



Published in final edited form as:

*J Public Health Manag Pract.* 2021 ; 27(3): E107–E118. doi:10.1097/PHH.0000000000001092.

## The Role of Health Informatics in Facilitating Communication Strategies for Community Health Workers in Clinical Settings: A Scoping Review

Avani Kolla, BPhil, Sahnah Lim, PhD, MPH, MIA, Jennifer Zanowiak, MA, Nadia Islam, PhD, MA

Department of Population Health, New York University School of Medicine, New York, USA

### Abstract

**Background:** Community Health Workers (CHWs) have been identified as effective members of healthcare teams in improving health outcomes and reducing health disparities, especially among racial and ethnic minorities. There is a growing interest in integrating CHWs into clinical settings using health informatics based strategies to help provide coordinated patient care and foster health promoting behaviors.

**Objective:** In this scoping review, we outline health informatics based strategies for CHW-provider communication that aim to improve integration of CHWs into clinical settings.

**Design:** A scoping review was conducted.

**Eligibility Criteria:** US-based sources between 2013–2018 were eligible.

**Study Selection:** Literature was identified through PubMed and Google queries and hand searching key reference lists. Articles were screened by title, abstract, then full text.

**Main Outcome Measures:** Health informatics based strategies for CHW-provider communication and their impacts on patient care were documented and analyzed.

**Results:** 31 articles discussed health informatics based strategies for CHW-provider communication and/or integration of CHWs into clinical settings. These strategies include direct CHW documentation of patient encounters in electronic health records (EHRs), and other web-based applications. The technologies were used to document patient encounters and patient barriers to healthcare providers, but were additionally used for secure messaging and referral systems. These strategies were found to meet the needs of providers and CHWs while facilitating CHW-provider communication, CHW integration, and coordinated care.

**Conclusions:** Health informatics based strategies for CHW-provider communication are important for facilitating CHW integration and potentially improving patient outcomes and

---

**Corresponding Author:** Avani Kolla, BPhil, Department of Population Health, New York University School of Medicine, New York, NY 10010.

**Funding Disclosure:**

The authors declare that they have no funding disclosures.

**Conflicts of Interest:**

The authors declare that they have no conflicts of interest.

improving disparities among minority populations. This integration can support the development of future disease prevention programs and healthcare policies, in which CHWs are an established part of the public health workforce. However, further investigation must be done on overcoming implementation challenges (e.g., lack of time or funding), especially in smaller resource-challenged community-based clinics that serve minority patients.

### Keywords

community health workers; electronic health records; health disparities

---

### Introduction

Racial and ethnic health disparities have been shown to consistently exist across various diseases in the United States,<sup>1,2</sup> contributing to earlier disease onset, greater severity of disease, and increased mortality rates.<sup>3</sup> These disparities can stem from barriers posed by the organization of health systems, such as complex reimbursement procedures for health education and counseling efforts, limited access to culturally and linguistically appropriate services, and lack of referral sources for social services.<sup>3</sup> Facilitating public health models that enhance linkages between community and clinical settings is one approach to reducing these barriers. Such approaches allow for the integration of culturally and linguistically tailored patient education programs into healthcare settings through multi-disciplinary, team-based care that leverages community strengths and resources.<sup>4,5</sup> Community-clinical linkage models provide opportunities to enhance patients' awareness and self-efficacy related to disease prevention and management, and have the potential to improve quality of care and patient outcomes, resulting in decreased health disparities among minority populations, especially in the context of chronic disease.<sup>4-7</sup> However, the majority of prior research on reduction of health disparities has focused on targeting patients, rather than healthcare institutions and communities. Thus, the most effective way to facilitate community-clinical linkage programs across various healthcare contexts remains poorly understood and organizational structures for the development of such programs remain limited.<sup>7</sup>

There has been growing interest in the integration of community health workers (CHWs) into healthcare settings as a community-clinical linkage model with special promise to reduce health disparities through coordinated care and disease prevention<sup>8,9</sup>. CHWs are public health professionals who are members of the community and share the same culture, language, socioeconomic status, and/or racial and ethnic backgrounds.<sup>10</sup> CHWs provide culturally and linguistically tailored health education/outreach; offer social, emotional, and mental support; connect patients to community resources; and offer medical screening services with the intent of helping individual community members manage their health.<sup>11-13</sup> Due to their unique role, CHWs have been shown to have positive impacts on health outcomes, lifestyle modifications, and disease prevention,<sup>14</sup> and the Community Preventive Services Taskforce has recommended that CHWs be integrated into services for cardiovascular disease prevention and diabetes prevention, and management.<sup>8</sup> Moreover, CHW programs have been shown to be cost effective by reducing unnecessary healthcare utilization and increasing net savings for institutions.<sup>15,16</sup>

There has been a recent call for the integration of CHWs into primary care teams to improve health disparities in minority populations, which has been supported by specific policy efforts. The Patient Protection and Affordable Care Act, for example, indicates that programs utilizing CHWs will be supported through grant funding and reimbursement opportunities.<sup>12</sup> The best practices for such integration, which involves the maximization of CHWs' roles in healthcare teams while maintaining their unique function, have been identified as: well-defined CHW roles, training team members on the value of CHWs, organized workflows, and improved communication between CHWs and clinical teams.<sup>6,7,9,11</sup> Notably, improved communication allows for a stronger mutual understanding between CHWs and other healthcare providers, which maximizes CHWs' impacts within care teams, including the public health workforce. Through regular interactions and better communication with CHWs, providers can have access to a broader scope of information on patients, allowing for a more patient-centered approach to coordination of care, and improved patient disease management and prevention.<sup>11,13,17</sup>

