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14. ABSTRACT

OBJECTIVES: We conducted a systematic review on outcomes and costs of community health worker (CHW) interventions. CHWs are increasingly expected to improve health outcomes cost-effectively for the underserved.

RESEARCH DESIGN: We searched Medline, Cochrane Collaboration resources, and the Cumulative Index to Nursing and Allied Health Literature for studies conducted in the United States and published in English from 1980 through November 2008. We dually reviewed abstracts, full-text articles, data abstractions, quality ratings, and strength of evidence grades and resolved disagreements by consensus.

RESULTS: We included 53 studies on outcomes of CHW interventions and 6 on cost or cost-effectiveness. For outcomes, limited evidence (5 studies) suggests that CHW interventions can improve participant knowledge compared with alternative approaches or no

15. SUBJECT TERMS

Community health workers, systematic review, underserved populations, use of health services, addressing disparities in health and healthcare

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Outcomes and Costs of Community Health Worker Interventions

A Systematic Review

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Objectives: We conducted a systematic review on outcomes and costs of community health worker (CHW) interventions. CHWs are increasingly expected to improve health outcomes cost-effectively for the underserved.

Research Design: We searched Medline, Cochrane Collaboration resources, and the Cumulative Index to Nursing and Allied Health Literature for studies conducted in the United States and published in English from 1980 through November 2008. We dually reviewed abstracts, full-text articles, data abstractions, quality ratings, and strength of evidence grades and resolved disagreements by consensus.

Results: We included 53 studies on outcomes of CHW interventions and 6 on cost or cost-effectiveness. For outcomes, limited evidence (5 studies) suggests that CHW interventions can improve participant knowledge compared with alternative approaches or no intervention. We found mixed evidence for participant behavior change (22 studies) and health outcomes (27 studies). Some studies suggested that CHW interventions can result in greater improvements in participant behavior and health outcomes compared with various alternatives, but other studies suggested that CHW interventions provide no statistically different benefits than alternatives. We found low or moderate strength of evidence suggesting that CHWs can increase appropriate health care utilization for some interventions (30 studies). Six studies with economic information yielded insufficient data to evaluate the cost-effectiveness of CHW interventions relative to other interventions.

Conclusions: CHWs can improve outcomes for underserved populations for some health conditions. The effectiveness of CHWs in many health care areas requires further research that addresses the methodologic limitations of prior studies and that contributes to translating research into practice.

Key Words: Community health workers, systematic review, underserved populations, use of health services, addressing disparities in health and healthcare

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Although the United States experienced remarkable improvements in public health and medicine throughout the past century, these improvements have not been accessible to all parts of society. Substantial disparities in life expectancy,[1] health, and health care persist,[2–6] and repeated measures of disparities in quality of care and access to care since 2003 demonstrate only minor improvements, at best.[2–6] According to an Institute of Medicine report, these seemingly intractable differences cannot be explained by clinically appropriate care, differing needs of patients, patient preferences, or access-related factors, such as insurance status and income.[7]

A core component in addressing health disparities is the involvement of the community, specifically the use of community health workers (CHWs).[7] The estimated number of CHWs supporting American communities rose 41%, from 86,000 in 2000 to >121,000 in 2005.[8] The role of CHWs in varying models of care ranges from being an integral part of the care delivery team to involvement as community navigators, education providers, or outreach agents.[8] CHWs are thought to reduce disparities by improving access to care, providing culturally competent health education, counseling, and sometimes rendering direct health services. Additionally, as trusted members of the community, CHWs may help to minimize barriers to care resulting from health beliefs and health values.[7]

Numerous recent reviews have examined the effectiveness of CHWs, but their scope has often been limited to specific disease conditions,[9,10] subpopulations,[11,12] or study designs.[13,14] The Agency for Healthcare Research and Quality (AHRQ) commissioned the RTI International-University of North Carolina Evidence-based Practice Center to conduct a systematic review on outcomes of CHW interventions.[15]

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This article addresses 2 key questions from that review: (1) What is the impact of CHWs on outcomes, particularly knowledge, behavior, satisfaction, health outcomes, and health care utilization? (2) What is known about the cost-effectiveness of CHWs for improving health outcomes?

METHODS

We searched Medline, Cochrane Collaboration resources, and the Cumulative Index to Nursing and Allied Health Literature for studies conducted in the United States and published in English from 1980 through November 2008, using more than 10 terms for CHWs, including the Medical Subject Heading term "community health aides."

Two members of the research team independently assessed each abstract and full-text article for inclusion or exclusion, abstracted data, rated study quality, and graded strength of evidence. This work was divided with consideration of level of expertise and training among all members of the research team (a senior health services researcher with expertise in CHW evaluations [M.V.], an internal medicine and pediatrics physician [D.E.J.], a general internist [J.L.K.], a preventive medicine physician [B.N.], an economist [A.A.H.], and 2 Evidence-based Practice Center staff members [L.C.M. and P.T.]). We resolved disagreements by discussion at weekly team meetings to reach consensus. We designed and used a structured data abstraction form to ensure consistency in evaluation and appraisal of each study. Evidence tables for each included study and more detailed description of our methods are available online with the full report.[15]

A key criterion for inclusion was that the study intervention included CHWs. We defined a CHW as someone who met all 3 of the following criteria:

- Performs health-related tasks beyond peer counseling or peer support alone to create a bridge between community members, especially hard-to-reach populations, and the health care system.
- Has health training associated with the intervention; training is shorter than that of a professional worker and does not form part of a tertiary education certificate.
- Is recognized (or can be identified) as a member of the community in which he or she works, defined by but not limited to, geographic location, race or ethnicity, and exposure or disease status.

We excluded studies that (1) were published in languages other than English; (2) did not report information pertinent to the key questions; (3) had fewer than 40 subjects for randomized controlled trials or nonrandomized cohorts with comparisons; (4) were not original studies; (5) did not include a distinct comparison arm; and (6) were designed such that the outcome of the intervention could not be definitively attributed to the CHW. Studies in this last group often compared usual care with a combination of interventions that may have included CHWs as one of several components but did not distinguish between the effect of the CHW and other components.

