A Systematic Review of Health-Related Outcomes from Community Health

Worker Interventions in Health Promotion, Disease Prevention and

Chronic Disease Management

By

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Background

Community health workers (CHWs) can serve as a bridge to the health care system for both disease prevention and management. We aimed to conduct a systematic review of the effectiveness of CHW interventions in the areas of health promotion, disease prevention and chronic disease management.

Methods

We searched Medline, the Cochrane Database, and CINAHL from their inception through October 2008 using 12 different terms for CHWs including the MESH term "community health aides." We included studies with a comparison group that were conducted in the United States, published in English, and included at least 40 participants. Two reviewers independently assessed each abstract and full text articles for inclusion. Disagreements were resolved by consensus. Data was extracted onto a standard form by one reviewer and checked for completeness and accuracy by a second reviewer. Trained reviewers abstracted data and assessed the methodologic quality (internal validity) of studies using predefined criteria based on the U.S. Preventive Services Task Force and the National Health Service Centre for Reviews and Dissemination (U.K.) criteria.

Results

Our initial search identified 992 articles. Of these, 24 studies met the inclusion criteria and addressed disease prevention or management. Identified studies were diverse in terms of target population, intervention design, and condition of interest. All of the studies focused on low income or minority populations. Trial duration ranged from 3 months to 4 years. Nineteen

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studies were randomized controlled trials and 5 were observational. Of the 24 studies, 2 were rated good quality, 14 fair, and 8 poor. Heterogeneity of study designs, conditions of interest and outcomes precluded quantitative synthesis of the results.

Eleven studies addressed disease prevention, including pediatric immunizations (3), cardiovascular disease (2), diabetes prevention (1), HIV prevention (1), second-hand smoke exposure (1), colorectal cancer prevention (1), and general preventive care (2). Eight of eleven studies found that CHW interventions were more effective than usual care in either changing knowledge (2 of 2), behavior (4 of 6), health outcomes (2 of 4) or health care utilization (2 of 2).

Thirteen studies addressed disease management, including diabetes mellitus (4), hypertension (4), asthma (2), back pain (1), tuberculosis (1), and mental health (1). In diabetes management, two of four studies found that a CHW intervention was more effective than usual care in decreasing HgbA1c. Studies addressing hypertension management (4) did not show a significant difference in blood pressure control between groups, although participants in the CHW groups improved when compared to baseline values. Both asthma studies demonstrated that CHW interventions were effective in reducing unscheduled health care services, but no more effective than comparisons for improving symptoms.

Conclusions

CHWs have been used in many different health conditions, largely targeting low income and minority populations. CHW interventions in the area of disease prevention show promising benefits in improving patient knowledge and health care utilization, when compared to usual care. For chronic disease management, the majority of CHW interventions failed to show greater improvement in health outcomes than usual care except in asthma.

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Introduction

Health Disparities in the United States

Health disparities exist for a significant number of United States citizens. African-Americans suffer a disproportionate burden of disease, disability and death due to health conditions. Although the top three leading causes of death are the same for whites and blacks, the age-adjusted incidence is substantially higher in blacks for certain cancers (colorectal, stomach and prostate) and stroke.¹ Additionally, African-Americans have a rate of new AIDS cases 10 times higher than whites.² Unfortunately, disparities in health care quality and access are not getting smaller.² Lack of insurance contributes heavily to health disparities, although care remains lower for racial and ethnic minorities even when controlling for access-related factors.

The etiology of health disparities are multi-factorial, including actors at several levels: health systems, insurers, health care providers and patients.³ The Institute of Medicine (IOM) Report – *Unequal Treatment: Confronting Racial and Ethnic Disparities in Health Care* – offers a number of recommendations for interventions to help eliminate disparities, including defragmenting health care systems, improving health care provider awareness of the problem, increasing health care workforce diversity, and strengthening culturally competent, multidisciplinary approaches to the health care delivery.³ Additionally, the IOM report specifically recommends support for the use of community health workers (Recommendation 5-10).³

Community Health Worker (CHW) interventions have been identified as one potential solution to address health disparities in the United States. Defining CHWs remains challenging,

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given the breadth of interventions and disease conditions with which they have been involved. Regardless of disease condition or type of patient interaction, common threads across CHWs include their role as health workers who share a relationship with their community (e.g., shared language, ethnicity, race or disease condition) and who do not have professional training. The relationship CHWs share with the community in which they work has long identified them as a natural bridge to the health care system. Additionally, as trusted members of the community, CHWs may help to minimize barriers to care resulting from health beliefs and health values.⁴

History of CHWs

The history of CHWs supports the role they continue today in providing services to marginalized populations. The earliest records of CHWs date back to a doctor shortage in early 17th century Russia, when lay people, called feldshers, received training to provide basic medical care to military personnel.⁵ A similar model also developed in China, where laypersons, many of whom could not even afford shoes, became known as "barefoot doctors" after receiving training in treating wounds, delivering babies and setting broken bones.⁶ Barefoot doctors provide basic primary care to rural regions of China that were without doctors. Today, thousands of health programs employ community health workers worldwide for similar reasons.⁷

Internationally, a global shortage of medical personnel has increased the call for community health workers. Significant health care workforce shortages are present in 57 countries, including those in sub-Saharan Africa, as well as Bangladesh, India and Indonesia.⁸ For instance, the country of Malawi has only 1.1 doctors for every 100,000 people, compared to 230 doctors for every 100,000 people in the United States.⁸ With guidelines for increasing CHW involvement in global healthcare dating back to 1978, the World Health Organization (WHO)

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continues to support their use today.⁸ The HIV/AIDS epidemic in developing countries facing a critical shortage of professional healthcare workers has strengthened the need to make greater use of CHWs. Task shifting allows CHWs to take on jobs that were previously performed by nurses and thus rapidly fill the healthcare workforce deficit. One of the advantages of employing CHWs is the relatively short amount of training time necessary. This allows CHWs to be ready to work with patients years before training is completed for new nurses or physicians. Ultimately, the hope is that task shifting will improve access to primary care and, thus, serve to strengthen health care systems around the world.⁸

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Despite the relatively high ratios of physicians to patients in the United States, a significant percentage of the population remains underserved. There are currently approximately 75 generalists per 100,000 people with models estimating shortages of 35,000-44,000 generalists by 2025.⁹ The identification of marginalized populations and the desire to reduce health disparities has led to an interest in CHW interventions within our own country. The development of the CHW workforce in the United States has occurred over four important time periods: early documentation (1966-1972), utilization of CHWs in special projects (1973-1989), state and federal initiatives (1990-1998), and public policy options (1999-current).¹⁰ There are few references in the literature to CHW interventions prior to the mid-1960's.

During the first time period, early documentation, CHWs were used to address problems of the poor as opposed to specific health improvement models. The New York City Health Department first documented CHW use in a 1960's tuberculosis program that involved "neighborhood health aides."¹¹ One of the first effectiveness studies on CHWs was published in

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1970 and consisted of a CHW intervention in which they worked with nurses and physicians to improve compliance in pediatric infections.¹²

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> Public and private funding of projects involving CHWs continued to grow from 1973-1989, resulting in more publications.¹⁰ Further attention was brought to CHWs as a result of a WHO declaration in 1978, proposing the development of national CHW programs as important for promoting primary health care.¹³ Another significant step for dissemination of CHW programs occurred when the "Resource Mothers" curriculum, prepared for the Virginia Task Force on Infant Mortality during the 1980s, became one of the early CHW curricula distributed nationally.¹⁴

> From 1990-1998, there were several state and federal bills introduced proposing CHW interventions, however, none of them passed. Despite this lack of legislative support, training centers dedicated to CHWs opened in Boston¹⁵ and San Francisco.¹⁶ Support remained high for the promise of CHW interventions, as summarized by the Pew Health Professions Commission report: "The widespread incorporation of CHWs into the health delivery system offers unparalleled opportunities to improve the delivery of preventive and primary care to America's diverse communities."

Legislation addressing the CHW workforce was first passed in 1999 in the state of Texas, starting the public policy options period (1999-2006).^{10, 17} During this time, a number of associations called for expansion of CHW roles and projects, including the National Rural Health Association, The American Association of Diabetes Educators, and The American Public Health Association. In 2003, the Institute of Medicines' Report also made recommendations regarding the role of CHWs in health disparity populations.³ During this time period the first national

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legislation on CHWs was passed: The Patient Navigator Outreach and Chronic Disease Prevention Act of 2005. This law provides funding for community health worker interventions to address health disparity populations with, or at risk for, cancer and chronic diseases. In 2000, there were an estimated 86,000 CHWs supporting American communities.¹⁰

A 2007 Health Resources and Services Administration (HRSA) report on CHW National Workforce identified six key areas of CHW activity: creating effective linkages with the health care system, providing health education, assisting underserved individuals in receiving appropriate services, providing informal counseling, addressing basic needs, and building community capacity in addressing health issues.¹⁰ As natural bridges between underserved communities and the health care system, CHWs have been used to gather information for medical providers, informants of community needs, as well as translators (Figure 1).



Figure 1. Community Health Workers as a Natural Bridge between Underserved Populations and Health Systems

CHW interventions cite theories of individual behavior change,^{18, 19} however, these interventions most certainly operate within models of community change,^{6, 20} even if not explicitly stated. They have also been used to teach health promotion and disease prevention, manage chronic diseases, make referrals, and provide follow-up. Models of care utilizing CHWs

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include incorporation into the care delivery team, as a community navigator, as an education provider and as an outreach agent.¹⁰ The disease conditions CHWs help to address include a wide spectrum, from AIDS prevention to smoking cessation, hypertension management to pediatric immunization, and asthma management to maternal and child care.

Systematic Review Question

The results discussed in this paper were obtained as part of a systematic review conducted by the RTI International-University of North Carolina at Chapel Hill Evidence-based Practice Center (RTI-UNC EPC) as commissioned by the Agency for Healthcare Research and Quality (AHRQ). The key question this paper addresses is the effectiveness of community health worker interventions on outcomes of knowledge, behavior, satisfaction, health, and health care utilization in disease prevention and chronic disease management. The operational definition of CHWs was created through a combination of literature review and advice from RTI-UNC EPC's technical expert panel members.²¹ A CHW:

- Performs health-related tasks to create a bridge between community members, especially hard-to-reach populations, and the health care system (i.e., performs tasks extending beyond peer counseling or peer support alone);
- Has health training associated with the intervention; training is shorter than that of a professional worker (i.e. training 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.

Figure 2. A Conceptual Framework for Outcomes of Community Health Workers



Methods

The RTI-UNC EPC team who developed the comprehensive evidence report on community health workers consisted of a senior health services researcher, Meera Viswanathan, PhD, a clinician-investigator, Dan Jonas, MD, MPH, a preventive medicine resident, Brett Nishikawa, MD, an economist, Amanda Honeycutt, PhD, two EPC staff members, Laura Morgan, MA, and Patricia Thieda, MA, in addition to this author.

Literature Review Methods: Inclusion and Exclusion Criteria

Inclusion and exclusion criteria used in the literature review are listed in Table 1.

Although the AHRQ commissioned report will include all CHW interventions, this paper focuses

on those in the categories of health promotion/disease prevention and chronic disease management, as determined by a team comprised of three physicians with backgrounds in internal medicine and/or pediatrics. Specifically, this paper excludes studies in the areas of (1) cancer screening and prevention; (2) injury prevention; and (3) maternal and child health. Studies in these areas were included in the full report.

Studies were limited to those conducted in the United States, to focus on data relevant to domestic healthcare concerns. Additionally, the search was limited to studies published in 1980 or later, to maintain relevance to current practice, and those published in the English language. Studies were required to report original research and needed at least 40 subjects to be included. We excluded studies if the effect of the CHW in the intervention could not be determined.

Table 1. Inclusion and Exclusion Criteria.

Category Populations	Criteria All US study populations with a community-health worker intervention	
Interventions	Intervention delivered by CHW (see working definition above), not peer counselors or health professionals	
Comparisons	CHW intervention must have a comparison arm; all comparisons are admissible assuming the effect of the CHW intervention can be isolated	
Outcomes	Knowledge, satisfaction, behavior, health, and health care utilization	
Time period	1980 – November 14, 2008	
Publication language	English	
Admissible evidence (study design and other criteria)	Admissible designs: controlled trials ($n \ge 40$), non-randomized controlled trails ($n \ge 40$), systematic reviews, meta-analyses, prospective trials with historical controls ($n \ge 40$)	
	 Other criteria: Original research studies providing sufficient detail regarding methods and results to enable use and adjustment of data and results Relevant outcomes able to be abstracted from data presented in papers Effect of CHW intervention must be abstractable 	

Literature Search and Retrieval Process

The search was conducted using MEDLINE®, Cochrane Collaboration resources, and Cumulative Index to Nursing and Allied Health Literature (CINAHL). Additionally, handsearches were performed of the reference lists of relevant articles to ensure relevant studies were not overlooked. The Technical Expert Panel (TEP) was consulted to identify any additional relevant studies.

The MEDLINE® search included the Medical Subject Heading (MeSH) search term "Community Health Aides." Additional search terms included: health advisor, health worker, health advocate, health paraprofessional, community health representative, outreach worker, dumas, promotoras, embajadores, and consejeras. The study was limited as described in the inclusion and exclusion criteria, including human subjects and the English language. The complete search strategy is described in Table 2.

The MEDLINE® search produced 640 unduplicated records and 175 new records were obtained from CINAHL and the Cochrane Collaboration resources, yielding 815 records. The search was updated November 14, 2008 and updated by hand-searches, background articles and input from the TEP, yielding a new total of 992 unduplicated records.

Article abstracts were used to determine study eligibility for inclusion. Two reviewers independently reviewed each abstract using an Abstract Review Form (Appendix A). If one reviewer concluded the article should be included at this stage, it was retained. Two reviewers read each article using a Full Text Inclusion/Exclusion Form (Appendix A) to determine whether it was eligible for inclusion. Table 2. MEDLINE® search strategy and unduplicated results for February 2007

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state.

