

## Roles for community health workers in diabetes prevention and management in low- and middle-income countries

O papel dos agentes comunitários de saúde na prevenção e manejo do diabetes em países de renda baixa e média

Roles de trabajadores comunitarios en salud para la prevención y gestión de la diabetes en países con medios y bajos ingresos

Masih A. Babagoli <sup>1,2</sup>  
Ramfis Nieto-Martínez <sup>3,4</sup>  
Juan P. González-Rivas <sup>5,6</sup>  
Kavita Sivaramakrishnan <sup>7</sup>  
Jeffrey I. Mechanick <sup>8,9</sup>

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### Abstract

Diabetes prevalence is increasing worldwide, especially in low- and middle-income countries (LMIC), posing the need for improved detection and management strategies. Chronic disease models and lifestyle medicine provide structures for action. Community health workers (CHWs) can significantly contribute to chronic disease care if they are trained and integrated into low-resource health systems. Although most current CHWs worldwide are performing maternal/child health and infectious disease-related tasks, other programs involving CHWs for noncommunicable disease prevention and management are increasing. In this article, we discuss the advantages, challenges, and questions regarding possible roles assigned to CHWs in the prevention and management of diabetes. These roles include performing simple screening tests, implementing lifestyle/behavioral interventions, and connecting patients with alternatives to biomedicine. Specifically, CHWs can aid diabetes epidemiological surveillance by conducting risk score-based screening or capillary glucose testing, and they can facilitate diabetes self-management by delivering interventions described in the transcultural diabetes nutrition algorithm. Furthermore, while this role has not formally been assigned, CHWs can leverage their intimate knowledge of local practices to provide decision-making support to patients in environments with pluralistic health systems. Ethnocultural differences in CHW functions and transcultural adaptations of their roles in diabetes care should also be considered. In summary, CHWs can improve diabetes care by screening high-risk individuals and implementing lifestyle interventions, especially in LMIC.

Community Health Workers; Delivery of Health Care; Diabetes Mellitus; Risk Reduction Behavior

### Correspondence

M. A. Babagoli  
24 Dinuba, Irvine/CA – 92602, U.S.A.  
mab2357@columbia.edu

<sup>1</sup> Institute for Global Health Sciences, University of California, San Francisco, U.S.A.

<sup>2</sup> Center for the History and Ethics of Public Health, Columbia University, New York, U.S.A.

<sup>3</sup> LifeDoc Health, Memphis, U.S.A.

<sup>4</sup> Harvard TH Chan School of Public Health, Harvard University, Boston, U.S.A.

<sup>5</sup> Foundation for the Clinic, Public Health, and Epidemiological Research of Venezuela, Caracas, Venezuela.

<sup>6</sup> International Clinical Research Center, St Anne's University Hospital, Brno, Czech Republic.

<sup>7</sup> Mailman School of Public Health, Columbia University, New York, U.S.A.

<sup>8</sup> Kravis Center for Clinical Cardiovascular Health at Mount Sinai Heart, New York, U.S.A.

<sup>9</sup> Division of Endocrinology, Diabetes and Bone Disease, Icahn School of Medicine at Mount Sinai, New York, U.S.A.



## Introduction

Globally, the prevalence of diabetes has increased from 151 million people in 2000 to 463 million people in 2019 <sup>1</sup>, which is largely associated with increases in body mass indices (BMI) <sup>2</sup>. Furthermore, 79% of individuals with diabetes are in low- and middle-income countries (LMIC) <sup>1</sup>. Generally, LMIC have low-quality, fragmented health care systems, and it has been estimated that 60% of deaths result from the poor quality of care of treatable conditions <sup>3</sup>. Although there are excellent clinical practice guidelines and algorithms derived from high-quality intervention studies to prevent and treat diabetes and transcultural aspects of such interventions have been considered <sup>4</sup>, the accessibility to these proven interventions to all socioeconomic strata and their sustainability over time are barriers to a large-scale implementation <sup>5</sup>. Therefore, low-resource settings need cost-effective interventions to improve access to quality health care.

Community health workers (CHWs) encompass multiple types of mid-level healthcare workers who link healthcare professionals with communities by providing health education, referrals, and preventive healthcare measures, as well as helping communities, families, and individuals to gain access to curative health and social services <sup>6</sup>. There are currently an estimated 5 million CHWs worldwide, with approximately 2.3 million across three CHW programs in India <sup>7</sup>. Most CHWs focus on infectious diseases and maternal/child health. There is, however, increasing evidence of CHWs' potential roles in non-communicable disease, and specifically diabetes, care in LMIC <sup>8,9</sup>. The American Association of Diabetes Educators has endorsed the role of CHWs, including them in Level 1 of the five levels of diabetes educators <sup>10</sup>. Furthermore, recent studies have reviewed the benefits of CHWs in preventing diabetes <sup>11</sup> and to implementation of CHW programs for diabetes care in LMIC <sup>8</sup>.

