TES

Trabalho, Educação e Saúde

The use of digital technologies in the practices of community health workers: an international scoping review

O uso de tecnologias digitais nas práticas de trabalhadores comunitários de saúde: uma revisão internacional de escopo

El uso de las tecnologías digitales en las prácticas de los trabajadores comunitarios de la salud: una revisión internacional del alcance

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Abstract

This article aims to map the literature on the applications and perceptions regarding the use of digital technologies in the practices of community health workers. This is a scoping review conducted on PubMed, Bireme, SciELO, Web of Science, Embase, and Scopus. A total of 63 articles reporting the use of digital technologies by these workers in 24 countries were included. As a result, it was identified that support for maternal and child health is the most prevalent condition in these practices. The identified benefits involve increased access, improved work management, qualification, diversification, expanded training, and increased legitimacy of the profession. The challenges are reflected in limitations regarding community engagement, continuity of care, internet access, electricity, and digital literacy. In conclusion, it supports analyses regarding the irreversibility of the use of information and communication technologies in the world of work, emphasizing the need for their rational use while ensuring comprehensive, universal, and equitable access.

Keywords primary health care; community health workers; telemedicine.

Resumo

Este artigo objetiva mapear a literatura sobre as aplicações e percepções acerca do uso de tecnologias digitais nas práticas de trabalhadores comunitários de saúde. Trata-se de uma revisão de escopo realizada na PubMed, Bireme, SciELO, Web of Science, Embase e Scopus. Foram incluídos 63 artigos que relatam o uso de tecnologias digitais por esses trabalhadores em 24 países. Como resultados, identificou-se que o suporte à saúde materno-infantil é a condição com maior predomínio das práticas. Os benefícios identificados envolvem a ampliação do acesso, a melhoria da gestão do trabalho, a qualificação, diversificação, ampliação da formação e ganho de legitimidade da categoria. Os desafios se traduzem nas limitações em relação ao vínculo com a comunidade, longitudinalidade do cuidado, acesso à internet, energia elétrica e alfabetização digital. Como conclusão, corrobora-se com análises acerca da irreversibilidade do uso de tecnologias de informação e comunicação no mundo do trabalho, destacando-se a necessidade do seu uso racional dessas com a garantia do acesso de forma integral, universal e equitativa.

Palavras-chave atenção primária à saúde; agentes comunitários de saúde; saúde digital.

Resumen

Este artículo tiene por objeto mapear la literatura sobre las aplicaciones y percepciones acerca del uso de tecnologías digitales en las prácticas de los trabajadores comunitarios de la salud. Se trata de una revisión del alcance realizada en PubMed, Bireme, SciELO, Web of Science, Embase y Scopus. Se han incluido 63 artículos sobre el uso de tecnologías digitales por parte de estos trabajadores en 24 países. Como resultado, se ha identificado que el apoyo a la salud maternoinfantil es la condición con mayor predominio de las prácticas. Los beneficios identificados implican la ampliación del acceso, mejora de la gestión del trabajo, calificación, diversificación, ampliación de la formación y aumento de la legitimidad de la categoría. Los desafíos se traducen en limitaciones en relación con el vínculo con la comunidad, la longitudinalidad de la atención, el acceso a Internet, la energía eléctrica y la alfabetización digital. En conclusión, se corrobora con análisis sobre la irreversibilidad del uso de las tecnologías de la información y la comunicación en el mundo del trabajo, y se destaca la necesidad de su uso racional con la garantía del acceso de manera integral, universal y equitativa.

Palabras clave atención primaria de salud; trabajadores comunitarios de la salud; salud digital.

Introduction

Experiences of lay healthcare provided by local residents, based on territorial knowledge and family guidance, have been recognized since the 1920s, starting with the work of barefoot doctors in China. Nearly 100 years later, at least 38 countries, including Brazil, across all continents, have been mapped with the presence of Community Health Workers (CHW) playing a significant role in the consolidation of the principles of Primary Health Care (PHC) (Méllo, Santos and Albuquerque, 2023).

The positive impacts of implementing CHW in healthcare systems and epidemiological indicators are well-described in the literature, particularly regarding the reduction of hospitalizations sensitive to PHC. (Pinto and Giovanella, 2018), chronic care management (Trump and Mendenhall, 2017; Khetan et al., 2018), healthcare access (Berini, Bonilha and Simpson, 2022), maternal and child health indicators (Santos et al., 2020). It is worth noting that this category of professionals in Brazil is known as *agente comunitário de saúde* (ACS)and represents approximately 260,000 workers in the Unified Health System (SUS - in portuguese), with the majority being women (Nogueira, 2019).

Given the importance of this workforce in healthcare systems, international studies have drawn attention to the approach of initiatives from different countries that incorporate CHW. The results of some studies highlight the need for robust financing to ensure their implementation and development (Masis et al., 2021), governance (Lewin, Lehmann and Perry, 2021), political support and legitimacy (Zulu and Perry, 2021), intersectionality (Afzal et al., 2021), adequate supervision (Westgate et al., 2021), deprecarization of work (Colvin, Hodgins and Perry, 2021), fair recruitment with continuing

education (Schleiff et al., 2021), broad attributions (Glenton, Javadi and Perry, 2021), in addition to evaluation and monitoring that considers qualitative and contextual aspects of its territorial work (Kok et al., 2021). The ultimate goal would be to reverse a scenario of underutilization of this workforce in order to ensure universal access to health and quality of care provision. (Hartzler et al., 2018; Hodgins et al., 2021).

The COVID-19 pandemic, one of the greatest health challenges ever faced by humanity, has directly impacted the work of CHW in Brazil and around the world, with their activities being canceled or reduced (Méllo et al., 2021; 2022b). At the same time, there has been an indispensability of their work in ensuring the monitoring of chronic patients, minority and vulnerable populations, including those with COVID-19, through a new modality of remote monitoring and care mediated by digital health technologies (Caetano et al., 2020; André and Ribeiro, 2020; Méllo et al., 2021; Méllo, Santos and Albuquerque, 2022).

