
Effectiveness of Community Health Workers in the Care of People with Hypertension

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Background: The contributions of community health workers (CHWs) in the delivery of culturally relevant programs for hypertension control have been studied since the 1970s. This systematic review examines the effectiveness of CHWs in supporting the care of people with hypertension.

Methods: Computerized searches were conducted of multiple bibliographic electronic databases from their inception until May 2006. No restrictions were applied for language or study design, and studies were restricted to those that reported at least one outcome among participants.

Results: Fourteen studies were identified, including eight randomized controlled trials (RCTs). Many of the studies focused on poor, urban African Americans. Significant improvements in controlling blood pressure were reported in seven of the eight RCTs. Several studies reported significant improvements in participants' self-management behaviors, including appointment keeping and adherence to antihypertensive medications. Four studies reported positive changes in healthcare utilization and in systems outcomes. Two of the RCTs showed significant improvements in other patient outcomes, such as changes in heart mass and risk of CVD.

Conclusions: Community health workers may have an important impact on the self-management of hypertension. Programs involving CHWs as multidisciplinary team members hold promise, particularly for diverse racial/ethnic populations that are under-served.
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Introduction

Uncontrolled high blood pressure (BP), a key risk factor for heart disease, stroke, and renal disease, is a significant public health problem.^{1,2} Nearly one in three adult Americans are hypertensive (BP ≥ 140 mmHg [systolic] or ≥ 90 mmHg [diastolic]); another 59 million are prehypertensive (BP 120 to 139 mmHg [systolic] or 80 to 89 mmHg [diastolic]).³ Only about 30% of people who are diagnosed with hypertension have their BP under control.^{2,4} Even worse, of the estimated 20.8 million people in the United States with diabetes, just 12% have their BP under control (BP < 130/80 mmHg).^{5,6}

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Rates of hypertension control remain low for a variety of reasons, including inadequate intensity of treatment and the failure of providers to comply with evidence-based guidelines.^{7–9} Poor and high-risk minority populations face additional barriers, including health beliefs and values (e.g., “medications only need to be taken as needed”), insufficient access to culturally sensitive care (or any care), and lack of knowledge about hypertension and how to treat or screen for this problem, and an absence of self-management skills.^{8,9}

In response to many of these barriers and to improve health outcomes in the community, the involvement of trained laypeople, known as community health workers (CHWs), has gained momentum.^{8,10–16} CHWs are also known as lay health advisors, community health representatives, *promotores de salud*, patient navigators, and outreach workers.^{8,13} They are important advocates who can bridge cultural and social gaps between providers of health and social services and the community members they seek to serve.^{8,13} CHWs provide culturally relevant and appropriate education, counseling, and social support, and they may provide clinical services such as measuring BP.⁸ They can facilitate access to care, promote continuity of care, make the use

of health care more appropriate, facilitate the adoption of self-care skills for disease management, and enhance compliance with treatment regimens.^{8,10-14,17}

The purpose of this systematic review was to examine the effectiveness of CHWs in the care of people with hypertension. In particular, the aim was to determine whether programs involving CHWs increase the number of people with sustained control of their BP.

Methods

This systematic review was part of a larger review examining the effectiveness of CHWs in the care of people with chronic diseases, and was performed¹² using the methodology outlined by the Cochrane Collaboration.¹⁸ A full description of the review methodology was described in an earlier report.¹² With the guidance of an information specialist, the authors searched seven electronic databases from their inception (in parentheses) to May 2006: MEDLINE (1966), Educational Resources Information Center (ERIC) (1966), Cumulative Index to Nursing and Allied Health (CINAHL) (1982), Sociological Abstracts (1963), Chronic Disease Prevention Databases (1977), PsychINFO (1967), and Web of Science (1981).

Community health workers were broadly defined as any health workers who carried out functions related to health-care delivery, were trained as part of an intervention, had no formal paraprofessional or professional designation, and had a relationship with the community being served. The included studies reported at least one outcome among participants. Studies that focused exclusively on outcomes among CHWs and those involving peers who merely led support groups were not included in this review.

There were no restrictions on language of publication, geographic location (country), or study design. Before-and-after or cohort studies were included, as they provide useful data pertaining to process outcomes such as the satisfaction of participants with CHW services.

Published abstracts were excluded because they generally do not provide an adequate description of interventions, and thus the quality of the study was difficult to assess. Dissertations were also excluded, as the full text was rarely available. The authors noted that numerous organizations (e.g., health departments, healthcare providers, and community-based programs) include CHWs in their teams but have not published evaluations of their programs. Unpublished data were not considered.

Relevant data from included studies were extracted by one author (FMC) and verified by a second (JNB) using a standardized abstraction template. Any discrepancies were resolved through consensus. Quantitative data are presented as mean values, with standard deviations (SD), percentages, or median values.