TABLE 1. Interpreting Strength of Evidence Grades and Domains*

Grade or Domain	Interpretation
Strength of evidence grades	High strength of evidence indicates high confidence in the estimate of effect and that the evidence reflects the true effect
	Moderate strength of evidence reflects moderate confidence that the evidence reflects the true effect; further research may change our confidence in the estimate of effect and may change the estimate
	Low strength of evidence implies low confidence that the evidence reflects the true effect
Risk of bias	Good-quality studies with strong designs result in low risk of bias
	Fair-quality studies result in medium risk of bias
	Poor-quality studies result in high risk of bias
Consistent evidence	Effect sizes across studies are in the same direction
Precise evidence	Effect sizes have a narrow range
Direct evidence	Evidence links the interventions directly to the outcome of interest

*Adapted from Owens et al, 2009.[16]

We evaluated the internal validity (risk of bias) of individual studies (good, fair, or poor) using standard predefined criteria and methods from the Evidence-based Practice Centers, the U.S. Preventive Services Task Force, and the National Health Service Centre for Reviews and Dissemination (United Kingdom).[15–18] We evaluated the strength of evidence (insufficient, low, moderate, or high) using the approach devised by AHRQ's Effective Health Care Program (Table 1).[16] The strength of evidence for each outcome incorporates risk of bias, consistency, directness, precision, and the presence of other modifying factors.[16] We dually evaluated the overall strength of evidence for each outcome based on a qualitative assessment of strength of evidence for each domain and reconciled all disagreements.

We evaluated the impact of CHWs on outcomes, with specific attention to the following 5 outcome categories: knowledge, behavior, satisfaction, health outcomes, and health care utilization. Some studies appear in >1 outcome category in our tables: if a study evaluated the impact of a CHW intervention on, for example, both knowledge and satisfaction, we evaluated the contribution of the study to each outcome independently of the study's results for other outcomes. In evaluating the effectiveness of CHW interventions, we recorded and evaluated the degree of heterogeneity in CHW interventions. Specifically, we evaluated place of service, type of service, type of educational materials used, duration of interaction with participants, and length of follow-up and found wide variation and inconsistent reporting for these elements.

We synthesized the variety of ways in which CHWs can interact with participants into a single measure of intensity that serves as a proxy of resource allocation. We classified interactions that reported at least 4 of 6 elements, suggesting a higher resource utilization (one-on-one, face-to-face, 1 hour per

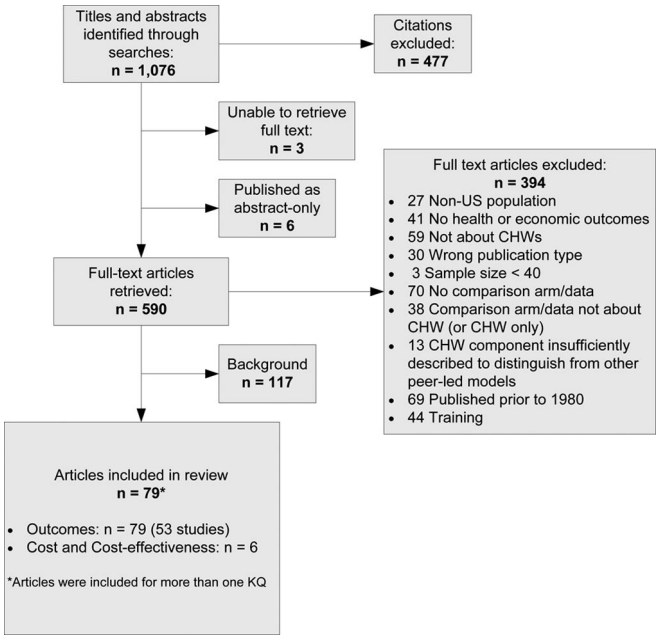

FIGURE 1. Results of literature search.

session or more, 3 or more months' duration, 3 or more interactions, and tailored materials) as high intensity; interventions with 2 or 3 elements as moderate intensity; and interventions with 0 or 1 of the elements as low intensity.

RESULTS

Effectiveness of CHW Interventions

Our searches yielded 1076 abstracts. Of these, we included 53 studies addressing outcomes and 6 studies addressing costs or cost-effectiveness (Fig. 1).

Of the total of 53 studies (79 articles), we classified 8 studies as low intensity,[19–31] 18 as moderate intensity,[32–54] and 27 as high intensity.[55–97] CHW roles and interventions were highly heterogeneous across interventions, but their intensity varied by clinical context: maternal and child health and chronic disease management interventions were all moderate or high intensity, whereas prevention and screening interventions were generally low intensity.

Knowledge

Five studies reported information on knowledge. Of these, 2 provided moderate strength of evidence that CHW interventions improve the knowledge of participants on aspects of disease prevention,[30,65,66] specifically, improved knowledge of label reading, fat in diet, and where to obtain free condoms; another 2 provided moderate strength of evidence on awareness of need for cervical cancer screening.[35,55,56] One study provided low strength of evidence that CHW interventions improve knowledge of food label reading for chronic disease management in patients with diabetes but only insufficient evidence for knowledge of other issues related to the clinical or self-management of diabetes, such as dietary knowledge, appropriate diet, frequency of checking blood sugar, understanding the need for eye doctor visits, knowledge of how diabetes affects the body, or understanding insulin or other medication (Table 2).[94]

This literature did not compare CHWs with a comprehensive range of health care providers. Nevertheless, for the subset of comparators and outcomes included in this literature, the studies together suggested that CHW interventions can improve participant knowledge compared with alternative approaches such as no intervention, media, mail, or usual care plus pamphlets.

Behavior

Twenty-two studies assessing the effect of CHW interventions on behavior (Table 3) demonstrated variable results by outcome examined; they yielded clear evidence of benefit of CHW interventions for some outcomes, mixed evidence for others, and no evidence of benefit for the remainder. Together, these studies suggested that CHW interventions can, in some instances, bring about greater positive changes in participant behavior than a range of alternatives (including no intervention, community intervention, usual care plus a newsletter, media, print, a less intense or delayed CHW arm, or a combination of interventions). In other instances, CHW interventions provided no statistically significant benefit compared with alternatives.

