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Health is Wealth: A Conceptual Overview of Virtual Healthcare & Future Research Directions [1995 – 2021]

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Abstract. The appearance of pandemics of various kinds that have shaken the world and transformed health paradigms has led many organizations and states to review their health strategies to ensure sustainable assistance to the population. Organizations are turning more towards a sustainable digital transformation, which considers multiple dimensions, including health. This study presents a topic-oriented mapping of a range of conceptual and practice-based efforts and strategies implemented in the virtual health paradigm. The systematic literature review conducted since the first insights in 1995 reveals the eagerness related to the digital transformation of health care and the popularization of digital health strategies. The resolutions of our study will enrich the emerging literature on virtual health in a wide range of settings.

Keywords: Virtual HealthCare, Covid19, Artificial Intelligence, Information Systems, Bibliometric

1 Introduction & Related Work

Socio-economic and cultural transitions, and climate change have placed the use of digital technologies at the center of developmental concerns and paradigm shifts in health care [1, 2]. The crowding of hospital beds, physical distance and the inability of doctors to provide meticulous follow-up to the growing number of patients have put the need and importance of telehealth to address global health crises back on the agenda [3]. At the height of the covid19 crisis, telehealth proved its decisive role in the whole chain of patient follow-up. Diverse researches highlight the importance of telehealth in a multi-contextual way, as it describes new frameworks that amply respond to emergency situations with better prospects of structural transformation [4]. This exponential transformation therefore poses an urgent need to study new digital approaches associated with health in order to theorize lessons learned and experiences in various theoretical anchors [5, 6].

This research aims to present a systematic review of the emerging literature from an analytical perspective of virtual health care in a global health emergency. We perform a global review since the first investigations that were conducted in 1995, until 2021. The presentation of the state of the art of the studied problem aims to draw up a nonexhaustive typology of the different theoretical and practical approaches of virtual health care carried out showing the evolution over time. In comparison with the literature available since the beginning of the year 2020, there is a need to highlight the different approaches carried out in a global health crisis situation following a consolidated and unique research.

After an outline of previous research conducted on the problem studied, we conduct a systematic analysis of the impact of virtual health care in a multi-contextual setting. Subsequently, we present some trends from the emerging literature with associated analyses. The concluding section of this research focuses on the theoretical and practical implications of our research. We also present the conclusions stemming from our work.

The spread of various diseases and pandemics like covid19 have revealed the use of tools and techniques associated with virtual health care. They incorporate ubiquitous patient collaboration. This is the case of the "CIGNA" project [7]. In addition, there is a project called "SAPHIRE" which allows patients to be monitored from their homes thanks to a connection of the various medical sensors associated with the decision support devices in hospitals [8]. Also, research such as that by [9] and [10] have focused on patient peer support and health care delivery, respectively.

Another study examined the practicality of using mobile devices as a rescue mission during an emergency on the road. This novel idea called "My Contact Person" is a naming convention saved on a mobile device that paved the way for the paramedical professionals or good Samaritans to link a victim of an accident or people in danger to their loved ones or connect the victims with an ambulance for first [11]. A good Samaritans can also make a video call to show the present situation of the victims. Virtual healthcare is growing and seems to be the future of Medicare care especially for the rural dwellers where there is abject poverty and lack of infrastructural facilities. Further, Virtual healthcare is a panacea for Africa and other countries with large crowds and where hospital beds are not sufficient for the patients that need care.

The ongoing COVID-19 corroborates the expansion of virtual healthcare. Meg, Vimal, Stacy and Jared [12] confirmed the increase and importance of virtual health care in the United States as an intervention for COVID-19 social distancing. Also, the authors mentioned that the inevitability of virtual health care has set the policy makers thinking on the virtual care services charges in the future. Seeking solution for this daunting task has stirred the American Medical Association (AMA), Manatt Health, a legal and consulting firm to come up with a framework that enables accessibility of the value of digital care [12]. In America, before COVID-19 the virtual health care adoption was extremely low, but the COVID-19 panic has increased the adoption rate. The literature synthesized and the existing studies attest to the under-development of virtual health care.