While the benefits of CHW integration into care teams through improved CHW-team communication methods have been well documented, there has been limited data on specific *mechanisms and tools* to most effectively accomplish such integration.<sup>4,18–20</sup> Specifically, there has been recent interest in exploring health informatics to enhance integration and communication through CHW access to technologies that allow for inclusion of CHW collected data into workflows and care plans.<sup>12,19–21</sup> These technologies include electronic health records (EHRs), cloud-based services, medical devices, mobile apps, and other non-EHR web-based technologies that transmit information without acting as official patient health records.<sup>22</sup> Health informatics can help organize and integrate patient social determinants of health (SDOH) data (e.g., income level and employment status) into clinical workflows to support actions such as referrals to community resources or appropriate patient education, potentially making them a useful tool for CHW documentation and communication<sup>23</sup>. Under this framework, health informatics strategies can support integration and optimization of CHWs' public health efforts by acting as an organizational platform where CHWs can document their work, which can then be interpreted by healthcare teams to better address SDOH needs and reinforce health promoting behaviors.<sup>23</sup>

Accordingly, we conducted a scoping review on health informatics based strategies for CHW-provider communication that aim to improve integration of CHWs into clinical settings. We also discuss the advantages, limitations, and future directions to maximize these strategies in the context of clinical care.

## Methods

A scoping review was conducted in order to identify and summarize strategies for communication between CHWs and medical providers in the context of improving CHW integration into clinical settings. A scoping review aims to examine literature using a broader framework with the intent of providing an overview of existing evidence and/or identifying gaps in literature rather than answering a specific question.<sup>24</sup> We utilized common procedures outlined by Levac *et al's* recommendations on Arskey and O'Malley's methodological framework for conducting scoping reviews (detailed in Figure 1).<sup>25</sup>

### Identifying the research question

The initial research question to guide the scoping review was “How can community health workers be integrated into the clinical setting?” Due to the wide breadth of strategies for integration, this question was narrowed down to focus on health informatics based strategies for communication between CHWs and clinic staff to allow for a more depth in exploration. The revised and final questions were “What are the various types of health informatics strategies that are currently being utilized to improve communication between CHWs and providers?” and “What is the impact of CHW use of health informatics on patient care?”

### Identifying relevant studies

The searches were conducted in July 2018. Relevant literature was identified through PubMed queries and hand searching of reference lists for peer reviewed articles. Google searches were also conducted to identify grey literature, which includes materials produced by institutions outside of commercial publishing, such as government agency reports, research institute working papers, or organization technical guides.<sup>26</sup> A broad set of search terms were utilized to encompass healthcare persons similar to CHWs (detailed in Table 1).

### Study selection

Identified literature was screened first by title, then abstract, then full text. Inclusion criteria for the study were: 1) the primary focus was CHW programs; 2) the CHW programs were implemented in clinical settings; 3) the CHWs did not have previous training in other healthcare careers (e.g., nursing, social work, etc.); and 4) specific health informatics based methods for how CHWs in the program communicated and/or interacted with medical providers were discussed. Manuscripts focusing on CHW programs based in countries outside the United States were excluded. Manuscripts published more than 5 years ago (before 2013) were excluded, unless they discussed strategies for CHW-provider communication not found in more recent literature. If multiple papers were discussing the same method for CHW-provider communication in the context of the same CHW program, only the most recent paper was included. One reviewer (AK) screened all the titles and abstracts; the methodology for study selection was reviewed and overseen by SL.

The initial search generated 7,315 records, of which 7,103 records were excluded due to not being within the past 5 years, not being based in the United States, and/or the titles not being relevant to the research question (Figure 2). The abstracts of the remaining 212 records were screened, of which 137 were excluded. The full text articles of the remaining 75 records were screened; 44 were excluded, resulting in 31 articles included in the scoping review.

### Charting the data

Information from the selected literature was documented in Microsoft Excel by recording key aspects of the CHW programs discussed, including name of the program, affiliated institutions, location, target population, target disease, CHW roles, strategies for and content of CHW-provider communication, and evaluation of strategies.

## Collating, summarizing, and reporting results

The data from each article was first deductively coded with the research questions in mind to provide a basic analysis of the characteristics and context of the literature. Second, the data was inductively coded using descriptive thematic analysis and narrative synthesis. Thematic analysis involves sorting of data, searching for themes by identifying patterns through tables or maps, and defining the themes.<sup>27</sup> Narrative synthesis includes exploring relationships in the data and assessing the validity of the data.<sup>28</sup> The data was coded by AK; the coding scheme and final themes were reviewed by SL.

## Results

31 papers were included in the review and are summarized in Tables 2 and 3. Seven of the strategies utilized web-based or mobile applications while twenty-four used EHRs. Thirteen of the papers were evaluations/descriptions of CHW programs, eleven were analyses (including randomized controlled trials) of CHW program outcomes, three were grey literature guides to implementation of CHW programs, two were perspective pieces, one was a case study, and one was a review. CHW programs were based in a variety of settings, including: academic hospitals or health systems (11); community clinics (8), two of which were closely affiliated with academic institutions; federally qualified health centers (3); and patient-centered medical homes (2), both of which were affiliated with academic institutions.

### Type of CHW access to health informatics

A majority of strategies for CHW-provider communication leveraged EHRs in the context of a variety of settings including community clinics and academic health systems. Nine papers reported CHWs having access to EHRs or EMRs, and five papers suggested this access should occur, but none of the paper specified in what format information would be captured.<sup>13,18,21,29–31,34,35,38,49–53</sup> Six papers discussed CHWs having access to specific forms, structured questionnaires, or templates in EHRs.<sup>20,32,33,36,37,39</sup> In one study, some of the CHWs input patient information directly into the EHR during the patient visit, while others took notes on paper and later input them into the EHR.<sup>13</sup> One paper suggested giving only CHW supervisors access to EHRs<sup>20</sup> while another had medical office assistants attach CHW documentation to the EHRs.<sup>40</sup> Two papers reported utilizing or suggested utilizing mobile applications for CHWs to collect patient information.<sup>41,54</sup> One program had CHWs document patient updates into an online research database,<sup>45</sup> while three utilized other web-based or cloud-based systems.<sup>42,43,46–48</sup> Of the programs using non-EHR web-based applications, all were associated with academic health systems; in one of these programs, reports generated from the system were faxed to the patient's provider to be added to the patient's medical record.<sup>47</sup>