Specifically, for asthma (use of bedding encasements), workplace safety (use of protective eyewear, and diabetes mellitus (dietary risk scores and adherence to a diabetes education program), evidence from 5 studies suggested that CHW interventions improved participant behavior compared with alternatives, such as a community intervention, a lower-intensity CHW intervention, and usual care combined with a pamphlet.[31,35,48,55,56,83–87,91,92,97] The strength of evidence is not uniformly similar for these 3 outcomes: it is moderate for the use of bedding encasements for asthma and low for workplace safety and diabetes mellitus.

Evidence from 14 studies evaluating disease prevention, child well-being and the environment, planned use of cancer screening tests, and breast self-examination was mixed; some studies demonstrated a statistically significant benefit of the CHW arm and others did not.[20,26,32,36–42,44,57,58,61,65,66,69,70,72,73,79] The strength of evidence for these outcomes is low.

Evidence from 5 studies evaluating smoking cessation and mold removal to reduce asthma, health promotion among Latinas, and injury prevention at home failed to demonstrate that CHW interventions result in significantly different outcomes than alternatives.[53,54,59,60,91,92,97] The strength of evidence for these outcomes is low.

Satisfaction

A single study, focusing on mental health among the homeless, found no differences between study arms in participant satisfaction[95,96]; the strength of evidence for this outcome is low.

TABLE 2. Effect of CHW Interventions on Knowledge: Strength of Evidence

No. Studies/ No. Subjects	Risk of Bias/ Design/ Quality	Consistency/ Directness/ Precision	Type of CHW Service	Results: Intensity of CHW Interaction With Participants	Overall Strength of Evidence
Health promotion and disease prevention: disease prevention					
2/6841[30,65,66]	Medium/1 RCT, 1 prospective cohort/ fair	Consistent/indirect/ precise	Counsel adults for diabetes prevention; hold group and individual sessions[65,66]; interview on sexual disease risk factors and prevention in at-risk adults (survey interaction)[30]	Favors CHW intervention vs. print or no intervention; 1 high, 1 low	Moderate
Cancer screening					
2/1788[35,55,56]	Low/2 RCTs/1 good, 1 fair	Consistent/indirect/ imprecise	Provide barrier-specific counseling to promote screening[34,55,56]; educate and assist with scheduling[55,56]	Favors CHW vs. media or mail; 1 high, 1 moderate	Moderate
Chronic disease management: diabetes mellitus					
1/150[94]	Medium/1 RCT/fair	NA/direct/precision NR	Hold participative classes for adults with diabetes mellitus; answer questions; reinforce education; promote behavior change; send biweekly postcards[94]	Favors CHW intervention vs. usual care plus pamphlets; 1 high	Low

CHW indicates community health worker; NA, not applicable (consistency unknown, single study); NR, not reported; RCT, randomized controlled trial.

Health Outcomes

Of the 53 included studies, 27 reported health outcomes (Table 4). Evidence of moderate strength showed that CHW interventions, compared with either a lower-intensity CHW intervention or a delayed-intervention control group (3 studies),[52,91,92,97] improved health outcomes for 2 clinical areas: back pain (1 study) and psychosocial outcomes among caregivers of children with asthma (2 studies).

Evidence for other outcomes (pediatric immunizations, prenatal care and perinatal outcomes, child development, environment conducive to child well-being, diabetes, and asthma symptoms), from 22 studies, was mixed. Some studies suggested that CHW interventions were more effective than alternatives (including no intervention, usual care, and nurses); other studies showed no difference between CHW interventions and alternatives.[45,46,48,61–64,67–88,91,92,94,97]

For disease prevention related to reduction in body mass index, blood pressure control, and mental health, the evidence from 5 studies suggests no difference between CHW interventions and alternative approaches, including the use of CHWs in a lesser capacity, nurses, and print materials; the strength of evidence for these outcomes is low.[49,50,65,66,89,90,93,95,96] We found no evidence to evaluate the effectiveness of CHW interventions for other clinical concerns.

Our overall assessment for the effect of CHWs on health outcomes is that similarly to their effect on behavior change, CHW interventions can have a greater effect on health outcomes than certain alternative options such as no intervention, usual care, and nurses. However, these findings were not consistent across all studies: several studies found no statistically significant benefit to the CHW arm compared with alternative approaches. The strength of evidence for the reported absence of differences is, therefore, low.

Health Care Utilization

More than one half of the identified studies reported on health care utilization (Table 5). Fifteen studies provide moderate strength of evidence that CHW interventions increase appropriate health care utilization for some outcomes.[19,21–29,32,34,36–38,40,44,51,55–58,91,92,97,98] Specifically, the evidence showed improved medical follow-up rates for elevated blood pressure (1 study), increased mammography screening (11 studies), adherence to first follow-up appointments for tuberculosis patients (1 study), and reduced unscheduled medical visits asthma (2 studies) compared with a range of alternatives such as no intervention, mail, print, or a less-intense CHW arm. Two studies provide low strength of evidence that CHW interventions provide benefits in health care utilization compared with nurses for prenatal and perinatal care and with usual care for hypertension.[47,74]

For health care utilization for cervical cancer screening and colorectal cancer screening, 8 studies provide mixed evidence. Some studies report statistically significant benefit for the CHW arm but others find no significant differences; the strength of evidence is low.[32,33,36–39,55–58] For health promotion among Latinas (1 study), child well-being (1 study), clinical breast examination (4 studies),