Although the pandemic scenario in 2020 served as a catalyst for increased use of these technologies in PHC (Caetano et al., 2020; André and Ribeiro, 2020; Méllo et al., 2021; Méllo, Santos and Albuquerque, 2022), The implementation strategy for digital health technologies has been recommended by the World Health Organization (WHO) since 2005 (World Health Organization, 2005). According to Celuppi et al. (2021, p. 2), The pandemic has demanded a shift from the traditional model of healthcare delivery, with investments in technological solutions. It is "believed that advancements in interactive health technologies can be an effective and safe option to facilitate communication between healthcare professionals and patients". On the other hand, in Brazil, the role of digital tools in the work process of CHW has not been a consensus among managers and the CHW category itself (Lotta et al., 2020; Méllo et al., 2021).

There is a debate about the concepts and definitions involved in the use of digital health technologies, such as those derived from telemedicine, then telehealth, and currently digital health. But, there is a common thread among these new care paradigms, which is the use of information and communication technologies to support services in healthcare, surveillance, education, and health information (André and Ribeiro, 2020; Caetano et al., 2020; Lisboa et al., 2023).

As a legacy of the COVID-19 pandemic, there has been a global movement to implement or expand the workforce of CHW in various countries as a response to the health crisis, particularly in high-income countries like the United States and England (Haines et al., 2020; Waters, 2020; Méllo, Santos and Albuquerque, 2022).

The expansion and consolidation of community work in healthcare, as well as the use of new digital technologies, require the development of studies that can contribute to the reflection and guidance of policies that locate these workers within an expanded scope of knowledge, functions, instruments, and practices (Hartzler et al., 2018; Méllo et al., 2021; Méllo, Santos and Albuquerque, 2022). One aspect to consider in the analysis of this work modality is that health needs are not static, they vary with the historical period, as each context introduces changes in the work to be done and its instruments in a way that responds to the new demands of society and the State (Boiteux, Sarti and Lima, 2020). Indeed, when we consider Brazil, the work of CHW nowadays is not the same as it was when this profession was initially established, and it is expected to continue evolving in the future. The specific work processes and professional configuration will be shaped by the health needs of the population, influenced by the interests of the CHW category, the State, and the market (Yasbek, 2009; Méllo et al., 2021).

Therefore, considering the accelerated changes brought about by the COVID-19 pandemic, the recent expansions of national strategies for CHW, and the extensive use of digital technologies in PHC, the objective of this article is to map the literature on the applications and perceptions of digital technologies in the practices of CHW.

Methodology

This literature review falls under the scope approach, following the guidelines proposed by the Joanna Briggs Institute – JBI (2015). It presents characteristics such as the ability to map evidence and concepts, systematizing them as a way to guide theoretical constructions, identify gaps, and highlight trends in a specific field of knowledge (Daufenback et al., 2022). This type of review is often used in studies of policy, planning, and health management, providing support for decision-making as well (Méllo, Santos and Albuquerque, 2022).

In the theoretical construction of the guiding question, the strategy employed was Population, Concept e Context (PCC) (Joanna Briggs Institute, 2015), being: P – community health workers; C – Digital technologies; and C – Practices, it converged on the question: How do community health workers apply digital technologies in their practices, and what are the benefits and challenges of these tools?

The direct translation into English of the expression *agentes comunitários de saúde* used in Brazil is community health workers. However, recognizing that there are analogous experiences in other countries where the nomenclature for this profession varies considerably, and with the intention of making the results of this article more robust, we employed the descriptors referenced by Méllo, Santos and Albuquerque (2022) in your international review also on ACS. Nonetheless, for the retrieval of articles on digital technologies in health, we adopted the terms Telemedicine; Mobile Health; Health, Mobile; mHealth; Telehealth; eHealth, in addition to the boolean operators OR e AND (Santos, Pimenta and Nobre, 2007). In Table 1, the search strategy is presented along with the virtual libraries/databases consulted between August 26 and August 31, 2022.

Table 1 - Virtual library/database and search strategy employed.

| Virtual library or database	Search strategy
PubMed, for access to studies published in the Medical Literature Analysis and Retrieval System Online (Medline); in the virtual libraries Bireme, for access to the Latin American and Caribbean Health Sciences Literature (Lilacs), and the Scientific Electronic Library Online (SciELO); as well as Web of Science, Excerpta Medica Database (Embase), and Scopus.	"Community Health Workers" OR "Frontline health workers" OR "Lay Health Workers" OR "Close-to community providers" OR "Anganwadi Worker" OR "Accredited Social Health Activist" OR "Auxiliary Nurse Midwife" OR "Gizi" OR "Kesehatan" OR "KB" OR "Community Health Agent" OR "Family Welfare Assistant" OR "Shasthya Shebika" OR "Health Assistant" OR "Community Based Skilled Birth Attendant" OR "Community Health Care Provider" OR "Health Extension Worker" OR "Health Development Army Teams" OR "Lady Health Worker" OR "Village Health Worker" OR "Village Health Teams" OR "Village Health Volunteer" OR "Home-Based Carer" OR "Lay Counselor" OR "Adherence Counselor" OR "Female Community Health Volunteer" OR "Maternal Child Health Worker" OR "Behvarz" OR "Brigadista" OR "Volunteer Midwives" OR "Volunteer Collaborators" OR "Health Promoters" OR "Community Health Volunteer" OR "Community Health Assistant" OR "Community Based Agent" OR "Health Surveillance Assistant" OR "Agentes Polivalentes Elementares" OR "Community health representatives" OR "Aboriginal health workers" OR "Community health aides" OR "Community navigators" OR "Health trainers" OR "Paraprofessional home visitors" OR "Community nutrition workers" OR "Barangay Health Workers" AND Telemedicine OR "Mobile Health" OR "Health, Mobile" OR mHealth OR Telehealth OR eHealth

Source: Authors' own elaboration.