Search number	Search Term	Yield
<u>#2</u>	Search "Community Health Aides" [Mesh] OR "health advisor" OR "health worker" OR "health advocate" OR "health paraprofessional" OR "community health representative" OR "outreach worker" OR dumas OR promotoras OR embajadores OR consejeras	<u>6051</u>
<u>#3</u>	Search "Community Health Aides" [Mesh] OR "health advisor" OR "health worker" OR "health advocate" OR "health paraprofessional" OR "community health representative" OR "outreach worker" OR dumas OR promotoras OR embajadores OR consejeras Limits: Humans, English	<u>3031</u>
<u>#6</u>	Search (("Outcome Assessment (Health Care)"[Mesh] OR "Pregnancy Outcome"[Mesh])) OR ("Treatment Outcome"[Mesh] OR "Outcome and Process Assessment (Health Care)"[Mesh] OR "Fatal Outcome"[Mesh]) Limits: Humans, English	<u>369350</u>
<u>#7</u>	Search #3 AND #6 Limits: Humans, English	<u>175</u>
<u>#17</u>	Search ((("Patient Education as Topic" [Mesh] OR "Patient Education Handout "[Publication Type])) OR "Professional-Patient Relations" [Mesh]) OR "Office Visits" [Mesh] Limits: Humans, English	<u>109582</u>
<u>#18</u>	Search #3 AND #17 Limits: Humans, English	<u>90</u>
<u>#26</u>	Search ("Costs and Cost Analysis" [Mesh] OR "Economics" [Mesh] OR "economics "[Subheading] OR "Cost-Benefit Analysis" [Mesh] OR "Cost Allocation" [Mesh] OR "Cost of Illness" [Mesh] OR "Cost Control" [Mesh] OR "Cost Sharing" [Mesh] OR "Cost Savings" [Mesh] OR "Health Care Costs" [Mesh] OR "Direct Service Costs" [Mesh] OR "Hospital Costs" [Mesh] OR "Employer Health Costs" [Mesh] OR "Drug Costs" [Mesh]) Limits: Humans, English	257114
<u>#27</u>	Search #3 AND #26 Limits: Humans, English	<u>254</u>
#28	Search united states Limits: Humans, English	606881
#29	Search #27 AND #28 Limits: Humans, English	71
#33	Search (("Education"[Mesh] OR "education "[Subheading])) OR "Education, Professional"[Mesh] OR training Limits: Humans, English	<u>370579</u>
<u>#34</u>	Search #3 AND #33 Limits: Humans, English	<u>1013</u>
<u>#35</u>	Search #34 AND #28 Limits: Humans, English	241
<u>#41</u>	Search (((("Randomized Controlled Trials as Topic"[Mesh] OR "Randomized Controlled Trial "[Publication Type])) OR "Single-Blind Method"[Mesh]) OR "Double-Blind Method"[Mesh]) OR "Random Allocation"[Mesh] Limits: Humans, English	<u>303728</u>
<u>#42</u>	Search #3 AND #41 Limits: Humans, English	<u>165</u>
<u>#44</u>	Search control OR controlled Limits: Humans, English	1368901
#45	Search #3 AND #44 Limits: Humans, English	<u>908</u>
#46	Search #45 AND #28 Limits: Humans, English	154
. <u></u>	Total unduplicated PUBMED records	640

Literature Synthesis

The RTI-UNC EPC team jointly developed the evidence tables. Articles were abstracted using the evidence tables initially by one trained team member. Outcomes were abstracted into the following categories: knowledge, behavior, satisfaction, health outcomes, and health care utilization. Completeness and accuracy of abstractions were checked by a second reviewer.

Individual studies were rated for quality (internal validity) using standard methods.^{22, 23} We used a standard form for RCTs and one developed by RTI and adapted for this systematic review for observational studies (Appendix A).²³⁻²⁵ Studies were evaluated on nine key domains: background, sample selection, specification of exposure, specification of outcome, soundness of information, follow-up, analysis comparability, analysis of outcome, and interpretation. Additionally, RCTs were evaluated on the quality of randomization. Studies were dually evaluated for quality using standard methods with reconciliation by consensus for disagreements.

Strength and Applicability of Evidence

Strength of evidence evaluations were based on the AHRQ Comparative Effectiveness Methods Guide (Table 4).²⁶ Each outcome was dually assessed for strength of evidence with reconciliation by consensus used for disagreements.

Table 4. Strength of evidence grades and definitions

Grade	Definition
High	High confidence that the evidence reflects the true effect. Further research is very unlikely to change our confidence in the estimate of effect.
Moderate	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	Low confidence that the evidence reflects the true effect. Further research is likely to change the confidence in the estimate of effect and is likely to change the estimate.
Insufficient	Evidence either is unavailable or does not permit estimation of an effect.

Qualitative assessment of the population, intensity or quality of treatment, choice of comparator, outcomes and follow-up timing were used to evaluate the applicability of the evidence. AHRQ's Comparative Effectiveness Methods Guide guided parameters for evaluation.²⁷

Intervention Intensity

CHW interventions were classified by a measure of intensity to serve as a proxy of resource allocation. Interactions were classified as low, moderate and high intensity by the number of elements of the described intervention: one-on-one, face-to-face, one-hour per session or more, three or more months' duration, three or more interactions, and use of tailored materials. High intensity interventions had at least four of six elements, moderate interventions had two or three elements, and interventions with only one or none of the elements were considered low intensity.

Overview of Results:

Of the 992 articles, 87 were relevant to address the overall systematic review questions and met our inclusion and exclusion criteria. Of the 87 articles, 24 identified interventions in the areas of health promotion/disease prevention and chronic disease management.

Results: Health Promotion and Disease Prevention

Pediatric Immunizations

Study Characteristics. Two RCTs, one good^{28, 29} and one fair quality³⁰, and one poor prospective cohort study, REACH-Futures,^{31, 32} examined outcomes of CHW interventions to improve pediatric immunization rates in inner cities. The RCTs used moderate-intensity interventions and the cohort study used a high-intensity intervention. Both RCTs used CHWs to provide reminder phone calls for upcoming clinic appointments. The good RCT, targeting children < 12 months in a county public health clinic in metro Atlanta, had CHWs make home visits only if a child remained behind on their immunization schedule. ^{28, 29} Additionally, this study compared four groups of children receiving: (1) CHW contact, (2) automated phone call reminders, (3) a combination of a CHW and automated phone call reminders, and (4) a control group defined by normal clinic procedure. ^{28, 29} Outcomes were assessed after 22 months.^{28, 29} The fair study, targeting low-income children in Manhattan, also used CHWs to provide basic immunization education and referral, in addition to assisting in obtaining immunization services through a combination of phone and home visits.³⁰ The fair study compared outcomes after six months for children receiving the CHW intervention to a control group who were informed of their child's immunization status at enrollment and instructed to reschedule the missed appointment.³⁰ Variations in measures of outcomes preclude quantitative synthesis of the results.

REACH-Futures was a prospective cohort study that compared a high-intensity intervention of CHW and nurse visits with historic controls of nurse-only home visits.^{31, 32} There were monthly home visits that started prenatally and ended at one year.^{31, 32} This study was rated poor for high potential for secular trends, given the time difference between comparators, and for other confounding.^{31, 32}

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Overview of results. Three studies, including two RCTs, one good,^{28, 29} one fair,³⁰ and one poor prospective cohort study^{31, 32} evaluated the impact of CHWs on vaccine series completion rates and differed in demonstrating CHW effectiveness. The good study ^{28, 29} found no difference between groups receiving the CHW intervention and the control group. In contrast, the fair study demonstrated that children in the CHW group were more up-to-date and less likely to be late for their immunizations than the controls.³⁰The control group for this study received more intervention directed at improving immunization rates, which would diminish the apparent effectiveness of the CHW. This study was more intensive, however, with regular home visits or phone calls over six months to ensure that requisite vaccines were received, which may have resulted in the difference in effectiveness between studies. REACH-Futures^{31, 32} also found that the CHW-intervention group had a higher proportion of fully immunized participants at 12 months, compared to historic controls who had received a nurse-only home visit.

Knowledge. None of the studies reported outcomes for knowledge.

Behavior. None of the studies reported outcomes for behavior changes.

Satisfaction. None of the studies reported outcomes for satisfaction.

Health outcomes. All of the studies evaluated immunization rates. The good study evaluated vaccine series completion rate from an immunization registry and found no difference between the CHW and control groups. 28,29 The fair study found that children in the CHW arm were more up-to-date on immunizations than in the control arm (75% vs. 54%, p=0.03) and less were late for immunizations (18% vs. 38%, p<0.5).³⁰ The poor cohort study, REACH-Futures, evaluated vaccine series completion rates at 12 months and found a higher proportion of children receiving the CHW and nurse home visits were up-to-date than historical controls (p<0.001).^{31, 32}

Health care utilization. Neither study reported outcomes for health care utilization.

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Author, Year Study Design Population Setting Sample Size Quality	Intensity of CHW intervention/Study Groups	Results
Rask, 2001; ²⁹	Moderate	Vaccine Series complete from
LeBaron, 2004 ²⁸		immunization registry
RCT Pediatric	G1: Autodial -received an automated telephone call or postcard to remind families 7 calendar days before child was due to be immunized. Patient received postcard if no number or nonworking. Delivered recorded message from HD medical staff	No statistical difference between CHW and control groups
Immunizations	HD medical stan.	
Children < 12 months in a country public health clinic in metro Atlanta	G2: Outreach - contacted by outreach worker following a standardized protocol imitated by a phone call within 1 week. Outreach worker made reminder call before appt if time known. If child remained behind the next month, a home visit was attempted monthly.	
N: 3050	G3: Combination of G1 & G2	
Good	G4: Control	
Barnes, 1999 30	Moderate	Up-to-date on immunizations
RCT	G1: Basic immunization education and referral. During	G1: 75%
Pediatric	throughout the remainder of follow-up, families were	G2: 54% (P = 0.03)
Immunizations	reminded of upcoming vaccinations and were re- contacted to ensure that requisite vaccines were	Late for immunization
Low-income children in	received. If a family required support or assistance to obtain immunization services.	G1: 18%
Manhattan, NY		G2: 38% (P < 0.05)
N: 434 Fair	G2: informed of their child's immunization status at the enrollment visit by the control group interviewer and were instructed to reschedule the missed appointment.	
Barnes-Boyd,	High	Higher proportion fully immunized
2000 ³²	G1: Monthly home visits over 1 year; visits at prenatal, 1, 6, and 12 months teamed with a nurse.	(p<0.001)
Cohort	G2: Historic controls with nurse home visits.	
Pediatric Immunizations		
Low-income inner- city African American women and infants in Chicago, IL		
N: 1922 Poor		

Health Promotion – Latina Health.

Study Characteristics. Two RCTs, one fair³³ and one poor quality,^{34, 35} examined outcomes of CHW interventions compared to mailings for health promotion in Latinas. The fair study³³ used a moderate-intensity CHW intervention in uninsured Hispanic women age 40 and older living at the US-Mexico border. The fair study³³ evaluated a CHW home visit in addition to a reminder postcard compared to reminder postcards alone to increase return to clinic for an annual preventive exam. The poor study, Secretos de la Buena Vida, used a high-intensity CHW model in the same target population living in San Diego County.^{34, 35} Secretos de la Buena Vida^{34, 35} evaluated the effectiveness of weekly CHW home visits and phone calls in addition to tailored print materials compared to tailored materials alone or off-the-shelf materials for changing dietary behavior. Variation in measures of health outcomes and health care utilization preclude quantitative synthesis of the results.

Overview of results. The fair study,³³ found that a moderate-intensity CHW intervention had a nonsignificant trend towards a greater increase in exam rates than a reminder postcard in increasing preventive exam appointments. Secretos de la Buena Vida was rated poor for internal validity due to a high potential for selection bias, measurement bias, and confounding.^{34, 35} Secretos de la Buena Vida demonstrated that a high-intensity CHW intervention group was different from those receiving weekly tailored dietary printed material in terms of dietary intake immediately post-intervention. However, this difference was no longer apparent after six months, although all three groups improved. ^{34, 35}

Knowledge. Neither study reported outcomes for knowledge.

Behavior. The Secretos de la Buena Vida project examined behavioral changes.^{34, 35} Immediately post-intervention, the CHW arm differed from the tailored printed materials arm in terms of total fat, saturated fat, glucose, and fructose intake. There were no significant

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differences between groups at six and 12 months post-intervention in dietary intake of fat or fiber, based on a validated measure for 24-hour diet recall.

Satisfaction. Neither study reported outcomes for satisfaction.

Health outcomes. Neither study reported outcomes for improved health.

Health care utilization. The moderate-intensity CHW study ³³ reported on the percentage of women returning to clinic for a second annual preventive exam. The CHW arm had a higher percentage of women returning for an exam (65% vs. 48%; RR 1.35; 95% CI 0.95-1.92) however, this difference was not statistically significant.

Table 6: CHW HPDP: Health Promotion Interventions

Author, Year Study Design Population Setting Sample Size Quality	Intensity of CHW Intervention	Study groups	Results
Hunter, 2004 ³³	Moderate	G1: Received postcards in the mail 2 weeks before the month their annual	Return to clinic for a second
RCT		exams were due, printed in language used to complete original G1: 48% (n=24)	G1: 48% (n=24)
Annual preventive exams		questionnaire	G2: 65% (n=33)
Uninsured Hispanic women, aged 40 and older, living at the US-Mexico border		G2: Received G1 intervention and were visited by a promotora 2 weeks after the postcard had been mailed. Promotora facilitated appointment scheduling and contacted them to facilitate rescheduling if appointment was missed.	RR=1.35 [95% CI 0.95-1.92]
Fair			
Elder, 2005 ³⁵	Hign	calls + tailored print materials	total fat gm, total fiber gm (Nutrition Data System 24-h dietary recall interview) (validated)
RCT: Secretos de la buena vida	·	G2: 12 weekly tailored newsletters & No significant	No significant difference between
Dietary behavior changes		G3: 12 weekly off-the-shelf dietary printed material	groups at 6 & 12 months post- intervention
Latinas in San Diego County			

N: 357 Poor

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Disease Prevention

Study Characteristics. Six studies, five RCTs^{18, 36-41} and one prospective cohort study,⁴² examined outcomes of CHW interventions for disease prevention in underserved populations throughout the US. Two studies were high-intensity and fair quality,^{18, 36, 38} two studies were moderate-intensity, one fair³⁷ and one poor, ^{39, 40} and two studies were low-intensity, one fair⁴² and one poor⁴¹. Studies focused on a broad range of disorders, including cardiovascular disease prevention^{37, 39, 40}, diabetes prevention,^{18, 36} HIV prevention⁴², second-hand smoke exposure³⁸, and colorectal cancer prevention⁴¹.

Three of the RCTs were of fair quality^{18, 36-38} and two were poor.³⁹⁻⁴¹ A fair quality RCT conducted in Missouri evaluated a high-intensity CHW intervention focused on diabetes prevention in a low-income, African-American female population. ^{18, 36} This study compared three months of weekly sessions, alternating between group and individual sessions, targeting stages of change to tailor dietary patterns to a control group that received a book to read. ^{18, 36} A fair quality RCT in San Diego evaluated a high-intensity CHW intervention focused on decreasing secondary tobacco smoke exposure in Latino neighborhoods.³⁸ The intervention consisted of six home and/or phone visits by CHWs over four months using culturally tailored behavioral problem-solving techniques to reduce secondary tobacco smoke exposure and was compared to no intervention (control).³⁸ A fair quality RCT study in Seattle evaluated a moderate-intensity CHW assistance with medical follow-up compared with verbal advice to see a medical provider in low-income neighborhood participants who were found to have elevated blood pressure.³⁷ A poor quality RCT in Baltimore evaluated a moderate-intensity intervention consisting of a NP and CHW team at a nonclinical site with exercise equipment, where the CHW provided dietary counseling, smoking cessation and exercise counseling.^{39,40} This was compared to "enhanced" primary care, the same risk-specific materials and information on local

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programs given to the intervention group, results and recommendations to the patients' primary care physicians. The Baltimore study was rated poor quality due to a high potential for measurement bias.^{39, 40} The WATCH trial was a poor-quality RCT conducted in rural, predominantly African-American churches in North Carolina.⁴¹ This study had four arms, including: (1) Control churches offered health education session and speakers not related to study objectives; (2) CHW intervention, consisting of organization and presentation of at least three church-wide activities on educating and enhancing support for healthy lifestyle and colorectal cancer screening; (3) four personalized computer-tailored newsletters and four targeted videotapes (TPV) focused on healthy lifestyle and colorectal screening mailed bimonthly to participants' homes; and (4) both the CHW and TPV intervention.⁴¹

The prospective cohort study was of fair quality and evaluated the effectiveness of a lowintensity CHW intervention in HIV prevention by street outreach to at-risk community members in Louisiana compared to a control group in a neighborhood receiving no intervention.⁴²

Overview of results. Disease prevention studies reported on outcomes of knowledge, behavior, health outcomes, and health care utilization. Overall, four of the six studies found that a CHW intervention was more effective in achieving outcomes than the respective control group. ^{18, 36, 37, 39, 40, 42} Two fair quality studies, the Missouri study and the prospective cohort study, reported improved knowledge of the respective diseases in the CHW intervention as compared to respective controls.^{18, 36 42} Two fair quality studies, the Missouri study^{18, 36} and the prospective cohort study⁴², and one poor study, the Baltimore study^{39, 40}, demonstrated that low- and moderate-intensity CHW interventions were more effective than controls in changing health behaviors. The two studies that targeted tobacco cessation found opposite results regarding CHW effectiveness.³⁸⁻⁴⁰ The San Diego study found no difference in smoking cessation between a

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high-intensity CHW intervention group and a group receiving nothing based on validated RIA of children's hair for nicotine and cotinine.³⁸ The Baltimore study found a significant difference between a moderate-intensity CHW intervention and enhanced usual care, however, this outcome was based on self-report.^{39, 40} One study, the Seattle study, measured health care utilization and demonstrated that a moderate-intensity CHW intervention increased medical follow-up compared to a group given verbal advice to seek medical care for elevated blood pressure.³⁷

Knowledge. Two fair quality studies^{18, 36 42} reported outcomes for improved knowledge of the respective diseases. The Missouri study^{18, 36} found that participants in the CHW intervention had an improved knowledge of label reading as assessed by a non-validated questionnaire (p<0.0001) that remained significant at six month follow-up compared to a control group receiving a book to read. The prospective cohort study⁴² demonstrated that a low-intensity CHW street outreach program was effective at increasing knowledge of where to obtain free condoms (90% vs. 74%, OR 3.2, p=0.001).