TABLE 3. Effect of CHW Interventions on Behavior: Strength of Evidence

Clinical Context/ No. Studies/ No. Subjects	Risk of Bias/ Design/ Quality	Consistency/ Directness/ Precision	Type of Service	Results: Intensity of CHW Interaction With Participants	Results: Overall Strength of Evidence
Chronic disease management: asthma, use of bedding encasements 2/572[91,92,97]	Low/2 RCTs/1 good, 1 fair	Consistent/indirect/ precise	Provide environmental assessment, individualized action plan, education and social support, and materials to reduce trigger exposure for asthma[91,92,97]; counsel on environmental tobacco smoke; provide integrated pest management services[97]	Favors CHW vs. less-intense CHW arm or delayed CHW arm; 2 high	Moderate
Chronic disease management: diabetes mellitus 2/213[48,83–87]	Medium/2 RCTs/fair	Consistent/indirect/ precise	Offer to schedule appointments and visits; provide education; mobilize social support[83–87] act as liaison between patients and health care providers; attend clinic sessions with patient; provide translation and appointment reminders; reschedule missed appointments; reinforce self-care instructions[48]	Favors CHW intervention vs. usual care plus newsletter; 1 high, 1 moderate	Low
Injury prevention: workplace safety 1/786[31]	High/1 prospective cohort/ poor	NA/direct/imprecise	Distribute eyewear, train on eyewear use and eye health and safety[31]	Favors CHW over community intervention; 1 low	Low
Health promotion and disease prevention: disease prevention 5/1125 + 12 churches[20,41,42,44,61,65,66]	Medium/5 RCTs/3 fair, 2 poor	Inconsistent/indirect/ imprecise	Provide information through existing networks; organize and conduct at least 3 church-wide activities focused on spreading information for colorectal cancer prevention[20]; counsel adults with risk factors for cardiovascular disease[41,42]; refer to medical care; help schedule appointment; send appointment reminder letter; follow up to determine whether the appointment was kept; schedule a new appointment for each missed appointment (up to 3); help reduce barriers to care through referral to community transportation, child care, or other services[44]; model problem-solving techniques to reduce environmental tobacco smoke exposure to children[61]; counsel adults for diabetes prevention; hold group and individual sessions[65,66]	Mixed results: 3 (2 fair, 1 poor; 1 high, 2 moderate intensity) of 5 studies favor CHW intervention vs. control (no intervention, combination of interventions, media/ print); 2 high, 2 moderate, 1 low	Low
Maternal and child health: environment conducive to child well-being 3/1052[69,70,72,73,79]	Medium/3 RCTs/2 fair, 1 poor	Inconsistent/direct/ imprecise	Create individualized family service plan with specific goals; support mother's needs; promote maternal-child relationship[69,70]; build relationships with families; actively help address existing crises; model problem-solving skills and effective parent-child interaction; link families with needed resources; provide parenting education; ensure presence of medical home for children[72,73]; counsel on infant development, health education, and mother-infant interaction[79]	Mixed results: 1 study (fair) show no difference between CHW vs. no intervention, 2 studies (1 fair, 1 poor) favor CHW over standard clinical care or no intervention for some but not all outcomes; 3 high	Low

(*Continued*)

TABLE 3. (*Continued*)

Clinical Context/ No. Studies/ No. Subjects	Risk of Bias/ Design/ Quality	Consistency/ Directness/ Precision	Type of Service	Results: Intensity of CHW Interaction With Participants	Results: Overall Strength of Evidence
Cancer screening: planned use of screening tests 2/1612[39,40]	Medium/1 RCT, 1 cohort/ 1 fair, 1 poor	Inconsistent/indirect/ imprecise	Tailor responses to individual barriers to cervical cancer screening; provide clinic referral and scheduling assistance, translation services, and transportation assistance[39]; provide education, counseling, and information on location of screening services during salon appointment[40]	Mixed results: 1 study (fair) shows benefit in CHW arm vs. usual, other shows no difference vs. no intervention; 2 moderate	Low
Cancer screening: breast self-examination 5/3798[26,32,36–38,40,57,58]	Medium/2 RCTs, 3 cohorts/3 fair, 2 poor	Inconsistent/direct/ imprecise	Conduct motivational speeches based on cancer survivor experience of CHWs; teach breast self-examination using a breast model; discuss resources for free- and reduced-cost mammograms[26]; provide one-on-one support, education, and ongoing and personal contact with clients[32]; conduct 12 weekly small group educational sessions[36–38]; provide education, counseling, and information on location of screening services during salon appointment[40]; educate on breast and cervical cancer and breast self-examination; provide educational materials on screening; facilitate to address logistical barriers to screening[57,58]	Mixed results: 2 of 5 (1 fair, 1 poor quality; 1 moderate, 1 low intensity) studies show benefit of CHW vs. alternative (mail or minimal CHW), 3 of 5 show no difference vs. delayed or no intervention; 1 high, 3 moderate, 1 low	Low
Chronic disease management: asthma, other behaviors (smoking cessation, removal of mold) 2/572[91,92,97]	Low/2 RCTs/1 good, 1 fair	Inconsistent/indirect/ imprecise	Provide environmental assessment, individualized action plan, education and social support, and materials to reduce trigger exposure for asthma[91,92,97]; counsel on environmental tobacco smoke; provide integrated pest management services[97]	No difference between CHW vs. less intense CHW arm or delayed CHW arm; 2 high	Low
Health promotion and disease prevention: health promotion—Latina health 1/357[59,60]	High/1 RCT/poor	NA/indirect/precision NR	Conduct home visits or phone calls for Latinas to make healthful dietary behavior changes[59,60]	No difference between CHW intervention and tailored or off-the-shelf interventions; 1 high	Low
Injury prevention: home safety 2/2909[53,54]	Medium/2 RCTs/1 fair, 1 poor	Inconsistent/indirect/ precise	Assess home for injury hazards such as falls, burns, and poisonings; recommend appropriate safety products and practices; refer families to the Child Safety Center[53]; recruit volunteer representative from each block to identify neighborhood resources, facilitate contacts with residents, and reinforce safety messages through monthly block meetings; conduct home safety inspections in the presence of residents and provide safety materials; instruct on correcting safety hazards, simple household repairs, use of ipecac and bathwater thermometer, and safety behaviors; identify community resources[54]	No difference between CHW and health professional or no intervention; 2 moderate	Low

CHW indicates community health worker; NA, not applicable (consistency unknown, single study); NR, not reported; RCT, randomized controlled trial.