2 Methodology

To achieve the aims of this research, we leverage on the systematic literature review methodology known as PRISMA (Preferred Reporting Items for Systematic Reviews

and Meta-Analyses) to gather literature on virtual healthcare research over time in order to understand the core concepts. The systematic review approach was adopted due to its ability to essentially summarize evidence relating to efficacy of any domain of discourse accurately and reliably [13]. The PRISMA statement guidelines were adopted for this study to select the core themes that pertain to virtual healthcare globally [14]. We used the keyword “virtual healthcare” OR “virtual health” focused on Scopus as our main source of scientific articles for our research goal. The metadata query results produced 1043 results and was limited to scientific papers in English language, papers published until 2021 (as of this article’s submission date) and full author information available (i.e. excluding book summary prefaces) – making 866 papers. To obtain research papers relevant to the goal of our study, our exclusion criteria:

- Duplicated articles.
- Articles (abstract, introduction, discussion, and conclusion) irrelevant to the theme of virtual healthcare or virtual health.

Our inclusion criteria:

- All articles published until 2021 (at the time of submission).
- Cited and uncited articles.
- Abstracts (abstract, introduction, discussion, and conclusion) and titles relevant to the theme of virtual healthcare or virtual health.

The total number of papers were 865 – 357 reviews, 343 articles, 117 conference papers, 12 notes, 11 conference reviews, 9 book chapters, 6 editorials, 6 short surveys, 3 letters, and 1 erratum. Figure 1 illustrates the process discussed.

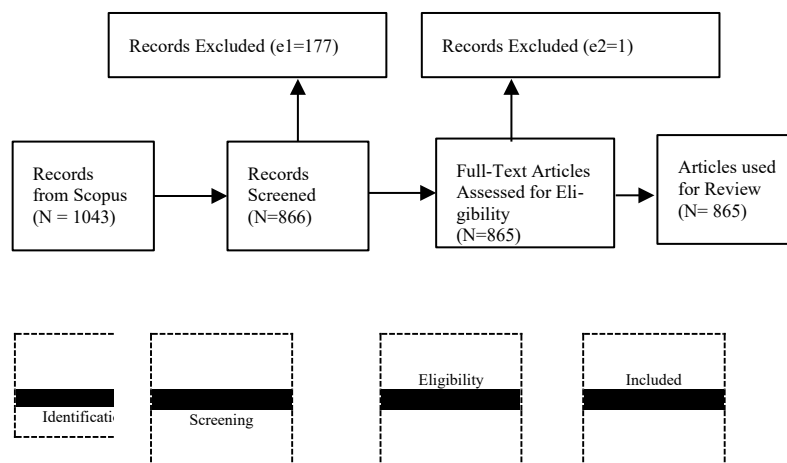


Fig. 1. Research Methodology – Data Collection and Article Screening Process

The research follows a thematic analysis approach which involves the comprehension of themes that represent ways of understanding the combined meaning of the text [15]. Thematic analysis aids in identifying patterns within data [16]. The study followed sixstep approach: (a) data familiarization, (b) generating initial codes, (c) theme search, (d) reviewing themes, (e) defining and naming themes, and (f) reporting [17].

This study made use of the biblioshiny, a web based interface built on the bibliometrix (the open-source scientometrics and bibliometrics research tool) package for R [18]. Results from our data analysis are presented in the next section.

3 Results

The bibliometric analysis conducted generated insightful results that indicates the country's scientific production, author's word growth, thematic map keywords, conceptual structural map, trends topics and thematic map evolution. This section discusses the six (6) stages of virtual healthcare transformation based on the academic literature synthesized with Biblioshiny algorithms. The descriptive statistics in Table 1 below shows that total documents of 842 accounts for 4.65 average years from publication, 8.43 average citations per documents and 1.53 average citations per year per document. The documents type consists of article (340), book chapter (9), conference paper (117), editorial (6), letter (3), note (11), review (350) and short survey (6). Collaboration wise, the single-authored documents accounts for 82, documents per author 0.25, authors per document 3.96, co-authors per documents 4.63 and the collaboration index 4.29. For document type, review was predominant and followed by article. Further, co-authorship excelled the single authorship.

Description	Results
DATA OVERVIEW	
Timespan	1995:2021
Sources (Journals, Books, etc.)	537
Documents	842
Average years from publication	4,65
Average citations per documents	8,425
Average citations per year per doc	1,534
References	1
DOCUMENT TYPES	
article 340 book chapter 9 conference paper 117 editorial 6	
letter 3 note 11	
review 350 short survey 6	
DOCUMENT CONTENTS	
Keywords Plus (ID)	5065
Author's Keywords (DE)	2216
AUTHORS	

Authors	3333
Author Appearances	3897
Authors of single-authored documents	73
Authors of multi-authored documents	3260
AUTHORS COLLABORATION	
Single-authored documents	82
Documents per Author	0.253
Authors per Document	3.96
Co-Authors per Documents	4.63
<u>Collaboration Index</u>	<u>4.29</u>

