and/or manage health information via a secure online website with 24-hour access such as recent visits, discharge summaries, medications. In addition, patient portals can enable the patient to securely communicate with physicians, request prescription refills, schedule appointments etc.[2]. By providing the opportunity to empower the patient to take over an active role in his/her own care [3], several studies came to the conclusion that patient portals and the patient engagement within can improve health outcomes or medication adherence[4]. However, the adoption rates are very low[5].

Many reviews already focused on various topics concerning patient portals. The aim of this scoping review of reviews is to search the literature for those existing reviews to provide an overview of patient portals' objectives, acceptance and effects on outcome.

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2. Methods

The *protocol* follows the PRISMA Statement [6] and its extension for scoping reviews [7]. It has not been published, but can be supplied by the authors. Studies fulfilling all the following *eligibility criteria* were included:

1. The patient portal is connected to a hospital information system.
2. The study investigates and describes at least one of the following characteristics of patient portals: structure, development, use or influence on the health status.
3. The type of study is systematic review or meta-analysis according to the PRISMA-Statement and the Cochrane Handbook of Systematic Reviews.
4. The study reports on data items listed below.

The Web of Science (Clarivate Analytics) was *searched* in the configuration "All databases" on March 15th 2021. The *search strategy* is shown in Fig. 1.

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portal* NEAR/3 (patient* OR health)
"systematic review*" OR "metaanaly*" OR "meta-analy*"
1 AND 2
portal* NEAR/3 (vein* OR thrombos* OR hypertens* OR "world health" OR placement OR position)
"trial* portal" OR "Health Evidence Portal"
4 OR 5
3 NOT 6
```

Figure 1: Search Query

The search was restricted to articles published between 2011 and 2021. For *study inclusion* the following steps were performed: (1) Titles and abstracts were scanned for mentioning of "portal" in the meaning of an internet portal and English language; (2) abstracts were scanned for the mentioning of a connection between portal and central hospital information system; (3) remaining full texts were checked for full concordance with the eligibility criteria described above. All steps were performed at least by two authors and ambiguous decisions were discussed by all authors until consensus.
The following *data items* were *extracted* from the included reviews (Tab. 1):

Table 1: Data Extraction Items

Item	Value	Explanation
Literature Search	Time period	For which time period was the literature search performed?
Studies included	Number of studies	How many studies were included in the review?
Health problem	Type of disease	Is a specified kind of health problem addressed?
Targeted Effect	Objective: e.g. improvement of patient-physician interaction	What is the health-related objective/targeted effect of the portal?
Type of study outcome	Type of outcome: e.g. usability, acceptance, health outcome, patient reported outcome	What has been measured/investigated in the study?
Functions	Type of functionalities: e.g. secure messaging	Which functions are available in the portal?

Categories for extracted values were defined by all authors so that each value is covered by one category and articles can be described most expressive with them. Articles were categorized and grouped according to the reported data items as shown in Tab. 1.

3. Results

From the initial search result of 89 articles, 19 articles were included for data extraction. The PRISMA diagram (Fig. 2) shows detailed reasons for exclusion.

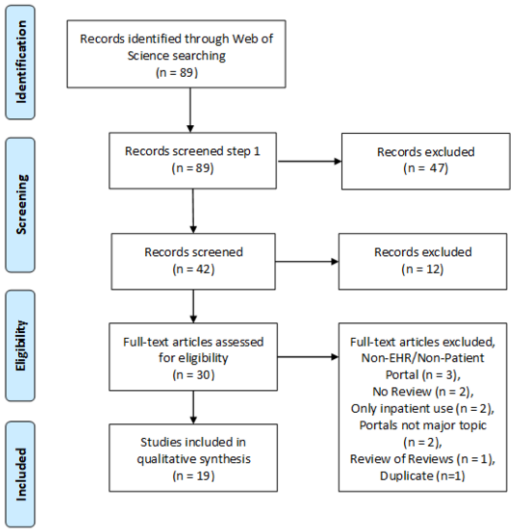

Figure 2: PRISMA diagram

Since most of the reviewed articles did not specify the health problem addressed and only mentioned chronic illnesses in general or vulnerable population [4,5,7–15], we did not include this column in the summary table (Fig 3a-c). However, four articles addressed diabetes [16–19].