TABLE 4. Effect of CHW Interventions on Health Outcomes: Strength of Evidence

Clinical Context/ No. Studies/ No. Subjects	Risk of Bias/ Design/ Quality	Consistency/ Directness/ Precision	Type of Service	Results: Intensity of CHW Interaction With Participants	Results: Overall Strength of Evidence
Chronic disease management: back pain 1/255[52]	Medium/1 RCT/ fair	NA/direct//precision NR	Lead classes on self-managing back pain; discuss strategies and barriers to achieve goals for managing pain[52]	Favors CHW intervention vs. usual care plus a book for Roland score at 6 mo and worry score at 12 mo; no difference in Roland score at 12 mo; 1 moderate	Moderate
Chronic disease management: asthma, caregiver psychosocial outcomes 2/572[91,92,97]	Low/2 RCTs/1 good, 1 fair	Consistent/direct/ precise	Provide environmental assessment, individualized action plan, education and social support, and materials to reduce trigger exposure for asthma[91,92,97]; counsel on environmental tobacco smoke; provide integrated pest management services[97]	Favors CHW vs. less intense CHW arm or delayed intervention; 2 high	Moderate
Health promotion and disease prevention: pediatric immunizations 3/5406[45,46,62–64]	Medium/2 RCTs, 1 cohort/1 good, 1 fair, 1 poor	Inconsistent/direct/ imprecise	Provide appointment reminder and assistance in overcoming barriers to appointment for pediatric immunizations if needed[45,46]; provide information and assistance, referral, and transportation to clinic if needed for childhood immunizations[62]; create family-focused care plan; provide support; model problem-solving skills; promote self-development of mother; instruct in infant care; provide transportation; find community resources for childhood immunizations[63,64]	Mixed results: 2 (1 fair, 1 poor) of 3 studies favor CHW intervention vs. control; 1 (good) shows no difference between CHW interventions and no intervention; 1 moderate, 2 high	Low
Maternal and child health: prenatal care and perinatal outcomes 5/3389[63,71,74,78,81,82]	High/2 RCTs, 3 cohorts/2 fair, 3 poor	Inconsistent/direct/ imprecise	Create family-focused care plan; provide support; model problem-solving skills; promote self-development of mother; instruct in infant care; provide transportation; find community resources for childhood immunizations[63]; provide one-on-one counseling on participants' attitudes toward infant feeding; correct misconceptions; conduct group support sessions on infant feeding[71]; provide psychosocial support; educate family about pregnancy; advocate; link to community services for stress reduction; inform on health risks during pregnancy and on nutrition[74]; counsel; provide meal planning, pregnancy education, and shopping; discuss medical recommendations[78]; counsel; help apply for government benefits, housing, employment, and education; generally advocate for families[81,82]	Mixed results: 2 (both fair) favor CHW over control; 1 (poor) shows benefit of CHW for some outcomes, no difference for others; 2 (both poor) show no difference between CHW and professionals or no intervention or usual care; 5 high	Low

(*Continued*)

TABLE 4. (*Continued*)

Clinical Context/ No. Studies/ No. Subjects	Risk of Bias/ Design/ Quality	Consistency/ Directness/ Precision	Type of Service	Results: Intensity of CHW Interaction With Participants	Results: Overall Strength of Evidence
Maternal and child health: child development 4/1664[69,70,72,73,75–78]	Medium/3 RCTs, 1 cohort/3 fair, 1 poor	Inconsistent/direct/ imprecise	Develop individualized family service plan with specific goals; support mother's needs; promote maternal-child relationship[69,70] build relationships with families; provide active assistance to address existing crises; model problem-solving skills and effective parent-child interaction; link families with needed resources; provide parenting education; ensure presence of medical home for children[72,73]; provide intensive home visitation; promote healthy behaviors, competent child care, pregnancy planning, education, and employment; link to social and health services; promote healthy family/friend relationships[75–77] counsel; provide meal planning, pregnancy education, and shopping; discuss medical recommendations[78]	Mixed results: 2 studies (2 fair) show some benefit for CHW vs. no intervention or health professional, 2 (1 fair, 1 poor) show no difference between CHW and health professional; 4 high	Low
Maternal and child health: environment conducive to child well-being 8/3009[61,67-70,72,73,75–77,79,80]	Medium/8 RCTs/ 1 good, 4 fair, 3 poor	Inconsistent/2 direct, 4 indirect, 2 with both direct and indirect measures/imprecise	Model problem-solving techniques to reduce environmental tobacco smoke exposure to children[61]; apply a task-directed approach to reduce risk of parenting problems; provide transportation, support, and assistance with participant needs; advocate on participant's behalf; model positive parenting and homecare skills[67,68]; build relationships with families; actively help address existing crises; model problem-solving skills and effective parent-child interaction; link families with needed resources; provide parenting education; ensure presence of medical home for children[72,73]; teach and counsel on infant development, health education, and mother-infant interaction[79]; counsel; share information on child health and behavior; link families with existing community resources[80]; develop individualized family service plan with specific goals; support mother's needs; promote maternal-child relationship[69,70]; provide intensive home visitation; promote healthy behaviors, competent child care, pregnancy planning, education, and employment; link to social and health services; promote healthy family/friend relationships[75–77]	Mixed results: 5 studies (1 good, 2 fair, 2 poor) show no difference between CHW and alternatives; 1 poor study favors control over CHW; 2 fair studies favor CHW for some outcomes, favor control for others, and show no difference for some outcomes; 8 high	Low
Chronic disease management: diabetes mellitus 4/479[48,83–88,94]	Low/4 RCTs/fair	Inconsistent/direct/ imprecise	Act as liaison between patients and health care providers for adults with diabetes mellitus; attend clinic sessions with patient; provide translation and appointment reminders; reschedule missed appointments; reinforce self-care instructions[48]; offer to schedule appointments and visits; provide education; mobilize social support for adults with diabetes mellitus[83–87]; provide diabetes self-management education; refer to registered dieticians and healing center[88]; deliver participative classes for adults with diabetes mellitus; answer questions; reinforce education; promote behavior change; send biweekly postcards[94]	Mixed results: 2 (2 fair) of 4 studies found CHW more effective than usual care, 2 found no difference; 3 high, 1 moderate	Low

(*Continued*)

TABLE 4. (*Continued*)