Table 1. Virtual Healthcare Literature Descriptive Statistics

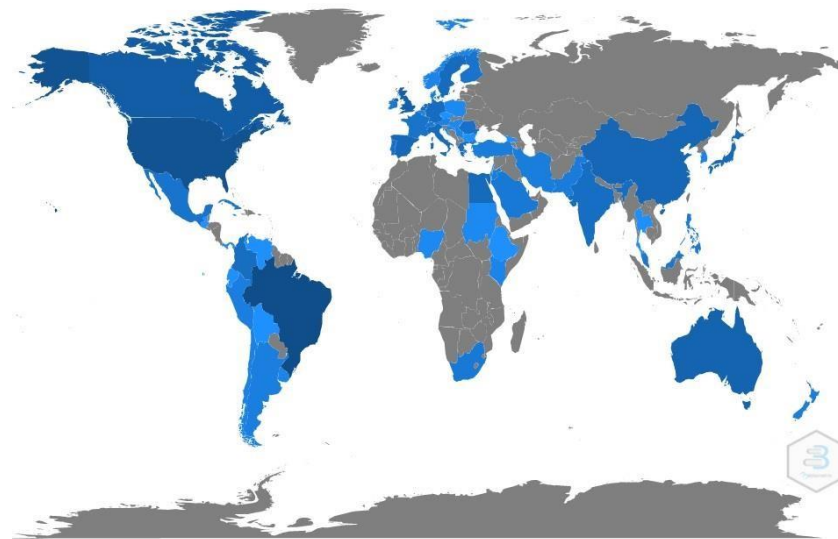


Fig. 2. Country Scientific Production

Figure 2 shows how Biblioshiny visualize country scientific production as a world map. The darkest blue shows the saturation of virtual healthcare paper production and followed in turn with blue and lighter blue colors. The grey color shows country gaps of virtual healthcare literature. Southern America tops the list of virtual healthcare literature and specifically Brazil with 776. Next to South America is Northern America and United States of America frequency accounts for 470 while Canada records 156. United Kingdom in Europe has 122, Australia has 77 and China in Asia has 56. Other countries like Spain records 48, Japan 43, Egypt 40, Italy and Netherlands 35, Sweden 33, Greece 31, Germany 30, Colombia 28, India 25, Portugal 22, Romania 18, France 16, Finland and Mexico 15, Cuba, Ireland, and Malaysia 10, Saudi Arabia, South Africa and Switzerland 9, Philippines 8, Jordan, Pakistan, Qatar, and Singapore 7, Iran and

Turkey 6, Argentina, Denmark, New Zealand and Peru 5, Austria and Chile 4, Belgium, Croatia, Israel, Kenya, Norway, Serbia, South Korea and Uruguay 3, Barbados, Hungary, Lebanon, Nigeria, Panama, Poland and Sudan 2, Bolivia, Bulgaria, Czech Republic, Ecuador, Ethiopia, Georgia, Guatemala, Jamaica, Malta, Thailand and Venezuela. The geographical frequencies of the papers captured in this study is quite interesting. The papers distribution cut across Southern America, Northern America, Europe, Australia, Asia, and Africa. The first ten countries in higher ranking are Brazil, USA, Canada, UK, Australia, China, Spain, Japan, Egypt, and Italy. Confirming the intensity and robustness of virtual healthcare in Brazil, a recent study reveals concerted 79 telemedicine-related legislations emanates from the Brazil federal government as a combination of laws, decrees, and ordinances. These legislations are in combination with another 31 regulations from the Federal Councils of Health Professionals [19]. Telemedicine commenced in Brazil in 2011 and it has survived for one decade. Our bibliometric results show virtual healthcare research gap in Greenland, Iceland, Russia, Panama, Oman, Yemen, Papua New Guinea. Apart from Egypt, Sudan, Ethiopia, Nigeria and South Africa, most of the other African countries have not played a significant role in academic productivity related to virtual healthcare.