The chronic disease care model provides a framework for implementing lifestyle medicine interventions on diabetes in primary care settings and, at this level, CHWs can develop specific roles within the organizational structure of the healthcare system <sup>12</sup>. The World Health Organization (WHO) has developed a guideline to support CHW programs <sup>6</sup>, but specific recommendations must be adapted to each culture. This is called transculturalization: the process of adapting evidence-based recommendations from one culture to another using experts from both cultures in an interactive setting <sup>4,13</sup>.

In this article, we aim to discuss the advantages, challenges, and remaining questions concerning three a priori roles of CHWs in diabetes prevention and management: (1) performing simple screening, risk-stratification, and diagnostic testing and providing referrals for higher-level care; (2) implementing lifestyle/behavioral interventions; and (3) providing support to individuals seeking non-traditional care (Box 1). We consider the gap filled by CHWs in the health system and supporting evidence with specific programs employing CHWs in each role. Additionally, we discuss ethnocultural differences in CHWs' functions and transcultural adaptations of their roles in diabetes care to understand how they can improve the success of CHW programs.

### Role 1: to identify individuals at high-risk for diabetes and refer them to higher-level care

#### Gap

Identifying subjects at risk of developing diabetes is a cornerstone for the timely implementation of preventive measures <sup>4,14</sup>. In places with limited healthcare information and data, low utilization of the health care system, and/or significant distances to the nearest health centers, it is necessary to identify individuals at risk for diabetes and engage them with the health system <sup>9</sup>. CHWs can perform screening tests either by visiting households or by having community-based sessions. While individual diabetes risk can be estimated using non-invasive screening tools, such as the *Finnish Diabetes Risk Score*, capillary glucose testing (CGT) can be an alternative. With support from mobile electronic decision support systems (EDSS) or locally generated clinical practice guidelines, CHWs can initiate referrals to higher-level care for individuals identified as high-risk for diabetes and continue to provide support for them.

**Box 1**

Summary of community health worker (CHW) programs/studies to improve prevention and care for diabetes or other noncommunicable disease (NCD) in low- and middle-income countries (LMIC).

ROLE	GAP	EVIDENCE IN LMIC COUNTRY/INTERVENTION/RESULT	CULTURAL COMPONENTS TO BE ADDRESSED	CONCLUSION
Identifying high-risk individuals using risk scores or CGT and facilitating referrals for diagnosis and treatment.	Epidemiological surveillance and community-health system connection.	Iran / CHWs screen individuals to identify those at high-risk for diabetes and refer them to rural community centers / Along with other roles, a decrease in FBG levels was shown <sup>15,16,17,73</sup> . Bangladesh, Guatemala, Mexico, and South Africa / CHWs screened community members at high-risk for CVD and provided either urgent or non-urgent referrals / Lower follow-up rate among those receiving non-urgent referrals <sup>18</sup> .	Using screening tool validated to regional ethnocultural parameters. Referral follow-up to identify local barriers for reaching health care in community centers.	Though limited evidence specific to diabetes, screening of individuals and other interventions by CHWs improved NCD outcomes. Local challenges in ensuring patient follow-up must be addressed.
		India / CHWs conduct CGT as one input in a CVD risk assessment tool; mobile EDSS calculates CVD risk, refers high-risk patients to physicians, and provides decision support to physicians for medication prescription / No significant effect on blood pressure levels <sup>22</sup> .	Acceptance of increased clinical role by relevant medical institutions and the community.	It has the potential to improve epidemiological surveillance and increase referral follow-up rates.
Counseling to improve nutrition, physical activity, medication adherence, and disease-specific knowledge.	Facilitate behavior changes and type 2 diabetes self-management.	Iran / CHWs hold training sessions on healthy diet and lifestyle habits for those at high-risk for diabetes; CHWs followed-up those with type 2 diabetes diagnosis to ensure medication supply, adherence and check for new symptoms / Along the epidemiological surveillance, this program has been shown to decrease FBG <sup>15,16,17,73</sup> .	Physical activity and medical nutritional therapy goals developed according to the population's lifestyle factors, customs, culture, and preferences. Diabetes education programs tailored to integrate regional perceptions of the disease.	Evidence differs in terms of length of study, a combination of interventions, and training of CHWs. However, improvements in biochemical markers and treatment adherence has been reported. Transcultural adaptations of behavioral interventions and goals may improve outcomes.
		Mexico / CHWs provided psychosocial support, counseling for medication adherence, and basic education on the disease for individuals with type 2 diabetes and/or hypertension / Significant improvement of disease control and treatment adherence <sup>41</sup> .		
		Guatemala / CHWs conducted weekly home visits to monitor treatment adherence, monitored patients' progress at clinics, and held group meetings for diabetics / After 4 months, biochemical markers improved, but no change in health behavior or diabetes knowledge were shown <sup>42</sup> .		
		Brazil / CHWs trained in motivational interviewing and behavioral action-planning conducted home visits for patients with poorly controlled diabetes / After 6 months, physical activity and biochemical markers improved, but no change in dietary habits <sup>43</sup> .		
		Pakistan / Lay health workers delivered home health education every 3 months focusing on improving diet, increasing physical activity, and decreasing smoking; another intervention involved training general practitioners in hypertension management / Treatment with both interventions combined had the greatest effect on reducing blood pressure and was the most cost-effective <sup>45,46</sup> .		