### Role of health informatics for CHW documentation

A majority of papers reported utilizing health informatics to document patient notes/progress from CHW encounters. Because a majority of papers indicate that the purpose of documentation is to share this information with providers, degree of documentation may allow for increased potential amount of communication. In one program, this included documenting patients' health concerns and referrals made to social services.<sup>40</sup> The patient

notes also included clinical indicators and sociodemographic characteristics (e.g., literacy, blood pressure) as well as patients' knowledge of their disease, physical activity, and quality of life.<sup>47</sup> In another program, screening test results alerting the provider to follow up with the patient were documented.<sup>39</sup> CHWs also documented specific SDOH barriers in health information systems,<sup>32,36,37,44</sup> such as transportation, housing, and childcare<sup>32</sup> as well as actions taken to these address barriers.<sup>37</sup> All of the papers that described documentation of patient barriers were associated with multiple studies conducted within one academic institution in an urban setting. In three papers, it was explicitly discussed that CHWs documented and/or shared the patient's care plan or intervention.<sup>36,43,48</sup> Of note, less than half of the papers described the variables that were documented by CHWs.

### **Role of health informatics for direct CHW-patient and CHW-provider communication**

Of the studies utilizing health informatics for CHW-provider communication, many had uses beyond documentation of encounters. CHWs used EHRs to generate reminders for patient follow-up,<sup>18</sup> to make appointments with patients,<sup>18,21</sup> or to view patients' histories before patient visits.<sup>13,39</sup> Three papers utilized web-based/cloud-based applications to generate reports on data from CHW encounters, such as frequency of contact with patients and achievement of patient goals.<sup>42,43,46,47</sup> CHWs also used health informatics to communicate with providers through secure direct messaging systems<sup>18,41</sup> or referral systems.<sup>21</sup> Additionally, in one program, EHRs were used to augment the work of CHWs by implementing culturally tailored order sets;<sup>19</sup> order sets consist of a "bundle" of evidence-based guidelines and/or educational materials that help providers order the appropriate prescriptions/labs, and counsel patients in a standardized manner.<sup>19,55</sup> In a different program, clinical pathways were embedded into web-based applications to prompt CHWs to contact providers immediately when urgent concerns, such as critically abnormal blood pressures or glucose measurements, arose.<sup>46</sup> In another study, CHWs used an IT application to directly contact patients and provide them with educational resources.<sup>48</sup> Of the papers that recommended health informatics strategies, none mentioned uses beyond documentation of patient encounters.

### **Impact of health informatics on CHW-provider communication**

Several studies found that CHW utilization of EHRs and other health information technologies improved communication between CHWs and providers.<sup>18,33,38,50</sup> Two papers found that it allowed for CHWs to maintain continuous communication with providers with real-time patient updates.<sup>37,53</sup> CHW use of EHRs also increased the ability of CHWs to contact providers regarding patient concerns, augmenting the overall amount of communication.<sup>34</sup> In two papers, the improved CHW-provider communication resulting from utilization of EHRs was shown to be key in enhancing the role of CHWs in clinical teams.<sup>21,30</sup> In focus groups conducted among CHWs, it was found that CHWs were more likely to be recognized and valued by providers due to the improved communication. This was found to be a necessary step in helping providers consider CHWs a part of their care teams.<sup>34</sup>

Furthermore, improved communication with CHWs was found to fulfill the needs of providers and CHWs in enriching their abilities to provide care in academic and community



health systems. Providers indicated that they wanted CHWs to enter patient progress updates in EHRs<sup>49</sup> and that this documentation facilitated their communication with CHWs.<sup>49,50</sup> Specifically, EHR notes from CHWs allowed providers to view patients' clinical data at the same time as contextual information on sociocultural backgrounds to enhance their understanding of the patients' motivations to seek care.<sup>50,51</sup> This system allows for data collected by CHWs to be imparted onto providers, thus increasing the level of communication. In one paper, it was found that sharing information about patient visits with providers through reports generated from a web-based application were useful in highlighting issues that may need to be addressed at subsequent visits with the provider.<sup>47</sup> Similarly, using EHRs allowed CHWs to tailor their patient education by allowing them to view patients' histories and gain insight on the barriers the patient may be facing.<sup>39</sup>

### **Impact of health informatics on patient care**

Health informatics based communication between CHWs and providers was also found to impact patient care and outcomes. It was found that CHW utilization of EHRs and web-based applications facilitated better-coordinated care and improved patient outcomes in the context of community clinics, such as a 7% increase in colon cancer screening rates and decrease in mean hemoglobin A1C from 8.7% to 7.4% in diabetes patients after intervention.<sup>39,47</sup> Another paper found that a CHW based health informatics intervention was associated with improvement in smoking cessation (5.6 vs 1.3 mean decrease in cigarettes smoked daily in CHW-health informatics group compared to control group).<sup>43</sup>

### **Barriers presented by health informatics**

In a few papers, CHW use of health informatics was found to present certain challenges. For example, in a provider focus group, not all of the information documented by CHWs was found to be useful in clinical decision-making and was considered excessive by providers<sup>40,49</sup>. On the other hand, certain information that is relevant to clinical care, such as social determinants of health, were found to be difficult to track via EHRs because these technologies have not been designed to document this information<sup>51</sup>. Additionally, in one CHW program, some providers were unaware that they were able to view CHWs' notes in EHRs, which would limit the benefits of this form of communication. Furthermore, the providers who were aware of the CHW notes felt it was too complicated and time consuming to view the notes<sup>13</sup>.

