To be or not to be digital? A bibliometric analysis of adoption of eHealth services

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Abstract

Purpose – The purpose of this study is to introduce new tools to develop a more precise and focused bibliometric analysis on the field of digitalization in healthcare management. Furthermore, this study aims to provide an overview of the existing resources in healthcare management and education and other developing interdisciplinary fields.

Design/methodology/approach – This work uses bibliometric analysis to conduct a comprehensive review to map the use of the unified theory of acceptance and use of technology (UTAUT) and the unified theory of acceptance and use of technology 2 (UTAUT2) research models in healthcare academic studies. Bibliometric studies are considered an important tool to evaluate research studies and to gain a comprehensive view of the state of the art.

Findings – Although UTAUT dates to 2003, our bibliometric analysis reveals that only since 2016 has the model, together with UTAUT2 (2012), had relevant application in the literature. Nonetheless, studies have shown that UTAUT and UTAUT2 are particularly suitable for understanding the reasons that underlie the adoption and non-adoption choices of eHealth services. Further, this study highlights the lack of a multidisciplinary approach in the implementation of eHealth services. Equally significant is the fact that many studies have focused on the acceptance and the adoption of eHealth services by end users, whereas very few have focused on the level of acceptance of healthcare professionals.

Originality/value – To the best of the authors' knowledge, this is the first study to conduct a bibliometric analysis of technology acceptance and adoption by using advanced tools that were conceived specifically for this purpose. In addition, the examination was not limited to a certain era and aimed to give a worldwide overview of eHealth service acceptance and adoption.

Keywords Technological innovation, Health care, Industry 4.0, Innovation, Service quality, Management systems

Paper type Research paper

1. Introduction

1.1 Digital innovation and healthcare industry

Many studies have described that, owing to digital tools, we are seeing a shift in the way that healthcare services are delivered (Carboni *et al.*, 2022; Gaddi *et al.*, 2013; George *et al.*, 2012). In this shift, information technology (IT) and information and communication technology (ICT) have played a critical role and have the potential ability to make healthcare more accessible, minimize adverse occurrences and lower operational costs (Thuemmler and Bai, 2017, pp. 2168–2194). The creation of technologies (i.e. apps, programs, software) has used IT

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and ICT tools to improve existing procedures inside healthcare facilities (Haluza and Jungwirth, 2018). The adoption of these technologies can result in a variety of benefits, including quicker access to personal health data and increased sustainability, efficacy, efficiency and quality of delivered services (Scheibner *et al.*, 2021).

In this sense, there are two major digital innovations that the healthcare industry can enjoy, namely electronic Health (eHealth) and Artificial Intelligence (AI) (Impedovo and Pirlo, 2019; Shaikh *et al.*, 2023). In the following paragraphs, these two categories of innovation will be reviewed, specifying that our study focuses on the adoption of one of the two, namely eHealth.

1.2 AI for the healthcare industry

The role played by AI in the digitalization process of various industry sectors, including healthcare, is substantial. The increasing utilization of EHRs and digital imaging offers AI the opportunity to support patients and providers (Shaikh *et al.*, 2023). AI applications include not only the utilization of machine learning (ML) algorithms for real-time data but also IoT eHealth ecosystems to support informal caregivers and vulnerable populations (Blasioli and Hassini, 2022). The proper management, interpretation and use of the data about the user or patient and their condition generated by the novel person-centered service model pose one of the major challenges in the relationship between eHealth and IoT. The techniques and ML methodologies finding application in healthcare depend on both the data and the IoT infrastructure under consideration (Cabestany *et al.*, 2018). Below, we offer a succinct description of the most common AI branches with eHealth applications.

Natural language processing (NLP). Computers' ability to understand and process the natural language. Systems can make sense of a written text and perform different tasks, including topic classification, translation, synthesis and spell checking.

ML (algorithms trained with datasets capable of producing outputs from given inputs) techniques:

(1) Supervised learning. Labeled datasets are used to trained ML models to learn and increase accuracy. The trained datasets include inputs and outputs: the accuracy in learning is measured by the algorithm by means of the loss function, minimizing the error until a threshold is met. Commonly used learning methods in this category include linear regression, logistic regression, neural networks, random forest and support vector machines (SVMs),

(2) Unsupervised learning. In this case, the datasets used are unlabeled. This technique allows us to find patterns or trends when there is no knowledge *a priori* available about the structure of the data. In this case, possible functions that can define the hidden structure from the unlabeled data are deduced as the learning algorithms do not contain any labels to supervise the learning/training (Dike *et al.*, 2018). Unsupervised ML algorithms typically involve clustering, anomaly detection and neural networks (NN), and

(3) Semi-supervised learning. By combining the two methods described above, algorithms attempt to enhance the performance in one of the tasks utilizing the information associated with the other. To tackle a classification problem, for example, additional data points for which the label is unclear may be used. On the other hand, for clustering techniques, the learning process might benefit by being aware of the fact that specific data points belong to the same class (Van Engelen and Hoos, 2020).

Access to recommendations and automated treatments, as well as personalized medicine, are two eHealth areas that could greatly benefit from the introduction of AI approaches (Cabestany *et al.*, 2018).

1.3 eHealth and its subcategories

The World Health Organization (WHO) defines eHealth as the cost-effective and secure application of ICT in support of health and health-related disciplines, such as healthcare services, health surveillance, health publications, and health education, knowledge, and research (World Health Organization [WHO], 2005, pp. 121–123). There is clear evidence that eHealth is having an increasing influence on the delivery of healthcare throughout the world, and it is making health systems more efficient and responsive to people's needs and expectations.

Increasingly, the term eHealth is placed alongside its subcategories mHealth, uHealth, telehealth and telemedicine (Bai *et al.*, 2021; Lee and Yoon, 2021). Often, these terms are used interchangeably although they have specific meanings that differentiate one from the other.

Specifically, *mHealth* is a subgroup of eHealth and refers to the use of mobile devices in healthcare (Hamberger *et al.*, 2022; Zhao *et al.*, 2018; Park, 2016). The growing number of mobile devices has increased interest in developing and creating applications that could be installed and used to monitor one's health.

However, *uHealth* refers to healthcare systems that are particularly useful in the management of chronic diseases or those that require long-term care (Hamberger *et al.*, 2022). It has the potential to facilitate diagnoses, improve the quality of care and reduce medical costs (Kim *et al.*, 2022).

The WHO (1998) defines *telemedicine* as:

> The delivery of health care services where distance is a critical factor by all health care professionals using ICT for the exchange of valid information for the diagnosis, treatment, and prevention of disease and injuries, research and evaluation, and continuing education of health care providers, all in the interests of advancing the health of individuals and communities (p. 10).

Finally, *telehealth* differs from telemedicine in that it encompasses a larger range of remote healthcare services than telemedicine. Although telemedicine refers to remote clinical services, telehealth may also refer to remote non-clinical services, such as provider training, administrative meetings and continuing medical education (Krupinski and Bernard, 2014).

In a chiaroscuro of opinions, eHealth services appear essential but there is considerable resistance to their adoption (Asthana *et al.*, 2019; Kim *et al.*, 2022; Klöcker, 2015). Thus, it is certainly appropriate to conduct a bibliometric analysis of the studies that have been conducted so far to take stock of the situation and to understand the ways to possibly act so that eHealth services are understood and the distrust that is encountered is comprehended.

More precisely, our study intends to answer the following research questions (RQs):

RQ1. How have studies on the adoption of eHealth developed over time?

RQ2. In which countries have studies been conducted on this topic and who are the authors who conducted these studies?

RQ3. What are the most cited studies that have inspired subsequent research?

RQ4. Based on our findings, what is the developing potential for further research?

We decided to focus our study circumscribing it to UTAUT and UTAUT2 for the following reasons:

(1) UTAUT and UTAUT2 are two of the most innovative research models, carrying the constructions of several earlier models (Tamilmani *et al.*, 2021).

(2) UTAUT and UTAUT2 have been effectively employed in other healthcare services studies to assess the rationale for technology adoption or non-adoption (Haikal *et al.*, 2022).

(3) UTAUT and UTAUT2 could anticipate whether the healthcare business would adopt new technology (Duarte and Pinho, 2019).

2. Bibliometric analysis in contemporary research

This study uses bibliometric analysis to conduct a comprehensive review to map the use of the unified theory of acceptance and use of technology (UTAUT) and the unified theory of acceptance and use of technology 2 (UTAUT2) research models in academic studies on healthcare industry. A growing body of scholarly work has been devoted to defining and to mapping the intellectual structure of diverse research topics.