Behavior. Five RCTs, three fair^{18, 36-38} and two poor quality³⁹⁻⁴¹, examined a variety of behavioral changes, with three demonstrating CHW effectiveness^{18, 36, 37, 39, 40} and two ^{38, 41} showing no difference as compared to their respective controls. The Missouri study on diabetes prevention^{18, 36} evaluated dietary change following CHW-led group and individual sessions and found a reduction in fat intake with a validated food frequency questionnaire as compared to a control group (p<0.0001). The San Diego study, a high-intensity CHW intervention of home and telephone visits to reduce second hand tobacco smoke to children as compared to a control group found no difference from baseline by self-report or validated RIA of child's hair for nicotine and cotinine.³⁸ In contrast, the Baltimore study ^{39, 40} evaluated a CHW intervention and found a

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difference in self-reported smoking cessation as compared to a standard of care group (16.2% reduction vs. 7.0%, p<0.001). Both groups reported less smoking, confirmed by measures of hair cotinine. The WATCH trial did not show a difference in either fruit and vegetable intake or physical activity as compared to the control arm.⁴¹ The prospective cohort low-intensity intervention study targeting HIV prevention⁴² demonstrated an increase in condom use reported in the intervention group (OR 1.37, 95% CI 1.20-1.56).

Satisfaction. None of the studies for health promotion evaluated satisfaction outcomes.

Health outcomes. The Missouri study of diabetes prevention found no difference within or between arms when comparing the high-intensity CHW intervention and the control group in terms of body weight and BMI at baseline (BMI 35.7 vs. 35.3) and after six months (BMI 35.7 vs. 35.4). ^{18, 36}

Health care utilization. The Seattle study of a moderate-intensity CHW intervention evaluated self-reported medical provider follow-up within 90 days of determined elevated blood pressure.³⁷ This study demonstrated an increased rate of completed follow-up in the CHW group as compared to the control group (65.1% vs. 46.7%, p=0.001) and the number needed to treat to bring one person to medical care was 5 (95% CI=3,13).³⁷

Table 7: CHW HPDP: Disease Prevention Interventions

Author, Year Study Design Population Setting Sample Size Quality	Intensity of CHW intervention	Study groups	Results
Auslander, 2002; ¹⁸ Williams, 2001 ³⁶ RCT Diabetes prevention Low-income African-American women in a large Missouri city	High	G1: Six group sessions (approximately six to eight participants per group) and six individual sessions targeting stages of change to tailor dietary pattern with a peer educator, meeting weekly over a 3-month period G2: Control - a book	FFQ – Validated Intervention was effective in reducing fat intake, as measured by percent of calories from total fat (baseline/6 months): G2 – 36.0/34.5, G1 – $35.9/32.3$, P<0.05 BMI: No significant difference between groups Knowledge of Label Reading Questionnaire (Unvalidated) – baseline/6 months: G2 – $5.4/5.7$, G1 – $5.5/6.3$ (p>0.0001)
N: 294 Fair			
Conway, 2004 ³⁸ RCT Secondary tobacco smoke	High	G1: home & telephone visits on problem-solving techniques to reduce ETS exposureG2: Control	RIA of child's hair for nicotine & cotinine (validated) No significant difference between groups
Latino neighborhoods in San Diego County N: 143			
Fair Krieger, 1999 37	Moderate	G1: CHW assistance with medical	Self-report of completed follow-up
RCT		follow-up	within 90 days (validated by medical provider report)
Hypertension		G2: advice to see medical provider, list of public & community clinics	G1: 65.1% G2: 46 7% (p=0.001)
Low-income neighborhoods in Seattle			
N: 421 Fair			
Becker, 2005 ⁴⁰ ;Cene, 2008 ³⁹ RCT Cardiovascular disease prevention Baltimore, MD N: 267	Moderate	G1: EPC- received risk-specific materials (same as intervention group), PCP received results and recommendations, sent info on local programs (ex. YMCA) G2: CBC - received care in 1 nonclinical site in the community from a NP and CHW. CHW provided dietary counseling, smoking cessation, and exercise counseling lasting 30 minutes.	Smoking Cessation (self-report): G1: 7% reduction G2: 16.2% reduction (p<0.001)

		· · · · · · · · · · · · · · · · · · ·	
Author, Year Study Design Population Setting Sample Size Quality	Intensity of CHW intervention	Study groups	Results
Campbell 2004 ⁴¹	Low	G1: Control churches were offered	Dietary Change Daily fruit and
		health education sessions &	vegetable servings
RCT		speakers on topics of their choice not	(baseline/follow-up):
		directly related to study objectives	G1: 3.3/3.4
African American			G2: 3.5/3.5
rural churches. NC		G2: Organize & conduct at least 3	G3: 3.3/3.9
·····,····,		church-wide activities on spreading	G4: 3.4/3.7
NR (12 churches:		info and enhancing support for	No sig change across arms for
completere/dropoute		healthy lifestyle & CPC screening	LHA interventions
of individual			ENA interventiona
porticipants from			Reveised Activity Represtional
participants from		C2: (nonconclized computer tailored	(madarate vigarave) activity MET
each church not		G3: 4 personalized computer-tailored	(moderate-vigorous) activity MET
reported)		newsletters & 4 targeted videotapes	nours/week, M(SE)
Poor		(TPV) corresponding to the same	(baseline/follow-up):
		behaviors mailed to participants'	G1: 9.3(0.88)/8.4(0.69)
		homes bimonthly for first 6 months	G2: 10.5(0.9)/10.6(0.70)
		after baseline data collection; 4th	G3: 9.5(0.80)/10.9(0.61)
		mailing was 9 months baseline	G4: 9.7(0.76)/9.7(0.60)
			No sig change across arms for
		G4: LHA + TPV	LHA interventions
Wendell, 200342	Low	G1: Discussions with community	Condom use Intervention vs.
		members during which they	Comparison
Prospective Cohort		assessed the client's needs,	odds ratio 1.37 (95% confidence
Study		imparted a risk- or harm-reduction	interval 1.20, 1.56; P<0.001)
,		message, answered questions.	
HIV Prevention		made referrals, and negotiated and	
		reinforced behaviour change	
At-risk		temerese sonarioar shangor	
neighborhoode in		G2: Comparison group	
Louiciana		oz. oompanson group	
Louisiana			

Table 7: CHW HPDP: Disease Prevention Interventions (continued)

N: 6547 Fair

Chronic Disease Management: Diabetes Mellitus

Study characteristics. Four studies, three RCTs^{20, 43-48} and one prospective cohort study⁴⁹, examined outcomes of CHW interventions for diabetes care among under-served minority populations with type 2 diabetes mellitus. Three studies^{20, 43-47, 49} used a high-intensity intervention and one study⁴⁸ used a moderate-intensity intervention. One fair-rated six month RCT conducted in Texas used a high-intensity intervention for Mexican-Americans that compared eight weekly, two-hour group classes with promotoras to usual care plus educational pamphlets.²⁰ One fair-rated RCT conducted in New York used a moderate-intensity intervention that evaluated the use of CHWs as clinic liaisons compared to nurse-patient encounters in innercity Hispanics and African-Americans.⁴⁸ Project Sugar, a fair quality RCT, compared several high-intensity interventions in inner-city African-Americans with type 2 diabetes: (1) CHW faceto-face home visits and phone contact, (2) nurse care manager intervention, (3) a combined nurse care manager and CHW, and (4) standard clinical care with an additional quarterly diabetes newsletter.⁴³⁻⁴⁷ The prospective cohort study was a fair quality study of a high-intensity intervention comparing CHW diabetes case management, including home visits, in addition to a multidisciplinary team to usual clinical care with a multidisciplinary team approach in Hawaii.⁴⁹ Heterogeneity of study designs, interventions, and outcomes preclude quantitative synthesis of results.

Overview of results. Of the four studies on diabetes management, two studies found the CHW intervention to be beneficial in decreasing HgbA1c as compared to usual care^{20, 49} and two studies found no difference between groups in mean change from baseline of HgbA1c.⁴³⁻⁴⁸ The Texas study also evaluated outcomes of knowledge and similarly found that the CHW intervention was effective compared to usual clinical care in increasing diabetes knowledge.²⁰

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The Hawaii study found that diabetes case management by a CHW in conjunction with a multidisciplinary team was more effective at decreasing HgbA1c than a multi-disciplinary team alone.⁴⁹ The New York study demonstrated that a CHW liaison was more effective than usual clinical care in behavioral changes leading to program completion rates.⁴⁸ Project Sugar, a high-intensity study, found significant changes from baseline within, but not between, groups for various health outcomes.⁴³⁻⁴⁷ In other words, CHW interventions resulted in no significant difference in health outcomes compared to controls.

Knowledge. The Texas study evaluated outcomes for improved knowledge in diabetic patients following 8 weekly CHW-led group classes in Mexican-Americans at six months.²⁰ A validated tool, the bilingual DKQ, showed a difference between arms, with an improved score in the CHW group compared to the usual care plus educational pamphlets group (p<0.002).²⁰

Behavior. Project Sugar evaluated dietary risk scores (which identifies positive as well as problematic dietary behaviors and measures potential barriers to dietary change) and found an improvement in score across all arms as compared to the usual clinical care group following a high-intensity CHW intervention (-2.4 \pm 1.99 vs. -3.45 \pm 1.87 vs. -2.13 \pm 1.92;P NR).⁴³⁻⁴⁷The New York study demonstrated an increased proportion of completion of a diabetes education program after a low-intensity CHW intervention compared to usual clinical care (80% vs. 47%, p=0.01).⁴⁸

Satisfaction. None of the studies reported outcomes for satisfaction in diabetes care.

Health outcomes. The Texas study demonstrated better improvement in diabetes control (measured by mean change in HgbA1c) in the CHW intervention group than in the usual care group after 6 months (p<0.001).²⁰ The Hawaii study found a high-intensity CHW intervention in conjunction with a multidisciplinary team was more effective in decreasing mean change in HgbA1c when compared to usual care with a multidisciplinary team (-2.2 vs. 0.2).⁴⁹ The p value

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comparing the groups for the Hawaii study was not reported but we calculated it using the data provided in the article and found it to be statistically significant (p<0.0001).⁴⁹ Project Sugar reported no significant change between the four study groups for the primary outcome, HgbA1c. The only group with a significant improvement from baseline to two years was the CHW plus nurse care manager arm (improvement of $0.8\% \pm 0.52\%$, p<0.05). ⁴³⁻⁴⁷Post-intervention, a power calculation showed the study was powered only to see a difference of 1.2% change in HgbA1c. Secondary outcomes from Project Sugar included LDL cholesterol, systolic blood pressure, and diastolic blood pressure, none of which differed significantly between study groups in change from baseline measures. LDL cholesterol changed for the worse within the nurse care manager plus CHW arm (+4 mg/dl, p<0.05).⁴³⁻⁴⁷

Health care utilization. None of the studies evaluated health care utilization outcomes.

Table 8: CHW Chronic Disease Management: Diabetes Mellitus

Author, Year Study Design Population Setting Sample Size Quality	Intensity of CHW Intervention/ Study groups	Results
Lujan, 2007 ²⁰	High	HgbA1c – Baseline (SD)/ 6 months (SD): G1: 8 21(2 2)/7 76(1 87)
RCT	G1: A team of 2 promotoras delivered 8	G2: 7.71(1.49)/8.01(1.8)
Mexican- Americans in a major Texas border city N: 150 Fair	weekly, 2 hour participative group classes and follow-up to intervention group, using multiple visual audio teaching aides & handouts, contacted class participants by phone biweekly to answer questions, reinforce education, promote behavior change, sent postcards biweekly;	Mean change between groups: P<0.001 Bilingual DKQ - validated: Baseline(SD)/6 months(SD): G1: 69.1(13.6)/77.2(14.4) G2: 66.9(15.2)/65.1(21.0) Mean change between groups:, P<.002
	G2: usual care by clinic staff - verbal information and 1 or 2 pamphlets on diabetes self-management	Diabetes Health Belief Measure (DHBM): Baseline(SD)/6 months(SD): G1: 56.4(12.2)/54.6(8.4) G2: 57.0(10.6)/50.8(13.6) Mean change between groups: P<0.01

7121124111242470264447011124670488000000000		
Author, Year		
Study Design		
Population		en andere en
Setting		
Sample Size	Intensity of CHW Intervention/	
Quality	Study groups	Results
Corkery, 1997 4°	Moderate	Diabetes Education Program Completion
RCT	G1: Intervention- CHW acted as liaison,	G1: 80%; G2: 47% (p=0.01)
	attended clinic sessions, interpreter,	
NYC – East	reinforced self are instructions and	
Harlem	appointment reminders	
Hispanic and		No difference in mean change in HobA1c
Africa- Americans	G2: Control - encounters occurred between	hetween groups
· · ·	nurse and patient only	bothoon groupo
N: 64		
Fair		·····
Batts 2001; ⁴⁵ Gary	High	HgbA1c, mean change from baseline at 2
2003;44 Vetter		years: G1: ref;
2004;"/ Gary	G1: continued on-going care from their own	G2: -0.31 ± 0.49%;
2005;4° Gary	health professionals + quarterly newsletter	G3: -0.30 ± 0.48%;
200045	containing info on diabetes-related health	G4: 0.8 ± 0.52% (P<0.05 for within-group
	topics.	change from baseline for G4 only)
RCT		
Project Sugar	G2: NCM intervention: NCM was RN +	LDL, mean change from baseline at 2
	certified diabetes educator, 45 min face-to-	years: G1: -16.7± 5.5 mg/dl
East Baltimore,	face clinic visits and/or phone contacts,	G2: +6 (approx) (P<0.05 for within-group
MD	direct patient care, management, education,	change from baseline).
African-Americans	counseling, follow-up, referral, physician	G3: +6 (approx.)
	feedback - goal was 3 visits/yr.	G4: + 4 (approx.) (P<0.05 for within-group
N: 149		change from baseline)
Fair	G3: CHW interventions were 45-60 min	
	face-to-face nome visits and/or phone	SBP, mean change from baseline at 2
	contacts, no direct implementation of	years: G1: ref;
	inerapeutic strategies but facilitated	G2: +6 (approx.) (P<0.05 for within-group
	preventive care by oliening to schedule	Change from baseline) GS: -4 (approx).
	appointments + provide education, 5	G4: -2 (approx).
	visits/yr.	Distancial assess mean change from
	C4: combined NCM + CWM three	baseline at 2 years: G1: ref
	visite/vear with each	$C_{2} = 2 \Lambda + 1 Q_{2}$
	visits/year with each.	$(322.4 \pm 1.33),$
		G4: -2 13 + 192
Beckham 2008 49	High	HohA1c, mean change from baseline:
Cohort		ngor no, mean onunge nom baseline.
SUNDER	G1: Diabetes case management by CHW	G1: -2 2(1 8)
Hawaii	including home visits. Based on needs of	Q12.2(1.0)
Health center for	natients. CHWs would collaborate with the	C2: 0.2(1.E)
underserved with	rest of the multidisciplinary team to	62: -0.2(1.5)
type 2 diabetes	determine high-priority learning areas and to	D 40 0004*
GPO E diabotoo	develop an intervention plan to implement	P<0.0001*
N: 116	during subsequent visits. Each plan	
Fair	included a blood glucose self-monitoring	Note: P value comparing the groups was
	regimen and target levels, diet plan.	not reported but was calculated using the
	exercise plan, medication schedule, insulin	data in the article
	injection plan, and preventive health/health	
	maintenance plan.	
	G2: Usual care with multidisciplinary team	
	approach, minus CHW.	