The following targeted objectives were found: 9 articles described effects on health outcome [8, 11–13, 16, 19–22], 8 the usage of patient portals [4,5,11–13,15,17,20], 8 facilitators [4,5,9,11,13,14,17,21], and 7 barriers [4,5,9,11,14,17,21]. Additionally, characteristics of the users [9,11,15,22], their adherence [11,12], patient empowerment [11], and effects on decision making [11]. Three reviews focused on portal design [4,10,15] and one on Meaningful Use [15].

The associated review outcomes can be grouped by three major topics: health outcome, facilitators and barriers: For health outcome 7 reviews reported an improved outcome [8,12,16,18–20,22] and 4 better adherence [12,16,22,23], however 3 reported insufficient evidence or no improvement [11,19,22]. 4 reviews declared better patient satisfaction and empowerment [11,12,18,23].

Facilitators mainly concentrate on assistance, training and provider/family engagement [9,10,13,18,21,23] as well as good and user-centered design of the portal [4,10,13,14,21], sociodemographic factors, e.g. younger users [4, 5, 9, 11, 17, 21], reminding users [10,14] and adequate policy strategies [10,14,21].

Most concerning barriers reported in the reviews were privacy and security concerns [4,5,9,10,13,23], limited access to the internet [5,13,14,17], lack of technology experience [17,21], literacy [14], lack of interest [5,9], and awareness [21,23].

Functions of reviewed patient portals contained secure messaging [4,9–14,16,17,19,20,22–24], access to EHR-data (e.g. lab results) [9–14,16,17,19,23], medication refills [11,12,14,16,17,22], appointment booking [10–13,16,17], patient education [11,12,14,16,17,22], add information [4,9,13,14], decision support [14,22,23]. For detailed results see Figure 3a, b, c.

4. Discussion

This scoping review examined 19 systematic reviews with different themes and variations in the setting and outcome. Most reviews concentrated on health outcome or patient portal facilitators and barriers. Nevertheless, we found an overlap in facilitators such as patient training and barriers such as privacy concerns.

Ammenwerth et al concluded in 2012 that the impact of patient portals is only limited [12]. Consistently, Goldzweig et al added that no sufficient evidence on health outcome, cost, or utilization can be found. However, some studies stated that patient portals can be beneficial for healthcare [4]. Especially in the field of diabetes clinical parameters and so the health outcome could be improved [16,18,22], although those reviews also reported insufficient evidence.

To improve patient portal acceptance and usage sociodemographic factors have to be overcome [11], training and pc/internet access has to be provided [5,9,10,21]. Frequent reminder and provider encouragement also have an impact on the regularly use of patient portals [14].

Although the reviews concentrated on various health problems, the patient portals had similar functions, which validates the findings of Goldzweig et al.

Dendere et al suggest to develop standardized outcome assessment and studies focusing on objective outcomes for a comprehensive evaluation of patient portals [4].
This review is *limited* to patient portals which are directly connected to hospital EHR systems. Although this scoping review is methodically limited, we followed the PRISMA statement for systematic reviews as closely as possible. A quality assessment of the included reviews will be included in future work.

5. Conclusion

With this scoping review of reviews, we provide an overview of the current research on patient portals and the opportunities they present for patient care. In addition, our review shows that more research is needed on the use and use cases of patient portals in order to gain insights into problems that arise and their solutions, such as increased usability.