Bibliometric studies are considered an important tool to evaluate research proceedings and to address knowledge gaps (Abramo and D'Angelo, 2011; Moed, 2006). Large-scale bibliometric research is possible because of the creation and development of the Science Citation Index (SCI), which currently incorporates the Web of Science (WoS), a Clarivate Analytics (formerly Thomson Reuters)-maintained platform, in 1963. In addition, within WoS, we find two more indexes that complement the SCI: the Social Science Citation Index (SSCI) and the Arts and Humanities Citation Index (A&HCI; Wouters, 2006). Until the creation of Scopus and Google Scholar in 2004, the scientific community relied uniquely on the WoS for citation analysis (Mongeon and Paul-Hus, 2016). However, the use of Google Scholar for research evaluation has raised doubts about its suitability because of the low quality of data that is found in it, leaving WoS and Scopus as the main sources for citation data (Mongeon and Paul-Hus, 2016). The WoS and Scopus are highly representative of the entire research output in the natural and formal sciences. Their use in bibliometric research makes this methodology a better solution than peer review in terms of robustness, validity, functionality, costs and execution times (Abramo and D'Angelo, 2011). During the past few decades, the WoS has been widely adopted as a source for bibliometric analysis in a variety of scientific fields (Hossain, 2020; Merigó and Yang, 2017; Shukla *et al.*, 2020; Yu and He, 2020; Yu *et al.*, 2017). The decision to adopt the WoS for our study reached a unanimous consensus given the database's features, its reputation and its suitability for the purpose of our work (Zhang *et al.*, 2016).

3. Research method

It was planned to perform a bibliometric analysis that would focus primarily on two acceptance models: (a) the UTAUT (Venkatesh *et al.*, 2003) and (b) the UTAUT2 (Venkatesh *et al.*, 2012). These models, among many others, were found as a result of the widespread investigation of the variables that influence technology acceptability in the healthcare industry (Rouidi *et al.*, 2022).

As was mentioned, the focus was on the adoption of eHealth services. Bibliometric data were analyzed by using a variety of tools, helping the authors to examine the phenomenon from various perspectives.

Records were initially searched by using the following association of keywords and Boolean operators: "eHealth" OR "telemedicine" OR "mHealth" OR "uhealth" OR "telehealth" AND "adoption" OR "acceptance" AND "utaut" OR "utaut 2" OR "utaut*" OR "Unified

Theory of Technology Acceptance" OR "Unified Theory of Technology Acceptance 2" OR "Unified Theory of Technology Acceptance*".

We searched the WoS database, which, as was said, is one of the most significant tools for gathering systematic information on worldwide scientific literature (Zhu and Liu, 2020). The records that emerged were filtered by language and scientific sectors. In particular, the study focused on records in English and that related to the WoS categories "economics," "management," "social psychology," "health literacy and telemedicine," and "health policy."

To strengthen the robustness of our study, we double-checked all the documents that were retrieved from this database. These records were compiled by using EndNote 20.2.1 software for further sorting. EndNote's "Find Duplicates" feature was used to eliminate duplicate data. Then, coauthors manually inspected the records to identify any duplicates that were not eliminated by the technology and publications that were not initially published in English.

We did not limit the examination to a certain era, and we included every record that was identified by the search criteria, regardless of the year that it was published. This was done to capture research from diverse periods. Further, we included any study, regardless of the sample's origin, because one of our purposes was to give a worldwide perspective, whereas proceedings, reports and non-peer-reviewed records were excluded.

After a careful reading of the books and book chapters deriving from the data collection, it was decided not to include them in the analyzed sample. In fact, although there were book chapters and books on the topic, these did not present empirical studies. On the contrary, they were mainly conceptual. Instead, we were interested in analyzing systematic contributions that have empirically studied eHealth adoption.

This stage of the sorting procedure resulted in the selection of 105 distinct English-language scientific articles (see Appendix).

4. Data analysis

4.1 Analysis overview

As was mentioned, we conducted a bibliometric analysis to study the evolution of the research on the topic of eHealth services acceptance and adoption and emerging research trends, evaluating the impact of the publications that were produced and the productivity of the authors, as well as understanding the potential collaboration patterns between countries.

The first part of this section presents some descriptive statistics about the impact of authors, scientific publications and journals. The second part analyzes the distribution of scientific publications by adopting a three-field plot in which the field selected have been, respectively, publications, keywords and journals. The third section focuses on the methodologies to perform network analysis: co-citation analysis, co-occurrence analysis and bibliographic coupling. Network analyses can help to explain the knowledge, the intellectual structure and the evolution of a research area. A methodology such as co-citation analysis allows for the mapping of subject-specific specialties and the identification of themes in research topics among the clusters of publications (Braam *et al.*, 1991).

4.2 Published literature: descriptive analytics

We conducted a preliminary analysis of the corpus of publications, as shown in Figure 1.

As can be seen from Figure 1, the number of studies that have used the UTAUT and UTAUT2 models has grown considerably and there was a particularly significant peak from 2019 to 2022 when the total number of publications equaled 75 units (71.4%), of the 105 that constitute the sample. It is even more significant that the greatest peak occurred between 2020 and 2022, which are years that were marked by the COVID-19 pandemic.

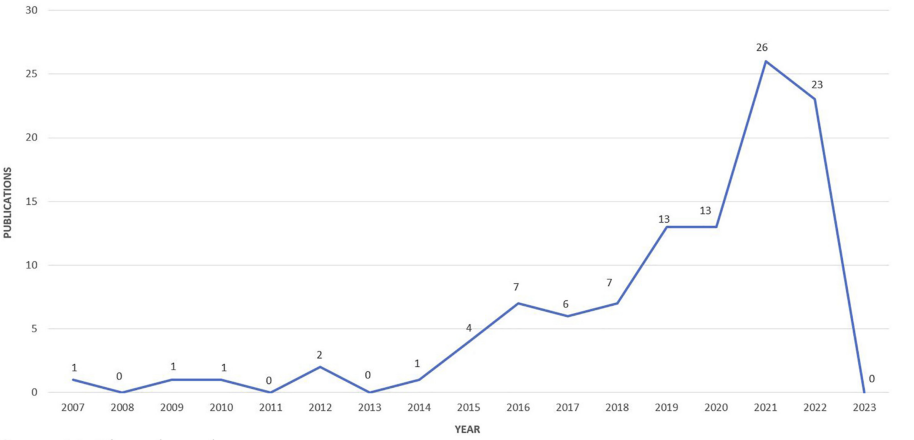


Figure 1.
Publications over time

Source(s): Figure by authors

Subsequently, we used the software *BibExcel*. This is a bibliometric software (Persson *et al.*, 2009) that was used to conduct a preliminary analysis of the publications and to generate a co-citation network file. Descriptive statistics are useful for capturing some of the major trends in the literature, embracing the distribution of publications studying the acceptance and/or adoption of eHealth.

In a second phase, the network file was opened using *Gephi*, a network science software (Bastian *et al.*, 2009), to display and to further analyze the co-citation data that was generated by *BibExcel*, resulting in different network maps and topic clusters of the co-citation network.

Table 1 displays the most cited authors, whereas Table 2 displays the most cited papers within our network. Table 1 highlights how Venkatesh is the most cited author (21 citations in total). Davis (1989) follows in order with 7 citations and the other authors in the table with 5 citations. Table 2 confirms the importance of Venkatesh's work. Precisely Venkatesh and Davis (2000) can be considered as seminal of the two papers Venkatesh *et al.* (2003) and Venkatesh *et al.* (2012) in which the UTAUT and UTAUT2 models have been precisely elaborated.

4.3 Three-field plot analysis

A three-field plot provides a graphical representation of data that are organized into three columns. To generate this graph, an R package that is known as *Bibliometrix* was used.