Table 8: CHW Chronic Disease Management: Diabetes Mellitus (continued)

Chronic Disease Management: Hypertension

Study characteristics. Four studies, two RCTs^{19, 50, 51} and two prospective cohorts,⁵²⁻⁵⁴ examined outcomes of moderate-intensity CHW interventions for blood pressure management among adult patients with hypertension. The two RCTs, one fair⁵⁰ and one poor^{19, 51} quality, evaluated CHW interventions in inner-city minorities. All four studies evaluated a CHW intervention as compared to an intervention that involved a CHW in a lesser capacity.^{19, 50-54} The fair RCT evaluated a CHW home visit for patient education, counseling and referral compared to a CHW home visit plus five additional visits for BP measurement, management and access to medical care.⁵⁰ The poor RCT, rated as such due to a high attrition rate and use of a completers analysis, and high potential for bias, evaluated CHW post-clinic appointment counseling sessions, CHW home visits, appointment reminder cards and calls, and standard clinical care in a large West coast city.^{19, 51} One of the prospective cohort studies, rated poor for internal validity due to a high potential for confounding and inappropriate statistical methods, evaluated a moderate-intensity CHW intervention in rural central Mississippi.^{52, 53} This study evaluated the use of CHWs as "hypertension health counselors" in providing monthly visits encouraging compliance to previously prescribed pharmacological and non-pharmacological therapies.^{52, 53} The other prospective cohort study, rated poor for internal validity due to a lack of methods describing an analysis plan a priori, a high potential for confounding, and lack of comparison of participant characteristics at baseline, evaluated a moderate-intensity CHW intervention in innercity Baltimore, MD African-Americans.⁵⁴ This study examined the impact on appointment follow-up of a CHW follow-up phone call after an Emergency Department visit during which patients had their blood pressure measured, were provided education counseling, and were assisted with appointment keeping and adherence to a treatment plan. The control group

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included patients who had received the single CHW visit in the ED but were not able to be contacted later for assistance in appointment keeping.⁵⁴ Heterogeneity of study designs, interventions, and outcomes preclude quantitative synthesis of results.

Overview of results. We did not find any fair or good quality studies that compared the impact of a CHW intervention with usual care on blood pressure control. Of the three studies that evaluated blood pressure control, only the Mississippi prospective cohort demonstrated a significant difference between study groups in terms of proportion of hypertensive subjects controlled (defined in this study as <160/95).^{52, 53} Neither of the RCTs demonstrated between group differences in blood pressure control.^{19, 50, 51} However, these studies did note improvement from baseline to study completion within all groups, some of which were statistically significant.^{19, 50, 51} The Baltimore prospective cohort did not evaluate blood pressure control but instead examined health care utilization.⁵⁴ This study demonstrated that CHW worker follow-up was more effective than no follow-up in increasing return visit appointment rates.

Knowledge. None of the studies reported outcomes for knowledge.

Behavior. None of the studies reported outcomes for behavior changes.

Satisfaction. None of the studies reported outcomes for satisfaction.

Health outcomes. We did not find any fair or good quality studies that compared the impact of a CHW intervention with usual care on blood pressure control. Three of the four studies reported on blood pressure control. Both RCTs found an improvement within most groups but no difference between groups in terms of blood pressure control.^{19, 50, 51} The fair-quality RCT demonstrated that the low-intensity CHW arm (one home visit) and the high-intensity CHW arm (six home visits) both resulted in improved blood pressure. However, the difference between the groups was not significant.⁵⁰ The poor-quality RCT also demonstrated an

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improvement in blood pressure within all groups, including the usual care arm, however, no significant difference between groups.^{19, 51} The Mississippi prospective cohort study did not report statistical tests to allow the determination of difference between or within groups.^{52, 53}

Health care utilization. The poor prospective cohort conducted in Baltimore demonstrated that patients in the low-intensity CHW intervention were more likely to return to the ED for a follow-up appointment compared to the control group (60% vs. 40%, p<0.001).⁵⁴ However, the control group consisted of patients seen in the ED who were not able to be contacted for follow-up by the CHW, thus biasing the results for this outcome in favor of the intervention arm.⁵⁴

Table 9: CHW Chronic Disease Management: Hypertension

Author, Year Study Design Population Setting Sample Size	Intensity of CHW Intervention/ Study	
Quality	droups	Results
Levine 2003 ⁵⁰	Hiah	Pre/Post BP:
2000		G1: 147.7/89.2 (95% CI 145.5, 149.9 /
RCT	G1: G2 care + 5 CHW visits with BP	87.8, 90.6) → 145/86.2 (95% CI 142.3,
Inner-city Baltimore, MD	measurement, addressing issues of BP management & access to medical care	147.7 / 84.2, 88.2) G2: 148.6/89.3 (95% Cl 146.4, 150.7 / 87.8, 90.8) → 142.1/84.7 (95% Cl 138.8,
African-Americans	G2: CHW home visit for education,	145.4 / 82.7, 86.7)
N: 789 Fair	counseling, & referral	P<0.05 for differences between baseline and follow-up for each group, P>.1 between groups
		% with adequate HTN control (<140/90): G1: 16% \rightarrow 36% G2: 18% \rightarrow 34% pre/post p<.01 group difference NS
Morisky, 2002; ¹⁹	Moderate	Percent with BP Control (<140/90) -
Ward, 2000 ⁵¹	-	Baseline/6 months/12 months:
RCT	G1: CHW post-clinic appt counseling session	G1: 35.2%/46%/46% (p<0.01);
West Coast City	G2: appt reminder cards & phone calls	G2: 40.2%/42%/48% (p<0.01);
Inner-city African-	FF	G3: 29.7%/% NR but "improved"
Americans and Hispanics	G3: home visits by CHW	G4: 36.9%/% NR but "improved"
N: 1367	G4: standard clinic care	All groups improved; Differences between groups NR
Poor Frate 1095: ⁵² Frate	High	Proportion of hyportonsives controlled
1983 ⁵³	nign	(<160/95):
Prospective cohort	G1: Hypertension Health Counselors: Monthly visits that encouraged	G1: 80.6%
Rural central	nonpharmacological therapy that had	G2: 90.0%
Mississippi	been prescribed	C2: 70 0%
NI: 007	G2: Family based self help	(p<0.0001)
N: 00/ Poor		(b. 110001)
	G3: Church based self help	
Bone 1989 ⁵⁴	Moderate	Returned to ED for follow-up appt: G1: 41%; G2: 60% (p<0.001)
Prospective cohort	G1: control (not able to be contacted by CHW);	
Baltimore, MD		
ER	G2: contacted by CHW; Initially, all	
Low-income, African-	patients were contacted initially by CHWs	
American	III ED. UHWS TOOK PUISE and BP	
N: 722	counseling, identified barriers related to	
Poor	referrals, assisted with appointment keeping and adherence to treatment plan. Session lasted about 20 minutes.	

Chronic Disease Management: Infectious Diseases

Study characteristics. One RCT of fair quality examined outcomes of a CHW intervention to facilitate access to health care for tuberculosis (TB) in a homeless population with positive PPD test results in San Francisco.⁵⁵ Subjects were randomized to one of three groups: an intervention involving a CHW for transportation to their clinic appointment, a monetary incentive and bus token to attend their clinic appointment, or a control group given a clinic appointment and a bus token only. This study used a moderate-intensity CHW model. CHWs who were familiar with homelessness were assigned to TB-infected individuals and responsible for accompanying them to their clinic appointments.⁵⁵ Outcomes were compared to a group receiving a monetary incentive to attend TB clinic in addition to an appointment and bus tokens and a control group who were given clinic appointments and bus tokens.⁵⁵

Overview of results. This RCT demonstrated that a CHW intervention was less effective than the monetary incentive but more effective than the control group in leading to adherence to a first follow-up appointment.⁵⁵

Knowledge. This RCT did not report outcomes for improved knowledge.

Behavior. This RCT did not report outcomes for improved behaviors.

Satisfaction. This RCT did not report outcomes of satisfaction.

Health outcomes. This RCT did not report outcomes of health.

Health care utilization. This RCT found that a moderate-intensity CHW intervention was less effective than a monetary incentive (\$5) in increasing adherence to a first follow-up clinic appointment (75%[95% CI=70-80] vs. 84%[95% CI=76-92], p=NR). However, the CHW intervention was more effective than a control group who received an appointment and bus tokens (75%[95% CI=70-80] vs. 53%[95% CI=47-59], p=0.004).⁵⁵

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Author, Year Study Design Population Setting Sample Size Quality	Intensity of CHW Intervention/ Study groups	Results
Pilote, 1996	Moderate	Adherence to first follow-up appointment (95% CI): p calculated vs. G3
RCT	G1: Peer health advisor- met with patient and took them to clinic appointment,	G1: Peer health advisor 75% (70-80);
Homeless people with	facilitated paperwork, reviewed physician	p = 0.004
positive PPD in San	recommendations	G2: Monetary incentive 84% (76-92);
Francisco, CA	G2: Monetary incentive - \$5 at clinic,	p < 0.001
	appointment and bus tokens	G3: Usual care 53% (47-59)
N=244	G3: Usual care - appointment and bus	
Fair	tokens	

Table 10: CHW Chronic Disease Management: Infectious Diseases

Chronic Disease Management: Back pain

Study characteristics. One RCT of fair quality evaluated an intervention of four 2-hour weekly group classes led by CHWs compared to usual care supplemented by a book on back pain.⁵⁶ This intervention was rated as moderate-intensity. The classes focused on applying problem-solving techniques to back pain self-management and included educational materials (book and videos) supporting active management of back pain.⁵⁶

Overview of results. This fair RCT found a moderate-intensity CHW intervention was effective in reducing back pain when compared to a control group at 6-months, but there was no difference between groups at 12 months.⁵⁶

Knowledge. This RCT did not report outcomes for improved knowledge.

Behavior. This RCT did not report outcomes for improved behaviors.

Satisfaction. This RCT did not report outcomes of satisfaction.

Health outcomes. This RCT found that a moderate-intensity CHW intervention was more effective in decreasing participant back pain than usual care supplemented by a book on back pain at 6 months.⁵⁶ More participants in the intervention arm achieved a 50% or greater reduction

in Roland Disability Score from baseline than in the control group at 6 months (47.9% vs. 33%, p=0.02).⁵⁶ However, Roland Disability Scores at 12 months did not differ between arms (5.75 ± 6.31 vs. 6.75 ± 6.39, p=0.092).⁵⁶ The authors attributed this lack of difference to the fact that the intervention was not intended to reduce pain intensity, but rather patient worries about back pain.⁵⁶ Additionally, participants receiving a CHW intervention had a lower worry rating (unvalidated tool) than those in the control group at 12 months (2.63 ± 2.58 vs. 3.83 ± 3.08, p=0.013).⁵⁶

Health care utilization. This RCT did not report outcomes of health care utilization.

Other outcome. This RCT found that participants in the CHW arm reported being more likely to self-manage back or leg pain than those in the control arm, a measure of self-efficacy (77% vs. 60%, p=0.008).⁵⁶

Table 11: CHW Chronic Disease Management: Back Pain

Author, Year Study Design Population Setting Sample Size Quality	Intensity of CHW Intervention/ Study groups	Results
Von Korff 199856	Moderate	"The next time I have back or leg pain, I
RCT		will try to manage the problem without
	G1: Four 2-hour classes held once a	seeing a health professional" - Not
People with chronic	week, with 10 to 15 participants, led by	validated
back pain in	two CHWs	G1: 77% agreed G2: 60% (p=0.008)
Washington state		
N. OFF	G2: Usual care includes back pain book	50% or greater reduction in Roland
N=255		Disability Questionnaire Score from
Fair		baseline at 6 months – validated
		G1: 47.9%; G2: 33% (p = 0.02)
		Roland Disability at 12 months –
		validated
		G1: 5.75 (6.31)
		G2: 6.75 (6.39) (p = 0.092)
		Worry rating (0-10) at 12 months - not
		validated
		G1: 2.63 (2.58)
		G2: 3.83 (3.08) (p = 0.013)

Chronic Disease Management: Mental Health

Study characteristics. One RCT of poor quality with three trial arms evaluated an assertive community treatment with a CHW intervention compared to an assertive community treatment alone and to a broker case management intervention.^{57, 58} The study population included people in St. Louis, MO who were homeless or at-risk for being homeless and were diagnosed with serious psychiatric diagnoses.^{57, 58} The community health workers' role was to assist with daily living and be available for leisure activities. This intervention was rated as high-intensity. A high rate of attrition (only 85 of 165 provided follow-up) contributed to the poor rating of this study.^{57, 58}

Overview of results. The trial found that clients in the assertive community treatment arm plus a CHW did not differ in results as compared to the assertive community treatment group alone, although for many outcomes both of these arms were superior to the brokered case management arm.^{57, 58} The assertive community treatment arms (both with and without a CHW) had more contact with their case managers and were more satisfied than those in the broker case management arm.^{57, 58} Clients in the assertive community treatment also had fewer psychiatric symptoms at 18 months than clients in the brokered condition.^{57, 58} There was no difference in days in stable housing between the groups.^{57, 58}

Knowledge. This RCT did not report outcomes for improved knowledge.

Behavior. This RCT did not report outcomes for improved behaviors.

Satisfaction. Clients in either assertive community treatment arm (both with and without a community health worker) were more satisfied with their treatment program than clients in the brokered case management arm $(3.12(0.57) \text{ vs. } 3.27(0.42) \text{ vs. } 2.74(0.68), \text{ p}<0.05).^{57, 58}$

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Health outcomes. This trial found that clients in the assertive community treatment arm plus a CHW did not differ in health outcome results as compared to the assertive community treatment group alone. Clients in either assertive community treatment arm (both with and without a community health worker) had fewer psychiatric symptoms as rated by the Brief Psychiatric Rating Scale (BPRS) at 18 months as compared to baseline than those in the brokered case management arm (baseline(SD)/18-month follow-up(SD): 57.97(20.29)/38.77(12.23) vs. 53.54(15.54)/39.96(12.25) vs. 50.60(14.31)/51.60(16.70), p=0.001 for any difference between the three groups; p for comparison of either assertive community

treatment arm NR).^{57, 58} There was no difference in days in stable housing between groups.