Results

Characteristics of the Studies and the Participants

Fourteen primary studies¹⁹⁻³² with six companion papers³³⁻³⁸ were identified that examined the effects of

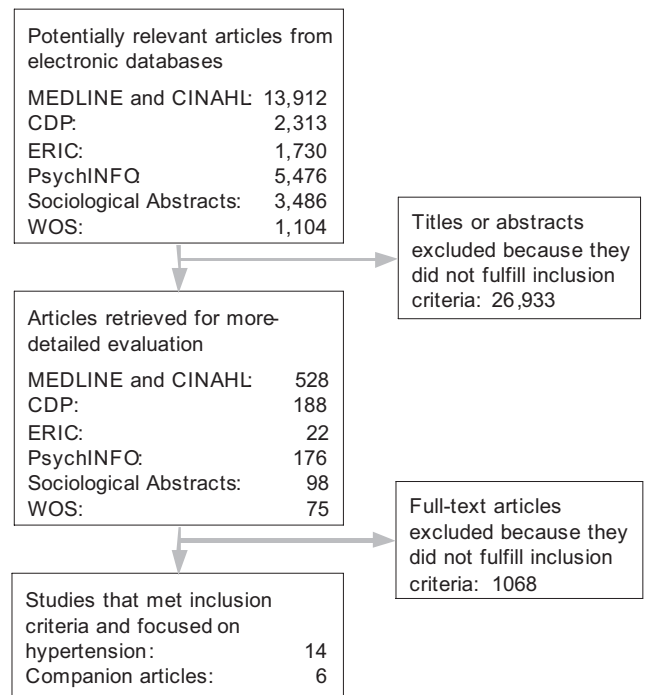


Figure 1. Systematic review flow diagram. CDP, Chronic Disease Prevention Database; CINAHL®, Nursing and Allied Health database; ERIC™, Educational Resources Information Center Database; WOS, Web of Science.

an intervention involving CHWs on the care of people with hypertension (Figure 1) (Table 1). The companion papers reported study characteristics or early follow-up data of a longer study, and their citations are included with the citations of the primary study that reported final outcomes. The 14 primary studies, which were published between 1983 and 2005, included eight randomized controlled trials (RCTs),^{19,25,26,28-32} three studies with a before-and-after design,^{22,24,27} one study with nonrandomized allocation of treatment and comparison groups,²¹ one time series,²⁰ and one survey²³ (Table 1). Sample size varied widely (range 20²⁷ to 1367,³¹ and one community of 56,000 members²⁹). The median follow-up interval was 24 months for the eight RCTs (range 12 to 96 months) and 21 months (range 12 to 24 months) for the six studies with nonrandomized designs.

Participants were middle-aged (range 39.0²⁶ to 57.4²² years), and 45.4% were female (range: 27.8%²⁸ to 78.0%²²). All studies but one²² focused exclusively on controlling hypertension. The frequency of participants' contact with the CHW varied from once a week^{21,24} to once a year.³²

Interventions were primarily targeted to minority populations (most commonly African Americans). Four studies focused exclusively on African American males in Baltimore,^{21,25,26,29} many of whom had high-risk behaviors or situations (e.g., alcoholism, use of illicit drugs, unemployment, no insurance, high rate of incarceration).

All of the studies were conducted in the U.S.; additional articles were identified in both developed and developing countries but contained no data on outcomes. Interventions were conducted in healthcare settings,^{21,27} community settings,^{23,24,26,28,29} and a combination of these settings.^{19,20,22,25,30–32} Community settings were generally participants' homes, but CHWs also conducted community outreach in places such as churches, community centers, food banks, and local jails.

Community health workers were either the sole focus of the intervention under study^{21–24,26–29} or one component of a multicomponent intervention^{31,32} or team.^{19,20,25,30}

The Characteristics, Roles, and Training of CHWs

The characteristics of CHWs were not as well described as those of the study participants. The CHWs, predominantly women, were recruited from the community, and resembled the participants in race/ethnicity and socioeconomic background (where this information was reported). The number of CHWs actively providing services to participants ranged from one to 38. Two studies reported age of the CHWs: in one report mean age was 59 years²¹ and in the other age ranged from 30 to 45 years.²² None of the CHWs had previous work experience in health care, but at least three studies indicated the CHWs had previous experience in community service,^{21,22,27} and one study recruited CHWs who had knowledge of social networks (e.g., social relationships among people who know each other) and organizations in the community.²⁴

The roles and duties of CHWs were consistent across the studies and reflected the common objective of BP control. A major role was to provide health education and information to patients and families on behavioral risk factors for hypertension, recommended changes in lifestyle, protocols for treatment and medication, the importance of adherence to treatments, and ways to reduce barriers to compliance with treatment.^{19–22,24–32}