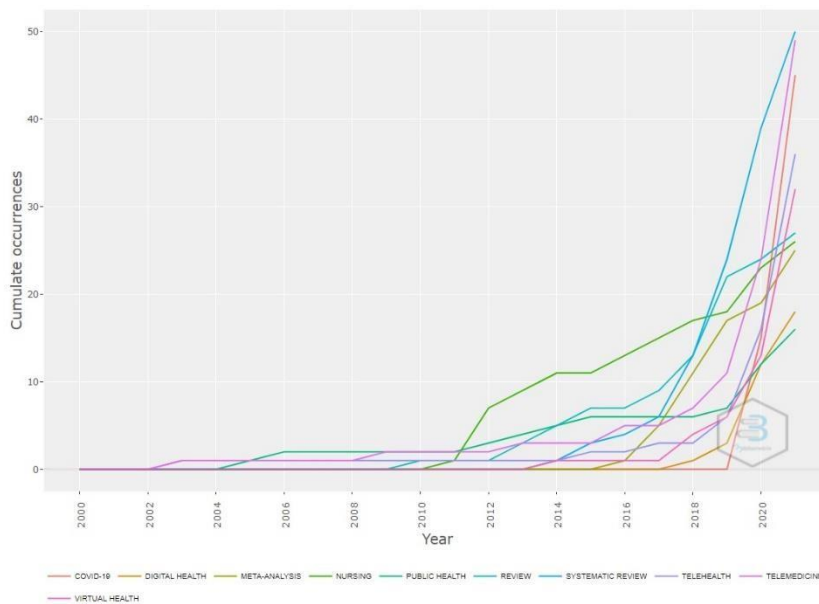


Fig. 3. Author Word Growth

Figure 3 elaborates the Author's word growth from 2000 – 2021 and shows different patterns of growth for ten keywords of systematic review, telemedicine, COVID-19, Telehealth, Virtual Health, Review, Nursing, Meta-Analysis, Digital Health and Public Health. Systematic review, Review and Meta-Analysis which indicates secondary study started evolving in different years. For example, systematic review first appeared in 2014 with 1 frequency and since 2014 it has been growing till date. Within eight years, it has grown from 1 to 50. Review appearance was earlier in 2010 and within 12 years it has grown from 1 to 32. For meta-analysis, its growth was a bit slow, and it emerged it emerged in 2016 and by 2021 it has grown from 1 to 25. Telemedicine, Telehealth,

Virtual Health, and Digital Health belongs to the same group and telemedicine and telehealth pattern of growth was similar. The duo emerged in the same year (2003) and by 2021, telehealth has grown from 1 to 36 while telemedicine outgrown telehealth with 13 (36 vs 49). For virtual health which is the focus of this study appeared for the first time in 2014 with 1 and by 2021, it has increased to 32. Digital health featured in 2018 and increased to 18 in 2021. Also, nursing as a keyword growth commenced with 1 in 2011 and reached 26 in 2021 but COVID-19 reflects in virtual healthcare literature in 2020 and till date records 45. Finally, Public Health commenced in 2005 and by 2021, it has grown to 16. Because of COVID-19 disruption, it only reflects in less than two years but its frequency almost catching up with the keywords that covers 19 years. The word growth shows the infancy of virtual healthcare research domain. The virtual health is growing linearly.