Health care utilization. This trial did not find a difference in health care utilization between the assertive community treatment plus a CHW arm and the assertive community treatment group alone. Clients in either assertive community treatment arm (both with and without a community health worker) had more days in contact with the program when compared to the brokered case management arm (6.95(4.91) vs. 8.29(7.51) vs. 0.3(0.49), p<0.05).^{57, 58} Table 12: CHW Chronic Disease Management: Mental Health

Author, Year Study Design Population Setting Sample Size Quality	Intensity of CHW Intervention/ Study groups	Results
Wolff, 1997; ⁵⁸	High	Days in stable housing for past month
Morse, 1997 57		Baseline(SD)/18 months(SD):
	G1: Assertive community treatment -	G1: 6.36(11.71)/21.75(12.76)
RCT	intensive individualized treatment,	G2: 4.94(11.08)/17.54(14.45)
	responsibility for providing or coordinating	G3: 7.18(12.38)/16.00(14.86) (p<0.31)
Homeless with serious	all services needed by client, persistent	
psychiatric conditions	follow-up and in vivo service delivery,	Client Satisfaction
in St. Louis, MO	performed by staff with backgrounds in	G1: 3.27(0.42); G2: 3.12(0.57); G3:
	psychology, social work, and counseling	2.74(0.68) p<0.01
N= 165		
Poor	G2: G1 + CHW, whose role was to assist	BPRS (Brief Psychiatric Rating Scale
	with activities of daily living and be	score) Total Symptom Score
	available for leisure activities	G1:53.54(15.54)/39.96(12.25) G2:
	· · · · ·	57.97(20.29)/38.77(12.23) G3:
	G3: Brokered case management	50.6(14/31)/51.6(16.7) p=0.001
		Program contact (days/month)
		G1:8.29(7.51); G2: 6.95(4.91); G3:
		0.3(0.49) p<0.001

Chronic Disease Management: Asthma.

Study characteristics. Two RCTs (three articles), one good,^{59, 60} and one fair,⁶¹ examined outcomes of CHW interventions for asthma care among pediatric patients with persistent asthma. Both studies used highly resource-intensive, comprehensive CHW interventions that included an environmental assessment, asthma action plan, education, referrals, allergy control mattress covers and pillows, vacuums, and cleaning supplies, pest management, and smoking cessation assistance. The interventions were delivered over the course of a year with several home visits. The Seattle King County Healthy Homes (SKCHH) project (Washington State) compared outcomes for children receiving a high-intensity multi-visit home intervention with those for children receiving a low-intensity single home visit that included an environmental assessment, some education, and bedding encasements, followed by the full intervention after a year. ^{59, 60}

The Community Action Against Asthma (CAAA) project adapted the SKCHH project to Detroit, Michigan, comparing a group receiving the high-intensity multi-visit home intervention with a control group receiving an asthma information booklet and the full intervention after a year.⁶¹ Variations in measures of health behavior, outcomes, and health utilization preclude quantitative synthesis of the results.

Overview of results. Two trials demonstrated that high-intensity CHW interventions are more effective than either low-intensity interventions or a control group in reducing unscheduled use of health care services and improving psychological outcomes for caregivers. Both studies demonstrated changes in behavior, such as increased use of bed encasements and vacuuming, associated with the materials distributed by the CHW, but not for other behaviors that may have required external or additional resources or change, such as removal of mold or reduced exposure to environmental tobacco smoke. Both studies demonstrated significant improvements within but not across trial arms for some measures of symptoms, reduced days with activity limitations, and reduced use of beta-agonists.⁵⁹⁻⁶¹ For health outcomes demonstrating a difference between trial arms such as symptom days, the more intense arm was more effective than the less intense or control arm.

Knowledge. Neither study reported outcomes for improved knowledge of asthma triggers.

Behavior. Both studies examined a variety of behavioral changes (Table 13). Both studies reported increased use of materials provided (ex. mattress covers, pillows, and vacuums) in the more intense arm. However, neither study found a difference between arms for behavioral changes associated with smoking cessation, removal of pets, use of exhaust fans in the bathroom^{59, 60} and removal of mold.⁶¹

Satisfaction. Neither study reported outcomes for satisfaction.

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Health outcomes. The SKCHH project reported on the number of symptom days in the past 2 weeks. The CAAA project looked at the occurrence of more than 2 symptom days per week for children not on any controller medication or corticosteroids (Table 14).

Author, Year Population Setting Sample Size	Intensity of CHW		
Quality	Intervention	Study Groups	Results
Krieger et al.,	High	G1: Environmental assessment;	Behavior, summary score of trigger reduction
2005;60		asthma action plan; education and social support; mattress	behaviors
Krieger et al.,		covers, pillows, vacuum,	Across groups comparison: GEE coefficient
2002 ⁵⁹		cleaning supplies; smoking	(95% Cl, 0.41 (-0.13-0.95); <i>P</i> = 0.141
RCT		12 months	The frequencies of actions to reduce dust exposure and the use of bedding encasements
Children ages 4-		G2: Environmental home	increased more in the high-intensity group.
12 years, with		assessment action plan limited	Kitchen ventilation improved more in the low-
persistent asthma,		education, bedding	intensity group. Neither group increased the
Low-income		encasements, run intervention	reduced exposure to pets (although pet
households in		alter 12 months	ownership was uncommon among participants)
King County,			and smoking in the home. The hebavior
Washington			summary score improved in both groups, and
N: 274			the across-group difference was not significant
Good			
Parker et al.	Hiah	G1: Environmental assessment:	Intervention Effect (or-intervention/or-control)
2008 ⁶¹	5	asthma action plan based on allergy tests: education and	Vacuum cleaner used: 29.5 (6.90, 126); P < 0.0001
RCT		social support: social support:	, , , , , , , , , , , , , , , , , , , ,
		mattrase covers nillows	Allergen cover on child's pillow:
Children ages 7-		vacuum clooping supplies:	19.7 (4.12, 94.2); P = 0.0006
11 years with		vacuum, cleaning supplies,	
persistent asthma		tobacco amplication integrated post	Allergen cover on child's mattress:
Southwest and		management services; minimum	9.70 (4.33, 21.7); <i>P</i> < 0.0001
eastside Detroit.		9 planned home visits over 12	Visible mold growth removed:
Michigan		months	0.74(0.33, 1.66); $P = 0.47$
		OD- A stars - information booklast	
N: 298		full intervention after 12 months	Child is around people who smoke: 0.60 (0.28, 1.32); P = 0.20
Fair			
			Statistically significant intervention effect in the reduction of concentration of dog allergen per gram of bedroom dust ($P < 0.001$) but not for cockroach, dust mite, or cat allergen concentration

Table 13. CHW asthma interventions and behavior

CI, confidence interval; GEE, generalized estimating equation; RCT, randomized controlled trial.

Table 14. CHW asthma interventions and health outcomes

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Author, Year			and the management of the second states of the
Study Design		Here and the second second second second	
Population			
Setting	Intensity of		
Sample Size	CHW		
Quality	Intervention	Study Groups	Results
Krieger et al.,	High	G1: Environmental assessment;	Pediatric Asthma Caregiver Quality of Life
2005;°°		asthma action plan; education	Scale (score range 1-7 with higher scores
Krieger et al.,		and social support; mattress	indicating better Qol)
2002 ⁵⁹		covers, pillows, vacuum,	Score at exit (G1 vs. G2): 5.6 vs. 5.4
		cleaning supplies; smoking	GEE coefficient 0.58 (95% Cl, 0.18-0.99),
RCT		cessation referral; 4-8 visits over	<i>P</i> = 0.005; NNT = 4.8
		12 months	
Children ages 4-			ITT analysis yielded similar results:
12 years with		G2: Environmental home	improvements in QoL were greater in G1 (data
persistent asthma,		assessment action plan, limited	NR, <i>P</i> = 0.009)
		education, bedding	
Low-income		encasements; full intervention	Asthma symptom days (self-reported number of
households in		after 12 months	24-hour periods during 2 weeks before
King County,			interview with asthma symptoms: wheeze,
Washington			tightness in chest, cough, shortness of breath,
			slowing down activities due to asthma,
N: 274			nighttime awakenings):
			G1 vs. G2 at exit: 3.2 vs. 3.9
Good			GEE coefficient -1.24 (95% Cl, -2.9, 0.4),
			<i>P</i> = 0.138
			Days with activity limitation over 2 week-period
			Score at exit (G1 vs. G2): 1.5 vs. 1.7
			GEE coefficient -1.5 (95% Cl, -2.840.15),
			OR, 0.22 (0.06, 0.86), <i>P</i> = 0.29
			$\mathbf{M} = \mathbf{M} + $
			Missed school in past 2 weeks (%):
			G1 VS. G2 at exit: 12.2 VS. 20.3
			GEE coefficient -0.77 (95% CI, -1.70, 0.16),
			OR, 0.46 (0.18, 1.18), P = 0.105
		·	Days used controller medication over 2 wook
			period:
			Clive C2 at evit: 3.5 ve: 3.6
			GEF coefficient 1 03 (05% CL -2 70-0 73)
			P = 0.250
•			Days used beta2-agonist over 2 week-period
			G1 vs. G2 at exit: 4 0 vs. 4 0
			GEE coefficient -0.23 (95% CL -1.88, 1.42)
			P = 0.781
			· · •
			Caregiver missed work in past 2 weeks (%):
			G1 vs. G2 at exit: 11.2 vs. 13.0
			GEE coefficient 0.07 (95% Cl, -0.91, 1.0.5),
			OR, 1.07 (0.40, 2.85), P = 0.890
CES-D, Center for Ep	idemiologic Stud	lies Depression Scale (CES-D); CI, cor	ifidence interval; GEE, generalized estimating equation;
ITT, intention to treat;	NNT, number not tr	eated; NR, not reported; OR, odds ratio; Q	OL, quality of life; vs., versus.

Table 14. CHW asthma interventions and health outcomes (continued)

Author, Year Population Setting	Intensity of		
Sample Size Quality	CHW Intervention	Study Groups	Results
Parker et al., 2008 ⁶¹	High	G1: Environmental assessment; asthma action plan based on allerov tests: education and	Caregiver depressive symptoms measured by CES-D
RCT		social support; social support; mattress covers, pillows,	Mean at baseline/endpoint G1: 1.62/1.54
Children ages 7- 11 years with persistent asthma,		vacuum, cleaning supplies; counseling on environmental tobacco smoke; integrated pest	G2: $1.58/1.64$ P = 0.0218
Southwest and eastside Detroit, Michigan		9 planned home visits over 12 months	emotional social support combined and instrumental support alone were not statistically significant (data NR)
N: 298		G2: Asthma information booklet, full intervention after 12 months	Child's self-reported average asthma symptom
Fair			G1: symptoms occurring less frequently than they had at baseline for all eight symptoms
			G2: symptoms occurring less frequently for 6 of 8 symptoms
			Persistent cough at baseline, post-intervention (on a six point scale, higher is worse): G1: 3.81, 3.36 G2: 3.48, 3.44 P = 0.034
			Cough with exercise at baseline, post (on a six point scale, higher is worse): G1: 4.27, 3.69 G2: 3.80, 3.66 P = 0.017
			Has any symptom more than 2 days per week and not on a corticosteroid G1 (pre/post) vs. G2 (pre/post) intervention effect (95% Cl)
			60/42 vs. 51/46; 0.56 (0.29, 1.06); <i>P</i> = 0.073
			Has any symptom more than 2 days per week and not on any controller G1 (pre/post) vs. G2 (pre/post) intervention effect (95% CI)
			53/32 vs. 38/37; 0.39 (0.20, 0.73); <i>P</i> = 0.004

These trials reported mixed results, with the Seattle (SKCHH) project reporting insignificant differences between the arms in the reduction in symptoms days and the Detroit (CAAA) project reporting significant differences between the trial arms for children not on any controller medication (OR, 0.39 [95% CI, 0.20-0.73]). ^{59, 60}

The Seattle (SKCHH) project examined differences in trial arms in days with activity limitation, use of beta-agonists, use of controller medications, missed school days for the child, and missed caregiver workdays and found no difference between the intervention arms.^{59, 60} However, caregiver quality of life was significantly higher (as measured by the Center for Epidemiologic Studies Depression Scale) in the more intense arm (coefficient for difference between groups in mean change from exit to baseline: 0.58 [95% CI, 0.18-0.99]). ^{59, 60}

The Detroit (CAAA) project found significant improvements in symptoms for both intervention and control arms, but differences were statistically significant only for two outcomes: coughing with exercise and persistent cough. Significant differences between trial arms were found in some but not all measures of lung function; these results could potentially be explained by seasonal influences, changes in instrumentation, and inadequate power.⁶¹ Finally, it reported a statistically significant reduction (P = 0.0218) in caregiver depressive symptoms (measured by the Center for Epidemiologic Studies Depression Scale) in the intervention arm (mean value at baseline and follow-up: 1.62 and 1.54) compared to a rise in depressive symptoms in the control arm (mean value at baseline and follow-up: 1.58 to 1.64). The study found no statistically significant differences between the two groups in changes in social support between baseline and the endpoint.⁶¹

Health utilization. Both studies (Table 15) found a significant difference in the reduction in unscheduled medical care as measure by number of emergency room visits, hospitalizations, and unscheduled doctor visits.⁵⁹⁻⁶¹

Author, Year Population Setting Sample Size Quality	Intensity of CHW Intervention	Study Groups	Results
Krieger et al., 2005; ⁵⁹ Krieger et al., 2002 ⁶⁰ Children ages 4-12 years with persistent asthma Low-income households in King County, Washington N: 274 Good	High	 G1: Environmental assessment; asthma action plan; education and social support; mattress covers, pillows, vacuum, cleaning supplies; smoking cessation referral; 4 to 8 visits over 12 months G2: Environmental home assessment action plan, limited education, bedding encasements; full intervention after 12 months 	Urgent health services used over 2 months (%) G1 vs. G2 at exit: 8.4 vs. 16.4 GEE coefficient -0.97 (95% CI, -1.8, -0.12), OR, 0.38 (0.16, 0.89), $P = 0.026$; NNT = 12.9 ITT analysis yielded similar results: improvements in urgent health services were greater in G1 (data NR, $P = 0.062$)
Parker et al., 2008 ⁶¹ Children ages 7-11 years with persistent asthma, Southwest and eastside Detroit, Michigan N: 298 Fair	High	 G1: Environmental assessment; asthma action plan based on allergy tests; education and social support; social support; mattress covers, pillows, vacuum, cleaning supplies; counseling on environmental tobacco smoke; integrated pest management services; minimum 9 planned home visits over 12 months G2: Asthma information booklet, full intervention after 12 months 	Reduction in unscheduled health care utilization for asthma Percent needed unscheduled medical care G1 (pre/post) vs. G2 (pre/post); intervention effect (95% CI) In past 3 months: 50/45 vs. 42/56; 0.43 (0.23, 0.80); $P = 0.007In past 12 months:65/59$ vs. 58/73; 0.40 (0.22, 0.74); $P = 0.004$

Table 15. CHW asthma interventions and health utilization

CI; confidence interval; GEE, generalized estimating equation; ITT, intention to treat; NNT, number not treated; NR, not reported; OR, odds ratio; RCT, randomized controlled trial.