### **Discussion**

A majority of the health informatics based strategies for CHW-provider communication identified through the 31 papers in the scoping review suggested giving CHWs access to EHRs, templates within EHRs, or web-based/cloud-based applications in order to provide a tool for CHW documentation of patient progress as well as communication of patient sociodemographic characteristics, clinical indicators, barriers, and action plans with providers. They also support CHW-provider and CHW-patient communication through additional features such as secure messaging systems and generated reports. The papers found that these strategies may allow for increased communication between CHWs and providers, deeper provider understanding of the patient with more tailored care, though most





To optimize this integration, EHRs should be complemented by regular healthcare team trainings on how to most effectively understand and utilize the social context data entered by CHWs in clinical decision-making.<sup>13</sup> This is important because CHWs are advocates for their patients and experts on their communities; effectively acknowledging their perspectives and integrating their work into clinic workflows creates a unique opportunity to provide enhanced, patient-centered, culturally tailored, and coordinated care in which cultural/linguistic barriers are reduced and patients are connected to appropriate community resources.<sup>9</sup> This elevated care in minority communities is a crucial component of reducing disease severity and working towards health equity. Moreover, as CHWs continue to become more integrated into clinical settings, they are at risk of becoming medicalized and their identities and impacts are being lost. CHWs utilizing EHRs and becoming habituated to the clinical algorithms and medical pathways embedded into such systems may propagate this process. Guidance from both community members and healthcare leaders in order to clearly define CHW identities, expectations, and roles as well as tailoring EHRs and relevant trainings will help minimize medicalization while highlighting the perspectives of CHWs.<sup>60</sup>

There are several limitations to this review. First, this review did not address the cost of different health informatics platforms as it was beyond the scope of the review, though it is an important area of research. The search, study selection, and study extraction were conducted by one reviewer, which could have allowed for selection bias. While the search was expanded to include terms alternately used for CHWs, papers using other terms for this role could have been missed. In addition, because papers were excluded based on titles and abstracts, it is possible that relevant papers were missed. However, this methodology allowed for us to identify a broader range of literature. Finally, because a scoping review, rather than a systematic review, was conducted, the quality of papers was not assessed using a standardized criteria.

## Acknowledgements:

We would like to thank the community health workers that are a part of NYU Department of Population Health's Section for Health Equity for their efforts and ongoing feedback on program enhancement.

**Funding:** This publication was supported by the National Institutes of Health (NIH) National Institute on Minority Health and Health Disparities (NIMHD) grant U54MD000538; Centers for Disease Control and Prevention (CDC) Grant U48DP001904; NIH National Institute of Diabetes and Digestive Kidney Diseases (NIDDK) grants R01DK110048 and R18DK110740; and NIH National Center for the Advancement of Translational Science (NCATS) Grant UL1TR001445. The contents of this publication are solely the responsibility of the authors and do not necessarily represent the official views of the NIH NIMHD, CDC, NIH NIDDK, or NIH NCATS.

## REFERENCES

1. Johnson-Askew WL, Gordon L, Sockalingam S. Practice paper of the American Dietetic Association: addressing racial and ethnic health disparities. *J Am Diet Assoc.* 2011;111(3):446–456. [PubMed: 21338747]
2. Institute of Medicine Committee on U, Eliminating R, Ethnic Disparities in Health C. In: Smedley BD, Stith AY, Nelson AR, eds. *Unequal Treatment: Confronting Racial and Ethnic Disparities in Health Care.* Washington (DC): National Academies Press (US)
3. Institute of M The National Academies Collection: Reports funded by National Institutes of Health. In: Smedley BD, Stith AY, Nelson AR, eds. *How Far Have We Come in Reducing Health Disparities? Progress Since 2000: Workshop Summary.* Washington (DC): National Academies Press (US) National Academy of Sciences.; 2012.

4. Fisher TL, Burnet DL, Huang ES, Chin MH, Cagney KA. Cultural leverage: interventions using culture to narrow racial disparities in health care. *Medical care research and review : MCRR*. 2007;64(5 Suppl):243s–282s. [PubMed: 17881628]
5. Islam NS, Kwon SC, Wyatt LC, et al. Disparities in diabetes management in Asian Americans in New York City compared with other racial/ethnic minority groups. *American journal of public health*. 2015;105 Suppl 3:S443–446. [PubMed: 25905853]
6. Chin MH, Clarke AR, Nocon RS, et al. A roadmap and best practices for organizations to reduce racial and ethnic disparities in health care. *J Gen Intern Med*. 2012;27(8):992–1000. [PubMed: 22798211]
7. Clarke AR, Goddu AP, Nocon RS, et al. Thirty years of disparities intervention research: what are we doing to close racial and ethnic gaps in health care? *Med Care*. 2013;51(11):1020–1026. [PubMed: 24128746]
8. Force CPST. Guide to Community Preventive Services. *Community Health Workers. The Community Guide*. 2017.
9. Islam N, Nadkarni SK, Peretz PJ, et al. Integration of Community Health Workers into Primary Care Health Systems: The Time for New York is Now! NYU-CUNY Prevention Research Center. 2016.
10. Love MB, Gardner K, Legion V. Community health workers: who they are and what they do. *Health education & behavior : the official publication of the Society for Public Health Education*. 1997;24(4):510–522. [PubMed: 9247828]
11. Association APH. Support for Community Health Workers to Increase Health Access and to Reduce Health Inequities. 2009.
12. Islam N, Nadkarni SK, Zahn D, Skillman M, Kwon SC, Trinh-Shevrin C. Integrating community health workers within Patient Protection and Affordable Care Act implementation. *Journal of public health management and practice : JPHMP*. 2015;21(1):42–50. [PubMed: 25414955]
13. Reinschmidt KM, Ingram M, Morales S, et al. Documenting Community Health Worker Roles in Primary Care: Contributions to Evidence-Based Integration Into Health Care Teams, 2015. *The Journal of ambulatory care management*. 2017;40(4):305–315. [PubMed: 28350634]
14. Roland KB, Milliken EL, Rohan EA, et al. Use of Community Health Workers and Patient Navigators to Improve Cancer Outcomes Among Patients Served by Federally Qualified Health Centers: A Systematic Literature Review. *Health equity*. 2017;1(1):61–76. [PubMed: 28905047]
15. Krieger JW, Takaro TK, Song L, Weaver M. The Seattle-King County Healthy Homes Project: a randomized, controlled trial of a community health worker intervention to decrease exposure to indoor asthma triggers. *American journal of public health*. 2005;95(4):652–659. [PubMed: 15798126]
16. Fedder DO, Chang RJ, Curry S, Nichols G. The effectiveness of a community health worker outreach program on healthcare utilization of west Baltimore City Medicaid patients with diabetes, with or without hypertension. *Ethnicity & disease*. 2003;13(1):22–27. [PubMed: 12723008]
17. Findley S, Matos S, Hicks A, Chang J, Reich D. Community health worker integration into the health care team accomplishes the triple aim in a patient-centered medical home: a Bronx tale. *J Ambul Care Manage*. 2014;37(1):82–91. [PubMed: 24309397]
18. Allen CG, Escoffery C, Satsangi A, Brownstein JN. Strategies to Improve the Integration of Community Health Workers Into Health Care Teams: “A Little Fish in a Big Pond”. *Preventing chronic disease*. 2015;12:E154. [PubMed: 26378900]
19. Lopez PM, Zanowiak J, Goldfeld K, et al. Protocol for project IMPACT (improving millions hearts for provider and community transformation): a quasi-experimental evaluation of an integrated electronic health record and community health worker intervention study to improve hypertension management among South Asian patients. *BMC health services research*. 2017;17(1):810. [PubMed: 29207983]
20. Allen C, Brownstein JN, Mirambeau A, Jayapaul-Philip B. Technical Assistance Guide for States Implementing Community Health Worker Strategies. CDC 2014.
21. Johnson SL, Gunn VL. Community Health Workers as a Component of the Health Care Team. *Pediatric clinics of North America*. 2015;62(5):1313–1328. [PubMed: 26318954]
22. Hemmat M, Ayatollahi H, Maleki M, Saghafi F. Future Research in Health Information Technology: A Review. *Perspectives in health information management*. 2017;14(1b).

