

# Classification of Patient Portals Described in Evaluation Studies Using the TOPCOP Taxonomy

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**Abstract.** Many patient portals have been introduced and evaluated in recent years. The results of evaluation studies are difficult to compare, however, as the evaluated patient portal is often not clearly or only incompletely described in the publication. This problem is common to evaluations in health informatics. We evaluated the completeness of descriptions of patient portals in 15 exemplary evaluation publications using the TOPCOP taxonomy. Our results show that core functionalities such as portal design, patient communication, educational features, or system notifications were quite clearly described in all 15 evaluation studies. Other descriptions, such as web accessibility or data management, were often not provided. We conclude that taxonomies such as TOPCOP should be used and even required for describing interventions in evaluation papers.

**Keywords.** Patient portal, taxonomy, evaluation, health informatics, information management

## 1. Introduction

A patient portal is a web-based application that allows patients to access their health-related data stored in the Electronic Health Record of a healthcare organization [1]. Due to their expected benefit for patient empowerment and quality of care, healthcare institutions have introduced patient portals in recent years, and researchers have evaluated their impact.

The results of evaluation studies are difficult to compare, however, as the evaluated patient portal is not clearly or only incompletely described in the publication. This problem is common to evaluations in health informatics, which has led to the development of recommendations for reporting evaluation studies [2]. Classifying patient portals using a taxonomy may help to reduce the problem [1].

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A taxonomy is a classification system to assign similar objects of a domain into groups based on distinct characteristics and offers a set of decision rules [3,4]. The reduction of complexity, identifying similarities and differences among objects, and the understanding of interrelationships are major advantages of taxonomies [5,6]. Furthermore, taxonomies help to systematize and enhance knowledge by observing and analyzing a domain, thus contributing to providing knowledge [7].

In the absence of a specific taxonomy for comparing evaluation studies of patient portals, we considered the TOPCOP taxonomy the best approach for our research. With 25 dimensions based on 65 characteristics, the TOPCOP taxonomy has a sufficient number of dimensions and characteristics to discriminate among patient portals and sufficiently explain the patient portals independent of clinical setting or country [4,8].

The aim of this study was to evaluate the completeness of the patient portal descriptions in evaluation studies by using the TOPCOP taxonomy.

## **2. Methods**

For our study, we selected 15 exemplary patient portal evaluation studies. We took all ten studies from a most recent Cochrane Review on Randomized Controlled Trials on patient portals [1], as this review comprised the most recent complete lists of published RCTs on patient portals. We added five non-RCT studies to cover other study designs with assumed different publication quality.

To evaluate the studies, we used the TOPCOP taxonomy [8,9] (Figure 1). We read the full text of the 15 evaluation studies and searched for a description of the intervention. TOPCOP was used to classify this description as best as possible. Ambiguous decisions were discussed by all authors until consensus was reached.

## **3. Results**

We classified all 15 studies according to the TOPCOP taxonomy, although many of these dimensions were not specified in the evaluation papers. Some studies mentioned a dimension but gave insufficient information to fully classify a paper according to the characteristic. In these cases, the classification was done by interpreting the available information. In cases where not enough information was available, we opted for the characteristic which indicates the non-existence of the respective feature. Hence, a feature defined as missing does not necessarily mean that the patient portal does not provide this feature, but only that the evaluation paper did not provide enough information.

We found ten described patient portals which were tethered to an EHR [10–19] and five that were integrated [20–24]. Eight patient portals were designed for secondary care [11–13,17,18,20–22], three for primary care [19,23,24], and one for tertiary care [16]. Another eight studies stated a disease-specific portal specialization [11,14,16–18,21,22,24], two universal [20,21], two extended [12,19], and another seven had a medical specialization [11,13,17,18,20,22,24]. One study described an insight to the activity monitoring [15].

| ASPECTS            | DIMENSIONS                  | CHARACTERISTICS  |                    |                   |                  |
|--------------------|-----------------------------|------------------|--------------------|-------------------|------------------|
| Portal Design      | D1: Portal Type             | tethered         |                    | integrated        |                  |
|                    | D2: Care Sector Target      | primary care     | secondary care     | tertiary care     | generic          |
|                    | D3: Patient Target          | outpatient       |                    | in & outpatient   |                  |
|                    | D4: Portal Specialization   | universal        | extended           |                   | disease-specific |
|                    | D5: Medical Specialty       | generic          |                    | specialized       |                  |
|                    | D6: Web Accessibility       | not supported    |                    | supported         |                  |
|                    | D7: App Expandability       | not expandable   |                    | expandable        |                  |
|                    | D8: Activity Monitoring     | no insight       |                    | with insight      |                  |
| Management         | D9: Appointment Booking     | no booking       | request            | schedule          | hybrid           |
|                    | D10: Prescription Renewal   | no renewal       |                    | with renewal      |                  |
|                    | D11: Portal Customizability | not customizable |                    | customizable      |                  |
| Communication      | D12: E-Consult              | no e-consult     | asynchronous       | synchronous       | both             |
|                    | D13: System Notifications   | no notifications | notifications      | reminder          | alerts           |
| Instruction        | D14: Patient Education      | no education     | non-personalized   | personalized      |                  |
|                    | D15: Therapy Instructions   | no instructions  | non-protocol-based | protocol-based    |                  |
| Self-Management    | D16: Medication Summary     | no summary       |                    | with summary      |                  |
|                    | D17: Health Monitoring      | no monitoring    | self-reported      | self-tracked      | combined         |
|                    | D18: Visit Preparation      | no preparation   |                    | with preparation  |                  |
| Self-Determination | D19: Declaration of Will    | no registration  |                    | with registration |                  |
|                    | D20: Second Opinion         | no inquiry       |                    | with inquiry      |                  |
|                    | D21: Study Sign-Up          | no sign-up       |                    | with sign-up      |                  |
| Data Management    | D22: Record Access          | no control       | shared control     | full control      |                  |
|                    | D23: Records Management     | no management    |                    | with management   |                  |
|                    | D24: Health Data Amend      | review           | correct            | delete            |                  |
|                    | D25: Health Data Upload     | no upload        |                    | with upload       |                  |