Clinical Context/ No. Studies/ No. Subjects	Risk of Bias/ Design/ Quality	Consistency/ Directness/ Precision	Type of Service	Results: Intensity of CHW Interaction With Participants	Results: Overall Strength of Evidence
Chronic disease management: asthma symptoms 2/572[91,92,97]	Low/2 RCTs/1 good, 1 fair	Inconsistent/direct/ imprecise	Provide environmental assessment, individualized action plan, education and social support, and materials to reduce trigger exposure for asthma[91,92,97]; counsel on environmental tobacco smoke; provide integrated pest management services[97]	Mixed results: 1 (fair) favors CHW vs. delayed intervention; no difference between CHW and less intense intervention; 2 high	Low
Health promotion and disease prevention: disease prevention 1/294[65,66]	Medium/1 RCT/ fair	NA/direct/precision NR	Counsel adults for diabetes prevention; hold group and individual sessions[65,66]	No difference between CHW intervention and print intervention (for change in body mass index); 1 high	Low
Chronic disease management: hypertension 3/2823[49,50,89,90,93]	Medium/2 RCTs, 1 cohort/1 fair, 2 poor	Consistent/direct/ precise	Counsel regarding lifestyle, medication-taking, and appointment-keeping; tailor to patient need for adults with hypertension[49,50]; monitor blood pressure; provide health education and support; promote self-management of hypertension for adults[89,90]; provide education, counseling, and referrals; inform on access to health care; answer questions for adults with hypertension[93]	No difference between CHW intervention and CHW in a lesser capacity; 2 high, 1 moderate	Low
Chronic disease management: mental health 1/165[95,96]	High/1 RCT/poor	NA/direct/precision NR	Help with activities of daily living and leisure activities for homeless people with psychiatric diseases[95,96]	No difference between CHW intervention and usual care (health professionals); 1 high	Low

CHW indicates community health worker; NA, not applicable (consistency unknown, single study); NR, not reported; RCT, randomized controlled trial.

TABLE 5. Effect of CHW Intervention on Health Care Utilization: Strength of Evidence

Clinical Context/ No. Studies/ No. Subjects	Risk of Bias/ Design/ Quality	Consistency/ Directness/ Precision	Type of Service	Results	Overall Strength of Evidence
Health promotion and disease prevention: disease prevention (elevated blood pressure)					
1/421[44]	Medium/1 RCT/fair	Consistency unknown (single study)/ direct/precise	Refer to medical care; help schedule appointment; send appointment reminder letter; follow up to determine whether the appointment was kept; schedule a new appointment for each missed appointment (up to 3); help reduce barriers to care through referral to community transportation, child care, or other services[44]	Favors CHW intervention vs. no intervention; 1 moderate	Moderate
Cancer screening: mammography					
11/17,401[19,21–29,32,34,36–38,40,55–58]	Medium/6 RCTs, 5 observational/2 good, 4 fair, 5 poor	Consistent/direct/ precise (when reported)	Provide barrier-specific telephone counseling to promote screening[19]; conduct motivational speeches based on cancer survivor experience of CHWs; teach breast self-examination using a breast model; discuss resources for free- and reduced-cost mammograms[26]; conduct personal education sessions to deliver health promotion messages[28,29]; provide barrier-specific telephone counseling to promote screening; discuss resources for free- and reduced-cost mammograms; provide translation services, transportation, and childcare assistance[21–25]; make presentations to community groups and events; conduct one-on-one conversations; use informational/motivational materials[27]; provide barrier-specific counseling to promote screening[34]; provide one-on-one support, education, and ongoing and personal contact with clients[32]; conduct 12 weekly small group educational sessions[36–38]; provide education, counseling, and information on location of screening services during salon appointment[40]; provide education and barrier-specific counseling to promote screening; provide scheduling assistance[55,56]; educate on breast and cervical cancer and breast self-examination; provide educational materials on screening; facilitate to address logistical barriers to screening[57,58]	8 of 11 studies (2 good, 3 fair, 3 poor quality; 2 high, 1 moderate, 5 low intensity) favor CHW vs. no intervention, mail, print, or minimal CHW; 3 show no difference CHW and no-intervention control; 2 high, 4 moderate, 5 low	Moderate
Chronic disease management: infectious diseases (tuberculosis)					
1/244[51]	Medium/1 RCT/fair	NA/direct/precise	Transport participants to clinic appointment for homeless people with tuberculosis; assist with paperwork and doctor's recommendations[51]	Favors CHW intervention vs. control group given bus tokens, but monetary incentive was more effective than CHW or control given bus tokens; 1 moderate	Moderate

(*Continued*)

TABLE 5. (*Continued*)

Clinical Context/ No. Studies/ No. Subjects	Risk of Bias/ Design/ Quality	Consistency/ Directness/ Precision	Type of Service	Results	Overall Strength of Evidence
Chronic disease management: asthma (unscheduled visits)					
2/572[91,92,97]	Low/2 RCTs/1 good, 1 fair	Consistent/direct/ precise	Provide environmental assessment, individualized action plan, education and social support, and materials to reduce trigger exposure for asthma[91,92,97]; counsel on environmental tobacco smoke; provide integrated pest management services[97]	Favors CHW vs. less intense CHW arm or delayed intervention; 2 high	Moderate
Maternal and child health: prenatal care and perinatal outcomes					
1/145[74]	Medium/1 RCT/fair	NA/indirect/imprecise	Provide psychosocial support; educate family about pregnancy; advocate; link to community services for stress reduction; provide information on health risks during pregnancy and on nutrition[74]	Favors CHW vs. health professional; 1 high	Low
Chronic disease management: hypertension					
1/722[47]	High/1 cohort/poor	NA/direct/precision NR	Measure pulse and blood pressure (in emergency room session); provide educational counseling; identify barriers related to referrals, appointment keeping, and adherence to the treatment plan for adults with hypertension[47]	Favors CHW intervention vs. no intervention; 1 moderate	Low
Cancer screening: cervical cancer screening					
6/4366[32,36–39,55–58]	Low/5 RCTs, 1 observa-tional/1 good, 4 fair, 1 poor	Inconsistent/direct/ imprecise (when reported)	Tailor responses to individual barriers to cervical cancer screening; provide clinic referral and scheduling assistance, translation services, and transportation assistance[39]; provide one-on-one support, education, and ongoing and personal contact with clients[32]; conduct 2 small group gatherings and individual direct contacts to help access medical services and schedule appointments[35]; conduct 12 weekly small group educational sessions[36–38]; provide education and barrier-specific counseling to promote screening; provide scheduling assistance[55,56]; educate on breast and cervical cancer and breast self-examination; provide educational materials on screening; facilitate to address logistical barriers to screening[57,58]	Mixed results: 3 of 6 studies (2 fair, 1 poor quality; 2 moderate, 1 low intensity) show some difference between CHW and minimal CHW, media, direct mail, and usual care, 3 show no statistically significant difference between CHW and mail or no intervention; 2 high, 3 moderate, 1 low	Low
Cancer screening: colorectal cancer screening					
2/NR,[20] 78[33]	High/2 RCTs/1 fair, 1 poor	Inconsistent/direct/ precision NR	Provide information through existing church networks; organize and conduct at least 3 church-wide activities focused on spreading information[20]; support and educate one-on-one with screening techniques and barriers to screening; assist with scheduling procedures[33]	Mixed results, 1 study (fair quality, moderate intensity) favors CHW versus usual care, the other shows no difference between CHW intervention and controls (no-intervention control, tailored print and video); 1 moderate, 1 low	Low