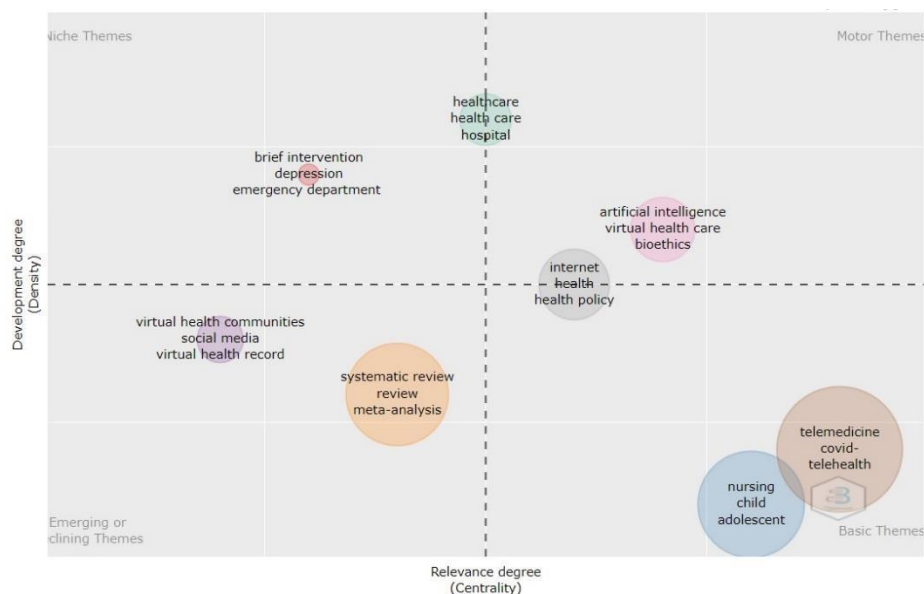


Fig. 4. Thematic Map Keywords

Biblioshiny classified the Thematic Map of Keywords in figure 4 into four quadrants of Motor themes in the upper right, Niche themes in the upper left, Peripheral themes in the lower left and Transversal and basic themes in the lower right. Density divides the vertical part of the quadrant while Centrality divides the quadrant horizontally. The motor themes in the first quadrant play a central role to the structure of the virtual healthcare research field and reflect both high centrality and density. Healthcare, artificial intelligence and Internet were clustered together in motor theme. Brief intervention is the only niche theme, and it indicates a marginal theme in the field of virtual healthcare. The peripheral themes clustered virtual health communities and systematic review together. These are the emerging and declining themes. The systematic literature review and meta-analysis are more pronounced than the virtual health communities, social media, and virtual health record. The last quadrant clustered telemedicine and nursing together. These concepts of telemedicine are not well developed. Overall, telemedicine has the highest centrality with 6.08, density of 65.84,

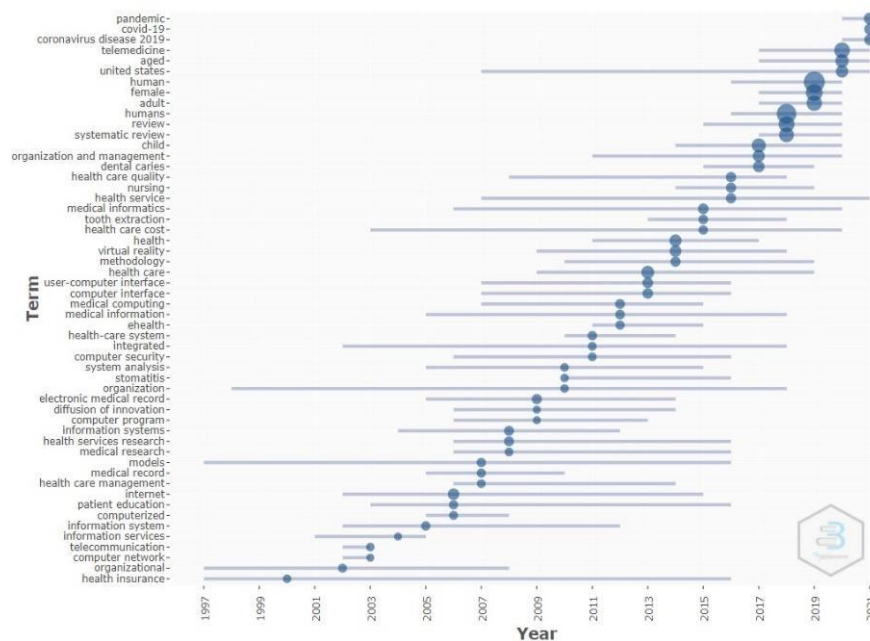


Fig. 6. Trending Topics over Time (1997 – 2021)

From figure 6, one very key concept to take note of is the topic “human”. This can be attributed to the shift from technology as a means of solving tasks (i.e. techno-centric) to technology that contributes to the wellness (physically, socially, and mentally) of individuals – i.e. human-centric [22-24].

4 Conclusion

The diffusion of modern technology, has played a key role in improving the living and working conditions of humanity; and is greatly influencing areas such as healthcare. The future of healthcare delivery is dependent on technology as a support medium for decision making. The SARS-COV-2 (Covid-19) pandemic that hit the entire globe in 2020 has revealed the need for healthcare delivery to be heavily invested into as well as novel techno-centric and human-centric solutions to be developed. Virtual healthcare is one of such promising technologies. Virtual healthcare is the vehicle through which healthcare delivery could be accessible to all communities and societies; so long as there exists affordable platforms for end users.

Our study delved into the world of virtual healthcare by presenting a bibliometric and thematic study on the state of the art. It was evident that with respect to virtual healthcare, artificial intelligence and internet health policy will be of great interest in the coming years in order to protect improve livelihood using data-driven techniques while not compromising on the privacy of individuals. Another revelation has to do with Brazil as a leader in the virtual healthcare space and this can be linked with the legal enabling environment created by the Brazilian Federal Government. This should be a lesson for emerging economies to adopt.

With respect to theoretical contributions, our study provides a thematic and bibliometric overview of virtual healthcare and provides researchers with emerging themes they could ride on to steer the field forward. With respect to practical contributions, these facts and figures presented, will be relevant to policymakers, software developers and investors to know where to target efforts in order to improve human livelihood. For future research, we recommend researchers to expand the search databases to sources our study did not cover, as well as languages aside the English language.

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