The eligibility criteria were as follows: a) inclusion: studies addressing the applications or perceptions of the use of digital technologies in the practices of CHW; b) exclusion: duplicate studies; literature reviews; documents issued by the public administration, theses, dissertations, or conference proceedings; studies that, although using the search strategy descriptor, focus on another actor rather than a CHW; studies that, although mention CHW and digital technologies, focus primarily on the development of software, applications, or study protocols without providing any response to the guiding question.

There was no minimum time limit for article retrieval, but the cutoff date was set as the year 2021. There was also no limitation regarding the language of publication for the articles.

The article search was conducted independently by two reviewers (RC and LS), and any discrepancies were resolved through consultation with a third reviewer (LM). In the first phase, the search key was used to identify relevant articles. In the second phase, articles were selected based on the review of titles and abstracts. During the third phase, all selected articles were fully read for final inclusion, following the guidelines of the JBI and the adapted checklist from Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) (Joanna Briggs Institute, 2015) (Figure 1).

Figure 1 - Flowchart indicating the study selection process adapted from the PRISMA
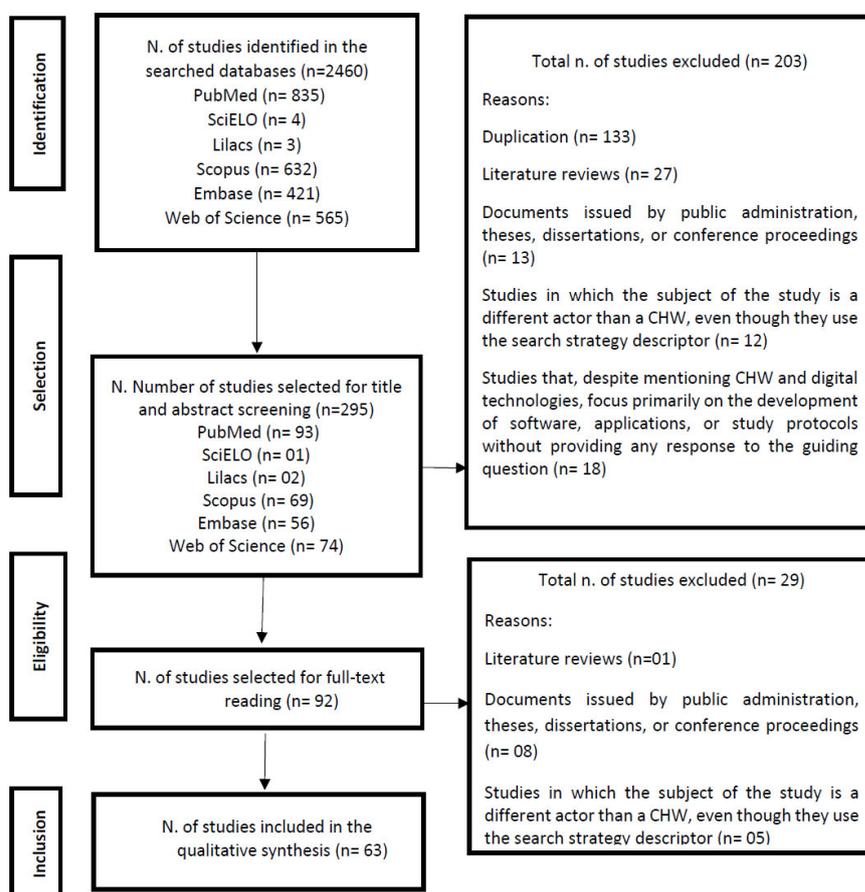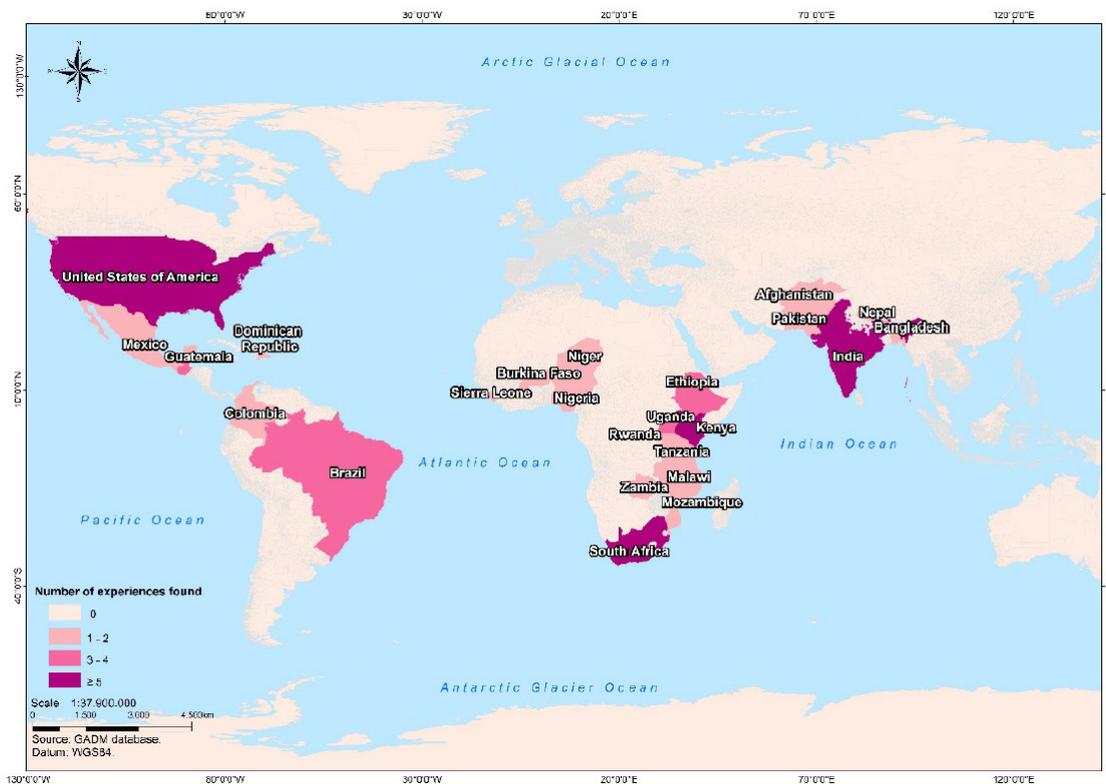

Source: Authors' own elaboration.