(*Continued*)

TABLE 5. (*Continued*)

Clinical Context/ No. Studies/ No. Subjects	Risk of Bias/ Design/ Quality	Consistency/ Directness/ Precision	Type of Service	Results	Overall Strength of Evidence
Health promotion and disease prevention: health promotion—Latina health					
1/103[43]	Medium/1 RCT/fair	NA/direct/imprecise	Facilitate appointment scheduling for annual preventive examinations for Latinas[43]	No difference between CHW and mail; 1 moderate	Low
Maternal and child health: environment conducive to child well-being					
1/730[72,73]	High/1 RCT/poor	NA/indirect/imprecise	Build relationships with families; actively help address existing crises; model problem-solving skills and effective parent-child interaction; link families with needed resources; provide parenting education; ensure presence of medical home for children[72,73]	No difference between CHW intervention and routine clinical care; 1 high	Low
Cancer screening: clinical breast examination					
4/3386[32,36–38,40,57,58]	High/2 RCTs, 2 observational/2 fair, 2 poor	Consistent/direct/ imprecise	Provide one-on-one support, education, and ongoing and personal contact with clients[32]; conduct 12 weekly small group educational sessions[36–38]; provide education, counseling, and information on location of screening services during salon appointment[40]; educate on breast and cervical cancer and breast self-examination; provide educational materials on screening; address logistical barriers to screening[57,58]	No difference between CHW intervention and mail, CHW in lesser capacity and no intervention; 1 high, 3 moderate	Low
Chronic disease management: mental health					
1/165[95,96]	High/1 RCT/poor	NA/indirect/precision NR	Help with activities of daily living and leisure activities for homeless people with psychiatric diseases[95,96]	No difference between CHW intervention and usual care (health professionals); 1 high	Low

CHW indicates community health worker; NA, not applicable (consistency unknown, single study); NR, not reported; RCT, randomized controlled trial.

TABLE 6. Cost and Cost-Effectiveness of CHW Interventions

Clinical Context/ No. Studies/ No. Subjects	Risk of Bias Design/Quality	Consistency	Annual Intervention Program Costs Per Person, 2008 Dollars*	Measures of Cost-Effectiveness or Potential Cost Savings	Results	Overall Strength of Evidence
Maternal and child health: child development						
2/130,[69] 630[75]	Low/2 RCTs	Consistent	$3,070 to $4,214	None	Cost for CHW home visitation program was lower than for nurse home visitation program; no comparison of costs to program effectiveness	Low
Cancer screening: mammography promotion						
2/851,[55] 1443[24]	Moderate/2 RCTs	Consistent	$70 to $505	Cost per additional mammogram received of $2,150 to $4,990 (2000 dollars) for women with no mammogram in 12 mo preintervention	Cost per additional mammogram is not a standardized measure that can be compared to the cost-effectiveness of other interventions	Low
Chronic disease management: mental health						
1/165[96]	High/1 RCT	Consistency unknown (single study)	$9514	Mental health services costs in the 6-mo period postintervention fell $1,300 for the CHW intervention and rose $4,500 and $8,000 for the 2 alternative non-CHW interventions	Intervention costs were slightly lower for the CHW arm than for traditional assertive community treatment; inconclusive results on the impact of CHW on net program costs	Low
Chronic disease management: asthma						
1/170[91]	Low/1 RCT	Consistency unknown (single study)	$1366	Estimated annual cost reductions of $1,200 to $2,000 per child for the high-intensity CHW intervention as compared to preintervention period	Larger urgent care cost reductions for high-intensity CHW group as compared to low-intensity CHW group	Moderate

For all studies, economic findings were direct, imprecise, and no other modifying factors were included.
*Incremental compared with baseline. Costs adjusted to 2008 dollars using the US Consumer Price Index for All Urban Consumers.
CHW indicates community health worker; RCT, randomized controlled trial.

and mental health (1 study), evidence from 7 studies suggest that the CHW intervention and alternatives do not differ; the strength of evidence for these outcomes is low.[32,36–38,40,43,57,58,72,73,95,96] We found no evidence to evaluate the effectiveness of CHW interventions for all other clinical concerns.

Together, these studies provide low to moderate evidence that CHW interventions promote appropriate health care utilization for some outcomes (eg, more use of cancer screening tests, less use of emergency services) compared with a range of alternatives for disease prevention, mammography, infectious diseases, and asthma. For other reported outcomes, however, the evidence does not consistently show a statistically significant benefit of the CHW arm.

Costs of CHW Interventions

We identified 6 studies in the literature providing economic analyses of CHW interventions (Table 6).[24,55,69,75,91,96] All 6 studies estimated intervention costs, but not all reported specific cost components or the year for which costs were estimated. Because the CHW interventions with cost information differed (eg, populations targeted, settings, alternatives

analyzed, targeted outcomes), determining the typical cost of a CHW intervention is challenging. Estimated annual costs per participant ranged from $70 to $9500, depending on intervention intensity. None of these 6 CHW intervention evaluations estimated the costs per quality-adjusted life year saved, as recommended to enable cost-effectiveness comparisons across CHW and non-CHW interventions.[99,100] In general, we found insufficient evidence to evaluate whether CHW interventions are a cost-effective alternative to clinical interventions to promote health and prevent disease.