23. Cottrell EK, Gold R, Likumahuwa S, et al. Using Health Information Technology to Bring Social Determinants of Health into Primary Care: A Conceptual Framework to Guide Research. *Journal of health care for the poor and underserved*. 2018;29(3):949–963. [PubMed: 30122675]
24. Bassi J, Lau F. Measuring value for money: a scoping review on economic evaluation of health information systems. *Journal of the American Medical Informatics Association : JAMIA*. 2013;20(4):792–801. [PubMed: 23416247]
25. Levac D, Colquhoun H, O'Brien KKJIS. Scoping studies: advancing the methodology. 2010;5(1):69.
26. Systemic Reviews: the process: Grey Literature. Duke University. Published 2019. Accessed 2019.
27. Nowell LS, Norris JM, White DE, Moules NJ. Thematic Analysis: Striving to Meet the Trustworthiness Criteria. *International Journal of Qualitative Methods*. 2017;16(1):1609406917733847.
28. Oliver S, Vojtkova M. Narrative approaches to systematic review and synthesis of evidence for international development policy and practice AU - Snilstveit, Birte. *Journal of Development Effectiveness*. 2012;4(3):409–429.
29. Valaitis RK, Carter N, Lam A, Nicholl J, Feather J, Cleghorn L. Implementation and maintenance of patient navigation programs linking primary care with community-based health and social services: a scoping literature review. *BMC health services research*. 2017;17(1):116. [PubMed: 28166776]
30. Gunn CM, Clark JA, Battaglia TA, Freund KM, Parker VA. An assessment of patient navigator activities in breast cancer patient navigation programs using a nine-principle framework. *Health services research*. 2014;49(5):1555–1577. [PubMed: 24820445]
31. Gunn C, Battaglia TA, Parker VA, et al. What Makes Patient Navigation Most Effective: Defining Useful Tasks and Networks. *Journal of health care for the poor and underserved*. 2017;28(2):663–676. [PubMed: 28529216]
32. Horny M, Glover W, Gupte G, Saraswat A, Vimalananda V, Rosenzweig J. Patient navigation to improve diabetes outpatient care at a safety-net hospital: a retrospective cohort study. *BMC health services research*. 2017;17(1):759. [PubMed: 29162073]
33. Jolly SE, Navaneethan SD, Schold JD, et al. Development of a chronic kidney disease patient navigator program. *BMC nephrology*. 2015;16:69. [PubMed: 26024966]
34. King C, Goldman A, Gampa V, et al. Strengthening the role of Community Health Representatives in the Navajo Nation. *BMC public health*. 2017;17(1):348. [PubMed: 28431541]
35. Ngo V, Hammer H, Bodenheimer T. Health coaching in the teamlet model: a case study. *Journal of general internal medicine*. 2010;25(12):1375–1378. [PubMed: 20862560]
36. Ramachandran A, Freund KM, Bak SM, Heeren TC, Chen CA, Battaglia TA. Multiple barriers delay care among women with abnormal cancer screening despite patient navigation. *Journal of women's health (2002)*. 2015;24(1):30–36.
37. Rohan EA, Slotman B, DeGross A, Morrissey KG, Murillo J, Schroy P. Refining the Patient Navigation Role in a Colorectal Cancer Screening Program: Results From an Intervention Study. *Journal of the National Comprehensive Cancer Network : JNCCN*. 2016;14(11):1371–1378. [PubMed: 27799508]
38. Spiro A, Oo SA, Marable D, Collins JP. A unique model of the community health worker: the MGH Chelsea Community Health Improvement team. *Family & community health*. 2012;35(2):147–160. [PubMed: 22367262]
39. Vora S, Lau JD, Kim E, Sim SC, Oster A, Pong P. Patient Navigation Program for Colorectal Cancer Screening in Chinese Americans at an Urban Community Health Center: Lessons Learned. *Journal of health care for the poor and underserved*. 2017;28(3):887–895. [PubMed: 28804067]
40. Wennerstrom A, Bui T, Harden-Barrios J, Price-Haywood EG. Integrating community health workers into a patient-centered medical home to support disease self-management among Vietnamese Americans: lessons learned. *Health promotion practice*. 2015;16(1):72–83. [PubMed: 25139872]
41. Cherrington AL, Agne AA, Lampkin Y, et al. Diabetes Connect: Developing a Mobile Health Intervention to Link Diabetes Community Health Workers With Primary Care. *The Journal of ambulatory care management*. 2015;38(4):333–345. [PubMed: 26353025]