Citations	Author(s)
13	Venkatesh V, 2003
8	Venkatesh V, 2000
7	Davis FD, 1989
5	Nazi KM, 2013
5	Tavares J, 2016
5	Hoque R, 2017
5	Dwivedi YK, 2019
5	Hoogenbosch B, 2018

Table 1.
Authors cited at least five times

Source(s): Table by authors

Citations	Paper
13	Venkatesh, V., Morris, M.G., Davis, G.B. and Davis, F.D. (2003), "User acceptance of information technology: Toward a unified view", *MIS Quarterly*, Vol. 27, No. 3, pp. 425-478
8	Venkatesh, V. and Davis, F.D. (2000), "A theoretical extension of the technology acceptance model: Four longitudinal field studies", *Management Science*, Vol. 46 No. 2, pp. 186-204
7	Venkatesh, V., Thong, J.Y.L. and Xu, X. (2012), "Consumer acceptance and use of information technology: extending the unified theory of acceptance and use of technology", *MIS Quarterly*, Vol. 36 No. 1, pp. 157–178
5	Tavares, J. and Oliveira, T. (2016), "Electronic health record patient portal adoption by health care consumers: an acceptance model and survey", *Journal of medical Internet Research*, Vol. 18 No. 3, article e5069
5	Hoque, R. and Sorwar, G. (2017). "Understanding factors influencing the adoption of mHealth by the elderly: An extension of the UTAUT model", *International Journal of Medical Informatics*, Vol. 101, pp. 75-84
5	Hoogenbosch, B., Postma, J., de Man-van Ginkel, J.M., Tiemessen, N.A., van Delden, J.J. and van Os-Medendorp, H. (2018), "Use and the users of a patient portal: cross-sectional study", *Journal of Medical Internet Research*, Vol. 20 No. 9, article e262
5	Dwivedi, Y.K., Rana, N.P., Jeyaraj, A., Clement, M. and Williams, M.D. (2019), "Re-examining the unified theory of acceptance and use of technology (UTAUT): Towards a revised theoretical model", *Information Systems Frontiers*, Vol. 21, pp. 719-734
5	Mann, D.M., Chen, J., Chunara, R., Testa, P.A. and Nov, O. (2020), "COVID-19 transforms health care through telemedicine: evidence from the field", *Journal of the American Medical Informatics Association*, Vol. 27 No. 7, pp. 1132–1135

Source(s): Table by authors

Table 2. Publications receiving at least five citations

Developed by Aria and Cuccurullo (2017), *Bibliometrix* is equipped with tools for quantitative research in bibliometrics and scientometrics, addressing data collection, data analysis (descriptive analysis, network analysis and normalization) and data visualization (conceptual structure and network mapping).

Three-field plots, using Sankey diagrams, were used to study the patterns, trends and relationships among three selected fields. A Sankey diagram is a visualization that is used to represent a flow from one set of values to another. Connected elements are called nodes and connections are called links. The use of encryption keys is ideal for showing a "many-to-many" mapping between two domains or multiple paths through a set of stages. Sankey diagrams are frequently used in bibliometric analyses (Linnenluecke *et al.*, 2020). Each column represents a dimension of the information. From left to right, the columns report:

(1) publications,

(2) keywords, and

(3) journals (called "sources").

We decided to limit the number of elements for each column to 10 (Zhang *et al.*, 2016). Each rectangular node's size indicates the frequency of occurrence of a certain publication, keyword or author in the studied data (larger rectangles indicate higher frequencies). The number of connections or linkages between the nodes is indicated by the breadth of the connections between them (bigger nodes indicate stronger connections between fields). These measurements offer a visual depiction of the relative weight or frequency of each data point. The first column, which includes the research papers' titles in more detail, indicates the articles' specific areas of interest. Information about the academic journals is provided in the third column, allowing us to determine the most productive writers in a certain subject and get a sense of the network of collaborative research initiatives. The categories authors-

keyword in the first graph and keyword-plus in the second graph are connected via the middle column.

In the WoS, *Keyword Plus* is a methodology to index scientific articles that allows for the inclusion of broader and more general terms than *Author Keywords* thus identifying related studies that might be missed if relying solely on the latter method (Zhang *et al.*, 2016). However, *Author Keywords* provides a more accurate and precise picture of the research topic. Given the complementary nature of the two methods, we display a three-field plot that uses *Author Keywords* and another that uses *Keyword Plus* (see Figure 2).

The article by Venkatesh *et al.* (2003; "User acceptance of information technology: Toward a unified view") dominated the network (frequency = 15.00), comprising seven out of the 10 keywords (*Author Keywords*). Specifically, the work by Venkatesh *et al.* (2003) was connected to seven of the research themes that were identified by the keywords in the central column. It was followed by the publication by Venkatesh *et al.* (2012; "Consumer acceptance and use of information technology: Extending the unified theory of acceptance and use of technology"), which was connected to six out of the 10 keywords in the central column (frequency = 8.00). The dominant theme that was identified by the *Author Keywords* was *eHealth* (frequency = 21.00), which emerged as a relevant theme in seven out of the 10 papers listed in the left column. Further, it had been treated by three out of the 10 journals listed in the right column (*Journal of Medical Internet Research*, *Canadian Family Physician* and *Journal of the American College of Clinical Pharmacy*). The keyword *digital health* (frequency = 4.00) appeared also significantly connected to the journals in the right column and had three connections in total. The most important journals were *International Journal of Pharmaceutical and Healthcare Marketing* (frequency = 7.00), which had three connections among the keywords, and *JMIR Formative Research* (frequency = 4.00), which had four connections among the keywords.

Substituting *Author Keywords* with *Keyword Plus* (see Figure 3), we can appreciate that the *Keyword Plus* algorithm resulted in a more diversified list than the list that was generated by *Author Keywords* in which some fields might overlap (such as eHealth and e-health). This allowed us to enrich the previous analysis. By expanding the coverage from keywords that were explicitly mentioned by authors to the co-occurrence of keywords within and across

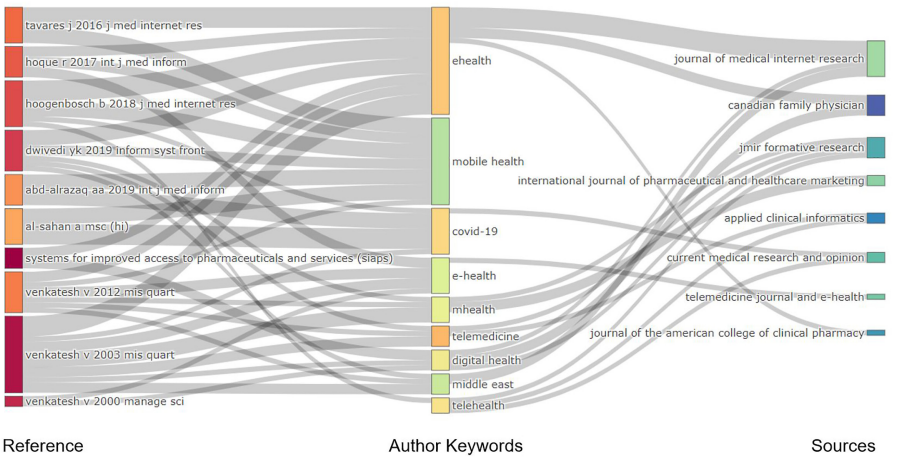
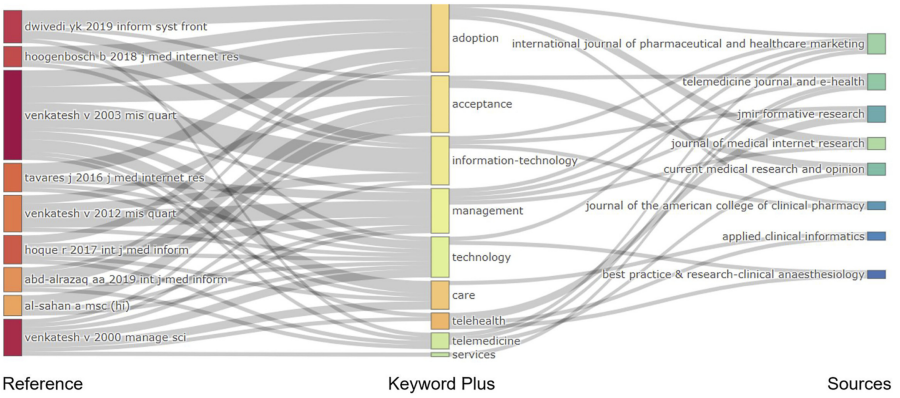


Figure 2.
Three-field plot using References, Author Keywords and Sources

Source(s): Figure by authors



Source(s): Figure by authors

Figure 3.
Three-field plot using Reference, Keyword Plus and Sources

papers, the resulting list of *Keyword Plus* helps to identify research areas that are interconnected and the most important or influential keywords in a specific field.