(continues)

**Box 1 (continued)**

ROLE	GAP	EVIDENCE IN LMIC COUNTRY/INTERVENTION/RESULT	CULTURAL COMPONENTS TO BE ADDRESSED	CONCLUSION
Providing support to use integrative medicine alternatives in environments with pluralistic health systems.	Connections with integrative medicine.	No published evidence formally assigning CHWs to this role in LMIC.	Understanding traditional systems of care and concerns or difficulties in seeking allopathic care. Include CHW-led integrative health care interventions. The most widely used therapies among patients with diabetes are nutritional/dietary and herbal supplements, nutritional advice, spiritual healing, and relaxation techniques (yoga).	There are no previous studies regarding this role. However, there is potential to improve community-health system connection and health system utilization in environments with integrative health care options.

CGT: capillary glucose testing; CVD: cardiovascular disease; EDSS: electronic decision support systems; FBG: fasting blood glucose.

### **Evidence**

- **Risk scores-based screening**

In Iran's Behvarz program, CHWs are actively involved in epidemiological screening for diabetes. CHWs are chosen from each community and receive two years of initial training followed by continued in-service training<sup>15</sup>. Based on their specific roles in Iran's National Diabetes Control and Prevention Program, CHWs conduct the first level of diabetes screening of the population in their area to find individuals at high risk for diabetes – based on age, weight, history of gestational diabetes and macrosomia, blood pressure, and diabetes symptoms – and refer them to physicians in rural community centers for early diagnosis and treatment<sup>16</sup>. This program, which includes other integrated interventions, has been shown to decrease fasting blood glucose (FBG) with an incrementally greater effect based on CHW density<sup>17</sup>.

The CHW role of collecting information, screening individuals, and facilitating referrals has been further tested for cardiovascular disease (CVD) risk assessment. In an observational study, CHWs in Bangladesh, Guatemala, Mexico, and South Africa were trained to use a non-laboratory-based CVD risk assessment model during a single household visit to identify high-risk individuals and refer them to existing referral networks<sup>18</sup>. CHWs' CVD risk-scoring was comparable to risk-scoring by health care professionals<sup>19</sup> suggesting the feasibility and effectiveness of equipping CHWs with screening tools for diabetes risk stratification. However, only 28% of those participants receiving non-urgent

referrals from CHWs attended follow-ups; reasons for missing follow-ups included anticipated costs of medication and transportation to the health center, limited risk self-perception, and deferral to traditional systems of medicine<sup>18</sup>. These challenges suggest that only screening individuals by CHWs may be insufficient to improve diabetes outcomes. Other structural barriers must be addressed alongside implementing CHW programs.

- **Capillary glucose testing-based screening**

Limited self-perception of risk as a reason for not following CHW referrals could be reduced by using CGT during household visits. A study with 994 participants in 20 rural villages in India simultaneously conducted a clinical questionnaire, CGT, and venous FBG tests. Compared to clinical variables (age, BMI, hypertension, waist and hip measurements, and waist-hip ratio) and two Indian diabetes risk scores, point-of-care CGT had a higher discriminatory power in detecting new diabetes cases defined by FBG levels. Notably, pairing risk scores with CGT failed to significantly increase this power<sup>20</sup>. Furthermore, a pilot study in Ghana showed the feasibility of assigning community nurses to conduct CGT on random patients to ascertain their diabetes status<sup>21</sup>. Lastly, in the SMARThealth trial in Andhra Pradesh, India, Accredited Social Health Activists (India's main CHWs) conducted CGT to measure blood glucose levels solely for use in CVD risk stratification<sup>22</sup>. Though there is limited evidence of current programs assigning CGT to CHWs, these studies suggest that it is feasible for CHWs to conduct CGT in low-resource settings. This could improve the identification of those at high-risk for diabetes. However, future research should analyze whether generating referrals based on glucose testing compared to a non-laboratory-based risk score increases patient follow-up rates. Additionally, while multiple studies report a strong correlation between CGT and venous FBG testing<sup>20,23,24</sup>, one challenge is that CGT is an inconclusive diagnosis. However, CHWs could still use CGT to identify those individuals at high-risk and refer them to higher-level care for diagnostic testing (with oral glucose tolerance test, glycated hemoglobin [A1c], and/or FBG). Lastly, assigning CHWs to conduct CGT will have greater costs than a non-laboratory risk score screening; cost-effectiveness analyses are needed to evaluate the impact of the increased costs on patient outcomes.