42. Kangovi S, Mitra N, Grande D, et al. Patient-centered community health worker intervention to improve posthospital outcomes: a randomized clinical trial. *JAMA internal medicine*. 2014;174(4):535–543. [PubMed: 24515422]
43. Kangovi S, Mitra N, Grande D, Huo H, Smith RA, Long JA. Community Health Worker Support for Disadvantaged Patients With Multiple Chronic Diseases: A Randomized Clinical Trial. *American journal of public health*. 2017;107(10):1660–1667. [PubMed: 28817334]
44. DeGroff A, Schroy PC 3rd, Morrissey KG, et al. Patient Navigation for Colonoscopy Completion: Results of an RCT. *American journal of preventive medicine*. 2017;53(3):363–372. [PubMed: 28676254]
45. Justvig SP, Li J, Caravella G, et al. Improving Adherence to Care Recommendations Using a Community Health Worker (CHW) Intervention with the Pediatric Medical Home. *Journal of community health*. 2017;42(3):444–452. [PubMed: 27743336]
46. Kane EP, Collinsworth AW, Schmidt KL, et al. Improving diabetes care and outcomes with community health workers. *Family practice*. 2016;33(5):523–528. [PubMed: 27418587]
47. Walton JW, Snead CA, Collinsworth AW, Schmidt KL. Reducing diabetes disparities through the implementation of a community health worker-led diabetes self-management education program. *Family & community health*. 2012;35(2):161–171. [PubMed: 22367263]
48. Percac-Lima S, Ashburner JM, Zai AH, et al. Patient Navigation for Comprehensive Cancer Screening in High-Risk Patients Using a Population-Based Health Information Technology System: A Randomized Clinical Trial. *JAMA internal medicine*. 2016;176(7):930–937. [PubMed: 27273602]
49. Brown A, Wong G, Gore R, Schwartz M. Baseline Assessment of Providers' Perspectives on Integrating Community Health Workers into Primary Care Teams to Improve Diabetes Prevention (google search).
50. Collinsworth A, Vulimiri M, Snead C, Walton J. Community health workers in primary care practice: redesigning health care delivery systems to extend and improve diabetes care in underserved populations. *Health promotion practice*. 2014;15(2 Suppl):51s–61s. [PubMed: 25359249]
51. Ingram M, Doubleday K, Bell ML, et al. Community Health Worker Impact on Chronic Disease Outcomes Within Primary Care Examined Using Electronic Health Records. *American journal of public health*. 2017;107(10):1668–1674. [PubMed: 28817321]
52. Matiz LA, Peretz PJ, Jacotin PG, Cruz C, Ramirez-Diaz E, Nieto AR. The impact of integrating community health workers into the patient-centered medical home (similar to Integratig Community Health Workers). *Journal of primary care & community health*. 2014;5(4):271–274.
53. Whiteman LN, Gibbons MC, Smith WR, Stewart RW. Top 10 Things You Need to Know to Run Community Health Worker Programs: Lessons Learned in the Field. *Southern medical journal*. 2016;109(9):579–582. [PubMed: 27598368]
54. Broderick A, Barnett K. Community Health Workers in California: Sharpening Our Focus on Strategies to Expand Engagement. California Health Workforce Alliance. 2015.
55. Clinical Decision Support: More than just 'Alerts' Tipsheet. Centers for Medicare & Medicaid Services.
56. Schlotthauer AE, Badler A, Cook SC, Perez DJ, Chin MH. Evaluating interventions to reduce health care disparities: an RWJF program. *Health affairs (Project Hope)*. 2008;27(2):568–573. [PubMed: 18332515]
57. Divney AA, Lopez PM, Huang TT, Thorpe LE, Trinh-Shevrin C, Islam NS. Research-grade data in the real world: challenges and opportunities in data quality from a pragmatic trial in community-based practices. *Journal of the American Medical Informatics Association*. 2019.
58. Hasnain-Wynia R, Baker DW, Nerenz D, et al. Disparities in health care are driven by where minority patients seek care: examination of the hospital quality alliance measures. *Archives of internal medicine*. 2007;167(12):1233–1239. [PubMed: 17592095]
59. Gold R, Bunce A, Cowburn S, et al. Adoption of Social Determinants of Health EHR Tools by Community Health Centers. *Annals of family medicine*. 2018;16(5):399–407. [PubMed: 30201636]

60. Garfield C, Kangovi S. Integrating Community Health Workers Into Health Care Teams Without Coopting Them. In. Health Affairs Blog: Health Affairs; 2019.

Author Manuscript

Author Manuscript

Author Manuscript

Author Manuscript

### Implications for Policy and Practice

- Given current policies, such as the Patient Protection and Affordable Care Act, continue to support CHWs through grant funding, it is important to evaluate their impact in clinical settings and improve their efficiency and efficacy to optimize health outcomes, especially for racial and ethnic minority communities.
- To improve CHW integration into clinics and communication with providers, encouraging direct CHW utilization of EHRs may be a best practice, particularly for capturing SDOH data and other contextual factors faced by patients that CHWs are uniquely suited to discover and document. However, careful attention must be placed on setting clear expectations, maintaining community identities, defining a unique scope of work, and integrating workflows for CHWs through balanced health-community partnerships.<sup>60</sup>
- To optimize CHW utilization of technology, further research should be done on conducting regular trainings for CHWs and healthcare providers regarding documentation and interpretation of SDOH data and other CHW-collected data on patient needs and experiences.
- To overcome implementation barriers in smaller community clinics, further research should be done on sustainability and efficacy of CHW use of health informatics in these settings to help guide local policies and municipal agencies in providing appropriate resources to support technologies that can be utilized by CHWs.