It is possible to note that the study by Venkatesh *et al.* (2003; frequency = 22.00) still dominates the network, having 8 out of the 10 connections among the keywords in the central column, followed by the work by Venkatesh and Davis (2000), frequency = 9.00), which shares 7 connections, and Venkatesh *et al.* (2012; frequency = 9.00), having 4 connections among the keywords. The most dominant keywords were *adoption* (frequency = 17.00) and *acceptance* (frequency = 14.00). The two shared six connections among the papers and three among the journals. The most relevant journal was *International Journal of Pharmaceutical and Healthcare Marketing* (frequency = 5.00), which treated five out of the 10 keywords, followed by *Telemedicine Journal and e-Health* (frequency = 4.00), having 4 connections among the keywords in the central column.

4.4 Network analysis

The network analysis that we present combines techniques. Specifically, we used co-citation analysis, co-occurrence analysis and bibliographic coupling (Boyack and Klavans, 2010). Bibliographic coupling and co-citation analysis originated several decades ago whereas co-citation analysis was adopted in the 1970s. Since then, it has been the preferred approach (Boyack and Klavans, 2010). Although these three approaches are not combined, Small (1997) proposed using them together. We present different results from the deployment of these methods to provide insights from distinct perspectives in the analysis of our network of publications.

A co-citation network analysis was performed by using Gephi, a powerful open-source software that is capable of displaying large networks in real time (Bastian *et al.*, 2009). Tracking pairs of publications that are referenced together in source articles is what co-citation analysis (Small, 1973) is about. When many writers mention the same pair of publications, research clusters emerge. The publications that are co-cited in these clusters usually have a shared subject. Gephi offers a wide range of filtering methods and tools, which allows for high levels of flexibility and performance in the handling of large sets of data. Co-citation studies represent a widely used methodology in quantitative studies of science, in particular, author co-citation analysis and document co-citation analysis. One of the most important insights that can be obtained by analyzing co-citation relationships is the identification of patterns, in addition to the uncovering of the intellectual structure of a field

(Pilkington and Meredith, 2009) and the unveiling of the ways that research has evolved (Chen *et al.*, 2010). A preliminary step consisted of manipulating the data set by using *BibExcel* through which a network file was generated and that was used in Gephi. Once generated, the co-citation network data were elaborated on by using Gephi for network analysis and visualization. For this purpose, we selected the first 200 co-cited documents. The obtained graph was weighted and directed and there was a total of 198 nodes and 3,445 edges. Each node represented a single publication, whereas each edge represented the co-citation relationship between the documents. The directed nature of the graph referred to the relationship between the nodes whereby the nodes interacted in a specific direction (Node A interacted with Node B, not vice versa). The degree of a node referred to the number of links incident on it. The in-degree index referred to the number of incoming links, whereas the out-degree referred to the outgoing links. The term weight referred to the strength of the co-citation relationship. Through the co-citation analysis, it is possible to assess the frequency with which two entities, in this case scientific publications, are cited together within a network of publications, which results in the degree of association between the two entities.

The graph was adjusted by using *ForceAtlas 2* to customize some of its parameters, such as the gravity and scaling parameters. *ForceAtlas 2* is a force-directed continuous algorithm that computes the forces between nodes and edges whereby nodes repulse and edges attract (Jacomy *et al.*, 2014). The corpus of forces that governs the algorithm ultimately finds a state of equilibrium.

Subsequently, a method for community detection was applied to identify and extract communities from the network. By selecting the *Modularity* function that is available from the Statistics panel, the software applied the Louvain algorithm (Blondel *et al.*, 2008), which allows the clustering process. We obtained a modularity index of 0.380, which can be considered an index of moderate quality, and that allowed us to identify some communities that are small and less distinct.

The network analysis resulted in six main clusters. Figure 4 shows how the co-citation and cluster analysis methods of scientometrics are used to perform a comprehensive analysis of the papers on the topic that is related to the study of eHealth services.

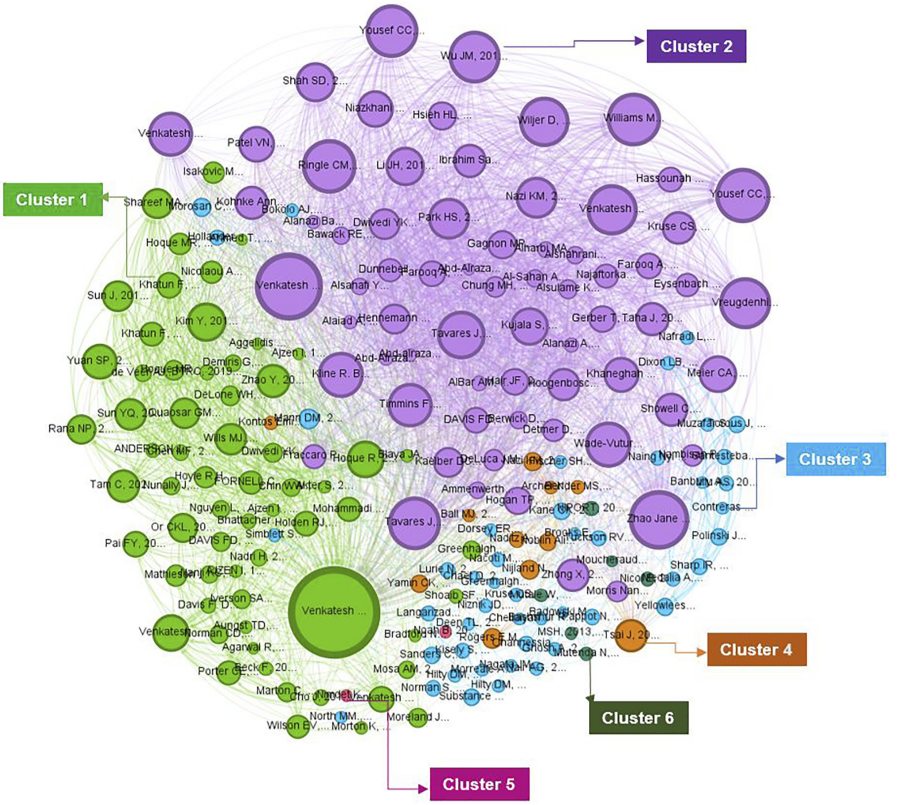
The complexity of the resulting network can be explained by looking at some key indicators, in particular, the PageRank algorithm that is used to order the documents according to their importance.

Conceived by Brin and Page (1998), this algorithm aimed to rank webpages by importance by making use of the link structure of the web, finding extensive applications in various domains. In the case of a co-citation network, the PageRank algorithm calculates a score for each document according to the PageRank scores of the other documents converging in it, weighting the score according to the importance of the edges. The computational process is iterative and stops once a stable value is found.

We defined G as a directed and weighted network, $G = (V, E)$, where V is the set of vertices that represents the documents and E is the set of edges that represents the citations. The indexes i and j belong to the set of vertices V $(i, j \in V)$ and identify, respectively, document i and document j; the number of citations from document i to document j is represented by one single directed edge $(i, j) \in E$ (Fiala and Tutoky, 2017). The PageRank score $PR(j)$ for document j depends on the PageRank scores of all the documents that cite j. Finally, we have a parameter, d, known as the damping factor, and the out-degree of $D_{out}(i)$.

The mathematical formulation of the algorithm follows:

$$PR(j) = \frac{1-d}{|V|} + d\sum_{(i,j)\in E}\frac{PR(i)}{D_{out}(i)} \tag{1}$$



Source(s): Figure by authors

Figure 4.
Co-citation network with six clusters

Therefore, PageRank was used to classify the publications that were extracted for each cluster because it represents a metric that describes the importance of a document in the network. We report the top 10 publications for each cluster (with the exception of Clusters 5 and 6, which had a smaller number of nodes), hierarchically selected according to the PageRank index, in Table 3.

Once the clustering process was complete, the main research topics for each cluster were analyzed. Table 4 presents the primary research themes, characterizing each community and the percentage of records in the sample that were investigated. Clusters 1, 2 and 3 represent the vast majority of our sample for a total of 88.4%. Clusters 4, 5 and 6 occupy a considerably minor space within the network.

5. Discussion and conclusion

The bibliometric analysis, conducted with the help of a variety of software to refine the search and to identify the relationships between the papers, leads to some noteworthy considerations.