DISCUSSION

CHW interventions have the potential to address 2 fundamental imperatives for improving health care in the United States: the need to address substantial and persistent health care disparities, and the need to translate more research into practice. CHWs, by virtue of their role as a bridge to the health care system, are expected to help to disseminate widely efficacious interventions to populations that rarely benefit from health care advances.[7]

Evidence about the effectiveness of CHWs relative to alternative interventions is mixed. In various comparisons, some studies demonstrated statistically significant benefits of the CHW approach but others showed mixed results or no statistically significant differences. These last studies may demonstrate a lack of true benefit of the CHW arm. Conversely, the choice of controls (including health professionals such as nurses or CHWs in a lesser capacity), inadequate study power, and the Hawthorne effect (improvement in outcome in response to being studied) may explain the lack of significant differences between CHWs and alternatives. Tables 2 to 5 demonstrate that effectiveness of CHW interventions did not seem to be associated with study quality or intensity of CHW involvement for specific outcomes, but inconsistencies and omissions in describing components of CHW interventions limit overall assessments of whether high-intensity interventions deliver greater value than low- or moderate-intensity interventions. We found no published studies that evaluate the effectiveness of CHW training on health outcomes.[15]

We found limited evidence showing that CHW interventions can improve participant knowledge compared with alternative approaches such as no intervention, media, mail, or usual care plus pamphlets. We found mixed evidence for CHW effectiveness on participant behavior change and health outcomes: some studies suggested that CHW interventions can yield greater improvements in participant behavior and health outcomes, but other studies suggested that CHW interventions provide no statistically different benefits. Low or moderate strength of evidence suggested that CHWs can increase appropriate health care utilization for some interventions. We found insufficient evidence to evaluate the cost-effectiveness of CHW interventions relative to other public health interventions.

Our review suggests that CHWs may serve as a means of improving outcomes for underserved populations for some health conditions, as described above. For other outcomes, the absence of statistically significant differences, with comparable gains in both arms, may favor the use of CHWs from a cost or resource perspective when the comparator is a high-resource alternative, such as health care professionals.[53]

To understand fully the effectiveness of CHW interventions for specific outcomes and vulnerable subpopulations, further evaluations are needed that address the methodological limitations of prior studies and help fill the gaps in research. We discuss methodologic improvements, design considerations, and substantive gaps below.

Methodological Improvements

Future studies should (1) give clear conceptual models that explain the expected mechanism of change initiated by the CHW intervention; (2) justify the choices of alternative or comparison; (3) specify a priori the primary outcomes to be measured; (4) state hypotheses that build on the conceptual framework and the choice of comparator; (5) calculate required sample size to ensure that they are adequately powered and report on those power calculations; (6) consider study designs using external or blinded personnel to assess outcomes, rather than the CHWs who deliver the intervention; and (7) adhere to reporting standards such as STROBE (STrengthening the Reporting of OBservational studies of Epidemiology)[101] and CONSORT (CONsolidated Standards of Reporting Trials).[102] Studies infrequently reported the gap between planned and actual protocol delivery. Reporting the fidelity to and adaptations of protocol delivery is critical to a better understanding of how to scale up effective interventions.

These recommendations are particularly relevant for research and evaluation studies. Program implementation efforts without a significant research and evaluation component must weigh the benefits of external evaluation that is less likely to be influenced by social desirability bias or other problems of internal validity of results against the practical difficulties of obtaining outcome data through external observers who (unlike CHWs) may not have a relationship with the community and may be viewed with a greater degree of mistrust.

Design Considerations

CHW interventions will also benefit from the use of practical clinical trials and use of models such as the RE-AIM (reach, effectiveness, adoption, implementation, and maintenance) framework.[103] Representative participants, multiple and diverse settings, clinically relevant alternative interventions, and a focus on measures relevant to decision makers, which include cost, quality of life, reach, and adoption, can enhance the utility of CHW studies for translational research.[104–106] The RE-AIM framework provides practical guidance for the development of measures of public health impact for CHW interventions. Studies in our review focused on effectiveness, but they rarely provided quantitative assessments of other aspects of the RE-AIM elements as measures of public health impact, despite their underlying reliance on models of community change in addition to individual change.

Substantive Gaps

CHW interventions may serve as a bridge to the health care system for the underserved and are expected to serve as a tool to reduce disparities in access to and quality of care. Theoretical models underpinning CHW interventions postulate changes in knowledge as precursors to changes in behavior, health outcomes, or health care utilization.

Our review uncovered few studies that examined changes in either knowledge, such as understanding the need for preventive health services, or satisfaction (5 studies). Although the focus on health outcomes and health care utilization is appropriate, additional evaluation of changes in knowledge and satisfaction will help to clarify the processes of change initiated by CHWs; such information will then aid investigators in refining aspects of their interventions that are not as effective as expected. Analysis of health outcomes associated with type of CHW training will also help to refine CHW interventions.

Despite evidence of effectiveness, colorectal cancer screening uptake has been suboptimal. We uncovered a single study focusing on CHW interventions for colorectal cancer[20]; future research in this area may be fruitful in identifying successful strategies for increasing screening rates. Weight loss interventions utilizing CHW interventions may represent an additional area of future focus, given the current United States obesity epidemic, especially among health-disparate populations.

Existing CHW interventions often focus on underserved populations defined by race, ethnicity, or geographic location. Underserved groups such as low-income populations, undocumented immigrants, or the elderly may also benefit from studies of CHW interventions. A mapping of published CHW studies with AHRQ's priority conditions suggests that important conditions for new investigations include mental health problems, dementia, including Alzheimer disease, and disabilities.

The small number of CHW studies that report intervention cost and differences in study design limit the generalizability of economic results. Future cost-effectiveness analyses should assess costs per measure of immediate intervention impacts, such as urgent care utilization, and for uniform measures, such as quality-adjusted life years. Additionally, prospective data collection on CHW intervention costs can ensure that economic outcomes are reported alongside effectiveness measures, thus improving our understanding of costs and cost-effectiveness.[99,100,107]

In the absence of consistent data on intervention costs, we created a pragmatic measure in this report to approximate the intensity of resources used for CHW interventions. Consistent data on costs in future studies will ideally provide the best information to evaluate intervention intensity. In the interim, further development and validation of pragmatic measures of resource intensity can help policy makers shape the specifics of CHW interventions to provide the most meaningful benefit for improved health outcomes.

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