### Identifying the Research Question

- "How can health informatics communication strategies between community health workers and providers be improved regarding patient progress?"

### Identifying Relevant Studies

- Key search terms searched in PubMed and Google
- Reference lists hand searched

### Study Selection

- Inclusion and exclusion criteria applied to titles, abstracts, and full records

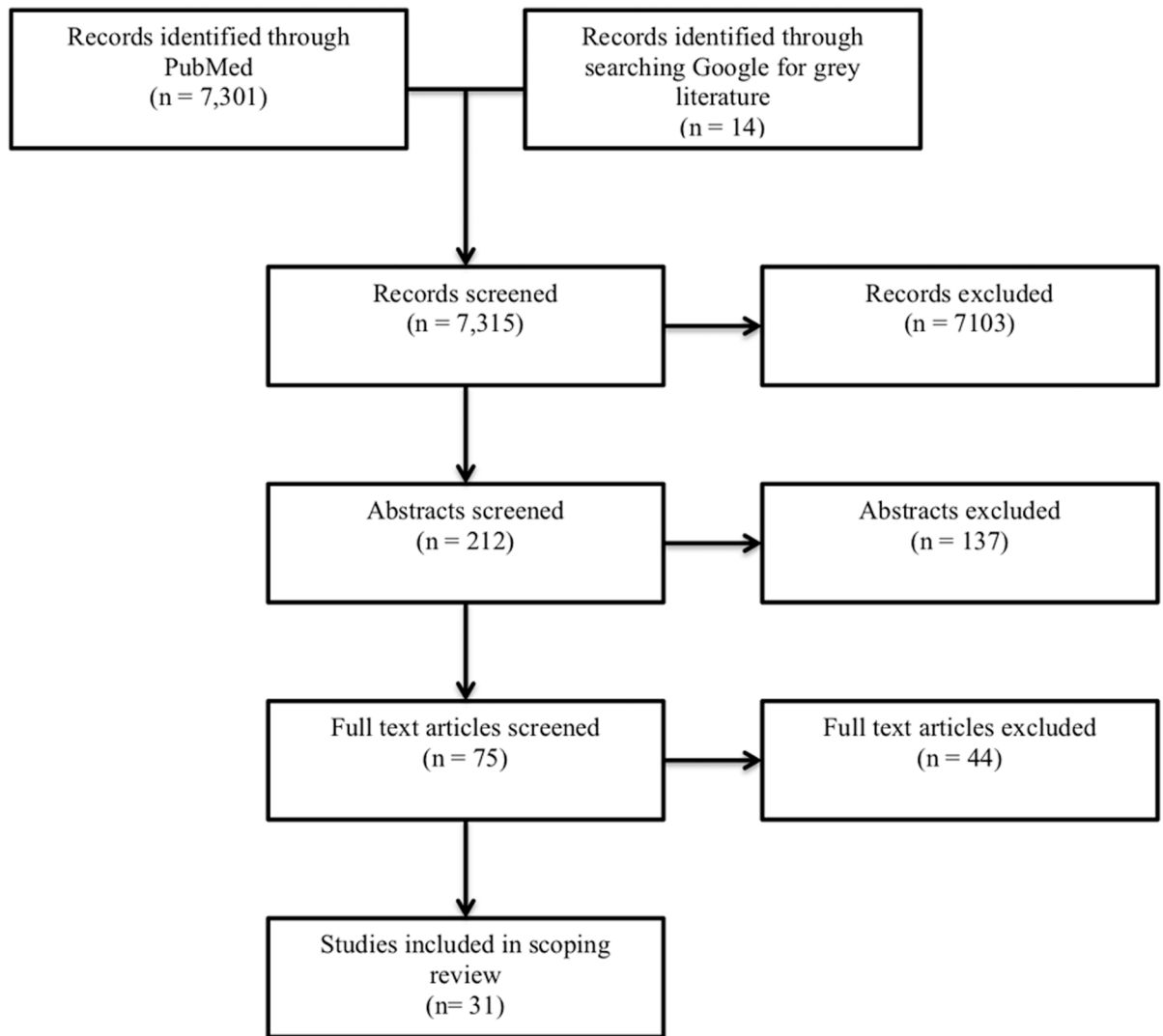
### Charting the Data

- Key aspects of literature summarized in Excel
  - e.g., strategy for CHW-provider communication, impacts of benefits of strategy, content of strategy

### Collating/Summarizing/Reporting Results

- Summarized data categorized into EHR-based or web-based
  - based on strategy for CHW-provider communication
- Key themes identified in summarized data

**Figure 1:**  
Overview of Methodology



**Figure 2:**  
Study Selection Process

**Table 1.**

Key Search Terms

<b>Concept or intervention</b>	<b>Context</b>
Community health worker(s)	Integration
CHW(s)	Strategy
Patient navigator(s)/navigation	Communication
Promotore(s)	