In regard to the dates of the publications, it can be said that the vast majority of them are after 2015. There are certainly some earlier contributions, but they represent only 10.5% of the sample of identified records. We found that as much as 89.5% of the investigated

Cluster 1	PageRank	Cluster 2	PageRank
Venkatesh *et al.* (2003)	0.036748	Zhong *et al.* (2020)	0.078758
Zhao *et al.* (2018)	0.030088	Zhao *et al.* (2018)	0.078166
Yuan *et al.* (2015)	0.016039	Yousef *et al.* (2021)	0.039222
Wilson and Lankton (2004)	0.015775	Yousef *et al.* (2020)	0.028048
Venkatesh and Davis (2000)	0.014546	Wu and Du (2012)	0.021263
Wills *et al.* (2008)	0.011541	Williams *et al.* (2015)	0.018158
Venkatesh and Morris (2000)	0.006946	Venkatesh *et al.* (2012)	0.017498
Tam *et al.* (2020)	0.006758	Wiljer *et al.* (2008)	0.014872
Porter and Heppelmann (2017)	0.005992	Vreugdenhil *et al.* (2019)	0.014343
Sun *et al.* (2013)	0.005919	Wade-Vuturo *et al.* (2013)	0.01366
Cluster 3	PageRank	Cluster 4	PageRank
Yellowlees *et al.* (2020)	0.010558	Tsai and Rosenheck (2012)	0.008009
Tuckson *et al.* (2017)	0.008908	Rogers (2010)	0.004805
Pappot *et al.* (2020)	0.008403	Yamin *et al.* (2011)	0.004723
Torous and Keshavan (2020)	0.006091	Nijland *et al.* (2011)	0.002905
Norman (2006)	0.005708	Nazi *et al.* (2013)	0.002626
Niznik *et al.* (2018)	0.004716	Naditz (2008)	0.00204
Ohannessian *et al.* (2020)	0.004702	Kontos *et al.* (2014)	0.00203
Sharp *et al.* (2011)	0.004493	Bender *et al.* (2014)	0.001647
Sanders *et al.* (2012)	0.004006	Ball and Lillis (2001)	0.001608
Cluster 5	0.003991	Cluster 6	PageRank
Noah *et al.* (2018)	0.002821	Nicol *et al.* (2017)	0.003955
Nimdet and Ngorsuraches (2015)	0.001525	Mutenda *et al.* (2016)	0.002776
		Mutale *et al.* (2013)	0.002163
		Moucheraud *et al.* (2017)	0.001525

Table 3.
Top 10 works clustered

Source(s): Table by authors

sample consisted of studies that were conducted between 2016 and 2022. It should be remembered that UTAUT dates to 2003 and the first study on the adoption of eHealth services through UTAUT to 2007. In fact, the studies that emerged often focused on the application of an eHealth system in relation to a specific service. It should be remembered that the UTAUT and UTAUT2 research models investigate the acceptance and the consequent adoption of an innovation, which, in our case, is eHealth services. Therefore, if there are relatively few studies that have been identified, it seems to be possible to say that much remains to be done to understand the true intention to adopt innovation in healthcare management.

In addition, it is interesting that among the records that were identified in the bibliometric analysis, the vast majority of journals were of a medical nature. If it is true that, by its nature, an issue, such as the adoption of eHealth services, is closely linked to medical practice, many studies have highlighted the ways that the adoption of innovative services, such as eHealth, can only take place in the presence of multidisciplinary skills (De Grood *et al.*, 2016; Van Velsen *et al.*, 2013), including technical and IT, as well as economic and managerial ones. It is interesting to note that medical studies themselves believe in the need for transversal skills in the adoption of innovations such as eHealth services (Razmak *et al.*, 2018; Swinkels *et al.*, 2018). This confirms the importance of creating teams to support healthcare professionals. For example, according to Gaddi and Capello (2014), the slow diffusion of telemedicine and its patchy distribution is closely linked to the fact that telemedicine must not be implemented by doctors alone, but interdisciplinary teams are needed.

Cluster	Label	Main research topics
Cluster 1 (32.32%)	User Acceptance of Information Technology in Healthcare	• Theoretical frameworks on ICT user acceptance in healthcare • Factors affecting mobile health adoption • Use and perception of eHealth • Medical applications of Augmented Reality (AR)
Cluster 2 (32.34%)	Patient Portal and Personal Health Record Adoption and Use	• Factors involved in PHRs' adoption • Impact of PHRs on Healthcare Service Utilization • EHRs: solutions, facilitators, and barriers • Effect on the use of healthcare Services • Chronic disease management and secure messaging
Cluster 3 (23.74%)	Telemedicine and Telehealth in Mental Health	• Implementation and integration of Telemedicine and Telehealth • Relationship between Telemedicine/Telehealth and patients: perspectives, attitudes, preferences and satisfaction • The role of telemedicine in using clinical Pharmacist Services • The Role of Telemedicine and Telehealth in Response to COVID-19 • The adoption and participation barriers for Telemedicine and Telehealth
Cluster 4 (5.56%)	eHealth Adoption and Utilization; Digital Divide; Health Literacy	• Diffusion of Innovations in eHealth • Digital Divide in eHealth • The relationship between Health Literacy and eHealth acceptance and utilization • Utilization of eHealth solution for self-care in patients with chronic conditions • Predictors of the eHealth usage and the digital divide
Cluster 5 (1.01%)	Remote Patient Monitoring and Health Economics	• The role of remote patient monitoring on clinical outcomes • Quality-adjusted life years and cost-effectiveness analysis
Cluster 6 (3.03%)	Health Information Systems and Data Collection in Africa	• The role of health information systems on decision making in African countries • Implementation strategies for improving health information systems in sub-Saharan Africa

Source(s): Table by authors

Table 4.
Main research topics identified in each cluster

From the bibliometric analysis that was conducted, it is clear that, at least in terms of scientific journals, there are very few IT, managerial and economic journals that deal with this topic. Referring to some of the most popular rankings for management and economics journals, none of the contributions that were covered by this bibliometric analysis were among the journals that were present in the FT50 rankings or in the broader Academic Journal Guide (AJG) 2021 rankings, produced by the Chartered Association of Business Schools. Yet, it is clear that the implementation of eHealth services has cost reduction among its objectives because the WHO defines eHealth as "the cost-effective and secure use of information and communications technologies in support of health and health-related fields" (WHO, 2005, p. 121). By its very nature, the implementation of eHealth services has economic and managerial implications, which, however, still need to be explored in the scientific literature.

From the analysis of the clusters of contributions making up the sample investigated, it emerges how Cluster 1 brings together works that study the healthcare services available through IT technologies. The studies were conducted on the end users to understand their level of acceptance of the new services provided. More specifically these studies focus on mobile health adoption factors, eHealth perception and use, and acceptance of augmented reality in healthcare. Part of these contributions focuses on user acceptance theories. Cluster 2 always focuses on end user acceptance and precisely on the factors that determine adoption in its various forms (i.e. the Barriers, Facilitators toward eHealth services). Cluster 2 focuses on end user acceptance again and precisely on the factors that determine adoption in its various forms (i.e. the barriers and facilitators towards eHealth services). Precisely, it focuses on the factors that determine adoption in its various forms (i.e. the barriers, facilitators towards eHealth services and the impact on healthcare systems of eHealth services utilization). A part of these contributions focuses on aspects of data privacy and security, while the attitude of healthcare professionals is studied only together with that of end users. Cluster 3 is entirely focused on Telemedicine and Telehealth as a tool for maintaining the relationship with their patient in relation to their mental health. A part of these contributions focuses on the mental disorders developed during the COVID-19 pandemic and tried to explain how eHealth services could be of help in the absence of physical presence between the end user and the healthcare professional. Custer 4 represents a small minority of the topics that emerged from the analysis. This appears to be quite surprising, as Cluster 4 collects relevant methodological contributions that try to explain, with an empirical approach, the factors that lead to acceptance or abandonment of eHealth services. It can therefore be said that from our sample it emerges that most studies have focused on a specific eHealth technology, but few have come to theorize or hypothesize the reasons for the greater or lesser acceptance of eHealth services in general. If the studies certainly have their own "internal validity", it cannot be said that there is "external validity". If Cluster 6 is entirely focused on the opportunity to provide eHealth services on the African continent, Cluster 5, absolutely minority compared to the others, brings together studies focusing on the economic impact and how eHealth services and in general the digitization of health services could bring at cost savings.