Finally, a *corpus* of the review was built with 63 included studies (Figure 1), followed by the organization and data extraction of interest from the articles into a standardized Excel® form, including author, year, country, role of digital technologies in the practices of CHW, social/health condition addressed by the digital technologies, description of the technology, tool utilized, methodology, benefits, and challenges of technology use.

Results

Of the places, objects, instruments, and roles of digital technologies in the practices of CHW

A total of 63 studies (Figure 1) were mapped, reporting the use of digital technologies by community health workers in 24 countries. Among these, 35 studies were conducted in African countries, 19 in the Americas, and 14 in Asia. The most frequently mentioned countries from each continent were South Africa, United States of America (USA), and India, with 7, 9, and 9 reports respectively. No findings were identified for Europe, Oceania, and Antarctica (Figure 2).

Figure 2 - Distribution by continent of the mapped experiences and number of studies per country.

Source: Author's own elaboration, based on the results obtained from the review.
Note: In some studies, more than one country was addressed as a research setting.

In Table 2, it can be observed that maternal health (21) was the most addressed health condition as the focus of digital technologies by CHW in the territories, followed by child health (19) and chronic conditions (15). The cell phone or smartphone was the main technological resource (48), and the functions of digital technologies in the practices of these workers highlighted data collection (33), support for clinical decision-making during home visits (22), or telemonitoring of health system users (18).

Table 2 - Characterization of the object, instrument, and role of digital technologies in the practices of community health workers.

Condition of health/social object of digital technologies	
Topic	**N. of approaches in the studies**
Maternal health (pregnancy, prenatal care, pre-eclampsia, childbirth, obstetric emergencies, general clinical examinations such as oxygen saturation and blood pressure, and biochemical examinations such as proteinuria, tuberculosis)	21
Child health (breastfeeding, pneumonia, growth, immunization, diarrhea, vomiting, childhood malaria, weight)	19
Chronic conditions (diabetes, asthma, hypertension, cardiovascular disease, nutrition, HIV, chronic pain, trauma, stroke, oral cancer)	15
Hearing health (hearing and hearing impairment, types, prevention and causes of hearing impairment, techniques for identification and diagnosis of hearing impairment, and general aspects of hearing impairment)	05
Pharmaceutical care (medication dosage, support, and supervision of medication adherence)	04
Mental health (signs and symptoms of common mental disorders, trauma, depression, epilepsy, substance abuse, postpartum depression)	04
Reproductive health (family planning, contraceptive methods)	01
Epidemics (Ebola)	01
Work instruments	
Technological resource	**N. of approaches in the studies**
Cell phone or smartphone	48
Tablet	11
Training process in a room equipped for video conferencing	04
Role of digital technologies in the practices of CHW	
Function	**N. of approaches in the studies**
Data collection	33
Clinical decision support (application for screening or diagnostic aid, risk stratification, personalized home visits)	22
Telemonitoring	18
Tele-education for CHW	10
Tele-education for users of the health system	10
Telediagnosis	01
Teleconsultation	01

Source: Authors' own elaboration based on the results obtained from the review.
Note: In some studies, multiple themes, resources, or functions of technology were addressed in the research.

Benefits and challenges of using digital technologies in the practices of CHW

Benefits of using digital technologies in the practices of community health workers have shown advantages for the healthcare system and these workers.

There is a convergence that the use of technological tools implies an expansion of access to healthcare in terms of its universal coverage (Schuttner et al., 2014; Ayiasi et al., 2015; Mengesha et al., 2018; Patterson et al., 2018; Shah et al., 2019; Shah et al., 2021), regarding the qualification of territorial care (Palazuelos et al., 2013; Ayiasi et al., 2015; Bonnell et al., 2018; Laktabai et al., 2018; Arnaert et al., 2019; Schaeffer et al., 2019; Zakus et al., 2019; Kenna et al., 2019), decentralization of diagnoses or exams. (Gaziano et al., 2015; Laktabai et al., 2018; Van Wyk et al., 2019; Schaeffer et al., 2019; Shinn et al., 2019; Adam et al., 2021; Vaughan et al., 2021), prevention of adverse outcomes in pregnancy, acute

or chronic diseases (Atnafu et al., 2015; Shah et al., 2019; Duffy et al., 2020; David, Utulu and Tyndall, 2021; Vaughan et al., 2021) and a short-term solution for the shortage of health workforce (Laktabai et al., 2018; Patterson et al., 2018; Willems et al., 2021).

In the professional category across different countries, there is an observed increase in legitimacy and recognition of the work among the healthcare team or within the community. This is due to the fact that these workers utilize technological resources, which leads to greater respect and trust from the community in their actions (Palazuelos et al., 2013; Gaziano et al., 2015; Thondoo et al., 2015; Ayiasi et al., 2015; Tiase et al., 2017; Coetzee et al., 2018; Steege et al., 2018; Ilozumba et al., 2018; Namatovu and Kanjo, 2019; Gopalakrishnan et al., 2020; Venkataraghavan et al., 2021; Kinshella et al., 2021; Janevic et al., 2021; Adam et al., 2021; David, Utulu and Tyndall, 2021). In addition to greater visibility of this work, there is increased visibility due to women having access to digital devices in communities where traditionally only men had cell phones (Steege et al., 2018) (Table 3).