Summary of Results

Overall, most of the interventions within health promotion and disease prevention were classified as moderate (36.4%) or high intensity (45.5%). A higher percentage of chronic disease management interventions were high intensity (61.5%) and the remaining studies were moderate intensity (38.5%) with no low intensity interventions described.

Table 16.	Number o	f studies,	by clinical	focus and	intensity	of intervention
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Clinical Context or Focus	Low Intensity (percent)	Moderate Intensity (percent)	High Intensity (percent)	Total Number of Studies (percent)
Health promotion and disease prevention	2 ^{41, 42} (18.2)	4 ^{28, 29, 33, 37, 39, 40} (36.4)	5 ^{18, 30, 31, 34-36, 38} (45.5)	11 (100)
Chronic disease management	None	5 ^{19, 48, 51, 54-56} (38.5)	8 ^{20, 43-47, 49, 50, 52, 53, 57-61} (61.5)	13 (100)
Total	2	9	13	24

Comparison arms

Comparison arm interventions varied between studies. Table 17. outlines the comparison arms for health promotion and disease prevention and Table 18. for chronic disease management. Comparators for health promotion and disease prevention included combining CHW with other interventions, using CHWs in a lesser capacity, another health professional, mailing and print, phone calls and community controls in addition to no intervention. Comparators for chronic disease management included combination of CHW with other interventions, CHW in lesser capacities, usual clinical care, monetary incentives, mail, print, and other health professionals.

Study	CHW intervention	Combination of CHW with other interventions	CHW in lesser capacity	No intervention	Health Professional	Mail	Print	Mail and print	Phone call	Community
Campbell 2004 ⁴¹	X	X						x		X
Wendell 2003 ⁴²	X			X						
Becker 2005 ⁴⁰ Cene 2008 ³⁹		X					X			
Elder 2005 ³⁵ Elder 2006 ³⁴		X				$\begin{array}{c} X \rightarrow \\ Tailored \\ X \rightarrow \\ off-shelf \end{array}$				
Hunter 2004 ³³	X					x				
Conway 2004 ³⁸	X			X						
Krieger 1999 ³⁷	Х			X						
Barnes 1999 ³⁰	X		x							
Rask 2001 ²⁹ LeBaron, 2004 ²⁸	x	X		X					X	
Barnes- Boyd 2001 ³¹ Nacion 2000 ³²	X				x					
Auslander 2002 ¹⁸ Williams 2001 ³⁶	X						X			

Table 17: Comparisons between CHW and other intervention arms for HPDP

Study	CHW intervention	Combination of CHW with other	CHW in lesser capacity	Usual clinical care	Monetary Incentive	Mail	Print	Health Professional	Other
Batts 2001 ⁴³ Gary ⁴⁴ Gary ⁴⁵ Gary ⁴⁶ Vetter ⁴⁷	x	X				X		X	
Beckham 2008 ⁴⁹	X			x					
Bone 1989 ⁵⁴	X		x						
Corkery 1997 ⁴⁸	X			х					
Frate, 1985 ⁵² Frate 1983 ⁵³	X		x family groups x- church groups						
Krieger 2005 ⁶⁰ Krieger 2002 ⁵⁹		X	X + delayed intervent ion						
Levine 2003 ⁵⁰	Х		Х						
Lujan 2007 ²⁰	Х						. X		
Morisky 2002 ¹⁹ Ward 2000 ⁵¹	X		X			X			
Parker 2008 61		x					X + delayed intervent ion		
Pilote 1996 ⁵⁵	X				X				X – given bus tokens & appt
Von Korff 1998 ⁵⁶	Х			kau			X	6/10/10/10/1	

Table 18: Comparisons between CHW and other intervention arms for Disease Management

Discussion

Summary of Findings

CHWs have been used in many different health conditions, largely targeting low income and minority populations. CHW interventions in the area of disease prevention show promising benefits in improving patient knowledge and health care utilization, when compared to usual care. For chronic disease management, the majority of CHW interventions failed to show greater improvement in health outcomes than usual care except in asthma.

Health promotion and disease prevention. Eleven studies evaluated CHW intervention effectiveness in health promotion and disease prevention, including the clinical areas of pediatric immunizations,²⁸⁻³² cardiovascular disease,^{37, 39, 40} diabetes prevention,^{18, 36} HIV prevention,⁴² second-hand smoke exposure,³⁸ colorectal cancer prevention,⁴¹ and general preventive care.³³⁻³⁵ While results for CHW interventions on behavior outcomes^{18, 34-41} health outcomes,^{18, 28-32, 36} and health care utilization^{33, 37} were mixed, two studies on disease prevention found that CHW interventions vs. print or no intervention were effective in changing knowledge.^{18, 36, 42} None of the studies evaluated outcomes in the area of satisfaction.

In summary, CHW interventions in health promotion and disease prevention appear to be effective in improving participant knowledge outcomes and possibly other outcomes in this area for underserved, minority populations.

Disease management. Thirteen studies evaluated CHW intervention effectiveness in the area of disease management, including diabetes mellitus,^{20, 43-49} hypertension,^{19, 50-54} asthma,⁵⁹⁻⁶¹ back pain,⁵⁶ mental health,^{57, 58} and tuberculosis.⁵⁵ Knowledge outcomes were addressed by only one study.²⁰ Outcomes related to behavior changes were addressed by two CHW interventions on diabetes⁴³⁻⁴⁸ and both asthma studies⁵⁹⁻⁶¹, favoring CHW interventions, except in smoking

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cessation for asthma. Only the mental health study evaluated outcomes related to participant satisfaction.^{57, 58}

2000 No. 2000 No.

In terms of health outcomes, two of four studies on diabetes management found the CHW intervention was more effective than usual care in decreasing HgbA1c.^{20, 49} None of the hypertension management studies showed a difference in blood pressure control between groups.^{19, 50-54} Symptom measures in the asthma studies showed mixed results, although caregiver psychosocial outcomes favored CHW interventions in both studies.⁵⁹⁻⁶¹ Four of five studies on chronic disease management found that a CHW intervention was more effective than usual care or a less intense CHW intervention in improving health care utilization.^{54, 55, 59-61}

Overall, the majority of CHW interventions failed to show increased effectiveness in disease management as compared to usual care, except in the case of asthma where they were effective for many outcomes.

The most common reported outcomes were health outcomes (15 of 24) and behaviors (10 of 24), while few studies reported on knowledge (3 of 24) or satisfaction (1 of 24).

Knowledge

Moderate evidence exists that CHW interventions improve knowledge of participants on disease prevention compared with either no intervention or a print intervention (Table 20).^{18, 36, 42} Low evidence supports CHW intervention use in increasing participant knowledge in diabetes management as compared to a print intervention.²⁰ None of the remaining studies evaluated knowledge outcomes.

Table 20. Evidence Profile: Knowledge

Number of studies (# of subjects)	Risk of Blas (low/med/high) Design/Quality	Consistency	Directness	Precision	Other modifying factors (intensity, confounding – present/absent, magnitude of effect – strong/weak)	Results (favors CHW intervention vs. x/favors control/No difference between CHW intervention and control/ Mixed results)	Overall strength of evidence (insufficient/low/ mod/high)
	annenggennesannesen annesen annesen	Dise	ase Managem	ent: Diabet	es Mellitus	n an	
1 (150) ²⁰	Medium	Consistency Unknown	Direct	Not reported	Absent	Favors CHW	Low
	1 RCT/Fair	(single				vs. usual care	
		Health Promoti	on and Diseas	e Prevention	n: Disease Preventi	on	
2 (6841) ^{18, 36,} 42	Medium	Consistent	Indirect	Precise	Absent	Favors CHW intervention	Moderate
	1 RCT, 1 prospective cobort/Fair					vs. control (for improved knowledge of	
	conortyran					label reading,	
						fat in diet, and knowledge of	
						obtain free	

Behavior

 $\frac{e^{-i \lambda - i \lambda - i \lambda}}{\sqrt{2}} = 0$

Overall, there was low strength of evidence supporting CHW interventions in changing participant behaviors in health promotion and disease prevention and chronic disease management. Low strength of evidence supports CHW interventions as compared to a combination of CHW with another intervention, mailings, other health professionals, and usual care for behavior changes related behavior change in diabetes. There were no differences in behavioral outcomes in Latina health when CHW interventions were compared to tailored or off-the-shelf mail interventions.^{34, 35} There were mixed results resulting in low strength of evidence for behavior change in the area of disease prevention, with three of five studies favoring CHW intervention vs. controls (consisting of no intervention, combination of interventions, or media/print). ^{18, 36-41}

In the area of asthma management, there was moderate strength of evidence supporting CHW interventions in the increased use of bedding encasements.⁵⁹⁻⁶¹ However, other behavioral changes in asthma management showed no difference between CHW interventions and less intense CHW interventions or delayed interventions. ⁵⁹⁻⁶¹

The comparison arms chosen in the studies may account for the absence of statistically significant differences between the groups, particularly when comparison arms consist of less intensive CHW interventions or fairly intensive alternatives. Additionally, observations of all study arms, often performed by CHWs, may induce observation-related improvement in performance.

Table 21. Evidence Profile: Behavior

Number of	Risk of Bias	Consistency	Directness	Precision	Other	Results	Overall
studies	(low/med/high)				modifying	(favors CHW	strength of
(# of subjects)	e se la seconda en el te				factors	intervention	evidence
	Design/Quality				(intensity,	control/No	(insufficient/
					confounding -	difference	low/ mod/high)
100000000000					present/absent,	between	
					effect -	CHW	2220-22-23-23-25-25-25-25-25-25-25-25-25-25-25-25-25-
					strong/weak)	intervention	
						and control/	
						Mixed results)	
13.48	- t	Disease M	Management:	Diabetes Me	ellitus		1.
2 (213)43-40	Medium	Consistent	Indirect	Precise	Absent	Favors CHW	Low
						intervention	
	2 RCTs/Fair					vs. usual	
						care plus	
						newsletter	
	Н	ealth Promotion	n and Disease	Prevention:	Latina Health		·
1 (357) ^{34, 35}	High	Consistency	Indirect	Not	Present	No	Low
		unknown		reported		difference	
	1 RCT/Poor	(single				between	
		study)				CHW	
			-			intervention	
						and control	
	Heal	th Promotion a	nd Disease Pre	evention: Dis	ease Prevention	-	
, 5 (1125+12	Medium	Inconsistent	Indirect	Imprecise	Present	Mixed	Low
churches) ^{18, 36-41}						results: 3/5	
	5 RCTs/Fair (3),					studies	
	Poor (2)					favor CHW	
						intervention	
						vs. control	
	Chronic	Disease Manag	ement: Asthr	na, use of be	dding encasemer	nts	
2 (572) ⁵⁹⁻⁶¹	Low	Consistent	Indirect	Precise	Absent	Favors CHW	Moderate
						vs. less	
	2 RCTs/1 good, 1					intense	
	fair					CHW arm or	
						delayed	
						CHW arm	
	Chronic Disease Ma	anagement: As	thma, other be	ehaviors (sm	oking cessation, n	nold removal)	
2 (572) ⁵⁹⁻⁶¹	Low	Inconsistent	Indirect	Imprecise	Absent	No	Low
				1		difference	
	2 RCTs/1 good, 1					between	
	fair					CHW vs. less	
						intense	
						CHW arm or	
						delayed	
						CHW arm	

Measures of patient satisfaction are important for determining patient-centered care, and a call for such measures to facilitate health care system designs was made by the IOM's Crossing the Quality Chasm.⁶² Patient satisfaction also serves as an indirect measure of improved access to the health care system, an often expected result of CHW interventions. We found low evidence for CHW interventions on patient satisfaction. Only one of the 24 studies evaluated patient satisfaction with a CHW mental health intervention,^{57, 58} and it did not demonstrate a difference in patient satisfaction between arms (see Table 22.).

Number of studies (# of subjects)	Risk of Bias (low/med/ high) Design/Quality	Consistency	Directness	Precision	Other modifying factors (intensity, confounding - present/abse nt, magnitude of effect - strong/weak)	Results (favors CHW intervention vs. x/favors control/No difference between CHW intervention and control/ Mixed results)	Overall strength of evidence (insufficient/low/ mod/high)
		Dis	ease Manage	ment: Menta	l Health		
1 (165) ^{57,} 58	High 1 RCT/poor	Consistency unknown (single study)	Direct	Not reported	Present	No difference between CHW intervention and control	Low

Table. 22. Evidence Profile: Satisfaction

Health Outcomes

Most (15 of 24) of the studies examined the effectiveness of CHW interventions in the area of health outcomes. Health outcomes varied depending on a given study's clinical focus. Moderate evidence was found to support CHW effectiveness in improving back pain as compared to usual care.⁵⁶ Additionally, CHW interventions were found to improve asthma caregiver psychosocial outcomes as compared to a less intense CHW arm or delayed intervention.⁵⁹⁻⁶¹ Low evidence was found to support CHW effectiveness in the areas of pediatric immunizations, ²⁸⁻³² disease prevention, ^{18, 36} diabetes management, ^{20, 43-49} hypertension management, ^{19, 50-53} and asthma symptom management.⁵⁹⁻⁶¹

Table 23	3. Evidence	Profile:	Health	Outcomes
----------	-------------	----------	--------	----------

Number of studies (# of subjects)	Risk of Bias (low/med/high) Design/Quality	Consistency	Directness	Precision	Other modifying factors (intensity, confounding – present/absent, magnitude of effect – strong/weak)	Results (favors CHW intervention vs. x/favors control/No difference between CHW intervention and control/Mixed results)	Overall strength of evidence (Insufficient /low/ mod/high)
		Disease	e Managemen	t: Diabetes M	lellitus	<u></u>	
4 (479) ^{20, 43-49}	Low 4 RCTs/Fair	Inconsistent	Direct	Imprecise	Absent	Mixed results: 2/4 studies found CHW more effective than usual care in decreasing mean HgbA1c	Low
		Disea	se Manageme	ent: Hyperten	sion		
3 (2823) ^{19, 50-53}	Medium 2 RCT/Fair (1), Poor (1); 1 cohort/Poor	Consistent	Direct	Precise	Present	No difference between CHW intervention and control; All studies evaluated a CHW intervention compared to an intervention that involved a CHW in a lesser capacity	Low

-Table 23. Evidence Profile: Health Outcomes (continued)

Number of studies (# of subjects)	Risk of Bias (low/med/high) Design/Quality	Consistency	Directness	Precision	Other modifying factors (intensity, confounding – present/absent, magnitude of effect – strong/weak)	Results (favors CHW intervention vs. x/favors control/No difference between CHW intervention and control/ Mixed results)	Overall strength of evidence (insufficient /low/ mod/high)
	1	Dis	sease Manager	nent: Back Pa	ain		
1 (255)	Medium 1 RCT/Fair	Consistency unknown (single study)	Direct	Not reported	Absent	Favors CHW intervention vs. usual care plus a book for Roland score at 6 months and worry score at 12 months; no difference in Roland score at 12 months	Moderate
		Disea	se Manageme	nt: Mental H	ealth	· · · · · · · · · · · · · · · · · · ·	
1 (165) ^{57, 58}	High 1 RCT/Poor	Consistency unknown (single study)	Direct	Not reported	Present	No difference between CHW intervention and control	Low
10 12	Heal	th Promotion ar	nd Disease Pre	vention: Pedi	atric Immunization	s	
3 (5406)20032	Medium 2 RCTs/Good (1), Fair(1); 1 Prospective cohort/Poor	Inconsistent	Direct	Imprecise	Present	Mixed Results: 2/3 studies favor CHW intervention vs. control	Low
	He	alth Promotion	and Disease P	revention: Di	sease Prevention		
1 (294) ^{18, 36}	Medium 1 RCT/Fair	Consistency unknown (single study)	Direct	Not reported	Absent	No difference between CHW intervention and control (for change in BMI)	Moderate
E0 64		Chronic Dise	ease Managem	nent: Asthma	Symptoms		
2 (572) ⁵⁹⁻⁶¹	Low 2 RCTs/1 good, 1 fair	Inconsistent	Direct	Imprecise	Absent	Mixed results, 1 favors CHW vs. delayed intervention; no difference between CHW and less intense intervention	Low
	Chronic	Disease Manag	ement: Asthm	ha, Caregiver F	Psychosocial Outcor	nes	
2 (572)	Low 2 RCTs/1 good, 1 fair	Consistent	Direct	Precise	Absent	Favors CHW vs. less intense CHW arm or delayed intervention	Moderate

Health Utilization

Of the 24 studies, 7 reported on outcomes related to health care utilization. Four of these studies provided moderate strength of evidence that CHW interventions increased appropriate health utilization for disease prevention³⁷ and the management of infectious disease⁵⁵ and asthma⁵⁹⁻⁶¹ when compared to a range of comparators including no intervention to a control group receiving a less intense CHW arm or delayed intervention. Three studies provided low strength of evidence that CHW interventions improved health care utilization in the areas of Latina health,³³ hypertension⁵⁴ and mental health.^{57, 58} A designation of low strength of evidence is given due to study design, choice of comparators, and the possibility of the Hawthorne effect.