Finally, from the analysis of the clusters it is clear that most of the articles focus on the acceptance of eHealth services by end users. There were very few studies that focused instead on the propensity to of healthcare professionals to adopt them. Certainly, it is important to know the propensity of the end user but the adoption process can only start with healthcare professionals. Therefore, before listening to the opinion of patients, it would be desirable to pay attention to the opinion of professionals. Their conviction and determination are, in fact, fundamental for innovative services, such as those investigated, to take hold (Veikkolainen *et al.*, 2023).

6. Limitations and further research opportunities

Like any research work, this study has some limitations. It could be pointed out that the data were collected from the WoS database. Therefore, the limitations of the use of one database may apply to this study. In truth, some scholars encourage the use of the WoS for bibliometric analysis (Hossain, 2020; Merigó and Yang, 2017; Shukla *et al.*, 2020; Yu and He, 2020; Yu *et al.*, 2017; Zhang *et al.*, 2016).

Other limitations of the study should be considered. For example, we are fully aware that this bibliometric analysis focused on two specific research models, UTAUT and UTAUT2. It would come as no surprise that the use of other models would lead to different records and hopefully different journals.

However, the overall goal of this study was to present an overview of the prominent trends according to key bibliometric indices. As a result, journal readers have gained a broad image of the most important records. However, these results are dynamic and subject to change when new mainstream themes emerge, and particular factors increase or decrease their place in the journals.

In regard to research opportunities, it is hoped that in the future, a more central role is given to the healthcare professional, who is believed to be the hub of the adoption of eHealth services. Until there is full awareness of their propensity to use these services, eHealth will remain an excellent project on paper that is only applied in particularly critical and extremely necessary moments (e.g. the COVID-19 pandemic).

The adoption of eHealth services should not happen suddenly or because of the good intuition of a luminary. The adoption of eHealth becomes fruitful when processes are created, and the entire interdisciplinary staff is committed to them.

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(The Appendix follows overleaf)

Appendix

Table A1.
The records constituting the sample analyzed

ID	Authors	Title	Source title	Year
1	Mittal, Amit; Mantri, Archana; Tandon, Urvashi; Dwivedi, Yogesh K	A unified perspective on the adoption of online teaching in higher education during the COVID-19 pandemic	*INFORMATION DISCOVERY AND DELIVERY*	2022
2	Schmitz, Anne; Diaz-Martin, Ana M.; Guillen, Jesus Yague	Modifying UTAUT2 for a cross-country comparison of telemedicine adoption	*COMPUTERS IN HUMAN BEHAVIOR*	2022
3	Khan, Tajdar; Khan, Khush Dil; Azhar, Muhammad Salman; Shah, Syed Nadir Ali; Uddin, Mohammed Mahin; Khan, Tariq Habib	Mobile health services and the elderly: Assessing the determinants of technology adoption readiness in Pakistan	*JOURNAL OF PUBLIC AFFAIRS*	2022
4	Ong, Ardvin Kester S.; Kurata, Yoshiki B.; Castro, Sophia Alessandra D. G.; De Leon, Jeanne Paulene B.; Dela Rosa, Hazel V.; Tomines, Alex Patricia J	Factors influencing the acceptance of telemedicine in the Philippines	*TECHNOLOGY IN SOCIETY*	2022
5	Tan, Yi Ru; Tan, Maw Pin; Khor, Mei Mei; Hoh, Hon Bing; Saedon, Nor'Izzati; Hasmukharay, Kejal; Tan, Kit Mun; Chin, Ai Vyrn; Kamaruzzaman, Shahrul B.; Ong, Terence; Davey, Gareth; Khor, Hui Min	Acceptance of virtual consultations among older adults and caregivers in Malaysia: a pilot study during the COVID-19 pandemic	*POSTGRADUATE MEDICINE*	2022
6	Liu, Yizhi; Lu, Xuan; Zhao, Gang; Li, Chengjiang; Shi, Junyi	Adoption of mobile health services using the unified theory of acceptance and use of technology model: Self-efficacy and privacy concerns	*FRONTIERS IN PSYCHOLOGY*	2022
7	Cruz, Antonio Miguel; Portillo, Hector Perez Lopez; Daum, Christine; Rutledge, Emily; King, Sharla; Liu, Lili	Technology Acceptance and Usability of a Mobile App to Support the Workflow of Health Care Aides Who Provide Services to Older Adults: Pilot Mixed Methods Study	*JMIR AGING*	2022
8	Pagaling, Gerald T.; Espiritu, Adrian I.; Dellosa, Marie Antoinette A.; Leochico, Carl Froilan D.; Pasco, Paul Matthew D	The practice of teleneurology in the Philippines during the COVID-19 pandemic	*NEUROLOGICAL SCIENCES*	2022
9	Tian, Xiu-Fu; Wu, Run-Ze	Determinants of the Mobile Health Continuance Intention of Elders with Chronic Diseases: An Integrated Framework of ECM-ISC and UTAUT	*INTERNATIONAL JOURNAL OF ENVIRONMENTAL RESEARCH AND PUBLIC HEALTH*	2022

(*continued*)

ID	Authors	Title	Source title	Year
10	Palas, Jahir Uddin; Sorwar, Golam; Hoque, Md Rakibul; Sivabalan, Achchuthan	Factors influencing the elderly's adoption of mHealth: an empirical study using extended UTAUT2 model	*BMC MEDICAL INFORMATICS AND DECISION MAKING*	2022
11	Kaphzan, Hanoch; Sarfati Noiman, Margaret; Negev, Maya	The Attitudes and Perceptions of Israeli Psychiatrists Toward Telepsychiatry and Their Behavioral Intention to Use Telepsychiatry	*FRONTIERS IN PSYCHIATRY*	2022
12	Rouidi, Mohammed; Elouadi, Abdelmajid; Hamdoune, Amine	Acceptance and use of telemedicine technology by health professionals: Development of a conceptual model	*DIGITAL HEALTH*	2022
13	Wu, Pei; Zhang, Runtong; Luan, Jing; Zhu, Minghao	Factors affecting physicians using mobile health applications: an empirical study	*BMC HEALTH SERVICES RESEARCH*	2022
14	Schretzlmaier, Patrik; Hecker, Achim; Ammenwerth, Elske	Suitability of the Unified Theory of Acceptance and Use of Technology 2 Model for Predicting mHealth Acceptance Using Diabetes as an Example: Qualitative Methods Triangulation Study	*JMIR HUMAN FACTORS*	2022
15	Zhu, Zhangxiang; Liu, Yongmei; Cao, Xianye; Dong, Wei	Factors Affecting Customer Intention to Adopt a Mobile Chronic Disease Management Service: Differentiating Age Effect From Experiential Distance Perspective	*JOURNAL OF ORGANIZATIONAL AND END USER COMPUTING*	2022
16	Ma, Yin; Luo, Muyuan	Older people's intention to use medical apps during the COVID-19 pandemic in China: an application of the Unified Theory of Acceptance and Use of Technology (UTAUT) model and the Technology of Acceptance Model (TAM)	*AGEING AND SOCIETY*	2022
17	Maleka, Ntibaneng Hunadi; Matli, Walter	A review of telehealth during the COVID-19 emergency situation in the public health sector: challenges and opportunities	*JOURNAL OF SCIENCE AND TECHNOLOGY POLICY MANAGEMENT*	2022
18	Choi, Wona; Chang, Se-Hyun; Yang, Yoon-Sik; Jung, Surin; Lee, Seo-Joon; Chun, Ji-Won; Kim, Dai-Jin; Lee, Woonjeong; Choi, In Young	Study of the factors influencing the use of MyData platform based on personal health record data sharing system	*BMC MEDICAL INFORMATICS AND DECISION MAKING*	2022

(*continued*)

Table A1.