In general, in the management of this work, there is an increase or improvement in supervision and collaboration between community health workers and other healthcare professionals within the healthcare team (Neupane et al., 2014; Thondoo et al., 2015; Braun et al., 2016; Pimmer et al., 2017; Steege et al., 2018; Laktabai et al., 2018; Ilozumba et al., 2018; Arnaert et al., 2019; Namatovu and Kanjo, 2019; Shah et al., 2019); There is also an increase in the organization, accuracy, and agility of the collected information (Palazuelos et al., 2013; Iyengar and Florez-Arango, 2013; Neupane et al., 2014; Surka et al., 2014; Brown and Mickelson, 2016; Schoen et al., 2017; Pimmer et al., 2017; Schaeffer et al., 2019; Hackett et al., 2019; Venkataraghavan et al., 2021); There is a decrease in travel costs to healthcare centers because CHW are now able to download reports from the territory directly in their homes using the internet (Thondoo et al., 2015); there is a time-saving aspect as well, as unnecessary in-person home visits are avoided, and community health workers can utilize applications or even phone calls instead (Zaidi et al., 2020; Venkataraghavan et al., 2021); reduction in the workload (Iyengar and Florez-Arango, 2013; Bhardwaj et al., 2020; Adam et al., 2021); increase in job satisfaction as well (Iyengar and Florez-Arango, 2013; Braun et al., 2016) (Table 3).

Regarding tele-education, both for the training of CHW and for health education within the community itself, mediated through video conferences, videos, or other resources, it is noted that regardless of the virtual strategy employed, there has been a gain in knowledge acquisition. This has influenced the outcomes of their work, including improvements in organization, engagement, health education, and decision-making (Melo et al., 2010; Conceição and Barreira-Nielsen, 2014; Heisler et al., 2014; Prentiss et al., 2018; Coetzee et al., 2018; Hackett et al., 2019; Keegan et al., 2020; Gopalakrishnan et al., 2020; Suryavanshi et al., 2020; Ward et al., 2020; Janevic et al., 2021; Hicks et al., 2021; Willems et al., 2021; Vaughan et al., 2021). When observed as a training resource for CHW some studies have mentioned that there is a similar quality between the applied technology and the traditional training method (O'donovan et al., 2018; Kenna et al., 2019; Vaughan et al., 2020) (Table 3).

In studies where CHW used apps to assist in clinical decision-making during home visits, such as patient screening, it is reported that there is both financial savings for diagnoses (Gaziano et al., 2015) as well as time saving compared to paper-based clinical risk stratification forms. (Palazuelos et al., 2013; Surka et al., 2014; Schaeffer et al., 2019; Hackett et al., 2019). There are also mentions of an increase in patient referral rates (Shinn et al., 2019; Zakus et al., 2019; Van Wyk et al., 2019), and improved adherence to treatment or medication (Vedanthan et al., 2019; Duffy et al., 2020; David, Utulu and Tyndall, 2021) (Table 3).

The challenges (Table 3) for the use of digital technologies in relation to the practices of CHW can be explained by the limited digital literacy of these professionals or the community. This is identified as one of the main barriers to their use in the field (Schuttner et al., 2014; Pimmer et al., 2017; Venkataraghavan et al., 2021), associated with low connectivity or poor internet quality (Atnafu et al., 2015; Medhanyie et al., 2015; Biemba et al., 2017; Ilozumba et al., 2018; Mannik et al., 2018; Mengesha et al., 2018; Gopalakrishnan et al., 2020; Venkataraghavan et al., 2021; David, Utulu and Tyndall, 2021)

or the scarce supply of electricity to recharge devices, especially when considering work in remote areas (Schuttner et al., 2014; Atnafu et al., 2015; Medhanyie et al., 2015; Braun et al., 2016; Mannik et al., 2018; Mengesha et al., 2018; Gopalakrishnan et al., 2020).

The language settings of mobile phones, tablets, or apps, when not adapted to the local language, also present a difficulty for the use of these resources (Thondoo et al., 2015; Medhanyie et al., 2015); similarly, the high financial costs of telephone networks or mobile data when not subsidized by the government pose a challenge, as it requires direct payment by the workers (Steege et al., 2018; Zaidi et al., 2020); there is also a lack of security in the territory, which leads to fear of device theft (Coetzee et al., 2018); low motivation (Musabyimana et al., 2018), insufficient education or training of CHW (Musabyimana et al., 2018; Bhardwaj et al., 2020; Venkataraghavan et al., 2021; Kinshella et al., 2021; Shah et al., 2021); insufficient collaboration from other professionals in carrying out the work (Ayiasi et al., 2015); and the intensive use of technology, disregarding physical interaction, is another challenge that has emerged in the studies (Schoen et al., 2017). It is worth noting that there have been studies mentioning an increase in workload caused by digital technologies, diverging from other experiences that cite a reduction in workload (Steege et al., 2018; Mengesha et al., 2018; Namatovu and Kanjo, 2019; Shah et al., 2019; Hicks et al., 2021) (Table 3).

Table 3 - Characterization of digital technologies incorporated in the activities of community health workers