Mobile EDSS is a significant addition to CHW programs that can facilitate risk stratification. A mobile EDSS for diabetes and hypertension was developed by the mPower Heart Project in India for use by nurses in resource-poor settings<sup>25</sup>. Moreover, the SMARThealth trial in Andhra Pradesh developed another mobile EDSS that aided CHWs in CVD risk stratification and referral and provided clinical decision support for primary care physicians to generate medication prescriptions. However, the larger SMARThealth trial failed to significantly improve blood pressure levels; the authors mention blood pressure variability (both normal and seasonal fluctuations) as a likely reason why mobile EDSS misidentified high-risk individuals<sup>22</sup>. This poses a challenge for using CHWs for risk stratification. Therefore, for similar interventions to be successful in diabetes risk stratification, this issue could be addressed if CGT is used as an initial indicator that is then verified by subsequent testing. However, when implementing mobile phone use for CHWs, challenges to consider include the high operational costs, digital literacy of the CHWs, and ultimate acceptance by CHWs and health care professionals<sup>26,27</sup>.

Overall, in this role, CHWs are not conducting any definitive diagnostic tests or delivering treatment. Therefore, the intervention will have limited impact if identified high-risk individuals are not routed for definitive diagnosis and management by the health care system. As such, both Iran's Behvarz program and India's SMARThealth trial integrated CHWs into an existing primary healthcare system. For example, Iran's CHWs were based at a specific village health house – the most peripheral unit of the primary health care system – so that patients had access to appropriate providers and resources, once identified by CHWs<sup>16,17</sup>. Similarly, CHWs in the SMARThealth trial were linked to primary health care physicians who followed up patients identified by the CHWs<sup>22</sup>. Therefore, CHWs should be assigned for this role in areas where primary health services are available, but diagnosis and treatment rates of diabetes and utilization of the health care services remain low.

## **Transcultural considerations**

One issue that requires consideration is whether the screening tool used in risk stratification is adapted to ethnoculturally specific parameters. The *Finnish Diabetes Risk Score* is the most widely used score to detect subjects at risk of diabetes<sup>14</sup> and has been externally validated in several LMIC<sup>28,29,30</sup>. A version similar to the original, which only modified the waist circumference cutoff for a Latino population, has been validated and proposed for use in Latin America<sup>31,32</sup>. However, a systematic review of such risk score-based diagnosis and prognosis models in Latin America and the Caribbean showed the need for more research to develop and externally validate risk score models in this population<sup>33</sup>.

Additionally, one of the reasons for the low follow-up rate after CHW referrals was preference towards traditional medicine<sup>18</sup>. Therefore, CHWs must be trained on understanding patients' preferences and addressing these cultural attitudes. Not surprisingly, it is important that CHWs share the same culture, customs, and language of the community members they serve to improve their cultural competence in interactions between patients and health care professionals<sup>6</sup>.

## **Role 2: to facilitate lifestyle changes and diabetes self-management by improving dietary habits, physical activity, and medication adherence**

### **Gap**

Considering that preventing and treating diabetes require significant behavioral changes, CHWs can provide education as well as emotional, informational, and appraisal support to aid diabetes self-management, as in multiple CHW programs in the United States<sup>34</sup>. The Diabetes Prevention Program is a large-scale trial that showed the long-term effect of lifestyle interventions on decreasing the risk for diabetes<sup>35,36</sup>. While we lack extensive studies in LMIC, a meta-analysis of interventions in the U.S. modeled on the Diabetes Prevention Program showed that their effectiveness was similar whether delivered by medical/allied health personnel or lay educators<sup>37</sup>. These results suggest that utilizing CHWs could be an option for delivering this Diabetes Prevention Program-type of care.

### **Evidence**

Most identified CHW interventions implementing the Diabetes Prevention Program are in the United States<sup>11</sup>. In these programs, CHWs promote healthy diets and physical activity via walking clubs, healthy cooking demonstrations, awareness events, and group classes<sup>38,39,40</sup>. A meta-analysis of Diabetes Prevention Program-modeled interventions showed additional weight loss – though not statistically significant – for every additional core session attended (-0.26 percentage point, 95%CI: -0.54; 0.01)<sup>37</sup>. Therefore, increasing the frequency of sessions by employing CHWs can potentially improve health outcomes, especially if these interventions are scaled in low-resource settings where it currently may not be possible to have regular follow-ups with dietitians and physicians<sup>9</sup>. Although few studies have been done in LMIC implementing the Diabetes Prevention Program through CHWs, there are multiple examples of similar interventions.