ID	Authors	Title	Source title	Year
19	Owusu Kwateng, Kwame; Darko-Larbi, Offei; Amanor, Kofi	A modified UTAUT2 for the study of telemedicine adoption	*INTERNATIONAL JOURNAL OF HEALTHCARE MANAGEMENT*	2022
20	Alam, Mohammad Zahedul; Khanam, Liza	Comparison of the young aged and elderly female users' adoption of mHealth services	*HEALTH CARE FOR WOMEN INTERNATIONAL*	2022
21	Bhatt, Vaidik; Chakraborty, Samyadip	Intrinsic Antecedents to mHealth Adoption Intention: An SEM-ANN Approach	*INTERNATIONAL JOURNAL OF ELECTRONIC GOVERNMENT RESEARCH*	2022
22	Vervier, Luisa; Ziefle, Martina	A Meta-analytical View on the Acceptance of Mhealth Apps	*ICT4AWE: PROCEEDINGS OF THE 8TH INTERNATIONAL CONFERENCE ON INFORMATION AND COMMUNICATION TECHNOLOGIES FOR AGEING WELL AND E-HEALTH*	2022
23	Yousef, Consuela C.; Salgado, Teresa M.; Farooq, Ali; Burnett, Keisha; McClelland, Laura E.; Abu Esba, Laila C.; Alhamdan, Hani S.; Khoshhal, Sahal; Aldossary, Ibrahim; Alyas, Omar A.; DeShazo, Jonathan P	Predicting Health Care Providers' Acceptance of a Personal Health Record Secure Messaging Feature	*APPLIED CLINICAL INFORMATICS*	2022
24	Ben Arfi, Wissal; Ben Nasr, Imed; Kondrateva, Galina; Hikkerova, Lubica	The role of trust in intention to use the IoT in eHealth: Application of the modified UTAUT in a consumer context	*TECHNOLOGICAL FORECASTING AND SOCIAL CHANGE*	2021
25	Ben Arfi, Wissal; Ben Nasr, Imed; Khvatova, Tatiana; Ben Zaied, Younes	Understanding acceptance of eHealthcare by IoT natives and IoT immigrants: An integrated model of UTAUT, perceived risk, and financial cost	*TECHNOLOGICAL FORECASTING AND SOCIAL CHANGE*	2021
26	Baudier, Patricia; Kondrateva, Galina; Ammi, Chantal; Chang, Victor; Schiavone, Francesco	Patients' perceptions of teleconsultation during COVID-19: A cross-national study	*TECHNOLOGICAL FORECASTING AND SOCIAL CHANGE*	2021
27	Rahi, Samar; Khan, Mubbsher Munawar; Alghizzawi, Mahmoud	Factors influencing the adoption of telemedicine health services during COVID-19 pandemic crisis: an integrative research model	*ENTERPRISE INFORMATION SYSTEMS*	2021

Table A1. (*continued*)

ID	Authors	Title	Source title	Year
28	Alam, Mirza Mohammad Didarul; Alam, Mohammad Zahedul; Rahman, Syed Abidur; Taghizadeh, Seyedeh Khadijeh	Factors influencing mHealth adoption and its impact on mental well-being during COVID-19 pandemic: A SEM-ANN approach	*JOURNAL OF BIOMEDICAL INFORMATICS*	2021
29	Tomczyk, Samuel; Barth, Simon; Schmidt, Silke; Muehlan, Holger	Utilizing Health Behavior Change and Technology Acceptance Models to Predict the Adoption of COVID-19 Contact Tracing Apps: Cross-sectional Survey Study	*JOURNAL OF MEDICAL INTERNET RESEARCH*	2021
30	Shiferaw, Kirubel Biruk; Mengiste, Shegaw Anagaw; Gullslett, Monika Knudsen; Zeleke, Atinkut Alamirrew; Tilahun, Binyam; Tebeje, Tsion; Wondimu, Robel; Desalegn, Surafel; Mehari, Eden Abetu	Healthcare providers' acceptance of telemedicine and preference of modalities during COVID-19 pandemics in a low-resource setting: An extended UTAUT model	*PLOS ONE*	2021
31	Wang, Huanlin; Liang, LanYu; Du, ChunLin; Wu, YongKang	Implementation of Online Hospitals and Factors Influencing the Adoption of Mobile Medical Services in China: Cross-Sectional Survey Study	*JMIR MHEALTH AND UHEALTH*	2021
32	AlQudah, Adi A.; Al-Emran, Mostafa; Shaalan, Khaled	Technology Acceptance in Healthcare: A Systematic Review	*APPLIED SCIENCES-BASEL*	2021
33	Pan, Minghao; Gao, Wei	Determinants of the behavioral intention to use a mobile nursing application by nurses in China	*BMC HEALTH SERVICES RESEARCH*	2021
34	Barua, Zapan; Barua, Adita	Acceptance and usage of mHealth technologies amid COVID-19 pandemic in a developing country: the UTAUT combined with situational constraint and health consciousness	*JOURNAL OF ENABLING TECHNOLOGIES*	2021
35	Moudud-Ul-Huq, Syed; Sultana Swarna, Rebeka; Sultana, Mahmuda	Elderly and middle-aged intention to use m-health services: an empirical evidence from a developing country	*JOURNAL OF ENABLING TECHNOLOGIES*	2021
36	Serrano, Karina M.; Mendes, Glauco H. S.; Lizarelli, Fabiane L.; Ganga, Gilberto M. D	Assessing the telemedicine acceptance for adults in Brazil	*INTERNATIONAL JOURNAL OF HEALTH CARE QUALITY ASSURANCE*	2021
37	Fitrianie, Siska; Horsch, Corine; Beun, Robbert Jan; Griffioen-Both, Fiemke; Brinkman, Willem-Paul	Factors Affecting User's Behavioral Intention and Use of a Mobile-Phone-Delivered Cognitive Behavioral Therapy for Insomnia: A Small-Scale UTAUT Analysis	*JOURNAL OF MEDICAL SYSTEMS*	2021

(*continued*)

Table A1.

ID	Authors	Title	Source title	Year
38	Yousef, Consuela Cheriece; Salgado, Teresa M.; Farooq, Ali; Burnett, Keisha; McClelland, Laura E.; Thomas, Abin; Alenazi, Ahmed O.; Abu Esba, Laila Carolina; AlAzmi, Aeshah; Alhameed, Abrar Fahad; Hattan, Ahmed; Elgadi, Sumaya; Almekhloof, Saleh; AlShammary, Mohammed A.; Alanezi, Nazzal Abdullah; Alhamdan, Hani Solaiman; Khoshhal, Sahal; DeShazo, Jonathan P	Predicting Patients' Intention to Use a Personal Health Record Using an Adapted Unified Theory of Acceptance and Use of Technology Model: Secondary Data Analysis	*JMIR MEDICAL INFORMATICS*	2021
39	Yousef, Consuela Cheriece; Salgado, Teresa M.; Farooq, Ali; Burnett, Keisha; McClelland, Laura E.; Abu Esba, Laila Carolina; Alhamdan, Hani Solaiman; Khoshhal, Sahal; Aldossary, Ibrahim Fahad; Alyas, Omar Anwar; DeShazo, Jonathan P	Health Care Providers' Acceptance of a Personal Health Record: Cross-sectional Study	*JOURNAL OF MEDICAL INTERNET RESEARCH*	2021
40	Beck-Hiestermann, Franziska Marie Lea; Kastner, Denise; Gumz, Antje	Online psychotherapy in times of coronavirus disease 2019 Cross-sectional survey of German psychotherapists	*PSYCHOTHERAPEUT*	2021
41	Ahadzadeh, Ashraf Sadat; Wu, Shin Ling; Ong, Fon Sim; Deng, Ruolan	The Mediating Influence of the Unified Theory of Acceptance and Use of Technology on the Relationship Between Internal Health Locus of Control and Mobile Health Adoption: Cross-sectional Study	*JOURNAL OF MEDICAL INTERNET RESEARCH*	2021
42	Yu, Kexin; Wu, Shinyi; Liu, Ruotong; Chi, Iris	Harnessing mobile technology to support type 2 diabetes self-management among Chinese and Hispanic immigrants: a mixed-methods acceptability study	*JOURNAL OF ETHNIC AND CULTURAL DIVERSITY IN SOCIAL WORK*	2021
43	Almegbel, Halah; Aloud, Monira	Factors Influencing the Adoption of mHealth Services in Saudi Arabia: A Patient-centered Study	*INTERNATIONAL JOURNAL OF COMPUTER SCIENCE AND NETWORK SECURITY*	2021
44	Adjei, Timothy Kwabena; Mohammed, Aliyu; Acheampong, Princess Ruhama; Acquah-Gyan, Emmanuel; Sylverken, Augustina; Twumasi-Ankrah, Sampson; Owusu, Michael; Owusu-Dabo, Ellis	Determinants of a mobile phone-based Interactive Voice Response (mIVR) system for monitoring childhood illnesses in a rural district of Ghana: Empirical evidence from the UTAUT model	*PLOS ONE*	2021

Table A1. (*continued*)