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Author	Literature Search	Studies included	Targeted Effect	Study Outcome	Portal Functions
Osborn et al, 2010	2000 - 2010	26	Improving health behaviors, outcomes, care and/or processes of care	Enhance patient-provider communication, increase overall satisfaction with care, expand access to health information, improve disease management and patient outcomes. User characteristics are crucial for positive effects	
Ammenwerth et al, 2012	1990 – 2011	4	Impact on patient care, e.g. improving communication provider-patient communication or increasing adherence to medication treatment	Impact on clinical outcome, health resource consumption, patient adherence, patient-physician communication, patient empowerment and satisfaction	Access to and export clinical data, medication refills, appointment scheduling, general medical information (e.g. guidelines), secure messaging
Goldzweig et al, 2013	1990 – 2013	46	Patient outcomes, satisfaction, adherence, efficiency, utilization, attitudes and patient characteristics, and barriers or facilitators	Evidence that patient portals Improve health outcomes, costs, or utilization insufficient. Patient attitudes positive. Need to overcome racial, ethnic, and literacy barriers	Medication refills, secure patient-provider messaging, viewing education/disease management information, medical test results, and notes / visit summaries
Amante et al, 2014	2005 - 2014	16	Enrollment and utilization, barriers and facilitators	Higher portal enrollment incl. higher education, younger age, higher income, and non-Hispanic/non-black; access to and trust in computer/internet, private health insurance; higher self-efficacy, more diabetes and insulin-related knowledge and better controlled diabetes, and higher health literacy; barriers incl. trust in provider and engagement, lack of interest	Secure messaging, access to test or lab results, refill prescriptions and schedule appointments
Kruse et al, 2015	2011 – 2014	271	Effects on quality, or chronic-condition outcomes; implications of meaningful use	Improvements in medication adherence, disease awareness, self-management, decrease of office visits, patient's request for additional information. Increase in quality in terms of patient satisfaction, customer retention, loyalty rate; lower appointment non-show rate; User tend to be female, Caucasian, under 65, well-educated, and prefer electronic means of communication	
Otte-Trojel et al, 2016	2004 - 2015	109	Identify main development problems and solutions; recommendations for advancement of evidence base in future research	Achieving patient engagement: patient-centered design, training and education, promotional initiatives; health service provider engagement: workflow engineering / training, notifications and signaling of urgency; appropriate data governance: policies for data availability and timing, in-person authorization/user agreements, electronic signatures; security and interoperability: international communication standards, access control, encryption, firewalls, audits, health information exchange; sustainable business model: trial period, appropriate reimbursement criteria	Access and capture personal health information, several communication (secure e-mail), self-management, administrative functionalities, linkages to convenience tools, e.g. online appointment scheduling

Figure 3a: Summary of findings in the reviewed literature

Author	Literature Search	Studies included	Targeted Effect	Study Outcome	Portal Functions
Ruth et al, 2016	2008 - 2014	11	Characterization of users, utilization, user testing, development of portal, issues of proxy and access to personal health information for teenagers	Portal utilization: registration from 4% to 65%, evidence for higher usage among children with chronic disease	View medical records, lab and test results, secure messaging, access notes / visit summaries
Powell et al, 2017	2009 - 2016	37	Characteristics of users, facilitators and barriers	Demographic characteristics (young, female, white), complexity and duration of disease; provider encouragement, access/control over health information, enhanced communication; lack of awareness / training, privacy / security concerns	
Dawn et al, 2017	2008 – 2017	17	Experience and use among older adults (>64), benefits and barriers, influence on health status	Barriers to usage: privacy / security, access to and ability to use technology and internet; facilitators: technical assistance, family/provider advice; design recommendations: design addressing barriers and facilitators	Check lab results, learning about health information, preparing for appointments through medication list management, secure messaging