Authors/Year/Country	Technology description	Method
Gaziano et al., 2015 South Africa, Mexico and Guatemala	App to track cardiovascular diseases	Quali-quantitative
Palazuelos et al., 2013 Mexico and Guatemala	App to assist with medication dosage calculations	Quali-quantitative
Thondoo et al., 2015 Uganda and Mozambique	App for data collection, guidance in work, and facilitating greater communication between patients, community health workers, and other healthcare professionals	Qualitative
Zaidi et al., 2020 Pakistan and Afghanistan	App for data collection on maternal and child health conditions. It also allows for phone calls and playback of short videos for patients	Qualitative
Neupane et al., 2014 South Africa	App for collecting patient information with real-time feedback from supervisors of community health workers	Quali-quantitative
Adam et al., 2021 South Africa	App for video dissemination about the importance and care of breastfeeding	Randomized clinical trial
Coetzee et al., 2018 South Africa	Videos on tablets as resources for maternal and child health education	Quali-quantitative
Van Wyk et al., 2019 South Africa	App for auditory screening in populations with HIV or vulnerable to infection	Qualitative
Surka et al., 2014 South Africa	App for risk stratification for cardiovascular disease	Quali-quantitative
Hussein et al., 2016 South Africa	App for hearing screening	Quali-quantitative
Arnaert et al., 2019 Burkina Faso	App for entering clinical data of pregnant women, as well as connecting midwives who remotely monitor the data to detect changes and prevent negative outcomes.	Qualitative
Medhanyie et al., 2015 Ethiopia	App for collecting data on aspects of pregnancy and childbirth	Quantitative
Atnafu et al., 2015 Ethiopia	App for data collection, communication with patients, and other healthcare professionals	Quantitative
Steege et al., 2018 Ethiopia	App for collecting data on maternal and child health with real-time feedback	Qualitative
Mengesha et al., 2018 Ethiopia	App for collecting data on maternal and child health	Quali-quantitative

Table 3 - Characterization of digital technologies incorporated in the activities of community health workers. Continuation

Namatovu and Kanjo, 2019 Malawi	App for guiding home visits with protocols for prenatal and postnatal care	Qualitative
Pimmer et al., 2017 Malawi	App for telemonitoring and data collection of users	Qualitative
Hicks et al., 2021 Nigeria	Training through a tablet via video conferencing and presentation of videos in the community on maternal and child health	Quali-quantitative
David, Utulu and Tyndall, 2021 Nigeria	App for providing guidance during home visits on general aspects of medication use	Qualitative
Zakus et al., 2019 Niger	App for collecting data and supporting the diagnosis of common diseases in children, such as malaria, pneumonia, and diarrhea	Clinical trial Randomized
Laktabai et al., 2018 Kenya	App for remotely monitoring rapid malaria tests and providing real-time feedback	Quantitative
Mannik et al., 2018 Kenya	App for collecting sociodemographic and lifestyle data, stratifying patients according to their risk of developing a cardiovascular event	Quantitative
Vedanthan et al., 2019 Kenya	App for collecting information about the care, signs, and symptoms of hypertension	Randomized clinical trial
Shinn et al., 2019 Kenya	App for auditory screening	Quantitative
Aw et al., 2020 Kenya	App for risk stratification for cardiovascular disease	Quali-quantitative
Musabyimana et al., 2018 Rwanda	App for data collection and automated reminders for clinical appointments and obstetric care	Qualitative
Mwendwa, 2018 Rwanda	App for data collection and sending messages about maternal and child health	Quantitative
Brown and Mickelson, 2016 Rwanda	App for collecting data on child health	Quantitative
Willems et al., 2021 Rwanda	Remote training on mental health signs, first aid, counseling, and referral	Quantitative
Kenna et al., 2019 Sierra Leone	Remote training on vaccination, outbreak response, and disease surveillance	Qualitative
Braun et al., 2016 Tanzania	App for collecting, monitoring, and providing care to patients regarding contraceptive methods and options	Quantitative
Hackett et al., 2019 Tanzania	App to improve data management, patient tracking, and health education for pregnant women	Qualitative
Ayiasi et al., 2015 Uganda	Use of cell phones during home visits by community health workers for remote telemonitoring by supervisors	Qualitative
O'Donovan et al., 2018 Uganda	Use of videos to train community health workers in recognizing, treating, and preventing pneumonia	Randomized clinical trial
Schuttner et al., 2014 Zambia	Phone calls to improve clinical guidance and data collection	Quantitative
Biemba et al., 2017 Zambia	App for collecting patient information with real-time feedback from supervisors	Quantitative
Schaeffer et al., 2019 Bangladesh	App for identification and management of conditions and risk factors for child development	Quali-quantitative
Gopalakrishnan et al., 2020 India	App for data collection, telemonitoring, and tele-education on general health conditions	Qualitative
Suryavanshi et al., 2020 India	App for collecting data during home visits, and using cell phones to facilitate communication between community health workers and patients with videos about HIV or breastfeeding	Clinical trial Randomized

Table 3 - Characterization of digital technologies incorporated in the activities of community health workers. Continuation

Patterson et al., 2018 India	App for addressing patients with suspected epileptic disorder	Quantitative
Birur et al., 2019 India	App for photographing the oral cavity and abnormal lesions, as well as collecting information about risk factors for oral cancer	Quantitative
Ward et al., 2020 India	Apps for broadcasting and disseminating messages and videos about maternal and child health	Randomized clinical trial
Shah et al., 2019 India	App for collecting data on maternal and child health	Quali-quantitative
Charanthimath et al., 2021 India	App for identification and management of signs and symptoms of pregnancy	Quantitative
Ilozumba et al., 2018 India	App for collecting data on maternal health	Quali-quantitative
Venkataraghavan et al., 2021 India	App for data collection, telemonitoring, and tele-education on general health conditions	Qualitative
Bhardwaj et al., 2020 Nepal	App for data collection and sending messages to users about mental health conditions	Qualitative
Kinshella et al., 2021 Paquistan	App to guide home visits on maternal care	Qualitative
Janevic et al., 2021 USA	Weekly phone calls for patients to establish care goals	Quantitative
Vaughan et al., 2021 USA	Video conference training on diabetes, along with telephone support from CHW to patients	Clinical trial Randomized
Vaughan et al., 2020 USA	Video conference training on diabetes care	Quantitative
Keegan et al., 2020 USA	Video conference training on diabetes care	Quali-quantitative
Shah et al., 2021 USA	Virtual platform for home visits during the COVID-19 pandemic	Qualitative
Tiase et al., 2017 USA	App for collecting data on asthma and diabetes medication	Qualitative
Heisler et al., 2014 USA	App for data collection to provide clinical guidance and health education on diabetes	Randomized clinical trial
Mundorf et al., 2018 USA	Phone calls or text messages to patients providing support for health promotion and disease prevention, as well as assessing sociodemographic conditions	Quantitative
Prentiss et al., 2018 USA	Training program and knowledge sharing on business management, government resource allocation, and communication	Quali-quantitative
Melo et al., 2010 Brazil	Video conference training on auditory health	Quantitative
Schoen et al., 2017 Brazil	Mobile application for collecting sociodemographic data	Qualitative
Conceição and Barreira-Nielsen, 2014 Brazil	Video conference training on auditory health	Quantitative
Iyengar and Florez-Arango, 2013 Colombia	App with clinical guidelines and protocols on child health, trauma, and chronic conditions to guide home visits. Additionally, the app provides voice instructions, images, or videos about specific diseases and conditions	Quantitative
Duffy et al., 2020 Guatemala	App for collecting data on clinical characteristics of diabetic patients. After each visit, the patient's data is reviewed by a doctor	Quantitative
Bonnell et al., 2018 Dominican Republic	Through an app used by community health workers during home visits, doctors monitor the data entered during the visits	Quantitative