In Iran's previously described Behvarz program, one of the CHWs' roles in diabetes care, in addition to risk stratification, was to hold training sessions on healthy diet and lifestyle habits for individuals at high risk for diabetes<sup>17</sup>. Additionally, CHWs followed-up with those already diagnosed with diabetes to ensure adequate medication access, supply, and adherence and to check for new symptoms<sup>17</sup>. Furthermore, in an observational study in Mexico, CHWs counseled individuals with diabetes and/or hypertension by focusing on medication adherence, disease education, and psychosocial support, resulting in improved disease control. The CHWs in this study consisted of women nominated at community meetings, selected by a non-governmental organization, and trained for one month in the basic concepts of chronic diseases and their duties as CHWs. Compared to no intervention, CHW counseling resulted in a two-fold increase in the odds of controlling diabetes and/or hypertension<sup>41</sup>.

In a diabetes intervention study in Guatemala, CHWs provided three interventions including weekly home visits to improve medication adherence, pre-consultations at clinics to monitor patient

progress, and weekly “diabetes club” meetings to teach self-management to patients. After four months of the intervention, there was a significant decrease in A1c levels, but no change in BMI, health behaviors, or diabetes knowledge among diabetic patients<sup>42</sup>. In a pilot CHW-led intervention in Brazil, 19 CHWs received additional training in motivational interviewing and behavioral action planning and were assigned to conduct monthly visits for six months to a group of patients with poorly controlled diabetes. The research team reported improvements in the quality of diabetes care, physical activity, A1c, and lipid profile, but no change in consumption of high-fat and sugary foods<sup>43</sup>. There is great variety in background responsibilities, training, and length of each CHW intervention. These differences limit the ability to make specific recommendations for optimal characteristics, and this article does not aim to assess CHW effectiveness. However, the aforementioned studies provide evidence that CHW programs can improve health behaviors, biochemical markers, and/or treatment adherence in patients with diabetes.

Lastly, cost-effectiveness studies of CHW interventions on non-communicable diseases in LMIC are limited. However, one study modeled the potential impact of employing CHWs to help individuals manage hypertension in South Africa and found the intervention to be cost-effective<sup>44</sup>. Another randomized-controlled trial in Pakistan compared three interventions in patients with hypertension: (1) home health education from lay health workers every three months focusing on improving diet, increasing physical activity, and decreasing smoking; (2) training general practitioners in the areas of the study to manage hypertension; and (3) combined intervention of home health education by lay health workers and training general practitioners<sup>45</sup>. The combined intervention was the most effective in reducing blood pressure and also the most cost-effective<sup>46</sup>. While these studies are targeted towards hypertension management, their results further underscore the significance of integrating CHW programs into other interventions throughout health care systems to facilitate lifestyle interventions, rather than viewing CHWs as a global fix.

### **Transcultural considerations**

The physical activity and nutritional management goals implemented by CHWs must be set considering the lifestyle factors of each population. Additionally, disease education programs must be tailored to integrate the regional perceptions of diabetes. One such framework for lifestyle changes in the treatment of diabetes is the transcultural diabetes nutrition algorithm (tDNA), a generalized evidence-based algorithm focused on nutrition in diabetes care that is adaptable to ethnocultural parameters<sup>13</sup>. The tDNA<sup>14,47</sup>, its adaptation to different countries<sup>48,49,50,51,52,53,54</sup>, the transcultural diabetes care<sup>55</sup>, and the frameworks for adapting diabetes clinical practice guidelines on a global scale<sup>4</sup> can provide a template for this transculturalization and implementation process, with a wide range of specific recommendations available. A randomized-controlled trial in Malaysia evaluated the clinical effectiveness of tDNA interventions, including culturally adapted medical nutrition therapy, meal plans, information on physical activity, and behavioral modifications with motivational interviewing<sup>56</sup>. Patients were followed up monthly by dietitians and physicians during the intervention phase and every three months during a 6-month post-intervention follow-up phase. The study found that tDNA interventions, coupled with motivational interviewing, significantly improved A1c and body weight levels in comparison to usual care; moreover, these effects were maintained even after the intervention phase<sup>56</sup>.