ID	Authors	Title	Source title	Year
45	Rahi, Samar	Assessing individual behavior towards adoption of telemedicine application during COVID-19 pandemic: evidence from emerging market	*LIBRARY HI TECH*	2021
46	Namatovu, Hasifah Kasujja; Oyana, Tonny Justus; Sol, Henk Gerard	Barriers to eHealth adoption in routine antenatal care practices: Perspectives of expectant mothers in Uganda - A qualitative study using the unified theory of acceptance and use of technology model	*DIGITAL HEALTH*	2021
47	Miguel Martins, Nayra Leandro; Duarte, Paulo; Pinho, Jose Carlos M. R	AN ANALYSIS OF DETERMINANTS OF THE ADOPTION OF MOBILE HEALTH (MHEALTH)	*RAE-REVISTA DE ADMINISTRACAO DE EMPRESAS*	2021
48	Miguel Martins, Nayra Leandro; Duarte, Paulo; Pinho, Jose Carlos M. R	An analysis of determinants of the adoption of Mobile Health (mHealth)	*RAE-REVISTA DE ADMINISTRACAO DE EMPRESAS*	2021
49	Aborujiah, Abdulaziz; Long, Zalizah Awang; Nassr, Rasheed Mohammad; Husen, Mohd Nizam; Al-Othmani, Abdulaleem	Post Acceptance Model for Online Teleconsultation services: An Empirical Study in Malaysia	*INTERNATIONAL JOURNAL OF ELECTRICAL AND COMPUTER ENGINEERING SYSTEMS*	2021
50	Connolly, Samantha L.; Miller, Christopher J.; Lindsay, Jan A.; Bauer, Mark S	A systematic review of providers' attitudes toward telemental health via videoconferencing	*CLINICAL PSYCHOLOGY-SCIENCE AND PRACTICE*	2020
51	Alam, Mohammad Zahedul; Hoque, Md. Rakibul; Hu, Wang; Barua, Zapan	Factors influencing the adoption of mHealth services in a developing country: A patient-centric study	*INTERNATIONAL JOURNAL OF INFORMATION MANAGEMENT*	2020
52	Alam, Mohammad Zahedul; Hu, Wang; Kaium, Md Abdul; Hoque, Md Rakibul; Alam, Mirza Mohammad Didarul	Understanding the determinants of mHealth apps adoption in Bangladesh: A SEM-Neural network approach	*TECHNOLOGY IN SOCIETY*	2020
53	Yamin, Mohammad Ali Yousef; Alyoubi, Bader A	Adoption of telemedicine applications among Saudi citizens during COVID-19 pandemic: An alternative health delivery system	*JOURNAL OF INFECTION AND PUBLIC HEALTH*	2020
54	Baudier, Patricia; Kondrateva, Galina; Ammi, Chantal	The future of Telemedicine Cabin? The case of the French students' acceptability	*FUTURES*	2020
55	Huang, Chin-Yuan; Yang, Ming-Chin	Empirical Investigation of Factors Influencing Consumer Intention to Use an Artificial Intelligence-Powered Mobile Application for Weight Loss and Health Management	*TELEMEDICINE AND E-HEALTH*	2020

(*continued*)

Table A1.

ID	Authors	Title	Source title	Year
56	Salgado, Tania; Tavares, Jorge; Oliveira, Tiago	Drivers of Mobile Health Acceptance and Use From the Patient Perspective: Survey Study and Quantitative Model Development	*JMIR MHEALTH AND UHEALTH*	2020
57	Ndayizigamiye, Patrick; Kante, Macire; Shingwenyana, Shalati	An adoption model of mHealth applications that promote physical activity	*COGENT PSYCHOLOGY*	2020
58	Hayotte, Meggy; Therouanne, Pierre; Gray, Laura; Corrion, Karine; d'Arripe-Longueville, Fabienne	The French eHealth Acceptability Scale Using the Unified Theory of Acceptance and Use of Technology 2 Model: Instrument Validation Study	*JOURNAL OF MEDICAL INTERNET RESEARCH*	2020
59	Magsamen-Conrad, Kate; Wang, Fang; Tetteh, Dinah; Lee, Yen-I	Using Technology Adoption Theory and a Lifespan Approach to Develop a Theoretical Framework for eHealth Literacy: Extending UTAUT	*HEALTH COMMUNICATION*	2020
60	Alabdullah, Jafar H.; Van Lunen, Bonnie L.; Claiborne, Denise M.; Daniel, Susan J.; Yen, Cherng-Jyh; Gustin, Tina S	Application of the unified theory of acceptance and use of technology model to predict dental students' behavioral intention to use teledentistry	*JOURNAL OF DENTAL EDUCATION*	2020
61	Senft, Nicole; Abrams, Judith; Katz, Anne; Barnes, Charity; Charbonneau, Deborah H.; Beebe-Dimmer, Jennifer L.; Zhang, Ke; Eaton, Tara; Heath, Elisabeth; Thompson, Hayley S	eHealth Activity among African American and White Cancer Survivors: A New Application of Theory	*HEALTH COMMUNICATION*	2020
62	Zhou, Lulin; Owusu-Marfo, Joseph; Asante Antwi, Henry; Antwi, Maxwell Opuni; Xu, Xinglong	Nurses' Readiness in the Adoption of Hospital Electronic Information Management Systems in Ghana: The Application of the Structural Equation Modeling and the UTAUT Model	*SAGE OPEN*	2020
63	Duarte, Paulo; Pinho, Jose Carlos	A mixed methods UTAUT2-based approach to assess mobile health adoption	*JOURNAL OF BUSINESS RESEARCH*	2019
64	Hussain, Akram; Quaresma, Rui; Rahman, Habibur	Investigating factors influencing the physicians' adoption of electronic health record (EHR) in healthcare system of Bangladesh: An empirical study	*INTERNATIONAL JOURNAL OF INFORMATION MANAGEMENT*	2019

Table A1. (*continued*)

ID	Authors	Title	Source title	Year
65	Balapour, Ali; Reychav, Iris; Sabherwal, Rajiv; Azuri, Joseph	Mobile technology identity and self-efficacy: Implications for the adoption of clinically supported mobile health apps	*INTERNATIONAL JOURNAL OF INFORMATION MANAGEMENT*	2019
66	Zhou, Min; Zhao, Lindu; Kong, Nan; Campy, Kathryn S.; Qu, Shujuan; Wang, Song	Factors influencing behavior intentions to telehealth by Chinese elderly: An extended TAM model	*INTERNATIONAL JOURNAL OF MEDICAL INFORMATICS*	2019
67	Alam, Mohammad Zahedul; Hu, Wang; Hoque, Md Rakibul; Kaium, Md Abdul	Adoption intention and usage behavior of mHealth services in Bangladesh and China A cross-country analysis	*INTERNATIONAL JOURNAL OF PHARMACEUTICAL AND HEALTHCARE MARKETING*	2019
68	Garavand, Ali; Samadbeik, Mahnaz; Nadri, Hamed; Rahimi, Bahlol; Asadi, Heshmatollah	Effective Factors in Adoption of Mobile Health Applications between Medical Sciences Students Using the UTAUT Model	*METHODS OF INFORMATION IN MEDICINE*	2019
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ID	Authors	Title	Source title	Year
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85	Adenuga, Kayode I.; Iahad, Noorminshah A.; Miskon, Suraya	Towards reinforcing telemedicine adoption amongst clinicians in Nigeria	*INTERNATIONAL JOURNAL OF MEDICAL INFORMATICS*	2017
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Table A1. (*continued*)

ID	Authors	Title	Source title	Year
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89	Cimperman, Miha; Brencic, Maja Makovec; Trkman, Peter	Analyzing older users' home telehealth services acceptance behavior-applying an Extended UTAUT model	*INTERNATIONAL JOURNAL OF MEDICAL INFORMATICS*	2016
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91	Alaboudi, Abdulellah; Atkins, Anthony; Sharp, Bernadette; Balkhair, Ahmed; Alzahrani, Mohammed; Sunbul, Tamara	Barriers and challenges in adopting Saudi telemedicine network: The perceptions of decision makers of healthcare facilities in Saudi Arabia	*JOURNAL OF INFECTION AND PUBLIC HEALTH*	2016
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95	Mengesha, Getachew Hailemariam; Garfield, Monica J	A Contextualized IT adoption and Use Model for e-health: The Case of Telemedicine at Black Lion Teaching Hospital, Ethiopia	*AMCIS 2016 PROCEEDINGS*	2016
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Table A1.

ID	Authors	Title	Source title	Year
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Table A1. **Source(s):** Appendix by authors

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