Source: Author's own elaboration, based on the results obtained from the review.

Discussion

The studies mapped here on the use of digital technologies by CHW focus on low- and middle-income countries. This characteristic demonstrates the importance of these workers in strengthening healthcare systems, particularly in guaranteeing the right to health for the entire population.

In this regard, it is worth highlighting the role of these professionals in the face of the significant health workforce deficit projected to reach 80 million professionals by 2030, a scenario that can particularly impact living conditions in African and Asian countries (Tulenko et al., 2013; Méllo, Santos and Albuquerque, 2022).

The health domain with the highest percentage of reports on the use of digital technologies is focused on aspects of maternal and child health, which is also a recognized field of work for CHW (Hodgins et al., 2021). However, in high-income countries like the USA, the work of these professionals has primarily been centered around guidance on non-communicable chronic diseases, aligning with other analyses (Méllo, Santos and Albuquerque, 2022; 2023).

Regarding the practices of CHW, it is observed that digital technologies are used to support the typical functions of this profession, such as care coordination, health counseling, social support, health assessment, case and medication management, clinical care in remote areas, monitoring, administration, and health education (Hartzler et al., 2018; Glenton, Javadi and Perry, 2021).

Digital technologies in healthcare seem to articulate a new technical process within this profession, through the interaction with medical and informational technologies, shaping new ways for these CHW to establish themselves in the world, considering the local and global aspects in an instantaneous and connected manner. However, the way care is provided in PHC has specific characteristics and occurs through face-to-face encounters. With these digital technologies, however, it transmutes into other possibilities, such as virtual encounters mediated by applications and social networks, giving rise to a new paradigm of care (Rezende et al., 2010; Caetano et al., 2020).

Studies on the Brazilian reality highlight that in-home visits constitute one of the main activities of CHW in PHC. Their contribution to social support, subjective exchange of meanings and experiences is widely recognized, which produces powerful forms of care and access to healthcare. Here, the encounter becomes a privileged space for listening, dialogue, and interpretation of the needs of families and communities, as well as for establishing bridges to address the population's demands in healthcare or social services (Alonso, Béguin and Duarte, 2021; Nepomuceno et al., 2021; Costa et al., 2022). However, a cautionary note arises based on Schoen et al.'s study (2017), which suggests that the intensive and uncritical use of technology by community health workers can overshadow the CHW-patient interaction, leading to significant disadvantages. This is because "the way the interaction is structured will reflect how professionals are able to build relationships with users" (Martins and Carbonai, 2022, p. 6).

In the management of the work of these professionals, digital technologies emerge as an important vector for qualification, diversification of activities, and large-scale training of the category. This strategy, on the one hand, allows for addressing the challenges arising from the scarce material and financial resources in low-income countries' healthcare systems (Tulenko et al., 2013), in the other hand, it reinforces the duality between universal coverage and universal health systems (Méllo, Albuquerque and Santos, 2022).

Nevertheless, studies indicate an increase in supervision and direct control over CHW (Neupane et al., 2014; Thondoo et al., 2015; Steege et al., 2018; Ilozumba et al., 2018; Namatovu and Kanjo, 2019; Shah et al., 2019), this reflects in the way this work is carried out. By placing a higher value on tasks linked to technological resources, coupled with increased remuneration based on the achievement of goals and indicators, there is a tendency to prioritize their execution, disregarding qualitative aspects of this work (Morosini and Fonseca, 2018; Nogueira, 2019).

Furthermore, regarding this aspect, Antunes (2021, p. 15) warns about a new dependency of workers in the digital era, "where cell phones, tablets, smartphones, and similar devices increasingly become important instruments of control, supervision, and command." In this sense, it can potentially reduce the autonomy and creativity of CHW, reinforcing the socio-technical division of labor.

On the other hand, there is evidence that technology has increased the visibility of CHW within the community. This visibility goes beyond simply being seen, as it represents a way of being and existing in the world where their presence is recognized and legitimized (Palazuelos et al., 2013; Gaziano et al., 2015; Thondoo et al., 2015; Ayiasi et al., 2015; Tiase et al., 2017; Coetzee et al., 2018; Steege et al., 2018; Ilozumba et al., 2018; Namatovu and Kanjo, 2019; Gopalakrishnan et al., 2020; Venkataraghavan et al., 2021; Kinshella et al., 2021; Janevic et al., 2021; Adam et al., 2021; David, Utulu and Tyndall, 2021). The expected outcome is altered power relations among workers, the community, and the State, with the affirmation of professional value and identity (Romagnoli and Samudio, 2017; Namatovu and Kanjo, 2019).