### **Role 3: to provide support to integrative medicine alternatives in environments with pluralistic health systems**

#### **Gap**

Regardless of the region, there are pluralistic health options, though their degree of use in relation to allopathic care varies. The informal health care sector is significant in certain countries<sup>57,58</sup>, and CHWs can inform individuals about the health care options available to them. For example, in Cameroon, a study in rural facilities showed that, compared with patients served by “Western health

care providers”, patients served by “traditional healers” traveled 2.5 times farther and paid 12 times more. Although traditional healers paid shorter visits, a higher proportion of content discussed was on lifestyle and the psychosocial aspects of care, with information communicated more emotionally. Therefore, a more patient-centered communication style with an emphasis on lifestyle and cultural practices could be a significant driver for choosing one of these “alternative” approaches <sup>59</sup>.

In addition to the rate of chronic diseases being greatest in LMIC, the global prevalence of individuals living with multiple chronic conditions (multimorbidity) is significant, and other comorbidities can interfere in diabetes management <sup>60,61,62</sup>. This requires a more holistic paradigm, different from previous vertical approaches that were primarily focused on biological drivers, instead of social and environmental factors <sup>61</sup>. Integrative medicine is defined as a healing-oriented medicine that considers the whole person (the nexus of biological, behavioral, and environmental drivers with their complex interactions) and is gaining favor in the management of chronic diseases <sup>63</sup>. Integrative care combines the Western biomedical paradigm of scientifically substantiated actions (i.e., proven safety and efficacy/effectiveness) with alternative paradigms that may be ignored in U.S. medical schools, address symptoms rather than complaints, and/or are unproven regarding safety and efficacy/effectiveness <sup>64</sup>. Employing alternative healing modalities may enhance trust in and adherence to CHWs’ instructions, as well as a positive behavior towards health. Both the significance of the informal health care sector and the potential value of integrative medicine create a gap in the health care system that can be filled by CHWs.

### **Evidence**

A qualitative study identified four modes of practice among Ghanaians suffering from diabetes – biomedical management, spiritual action, cure-seeking, and medical inaction. Though individuals sought biomedical care initially, some turned to homeopathic practices for reasons including inability to cover costs and inability of biomedicine to provide a cure for diabetes <sup>65</sup>. Therefore, a potential role for CHWs is helping individuals navigate care-seeking decisions in environments where there are multiple systems of medicine, including homeopathic and other traditional systems.

An ethnographic study of CHWs’ experiences in India observed that, in addition to promoting immunizations and institutional deliveries, some CHWs tasked with maternal/child health duties participated in traditional rituals of childbirth and/or helped pregnant women seek alternative care for infertility; notably, CHWs hid this from their health supervisors out of fear of being seen as quacks <sup>66</sup>. In another example from the study, CHWs “repackaged” and explained the benefits of vaccinations in terms of local values as part of their efforts to build trust with the community and account for traditional concerns <sup>67</sup>. These instances emphasize that the integration of local medical systems should be considered in health system interventions and that CHWs’ intimate knowledge of the local practices can allow them to support care in pluralistic environments and serve as an interface between the health system and community. If all interaction with traditional medicine is viewed negatively, then CHWs’ potential to serve this important role is lost <sup>67</sup>.

How can CHWs help patients’ decision-making process? CHWs could still serve as patient advocates even if individuals seek alternative care. This role is similar to that in multiple U.S. programs, where they provide advocacy and instrumental support by helping individuals communicate with health care professionals and other professional staff to obtain referrals and financial assistance <sup>34</sup>. However, the proposed role would go further and assign CHWs to openly discuss the advantages and disadvantages of treatments, both allopathic and traditional. One challenge may be potential conflicts of interest that may arise in carrying out this role if CHWs are employed by the health care system but are expected to advise patients on issues regarding traditional healthcare practices. Also, in this role, CHWs need to gain the confidence of the community members to provide advice. Furthermore, any integrative medicine approach endorsed by CHWs needs a reasonable level of evidence-based substantiation of clinical safety and effectiveness. Therefore, this would include many forms of spirituality and mind-body methods, but not all botanicals and glandulars <sup>64</sup>. A higher level of training would be required for CHWs to carry out this more complex role.



## **Transcultural considerations**

Transcultural medicine should allow patients to select the therapeutic components that match their beliefs and practices. For example, the integration of Western biomedicine and alternative care models is accepted and practiced in many health care systems worldwide, including several Latin American countries (Chile, Ecuador, Suriname, Guatemala, and Colombia)<sup>68</sup> and in Eritrea<sup>69</sup>. CHWs would be required to understand both systems of care, which are not mutually exclusive, and the concerns individuals may have with either system. Western biomedical, CHW-led interventions should not aim to replace these alternative systems when they are deemed safe and effective but rather integrate with local systems of medicine to ultimately improve diabetes care.