Author Manuscript

Author Manuscript

Author Manuscript

Author Manuscript

**Table 2.**

Characteristics of Included Studies Utilizing Health Informatics Strategies

Type of Health Informatics Technology	Primary Role of Health Informatics in Communication	First Author	Study Type	Setting	Comments on Strategy
EHR – Direct Access	Direct CHW Communication with Providers  Documentation of CHW Encounters	Allen <i>et al.</i> , 2015 <sup>18</sup>	Evaluation of CHW perspectives	CHWs recruited from American Public Health Association	CHWs used EHRs to communicate directly and indirectly with providers, make appointments, and track patients
		Valaitis <i>et al.</i> <sup>29</sup>	Scoping review	Patient navigator programs across US	Navigators used EHRs to share information with providers
		Gunn <i>et al.</i> , 2014 <sup>30</sup>	Exploratory study	Patient navigation programs across US	Navigators used EMRs, charts, or other systems to document patient care
		Gunn <i>et al.</i> , 2017 <sup>31</sup>	Mixed-methods analysis	Patient Navigation Research Program	Navigators documented/communicated patient progress with providers via EMR/IT systems
		Homy <i>et al.</i> <sup>2</sup>	Retrospective cohort study	Boston Medical Center	Navigators recorded information, including patient barriers, in detailed navigator template forms in EMRs
		Johnson <i>et al.</i> <sup>1</sup>	Perspective on CHWs	Children’s Hospital of Wisconsin	CHWs used EHRs to receive providers’ referrals and document patient progress
		Jolly <i>et al.</i> <sup>3</sup>	Description of program	Cleveland Clinic	Navigators used EHR templates to document/communicate patient data
		King <i>et al.</i> <sup>4</sup>	Evaluation of programs	Navajo clinics in Southwest US	CHWs documented patient encounters in EHR
		Ngo <i>et al.</i> <sup>5</sup>	Guide	Sinat Urban Health Institute	CHWs documented case notes in EHRs
		Ramachandran <i>et al.</i> <sup>6</sup>	Secondary analysis	Boston Patient Navigation Research Program	Navigators documented patient encounters, barriers to care, care plans, and progress in a template in EHR
EHR – Indirect Access	Documentation of CHW Encounters	Reinschmidt <i>et al.</i> <sup>3</sup>	Evaluation of programs	Federally Qualified Health Centers in Arizona	CHWs documented patient encounters into EHRs (directly during visits or copy from paper)
		Rohan <i>et al.</i> <sup>7</sup>	Randomized trial	Boston Medical Center	Navigators documented patient notes in medical records system form
		Spiro <i>et al.</i> <sup>8</sup>	Description of CHW model	Massachusetts General Hospital Chelsea Community Health	CHWs entered patient progress into EMRs
		Vora <i>et al.</i> <sup>9</sup>	Report on program	Charles B Wang Community Health Center	Navigators updated patient flow sheet in EMR; navigators reviewed patient history and patients’ barriers in EMR
		Wennerstrom <i>et al.</i> <sup>0</sup>	Description and evaluation of program	Patient Centered Medical Home in Louisiana	CHWs tracked patient information in electronic spreadsheets; medical office assistants attached spreadsheets to EHR

Type of Health Informatics Technology	Primary Role of Health Informatics in Communication	First Author	Study Type	Setting	Comments on Strategy
	Other	Lopez <i>et al</i> <sup>9</sup>	Protocol for randomized controlled trial	Community clinics in New York City	EHR intervention (routine patient registry reports, medical alerts, culturally tailored order sets) combined with CHW program
<b>Mobile Applications</b>	Direct CHW Communication with Providers AND Documentation of CHW Encounters	Cherrington <i>et al</i> <sup>41</sup>	Description of web application	Congregations for Public Health and Cooper Green Mercy Health System	CHWs used web based mobile application to document progress reports, track patients, and communicate with healthcare team
<b>Cloud Based Systems</b>	Direct CHW Communication with Providers AND Documentation of CHW Encounters	Kangovi <i>et al</i> , 2014 <sup>42</sup> Kangovi <i>et al</i> , 2017 <sup>43</sup>	Randomized clinical trial	University of Pennsylvania IMPaCT Model	CHWs utilized cloud based software that integrates with EHRs to track workflow, analyze patient progress, create reports, and can be used to message providers
<b>Web-Based Systems</b>	Documentation of CHW Encounters	DeGroff <i>et al</i> <sup>44</sup>	Randomized control trial	Boston Medical Center	Navigators documented participant barriers in navigator database
		Justwig <i>et al</i> <sup>45</sup>	Prospective description	Stony Brook University Hospital	CHWs documented patient visits in Research Electronic Data Capture
		Kane <i>et al</i> <sup>46</sup> Walton <i>et al</i> <sup>47</sup>	Analysis of CHW program outcomes	Baylor Health Care System/ Baylor Scott and White Health community clinics	CHWs and providers utilized a HIPAA compliant web-based system to record patient progress and create reports that were added to patient's medical records
		Percac-Lima <i>et al</i> <sup>48</sup>	Randomized clinical trial	Massachusetts General Primary Care Practice Research Network	Navigators used IT application to track/contact patients and document interventions

**Table 3.** Characteristics of Included Studies Recommending Health Informatics Strategies

Type of Health Informatics Technology	Primary Role of Health Informatics in Communication	First Author	Study Type	Setting	Comments on Strategy
<b>EHR – Direct Access</b>	Documentation of CHW Encounters	Allen <i>et al.</i> , 2014 <sup>20</sup>	Guide	CHW programs in US	Recommend giving supervisor access to EHR or CHW access to EHR templates
		Brown <i>et al.</i> <sup>69</sup>	Evaluation of provider views	Bellevue and VA NY Harbor Hospitals	Suggest CHWs enter patient updates into EHRs
		Collinsworth <i>et al.</i> <sup>70</sup>	Evaluation of programs	Community clinics in Dallas	Suggest giving CHWs access to EHRs
		Ingram <i>et al.</i> <sup>71</sup>	Qualitative analysis	Federally qualified health centers	Suggest CHWs use EHRs to collect data
<b>Mobile Applications</b>	Documentation of CHW Encounters	Matiz <i>et al.</i> <sup>72</sup>	Case study	Patient Centered Medical Homes in New York City	Suggest CHW data collection via EHRs rather than paper forms
		Whiteman <i>et al.</i> <sup>73</sup>	Perspective on programs	N/A	Suggest CHWs should record patient progress summaries in EMRs
		Broderick <i>et al.</i> <sup>74</sup>	Guide	CHW programs in California	Recommend partnering with mobile health technology organizations to utilize CHW mobile data collection strategies