Fraccaroa et al, 2017	2002 – 2016	40	Usage (adoption rates), usability, effect on decision making and influence on clinical endpoints / health improvements	Overall mean adoption rate: 52% (95% CI, 42 to 62%), controlled experiments: 71% (95% CI 64 to 79%), real-world experiments: 23% (95% CI, 13 to 33%); suggestions: adoption rate in controlled studies do not reflect everyday clinical practice, unlikely influence on clinical endpoints in real-world setting; future focus: identify factors and processes that affect adoption	Access to EHR data, enter data / share information with provider, appointment scheduling, recording symptoms, communications with provider
Steven et al, 2017	2002 – 2017	12	Evaluate effects on glycemic control by using patient portals	Uncertain causality of patient-clinician secure messaging and improved glycemic control	Secure messaging
Zhao et al, 2018	2000 – 2017	32	Barriers, facilitators and solutions	Barriers: negative attitude, interface problems; facilitators: training, perceptions of benefits, institutional/family support; solutions: better interface design, marketing/outreach, training/support, policy changes, research	
Han et al, 2019	Before 11/2018	24	synthesize evidence with regard to the characteristics and psychobehavioral and clinical outcomes	Improve few psychological outcomes, medication adherence, preventive service use. Insufficient evidence to support patient portal use to improve clinical outcomes	Customized education, alert for chronic condition management, medication refill, secure messaging
Grossman et al, 2019	Before 9/2018	18	Increase portal use/predictors, reduce disparities	Assist patients, engage providers, simplify content, improve utility of existing content, more transparency of EHR information, translations, user-centered design, portal interfaces for users with disabilities, limited literacy, technology experience, or broadband access, assign patient tasks, offer devices or internet access, policy strategies, remind about portal use	

Figure 3b: Summary of findings in the reviewed literature

Author	Literature Search	Studies included	Targeted Effect	Study Outcome	Portal Functions
Abd-alrazaq et al, 2019	2000 – 2019	97	Patients' intention to use, subjective measures, objective measures	Positive Factors: facilitating conditions, perceived usefulness, internet/computer access, awareness of ePHRs, perceived ease of use, internet use, income, educational level, married, socioeconomic status, residence place, language, employed; negative: privacy and security concerns; no effect: health status, ethnicity, sex	Accessing records, messaging providers, appointment scheduling, setting reminders, adding information, requesting referrals, discussion groups, communicating peers, calendar, refilling prescriptions, educational materials, tracking system, assessment tools, checking billing, tele-monitoring, clinical decision support system
Dendere et al, 2019	2005 – 2017, update 8/2018	58	Input factors (e.g. portal design, hardware/software), process factors (e.g. portal use), output factors (e.g. benefits)	Not clear if patient portals are beneficial, good patient portal design crucial, user wish for mobile device use, factors for use: privacy concerns, sociodemographic factors, messaging	
Ammenwerth et al, 2019	Before 2019	10	Effects of providing EHR access on patient knowledge/empowerment, health related outcomes	Portal user show better outcome than none portal user, only small improvement of outcome, portal use declines over time	Access, communicate, share, manage, educate, remind
Alturkistani et al, 2020	Up to 9/2019	12	Patient portal use, health and health care quality outcomes, incl. health care utilization outcomes (diabetes)	Association with glycemic control, reduced glycated hemoglobin A1c, reduced blood pressure, increased office visits, reduced hospitalizations, medication adherence and adjustment. No difference in BMI among users/non-users (one study). Refilling medications associated with glycemic control, blood pressure control, medication adherence. Association between medication refill exclusively through portal improved statin adherence (one study)	View lab results, visit notes, appointment booking, medication refill, secure messaging, patient education
Lauren et al, 2021	2014 – 2018	87	Type of quantifiable metrics of portal use	Provider use 30 (34%), patient use 78 (90%), frequency 56 (64%), duration 27 (31%), intensity 59 (68%), super user 21 (24%). Meaningful use as driver for portal adoption and utilization	Patient login: 45 (59%), send secure message to provider: 45 (59%), view-download-transmit: 9 (12%)

Figure 3c: Summary of findings in the reviewed literature

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