## **Program comparison and discussion**

This article discussed the advantages, challenges, and remaining research questions associated with three a priori roles that could be assigned to CHWs to improve diabetes outcomes. The aforementioned example programs and studies differed in CHW training, task distribution, and degree of integration. Since this is not a systematic review, we can neither judge the effectiveness of CHW programs in improving diabetes care nor compare the relative effects of different program characteristics. However, qualitative comparisons of programs do yield insights.

First, most studies integrated CHWs within the existing health care system to varying degrees. For example, considering that Brazil's Family Health Strategy uses teams including one physician, one nurse, two nurse assistants, and four to six CHWs to serve each area, the CHWs piloting the diabetes intervention in Brazil were linked to higher-level providers, though their intervention was delivered during individual home visits<sup>43</sup>. Meanwhile, one of CHWs' formal responsibilities in the Guatemala and Mexico studies involved interacting with patients and their providers during patient visits at the clinics, allowing them to connect with higher-level providers<sup>41,42</sup>. Lastly, CHWs in Iran's Behvarz program were assigned specific primary care roles in the country's National Plan for Prevention and Control of Diabetes, which delineated responsibilities for all other levels of healthcare providers<sup>16,17</sup>. These efforts help ensure continuity of care and the appropriate link between patients and the health care system.

Additionally, the examples differed in whether the diabetes interventions were paired with other health services, and it is impossible to directly compare the relative effectiveness of the approaches given the current studies. The CHWs in Brazil and the Behvarz in Iran carried out their respective interventions alongside several other primary care activities<sup>15,43</sup>. In contrast, CHWs in the Mexico study solely implemented a diabetes intervention<sup>41</sup>. While there are concerns that adding noncommunicable disease responsibilities to their existing duties could overload CHWs, Brazil's CHWs failed to mention such concerns in the qualitative interviews conducted in the study<sup>43</sup>. Therefore, future research must analyze the potential impacts of new noncommunicable disease responsibilities on the delivery of other CHW responsibilities and explore the cost-effectiveness and sustainability of both delivery models.

In the aforementioned studies in which CHWs conducted screening and/or facilitated lifestyle interventions, there were significant differences in the demographics, initial training, and continued training of CHWs. For example, CHWs in Iran's Behvarz program were either male or female and held at least a high school degree. They received two years of initial training covering all of their responsibilities followed by regular in-service training, and their roles in diabetes care were part of their regular training<sup>15</sup>. Meanwhile, CHWs in India's SMARThealth trial (Accredited Social Health Activists) were females who received 23 days of initial training; in each following year, they received 12 days of training<sup>70</sup>. The CHWs in this trial received an additional 5-day training in mobile EDSS for screening participants<sup>22</sup>. Brazil's CHWs were mostly female and received 40 hours of initial training. The CHWs recruited to participate in the diabetes intervention received 32 hours of additional training in motivational interviewing and four hours per month of booster training during the six months of the study<sup>43,71</sup>. Overall, though there were significant differences in training structure

and duration, continued in-service training was part of these programs and other CHW interventions. However, these studies provide limited information regarding the specific content of such in-service training.

Lastly, CHW supervision is essential to ensure the success of the program<sup>72</sup>. The SMARThealth trial implemented in India had field supervisors visit CHWs one to three times per month<sup>22</sup>. Likewise, in Iran's Behvarz program, rural health centers periodically visited the village health houses, the most peripheral primary healthcare center, in which CHWs were based<sup>15</sup>. However, most of the other studies described in this article have little to no mention of their supervisory mechanisms. The United States Agency for International Development's (USAID) CHW reference guide outlines four different approaches to CHW supervision. Aside from external supervision, which is similar to the approaches described above, three alternate approaches include group supervision (where CHW groups meet with supervisors), community supervision (where community members track CHW activity), and peer supervision (where CHWs supervise each other)<sup>72</sup>. The suitability of each supervisory mechanism differs based on the existing primary healthcare system. Further research could compare the effectiveness of approaches in various contexts.

## Conclusion

The role of CHWs in preventing and treating diabetes is best understood when considering the gaps in healthcare delivery. In low-resource settings with fragmented health care systems, CHWs can identify individuals at high-risk of diabetes through non-laboratory screening tools or point-of-care CGT and facilitate diabetes self-management. The evidence on the combination of responsibilities, training of CHWs, and length of intervention varies significantly, but such programs have improved treatment adherence, among other outcomes. Lastly, the role of CHWs in helping individuals understand integrative medicine in pluralistic health environments has received less attention, but it has significant potential due to CHWs' intimate knowledge of the local culture and health practices. Each CHW role described has the potential to fill gaps in low-resource health systems and improve the prevention and management of diabetes. However, CHW interventions need to be transculturalized to a population's genetic, social, racial, and environmental factors to optimize their effectiveness.