**Figure 1.** TOPCOP taxonomy of patient portals [8].

For the portal design, the dimensions Web Accessibility and App Expandability were not specified by any study.

For the aspects of management, six studies reported a function for prescription renewal [12,16,18,21–23], three an appointment booking request [12,16,22], and three an appointment booking scheduling [15,21,23]. Only two described the ability to customize the patient portal [15,16].

One of the most reported specifications concerned the aspect of communication. An asynchronous e-Consult was provided by twelve patient portals [10,12,13,16–18,20–23], one synchronous [20], and one both [15]. In the dimension of system notifications, eight patient portals provided a reminder function [10,13,17,19,21–24], four alerts [11,16,18,20], and two notifications [15,18].

Another frequently specified aspect was instructions with seven patient portals which provided non-personalized education [13,15–17,20,21,24], five personalized education [10,11,18,19,22], seven had protocol-based therapy instructions [15,17–22], and three non-protocol-based [10,11,13].

Several studies reported self-management aspects as medication summary provided in twelve patient portals [10–12,14–18,20–23] and three visit preparation [15,22,23]. Health monitoring was specified as self-reported by five studies [10,11,21–23], combined by three studies [15,16,24], self-tracked by two [17,18], and one had no monitoring [19].

Only a few studies reported on self-determination aspects. Three provided a study sign-up [10,15,24] and two papers were assessed as lacking this function [13,21]. One

patient portal had a function for a declaration of will registration [23] and one an inquiry for a second opinion [15].

The last classified aspect was data management, which was not specified very often. Two studies stated shared control to record access [15,24], two no control, and one full control [16]. One patient portal enabled record management [15] and four described no available management [10,12,21,22]. A health data amend review was available in five patient portals [10,12,19,21,24] and one allowed the correction [22]. One portal described that no upload of health data is possible [22].

#### **4. Discussion**

Already in 2013, Goldzweig et al [25] concluded that, among other things, a better understanding of the implementation factors for patient portals is required. Kruse et al [26] reported in their systematic review of patient portals that often only specific features were analyzed instead of the full patient portal. Ammenwerth et al [27] stated in their review of patient portals that an aggregation of evidence is needed which could be achieved by a taxonomy.

We used the TOPCOP taxonomy to evaluate the completeness of descriptions of the patient portal in evaluation studies. We found that the description of core functionalities such as portal design, patient communication, educational features, or system notifications were quite clearly described in all 15 evaluation studies. Other descriptions, such as web accessibility or data management, were not provided in many studies.

We could not see any difference in completeness between RCTs and non-RCT studies. Both had gaps in describing their intervention.

The TOPCOP taxonomy was developed for health information managers to classify and compare patient portals to help them choose the most suitable solution for their needs [8,9]. We used the taxonomy for classifying patient portals used in evaluation studies. We can recommend this taxonomy for specification and comparison of evaluation studies. Since most taxonomies are built for a specific purpose, a different purpose may lead to a different taxonomy structure and other characteristics. This was the first research for evaluating the completeness of patient portal descriptions in 15 evaluation studies applying the TOPCOP taxonomy. Therefore, additional research may assess the suitability of TOPCOP for this purpose on a broader approach.

Another direction for subsequent research could be to assess whether further concepts should be added to the taxonomy to extend its usefulness, e.g. to classify evaluation studies. Van Mens et al [28] adapted the Clinical Adoption Framework (CAF) to expand the analysis of EHR adoption with the patients as an end-user. CAF classifies categories about people, organization, system quality, system use, and net benefits. Future work may compare if aspects described in CAF could be integrated into the TOPCOP taxonomy and so improve the taxonomy's usefulness.

Since the evaluation studies were often unclear in many dimensions, we interpreted the paper in a team of two authors, reaching consensus in all cases. We focused our study on 15 papers. A larger sample of evaluation studies could now be reviewed to confirm our results.

We conclude that the completeness of portal description was often incomplete. Health informatics should increase the use of taxonomies such as TOPCOP to better describe intervention in evaluation studies. This would better make it possible to compare and summarize the published evidence and as a basis for Evidence-Based

Health Informatics [29]. Further, all patient portals are in continuous development and change. Therefore an institution similar to HON (Health On the Net) which promotes deployment of useful and reliable internet-based health information, enabling its appropriate and efficient use [30] would also be useful in the context of patient portals to tackle the challenge of sustained and regular evaluation of such portals.

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