Table 24. Evidence Profile: Health Care Utilization

Number of studies (# of subjects)	Risk of Bias (low/med/ high) Design/ Quality	Consistency	Directness	Precision	Other modifying factors (intensity, confounding – present/ absent, magnitude of effect – strong/weak)	Results (favors CHW intervention vs. x/favors control/No difference between CHW intervention and control/ Mixed results)	Overall strength of evidence (insufficient/low /mod/high)
		Di	sease Manage	ment: Hype	rtension		w
1 (722) ⁵⁴	High	Consistency unknown	Indirect	Not reported	Present	Favors CHW intervention	Low
	1 Prospective cohort/Poor	(single study)				vs. no follow-up	
	· ·	Disea	ise Manageme	nt: Infectio	us Diseases	•	
1 (244) ⁵⁵	Medium	Consistency unknown	Indirect	Precise	Absent	Favors CHW intervention	Moderate
	1 RCT/Fair	(single study)				vs. control group given bus tokens, but monetary incentive was more effective than CHW or control given bus	

Table 24. Evidence Profile: Health Care Utilization (continued)

حاذلتهم

Number of studies (# of subjects)	Risk of Bias (low/med/ high) Design/ Quality	Consistency	Directness	Precision	Other modifying factors (intensity, confounding present/ absent, magnitude of effect strong/weak)	Results (favors CHW intervention vs. x/favors control/No difference between CHW intervention and control/ Mixed results)	Overall strength of evidence (insufficient/low /mod/high)
	P	Dis	ease Manager	nent: Menta	al Health		
1 (165) ^{57, 58}	High 1 RCT/Poor	Consistency unknown (single study)	Indirect	Not reported	Present	No difference between CHW intervention and control	Low
			Disease Mana	gement: As	thma		
2 (572) ⁵⁹⁻⁶¹	Low 2 RCTs/1 good, 1 fair	Consistent	Direct	Precise	Absent	Favors CHW vs. less intense CHW arm or delayed intervention	Moderate
		Health Prom	otion and Dise	ase Prevent	ion: Latina Healt	h	
1 (103) ³³	Medium 1 RCT/Fair	Consistency unknown (single study)	Indirect	Imprecise	Present	No difference between CHW and control	Low
		Health Promoti	on and Disease	Prevention	: Disease Preven	tion	
1 (421) ³⁷	Medium 1 RCT/Fair	Consistency unknown (single study)	Indirect	Precise	Absent	Favors CHW intervention vs. no assistance with follow- up	Moderate

Applicability of Findings

Applicability was determined by evaluating studies for populations, intensity of treatment, comparator choice, outcomes and follow-up timing. Studies were reviewed by clinical context (see Appendix B). Results are summarized below:

Population – In general, CHW interventions were conducted in underserved populations, including inner city and rural communities. Many studies focused on specific subsets of patients, including inner city African-Americans, homeless people and border-state Latinas, limiting the ability to translate findings beyond these patient populations.

Intensity of treatment – Most studies were high intensity, especially in the area of disease management. There was no clear evidence of variation in CHW intervention effectiveness by intervention intensity for the outcomes reviewed. Additionally, high-intensity interventions are resource-intense and may not be cost-effective when applied to a larger population.

Choice of Comparator – Significant heterogeneity existed between study comparators. In general, comparators were appropriate in terms of commonly employed methods and less resource-intense alternatives. However, the heterogeneity limits the generalizability of study findings.

Outcomes – The outcomes evaluated in the reviewed studies were appropriate for the clinical conditions of interest, as either direct or indirect measures. The lack of standardization precluded quantitative synthesis.

Timing of Follow-up – Overall, studies of health promotion and disease prevention and disease management chose appropriate lengths of follow-up to accurately determine the intervention effects.

Limitations of the Literature

The evidence base was limited for multiple reasons. First, individual studies had significant limitations. CHW interventions were inconsistently described in detail, which frequently limited the critical appraisal of internal validity and applicability evaluation.

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Specifically, descriptions of CHW training, intervention protocol (including number and duration of sessions) and adherence to protocol, were missing for a significant percentage of studies. In addition to heterogeneity within CHW interventions, there was great heterogeneity in comparison groups as well. When comparing higher intensity CHW interventions to lower intensity CHW interventions, the potential for a Hawthorne effect diluting the results is certainly a possibility.

Study design was a significant limitation of several of the studies we reviewed. Specifically, many studies failed to report a priori hypotheses, lacking primary outcomes and power calculations. This may have resulted in a lack of power to determine a difference. Also, few studies appropriately adjusted for confounders and effect modifiers in their statistical analyses. As a result of this combination of deficiencies, consistency and validity of the evidence was limited to at most moderate strength.

Additionally, our systematic review has also has limitations. We limited the review to studies published in English and conducted in the United States. Therefore, we cannot address the outcomes for community health worker interventions in other parts of the world, particularly developing countries.

Future Research Directions

Several research gaps in key clinical areas and domains were identified. Table 19 summarizes the number of studies for each outcome area by clinical section.

	Number of studies							
Clinical Context	Knowledge	Behavior	Satisfaction	Health Outcomes	Health Utilization	Total*		
Health promotion and disease prevention: pediatric immunizations	None	None	None	3	None	3		
Health promotion and disease prevention: health promotion – Latina health	None	1	None	None	1	2		
Health promotion and disease prevention: disease prevention	2	5	None	1	1	6		
Chronic disease management: diabetes mellitus	1	2	None	4	None	4		
Chronic disease management: hypertension	None	None	None	3	1	4		
Chronic disease management: infectious diseases	None	None	None	None	1	1		
Chronic disease management: back pain	None	None	None	1	None	1		
Chronic disease management: mental health	None	None	1	1	1	1		
Chronic disease management: asthma	None	2	None	2	2	2		

Table 19. Summary of studies reporting on outcomes by clinical context

*Total may be less than sum of cells because of overlapping studies.

3

Total*

Although a substantial number of studies were included in our review, we identified several gaps in the literature. A significant number of studies included in the review were of fair or poor quality. Studies with improved methodologies, including *a priori* specification of primary outcomes, sample size calculation, and hypotheses based on a conceptual model, would help strengthen the evidence base. Additionally, studies should have outside evaluators for outcome measurement as opposed to using the CHWs to limit biases due to social desirability.

1

15

7

24

10

Studies were also limited in terms of their design. CHW interventions are examples of community-based research, which is vital for successful type 2 translation – the adaption of evidence-based interventions to real-world settings.⁶³⁻⁶⁵ However, study design can significantly limit the validity of these trials. Criteria identifying practical clinical trials (PCTs) can help to evaluate the applicability and generalizability of research by including representative participants, multiple and diverse settings, and a focus on measures relevant to decision makers (including cost, quality of life, reach and adoption).⁶⁶ One essential element of a PCT is the utilization of diverse and representative settings and staff in the delivery of the intervention.⁶⁷ Additionally, studies should compare clinically relevant alternative interventions and measure a broad range of relevant health outcomes.⁶⁸ PCTs are especially important for assessing efficacious interventions for common conditions, such as obesity, as they provide key information relevant to type 2 translation.⁶⁸⁻⁷⁰

A significant gap in the literature we found was that none of the interventions focused obesity prevention or weight loss interventions. The obesity epidemic in the United States has reached unprecedented numbers, with wide-spread health and economic effects. Over 72 million US adults are obese (body mass index (BMI) > 30), accounting for more than one-third of the population.⁷¹ In addition, a staggering one in three children are overweight, and approximately 16% are obese.⁷¹ Health disparities are prominent, with African-American and Mexican-American girls more likely than white girls to have a high BMI for their age.⁷² Obesity has been associated with significant mortality as well as morbidity, including an increased risk of developing type 2 diabetes mellitus, hypertension, coronary heart disease, stroke, and many others.⁷³ Lifestyle-modification programs have led to weight loss and maintenance of weight in

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addition to a decreased incidence of obesity-related conditions, suggesting there may be a role for CHW interventions.⁷⁴

Appendix A.

Full-text review form (Originally in EXCEL)

Column	Question
A	Refid
В	Author, year
C	Reviewer Initials
D	Abstract only
E	Wrong population (non-US)
F	Wrong Outcomes (no patient related health
	or economic outcomes)
G	Study not about CHW
H	Wrong publication type (review or letter to
	the editor)
	Sample size too small (<40)
J	No comparison arm/data
K	Comparison arm/data not about CHW or
	CHW alone
L	CHW component insufficiently described to
	distinguish between CHW and other peer
· · · · · · · · · · · · · · · · · · ·	led models
М	Other?
N	Exclude but save for background, cost,
	training or setting, pick one! (only if yes for
	at least one column D-M)
0	Should be included for KQ 4a
	(What are characteristics of training for community
	health workers in the outpatient setting?)
P	Should be included:
Q	Need more information
	Related citations
<u> </u>	Left Diank
Т	Specifically, what is the place of service, type of service, type
	of educational materials used, duration of interaction with
	clients, and length of followup? What is the impact of community health workers on
0	outcomes, particularly knowledge, behavior, satisfaction,
	health outcomes, and health care utilization?
V	health workers for improving health outcomes?
W	Are particular training characteristics associated with
V	improved outcomes for patients?
X	Study design
Y	Comparisons (identify arms) i
Σ	Health condition of interest
AA	Name of intervention
AB	Notes- including additional citations

Abstraction Form for Evidence Tables (Originally in EXCEL)

Column	Category	Question
A	Identifying information	Reviewer Initials
В		Author
		Year
C	-	Trial Name
D -		Objective or aim
F	Setting	Setting: Geography
F		Setting: Organizational, Social, Cultural
G	-	What is the community? (neighborhood, disease etc.)
H		Study design: RCT/Prospective cohort/Retropective cohort/Prospective cohort with historic control/case-control/case series/other
	-	Start date- year
J		Duration length
K	N	Eligible
L		Enrolled
М		Randomized
N		Completers
0		Withdrawals or dropouts
Р	· · ·	Health condition of interest
Q	Inclusion/Exclusion	Inclusion criteria
R	-	Exclusion criteria
S	Groups	Groups (please use- G1: G2: G3: etc.)
Т		Describe interventions (if necessary)
U		n of each group
v	Community Health	CHW definition:
W	Worker	CHW training:
Х		Place of service
Y	_	Title of CHW (specify: lay health advisor, community health worker, etc)
Z	-	Paid or volunteer
AA	_	Relationship with the community (rshared race, ethnicity, disease condition, etc)
AB	Community Health	N of CHW
AC	Worker (continued)	Supervision of CHW (who supervises [clinician vs non clinician] and frequency of supervision)
ad		Prior training of CHW
AE		Type of service
AF		Type of educational materials utilized
AG		Duration of interaction with clients
AH		Length of followup
AI	Baseline characteristics of	Age (mean)

	patients	
	4	Say (9/ famala)
AJ	4	
AK	_	Cthor?
AL	Deensiting and	
AM	retention	Role of CHW in recruiting and retention
AN		Recruitment: Need rates for each group
AO		Retention: Need rates for each group
AP	Knowledge and	Measure (Is it valdidated?)
AQ		Results
AR		Measure (Is it valdidated?)
AS		Results
AT		Measure (Is it valdidated?)
AU		Results
AV	Quality of Life	Measure (Is it valdidated?)
AW		Results
AX		Measure (Is it valdidated?)
AY		Results
AZ		Measure (Is it valdidated?)
BA	_	Results
BB	Health Outcomes	Measure (Is it valdidated?)
BC	-	Results
BD		Measure (Is it valdidated?)
BE		Results
BF		Measure (Is it valdidated?)
BG	-	Results
BH	Healthcare utilization	Measure (Is it valdidated?)
BI	-	Results
BJ		Measure (Is it valdidated?)
BK		Results
BI		Measure (Is it valdidated?)
BM	-	Results
BN	Costs (Economics)	Measure (Is it valdidated?)
BO		Results
BD	-	Measure (Is it valdidated?)
BO		Results
		Explanation of overall outcomes
		Quality rating: Good / fair / poor
DJ	Applicable key	KO1 - How do community health workers interact
RI	questions	with clients? Specifically what is the place of
	1	service, type of service, type of educational
		materials used, duration of interaction with clients,
		and length of followup?
BU		KQ 2 - What is the impact of community health
		workers on outcomes, particularly knowledge,
		health care utilization?
BV	1	KQ 3 - What is known about the cost-

		effectiveness of community health workers for improving health outcomes?
BW/	1	KQ 4a - What are characteristics of training for
		community health workers in the outpatient
		setting?
BX		KQ 4b - Are particular training characteristics
		associated with improved outcomes for patients?
BY	Additional outcomes	Measure (Is it validated?)
BZ	(please add more	Results
CA	nere at the end if	Measure (Is it validated?)
СВ	you muse)	Results
CC		Measure (Is it validated?)
CD		Results
CE	-	Measure (Is it validated?)
CF		Results
CG	· · · · · · · · · · · · · · · · · · ·	The gulf between the rest and KQ4a
СН		(Blank)
	Training	Elicibility for CHW training (inclusion criteria for
	Characteristics	CHW)
CJ	-	Input of CHW in curriculum development
СК	-	Training on cultural competency (describe
		content; instructional method; number of sessions;
		testing)
CL		I raining on recruitment and retention process
	(continued)	content: instructional method: number of sessions:
		testing)
CM		Training on intake/assessment, (describe content;
		instructional method; number of sessions; testing)
CN		Training on protocol delivery, i.e., recruitment,
		followup, fidelity to the intervention, referrals
		(describe content; instructional method; number of
<u> </u>		Training on health topic (describe content:
		instructional method: number of sessions: testing)
СР		Training on evaluation (describe content;
		instructional method; number of sessions; testing)
CQ		Other training (describe type)
CR		Other training content; instructional method;
	4	number of sessions; testing
CS		Other training (describe type)
СТ		Other training content; instructional method; number of sessions: testing
CU		Name of curriculum
CV	4 	Availability
CW/	1	Evaluation and testing results of the curriculum
		(improvements in CHW knowledge)
сх	1	Certification (any certication [yes/no/nr]; if yes,
		name of certifying body
Quality Review for randomized controlled trials (Originally in EXCEL)