## Contributors

M. A. Babagoli contributed to the study conception and design, drafting the article, manuscript revisions, and final approval of the manuscript. R. Nieto-Martínez, J. P. González-Rivas, K. Sivaramakrishnan, and J. I. Mechanick contributed to the study conception and design, manuscript revisions, and final approval of the manuscript.

## Additional informations

ORCID: Masih A. Babagoli (0000-0002-3753-3818); Ramfis Nieto-Martínez (0000-0002-0575-7534); Juan P. González-Rivas (0000-0001-7676-7900); Kavita Sivaramakrishnan (0000-0002-5584-2585); Jeffrey I. Mechanick (0000-0002-0657-588X).

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## Resumo

A prevalência do diabetes está aumentando em nível global, sobretudo nos países de renda baixa e média, o que exige melhor detecção e manejo da doença. O modelo de doenças crônicas e a medicina de estilo de vida fornecem estruturas para a ação nesse sentido. Os agentes comunitários de saúde (ACS) podem contribuir de maneira significativa para a assistência às doenças crônicas, desde que sejam capacitados e integrados aos sistemas de saúde, que dispõem de recursos limitados. Embora a maioria dos ACS no mundo esteja desempenhando tarefas relacionadas à saúde materno-infantil e doenças infecciosas, estão crescendo outros programas que envolvem a prevenção e manejo das doenças não transmissíveis. O artigo discute as vantagens, desafios e questões relacionados aos possíveis papéis definidos para os ACS na prevenção e manejo do diabetes. Esses papéis incluem testes simples de triagem, implementação de intervenções comportamentais e de estilo de vida e recomendação de alternativas à biomedicina para os pacientes. Especificamente, os ACS podem auxiliar na vigilância epidemiológica do diabetes, realizando triagem baseada em pontuação de risco ou testagem de glicemia capilar, e podem facilitar o auto-manejo do diabetes através de intervenções baseadas no algoritmo nutricional transcultural do diabetes. Além disso, embora o papel não tenha sido definido formalmente, os ACS podem alavancar seu conhecimento íntimo das práticas locais para apoiar decisões pelos pacientes em contextos com sistemas de saúde pluralistas. Devem ser consideradas as diferenças etnoculturais nas funções dos ACS e nas adaptações transculturais de seus papéis durante a assistência ao diabetes. Em resumo, os ACS podem melhorar a assistência ao diabetes através da triagem e da implementação oportuna de intervenções de estilo de vida, principalmente nos países de renda baixa e média.

*Agentes Comunitários de Saúde; Atenção à Saúde; Diabetes Mellitus; Comportamento de Redução do Risco*

## Resumen

La prevalencia de diabetes está aumentando en todo el mundo, especialmente en los países de bajos y medios ingresos (LMIC por sus siglas en inglés), imponiendo la necesidad de una detección y gestión mejoradas. Un modelo de enfermedad crónica y la medicina del estilo de vida proporcionan estructuras para la acción. Los trabajadores comunitarios de salud (CHWs por sus siglas en inglés) pueden contribuir significativamente al cuidado de la enfermedad crónica, si son entrenados e integrados en sistemas con pocos recursos de salud. A pesar de que la mayoría de los actuales CHWs en todo el mundo están desarrollando tareas relacionadas con enfermedades infecciosas en la salud materno/infantil, otros programas que implican a los CHWs para la prevención y gestión de enfermedades no comunicables están aumentando. En este artículo, discutimos las ventajas, desafíos, y preguntas respecto a los posibles roles asignados a los CHWs, en la prevención y gestión de la diabetes. Estos roles incluyen realizar simples pruebas de detección, implementando intervenciones de estilo de vida/comportamentales, y conectando pacientes con alternativas a la biomedicina. Específicamente, los CHWs pueden ayudar en la vigilancia epidemiológica de la diabetes, llevando a cabo pruebas de detección basadas en marcadores de riesgo o pruebas de glucosa capilares, y pueden facilitar el autocontrol de la diabetes proporcionando intervenciones descritas en el algoritmo transcultural de nutrición en diabetes. Asimismo, mientras este rol no se les haya asignado formalmente, los CHWs pueden potenciar su conocimiento profundo de prácticas locales para proporcionar apoyo en la toma de decisiones a pacientes en entornos con sistemas de salud plurales. Las diferencias etnoculturales en las funciones de los CHW y las adaptaciones transculturales de sus papeles en el cuidado de la diabetes deberían también ser consideradas. En resumen, los CHWs pueden mejorar el cuidado de la diabetes detectando e implementando oportunamente las intervenciones de estilo de vida, especialmente en LMIC.

*Agentes Comunitarios de Salud; Atención a la Salud; Diabetes Mellitus; Conducta de Reducción del Riesgo*

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