The challenges that arise from the use of technology by CHW, such as inadequate training, low education or motivation, low professional motivation, and insufficient resources, are well described in the literature that addresses government strategies for managing this work (Glenton, Javadi and Perry, 2021). However, some barriers to the implementation of work with digital technologies seem to arise, specifically regarding the quality, access, and connectivity of the internet, provision of electricity, and digital literacy, both for these workers and the population receiving the service. Therefore, the current situation intensifies health inequities due to the digital exclusion that emerges (Méllo et al., 2021). Particularly, concerning older populations and CHW, given the evidence discussing the association between aging and challenges in using new information and communication technologies (Mubarak and Suomi, 2022).

Regarding workload, studies are divergent, sometimes indicating a reduction (Iyengar and Florez-Arango, 2013; Coetzee et al., 2018; Bhardwaj et al., 2020; Adam et al., 2021), sometimes indicating an increase in this workload (Steege et al., 2018; Mengesha et al., 2018; Namatovu and Kanjo, 2019; Shah et al., 2019; Hicks et al., 2021). Although it is a reflection that requires further analysis, it points to a historical crossroads. On the one hand, the use of digital technologies can make production processes more efficient, reduce costs, and expand coverage (Pereira and Simonetto, 2018; Venturini, Pinto and Oliveira-Neto, 2021), on the other hand, there is no consensus regarding the benefits of this technological incorporation for healthcare and the professional valorization of these workers.

The emergence of new skills and practices for CHW through the use of digital technologies in healthcare makes it urgent to consider the meanings of this change in the very constitution of these professionals as individuals and workers in a technological revolution reality. The paths presented for this profession through transformations in the world of work raise the following questions: a) rather than responding to health needs, in the current cycle of capitalism, the technological revolution may primarily cater to market needs, further precarizing and objectifying these workers, reducing them to mere sources of extracting surplus value in the digital world (Souza and Mendonça, 2017); or b) whether they will be recognized as indispensable professionals for the reorientation of the healthcare model towards comprehensive, territorial, and community-based care (Gomes et al., 2010).

A hint about the future of work in this digital era, even for CHW seems to emerge in the critical analyses pointed out by Antunes (2020), as these technologies do not have the capacity to eliminate the workforce but rather exacerbate the contours of precarity. It involves the working class in a new morphology, amplifying exploitation, control, repetition, and alienation.

In this context, there is a risk of a path towards technological mediation supported by a double dehumanization,

> the individual receiving assistance is reduced to the disease they have or to a mere consumer of a service, with their health being alienated from themselves. And the healthcare worker, in turn, has their subjectivity (intelligence, analytical power, creativity) subordinated to technology (Souza, 2021, p. 7).

Lastly, as Graham and Anwar (2021) further reflect upon

> If workers can perform their work based on information, without the need for direct contact with the object of work, and if this information can be transmitted around the world, then theoretically, this work can be done from anywhere and by anyone (Graham and Anwar, 2021, p. 47).

Thus, it must be considered that digital technologies in healthcare have brought about adjustments that appear to be disruptive not only to the conditions of work but also to the forms of care production and contact with healthcare service users.

The overcoming of these consequences in the world of work will involve the establishment of alternative ways to analyze and address increasingly complex health needs. These approaches should be based on cognitive foundations and rationalities that are not implicated in the exploitation of labor and capitalist development. Even in a digital scenario with extensive use of technologies, it is crucial that the working conditions and training of these professionals promote their autonomy, strengthen human relationships, and foster a critical awareness of their role in the development of their work. But this will only happen, too, if the class struggle is in line with the fight for universal health (Souza, 2021).

Conclusion

The results synthesized in this review support analyses regarding the irreversibility of the use of information and communication technologies in the world of work. Digital technologies in the practices of CHW appear to be an important strategy in the development of actions and healthcare.

Regarding the publication period of the articles, it is noted that the initial search was not conducted with a specific time frame in order to identify the earliest publications on the topic. In this regard, the first mapped article dates back to 2010, with the highest annual production concentrated in 2018 (13 articles or 20.6%), encompassing the production of the four years (2018, 2019, 2020, and 2021), which accounted for 70% of the total publications. While a larger number of publications was identified during the mentioned period, and there are some hypotheses that justify this finding, such as the increased use of digital technologies during the COVID-19 pandemic or the advancement of technologies in the healthcare field, further research is needed to identify the conditions, determinants, and consequences of using these technologies in the healthcare sector.

The benefits of using digital technologies in healthcare present two perspectives. In the first perspective, there is an expansion of access to PHC, but further studies are needed to understand the impacts on the attributes that characterize this level of care, particularly continuity of care and territorial bonding. The second perspective relates to the changes in the work of CHW, including qualification, diversification, expanded training, and the gaining of legitimacy for the profession.

The challenges, in turn, reaffirm old and new problems, with a particular focus on those specific to the new configuration of work: limited digital literacy among professionals and the community; inadequate electricity supply in territories, preventing the charging of cell phones or tablets; and issues related to internet connectivity.

Regarding the workload that is influenced by technology, the mapped articles diverge on whether it increases or decreases, also lacking further analysis to understand to what extent the integration of digital technologies would constitute another factor of work precariousness.

Additionally, it is suggested to develop studies that address the new configurations of this community work, taking into consideration the mediation of technology use in dimensions such as care, surveillance, education, communication in health, social mobilization, and intersectoral coordination.

Lastly, policymakers, when planning health actions and services that involve community health workers as a key element, need to consider, in the decision-making process of technological incorporation, a clear understanding of their potentialities regarding the following aspects: access to health for remote populations; decentralization of care, establishment and strengthening of health networks, and the possibility of remote monitoring and training; as well as the limits that conform in the little establishment of the territorial bond; access to equipment and connectivity; in addition to the costs associated with the incorporation of these technologies.

It is also important to highlight that any technological advancement should be ensured from the perspective of enhancing the responses of health systems and services to the health needs of populations, particularly in contexts where inequalities are deepened and where the complexity of problems requires equally complex and intersectoral.

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