Column	Category	Question	
А		REFID	
В		Reviewer initial	
С	Background/context	Is the hypothesis/aim/objective of the study described? Yes	
D	Sample Definition and Selection	Are the inclusion/exclusion criteria clearly stated (does not require the reader to infer)? [Abstractor: use "Partially" if only some criteria are stated clearly.] Yes Partially	
		No	
E		Did the authors report conducting a power analysis or some other basis for determining the adequacy of study group sizes for the primary outcome(s) being abstracted?	
		Yes No	
F	Randomization	Was the assignment to the treatment groups adequately randomized?	
		 i.e., computer-generated random numbers, random numbers tables) No (Inadequate approaches to sequence generation, i.e., use of alternation, case record numbers, birth dates or week days) 	
G		Was allocation of randomization adequately concealed?	
		Yes (Adequate approaches to concealment of randomisation, i.e., centralised or pharmacy-controlled randomisation, serially- numbered identical containers, on-site computer based system with a randomisation sequence that is not readable until allocation, other approaches with robust methods to prevent foreknowledge of the allocation sequence to clinicians and patients)	
		No (Inadequate approaches to concealment of randomisation, i.e., use of alternation, case record numbers, birth dates or week days, open random numbers lists, serially numbered envelopes (even sealed opaque envelopes can be subject to manipulation)	
		NA (study not adequately randomized)	
		NR	
H	Interventions/Expos ure	What is the level of detail in describing the intervention or exposure?	
		Low (unclear, many details missing) Medium (pretty clear, most details provided)	

		High (very clear, all required details provided)	
	-	Is usual clinical care (sometimes called standard care)	
t		described?	
		Vos	
		1 dS	
		INO NA (ast as interpreting study)	
		NA (not an intervention study)	
J	Contamination	Did researchers rule out any impact from an unintended	
		intervention/exposure that might bias results, e.g., through	
		multivariate analysis, stratification, or subgroup analysis?	
		Vos	
		No	
		NA (no unintended interventions reported)	
V	-	Could variation from the protocol have compromised the findings	
n n		of study?	
		Veg (veriation from protocol evints and could have compromised	
		findinge)	
		IIIIdiigs)	
		No (variation from protocol exists, but unikely to have	
		compromised indings)	
		Cannot determine (no variation from protocol reported)	
		INA (study does not require protocol, or no variation from protocol	
		exists)	
L	Blinding	Outcome assessors masked?	
		Yes	
		NO	
		Yes, but method not described	
	_	Not reported	
М		Care provider masked?	
		Yes	
		No	
		Ves but method not described	
		Not reported	
		NA	
N	-	Patient macked?	
		Vae	
		No	
		No Voc. but mathed not described	
		Net reported	
	Soundhoos of	Are interventional eventures measured in a valid and taliable	
0	information	Are milerventions/exposures measured in a valid and reliable	
	mormation	Objective (clinical reports, lab findings, proviously validated	
		Objective measures not validated	
		Droppotive documentation (industing cold report in doity distance)	
		Prospective documentation (including self-report in daily diaries)	
		Net reported	
	4		
P		Are outcomes measured in a valid and reliable manner?	
		Objective (clinical reports, lab findings, previously validated	
		measures)	
		Objective measure, not validated	

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-		
		Prospective documentation (including self-report in daily diaries) Retrospective self-report (patient/participant response) Not reported
Q	Follow-up	Is the length of time following the intervention/exposure sufficient to support the conclusions of the study regarding outcomes?
		Yes
		NO
R		Did attrition from any group exceed 20 percent (after randomization)?
		Yes - how much?
		Connet determine
	4	
S		Did attrition differ between groups by more than 15 percentage points (after randomization)?
		Yes - how much?
		Cannot determine
Т	Analysis Comparability	Are baseline characteristics similar in exposed and comparison cohorts?
		No.
2		Yes
		No
		Cannot determine
U		Does the analysis control for baseline differences?
		Yes
		No
		Cannot determine
		NA (no baseline differences reported)
	A solution O 1	In the sector of
V	Analysis Outcome	Is the analysis conducted on an intention-to-treat (111) basis, that
		is, the intervention allocation status rather than the actual intervention received?
		Yes
		No
W		Were there any post-randomization exclusions?
		Yes (how many?)
		Cannot tell
X	Interpretation	Are conclusions supported by results with possible bias and
		Yes
		Partially
		No
Y	Quality	Good
		Fair
		Poor

Quality Review for observational trials (Originally in EXCEL)

Column	Category	Question	
А		REFID	
В		Reviewer initial	
С	Background/	Is the hypothesis/aim/objective of the study described?	
	Context		
		Yes	
	Sample	Are the inclusion/exclusion criteria clearly stated (does not require	
	Definition and	the reader to infer)? [Abstractor: use "Partially" if only some criteria	
	Selection	are stated clearly.]	
3	Sciection		
		Yes	
•		Partiany No	
E		Did the authors report conducting a power analysis or some other	
		basis for determining the adequacy of study group sizes for the	
		primary outcome(s) being abstracted?	
		Vaa	
		No	
F	Interventions/	What is the level of detail in describing the intervention or	
	Exposure	exposure?	
	•	Intensity, duration, frequency, setting and timing	
		l ow (unclear, many details missing)	
		Medium (pretty clear, most details provided)	
		High (very clear, all required details provided)	
G		Is usual clinical care (sometimes called standard care) described?	
		V	
		No	
		NA (not an intervention study)	
H	Contamination	Did researchers rule out any impact from an unintended	
		intervention/exposure that might bias results, e.g., through	
-		multivariate analysis, stratification, or subgroup analysis?	
		Yes	
		No	
		NA (no unintended interventions reported)	
1		Could variation from the protocol have compromised the findings of	
		study?	
		Yes (variation from protocol exists and could have compromised	
		findings)	
		No (variation from protocol exists, but unlikely to have	
		compromised findings)	
		NA (study does not require protocol, or no variation from protocol	
		exists)	
J	Blinding	Were the outcome assessors blinded to the intervention or	

		exposure status of participants?
		Yes No
		NA (not an intervention study)
K	Soundness of information	Are interventions/exposures measured in a valid and reliable manner?
		Objective (clinical reports, lab findings, previously validated measures)
÷		Objective measure, not validated
		Prospective documentation (including self-report in daily diaries) Retrospective self-report (patient/participant response) Not reported
L		Are outcomes measured in a valid and reliable manner?
		Objective (clinical reports, lab findings, previously validated measures)
		Objective measure, not validated Prospective documentation (including self-report in daily diaries) Retrospective self-report (patient/participant response) Not reported
M	Follow-up	In cohort studies, do the analyses adjust for different lengths of follow-up of patients, or in case-control studies, is the time period between the intervention/exposure and outcome the same for cases and controls? [Abstractor: Where follow-up was the same for all study patients the answer is yes. If different lengths of follow-up
		Studies where differences in follow-up are ignored should be answered NA.]
		Yes
		No
		Cannot determine NA (cross-sectional)
N		Is the length of time following the intervention/exposure sufficient to support the conclusions of the study regarding outcomes?
		Yes
		NA (cross-sectional)
0		Did attrition from any group exceed 20 percent (after allocation of treatment)?
		Yes - how much?
		NO Operand data
		NA (cross sectional)
Р	_	Did attrition differ between groups by more than 15 percentage points (after allocation of treatment)?

		Yes - how much?
		No
		Cannot determine
		NA (cross sectional)
0	Analysis	Are baseline characteristics similar in exposed and comparison
	comparability	cohorts?
		Yes
		No
		Cannot determine
		NA (case series)
R		Does the analysis control for baseline differences?
		Yes
		No
		Cannot determine
		NA (no baseline differences reported)
S		Were the important confounding and modifying variables taken into account in the design and analysis (e.g., through matching, stratification, or statistical adjustment)?
		Yes
		Partially
		No
		Cannot determine
Т	Analysis	Is the analysis conducted on an intention-to-treat (ITT) basis, that
	Outcome	is, the intervention allocation status rather than the actual intervention received?
		Yes
		No
U	-	Is the impact of loss to follow-up (or differential loss to followup)
		assessed (e.g. through sensitivity analysis or other intention-to- treat adjustment methods?
		Yes
		No
		Cannot determine
		NA (cross-sectional or case-control selected on outcome)
V		Are the statistical methods used to assess the primary outcomes
		used must be appropriate to the data. For example, non-parametric
		methods should be used for small sample sizes (N<30). If studies
		have not accounted for differences between the unit of allocation
		and the unit of analysis, (e.g., through mixed models or generalized
		estimating equations for analysis of individual covariates or through
		t-tests or weighted t-tests for cluster-level analysis) then the
		answer is no. If outcomes are rare and little or no statistical
		analysis has been conducted, answer yes if studies have
		accounted for alternative causes other than the
		intervention/exposure. For details on whether specific statistical
	1	lesis are appropriate, yo to

<u>_____</u>

	······	http://bama.ua.edu/~jleeper/627/choosestat.html.4]		
		Yes		
		Partially		
		No		
		NA (not reported)		
W		For cohort studies only, if the outcome has a greater than 10		
		percent prevalence, is the risk ratio and relative risk calculated		
		directly (not using logistic regression)?		
		Yes		
		No		
		NA (not a cohort study)		
X		Does the study report appropriate estimates of the random		
		variability in the data for the main outcomes?4 [Abstractors: In non-		
		normally distributed data the inter-quartile range of results should be reported. In normally distributed data the standard error.		
		be reported. In normally distributed data the standard error,		
		standard deviation or confidence intervals should be reported.]		
		Yes		
		No		
γ	Interpretation	Are conclusions supported by results with possible bias and		
		limitations taken into consideration?		
		Yes		
		Partially		
		No		
Z	Quality	Good		
		Fair		
		Poor		

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Appendix B.

Assessing applicability: Pediatric Immunization Interventions

Population	3 of 3 studies (n=5,406) assessed children, ages 0-24 months, focused specifically on inner-city.	The effectiveness of CHW interventions on rural children or those outside of the inner-city, who may also be at risk for improper vaccination, was not assessed.
Intensity or quality of treatment	All interventions studied in this domain were high-intensity, involving home visits and phone calls.	High-intensity interventions are resource-intense and may not be cost-effective if applied to a larger population.
Choice of, and dosing of, the comparator	Comparators varied by study and included historic controls with professional health worker home visits, an autodialer, and an in-person reminder.	Comparators were appropriate in terms of commonly employed methods and less resource- intense alternatives.
Outcomes	Immunization rates	Appropriate outcome for intervention
Timing of follow-up	Follow-up ranged from 12-24 months	Appropriate to determine outcome

Assessing applicability: Latina Health

Population	Two studies (n=460) focused on adult Latinas in border states, ages 18-65 years.	The effectiveness of CHW interventions on Latinas may differ in non-border states.
Intensity or quality of treatment	One study evaluated a moderate-intensity intervention and one study evaluated a high- intensity intervention.	High-intensity interventions may not be cost-effective if applied to a larger population.
Choice of, and dosing of, the comparator	Comparators included postcard reminders or newsletters	Comparators reflect lower-cost interventions that are more than usual care (i.e. no reminders).
Outcomes	Completion of clinical exam; Dietary intake	Appropriate outcomes for the respective interventions
Timing of follow-up	Follow-up range: 0-12 months	Appropriate for outcomes and interventions

Assessing applicability: Disease Prevention

Population	Patients age range: > 18+ years. All 6 studies (n=7,672) focused on minorities, with 5 of 6 focused on low-income city populations.	Age range is appropriate for adult interventions. Results not likely to apply to non-minorities.
Intensity or quality of treatment	Studies range from low (n=2), moderate (n=2), and high- intensity (n=2) interventions.	Intensity reflects complexity of intervention; high-intensity interventions require greater resources that may not be cost- effective for larger populations.
Choice of, and dosing of, the comparator	Comparators include control groups without any intervention (n=2), verbal advice (n=1), condition specific print materials (n=3).	Comparators without any intervention reflect usual clinical care. Lower resource-intense controls reflect more than usual care and may be effective.
Outcomes	Outcomes vary depending on condition of interest and include: smoking cessation rates, food frequency questionnaires, follow-up clinical rates, condom use.	Most outcomes are applicable to key health indicators, either directly (e.g., smoking cessation) or indirectly (e.g., condom use).
Timing of follow-up	Follow-up ranges from 0-5 years.	Follow-up time was adequate for outcomes measured.

Assessing applicability: Disease Management – Diabetes.

Population	Four studies (n=479) focused on underserved populations with	I he effectiveness of CHW interventions in study
	diabetes, including Hispanics	populations are likely to be
	(n=2), African-Americans (n=2),	generalizable to similar target
	and Native Hawaiians (n=1).	populations of underserved
		minorities with diabetes.
Intensity or quality of treatment	Three studies were high-	High-intensity interventions may
	intensity and one study was	not be cost-effective in larger
	moderate-intensity.	populations.
Choice of, and dosing of, the comparator	Comparators included usual	Comparators reflect the current
	clinical care alone (n=2) or with	standard for clinical care and
	print material (n=2).	are appropriate for the
		interventions studied.
Outcomes	Outcomes varied between	HgbA1c is an appropriate
	studies but all evaluated	measure of diabetes control and
	HgbA1c.	an appropriate outcome for
		these interventions.
Timing of follow-up	Follow-up ranged from 3-24	The follow-up time was
ining of solow-up	months	appropriate for outcomes
		evaluated (specifically HobA1c).

Applicability Tables: Disease Management - Hypertension

Population	All four studies (n=3,545) evaluated adults with hypertension. Three studies evaluated interventions in inner- city African-Americans.	The effectiveness of CHW interventions may not translate to other ethnic or racial groups or African-Americans living in other parts of the country.
Intensity or quality of treatment	Two of the studies were high- intensity and two of the studies were moderate-intensity.	Interventions that are higher intensity also require greater resources and may not be cost- effective if applied to a larger population.
Choice of, and dosing of, the comparator	Comparators included standard clinical care (n=2) and lower intensity CHW interventions (n=1).	Comparators are appropriate given the current standard of care. Lower intensity interventions may reduce the effect size seen in the higher- intensity intervention.
Outcomes	The most common reported outcome was blood pressure (3/4), however, one study evaluated health care utilization.	BP control is an appropriate outcome for these interventions.
Timing of follow-up	Range of follow-up: 0-36 months.	Follow-up time was adequate for the outcomes measured.

Applicability Tables: Disease Management - Other

Population	Three studies (n=664) evaluated GHW disease management interventions on other conditions in adult patients. Two of these studies addressed disease management in homeless populations.	The effectiveness of CHW interventions will be limited to generalizability in the respective target populations (e.g., homeless).
Intensity or quality of treatment	Two studies evaluated moderate-intensity interventions and one study evaluated a high- intensity intervention.	High-intensity interventions may not be cost-effective if applied to a larger population.
Choice of, and dosing of, the comparator	Comparators included assertive community treatment without a CHW (n=1), bus token and monetary incentives (n=1), and print material (n=1).	Comparators reflect more than usual clinical care, which may reduce the effect size seen in the CHW interventions.
Outcomes	Outcomes where disease- specific and included: rate of follow-up, back pain, and psychiatric symptoms.	Most outcomes are applicable to key health indicators, either directly (e.g., back pain) or indirectly (e.g., rate of follow- up).
Timing of follow-up	Range of follow-up: 0-18 months.	Follow-up time was adequate for the outcomes measured.

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