A second major role was to ensure that participants received services necessary for BP control, including assistance with insurance matters, referrals, and maintaining services necessary for BP control. Many CHWs offered instrumental support, such as arranging for transportation to medical appointments.^{20–22,24–32}

A third role was to provide direct services to participants, including measuring and monitoring BP,^{20,21,27–30,32} and a fourth was to provide social support to the participants and their family members by talking to and listening to them, motivating them, reducing their isolation, and leading self-help groups.^{19,22,24,31}

Finally, CHWs served as mediators between participants and the healthcare and social service systems. These workers focused on management of healthcare utili-

zation (e.g., making appropriate use of the emergency room), and they provided referrals to social services, additional information on community resources,^{19,28,32} and translation services.³²

The content of the training programs for the CHWs was generally consistent across studies that provided this information^{21,25,27,28,30–32} and included the following: measuring BP and pulse rate; monitoring BP (following American Heart Association [AHA] guidelines in effect during the period of the study) and following up in this area; and providing education on high BP, healthy lifestyles, strategies for adherence to treatment, and community resources. CHWs trained in Baltimore were certified by the Johns Hopkins University and the State Health Department of Maryland.²¹ Several studies trained their CHWs according to the AHA guidelines, and one²⁸ used the American Red Cross to certify CHWs (another study did not identify the certifying agency).³² The duration of training (when reported) ranged from 30²¹ to 100²⁸ hours; in two other studies it lasted an unknown number of hours over 3 weeks²⁴ or 3 months.³⁰ In many studies nurses or physicians trained and supervised the CHWs.^{19–23,25,27,30}

Outcomes of the Studies

The outcomes of the CHW interventions are reported in Table 2. Given the heterogeneity of the populations, settings, interventions, and outcomes, a quantitative synthesis (meta-analysis) was not possible, and thus the data are presented and synthesized in a narrative fashion.

Positive behavioral changes were noted in nine of the ten studies measuring such changes (Table 2). Four RCTs^{28,29,31,32} and one comparison study²¹ reported significant improvements in appointment keeping that ranged from 19% to 39% (relative changes) over 12 to 24 months. One RCT did not show any differences in this outcome at 12 months.²⁶

Five studies^{19,20,25,27,31} focused on adherence to medications. Two of them, both RCTs,^{19,31} noted significant improvement in the intervention group (in which CHWs were used) when compared with the control group (between-group differences ranged from 8% to 14% at follow-up from 12 to 60 months). Another study, also an RCT,²⁵ found 26% greater compliance among patients receiving intense CHW interventions. A before-and-after study²⁷ found a 17% significant improvement in adherence to medication with counseling by CHWs, and a time-series study noted that 86% of CHW-assigned patients were on BP medications.²⁰

Of the ten studies that examined the effects of CHWs on BP control, nine reported positive improvements, including six RCTs,^{19,25,29–32} one time-series study,²⁰ and two before-and-after studies^{24,27} (Table 2). The RCTs found differences between CHW and control

Table 1. Study characteristics

Author (year) ^{ref} Study design/ follow-up (mo)	Client, n/ CHW, (n)	Quality (attrition) Clients (%); CHWs (%)	Recruitment of participants	Participants		
				Age, years (mean) [SD]	Race/ ethnicity; (% female)	Education, years/ HS; income
Becker (2005) ¹⁹ RCT (12)	364 (1)	27; NA	Siblings (30–59 yr) of black probands hospitalized for CHD events. Siblings had no history of CAD, chronic glucocorticosteroid therapy, autoimmune disease, current cancer therapy, immediate life-threatening comorbidity. Randomized to CBC or EPC group	47.7	100% AA; (63.3)	12.8 (mean); 78.6% employed
Bloom (1987) ²⁰ Time series (24)	262 (2)	18 (calculated); NR	Randomly selected from households, health fairs	Range: <40: 5.9% M, 5.2% F; 40–59: 6.5% M, 15.7% F; ≥60: 10.4% M, 12.5% F	AA and non-AAs; (55.8)	NR; NR
Bone (1989) ²¹ Comparison group (24)	800 (6)	NR; NR	HTN patients referred to primary care clinic from the emergency department	34 (median)	85% AA; (53.0)	NR; 50% public assistance
Fedder (2003) ²² Before-and-after (12)	117 (68 trained, 38 provided services)	NR; 56 (38/68 provided services)	Medicaid discharge rolls and diabetes care program	57.4 [12.0]	AA; (78.0)	NR; NR
Felix-Aaron (2002) ²³ cross-sectional	84 (NR)	NA; NA	Randomly selected, received CHW services	53.5	100% AA; (40.5)	44.0% at least HS education; 28.6% full/part- time employment
Frate (1985) ^{24,33} Before and after (12, 14, 18)	229 (NR)	NR; NR	Randomly selected, community survey	NR	~50% white, 50% AA; (NR)	NR; (1979) per capita—\$5839 white, \$2468 AA
Hill (2003) ²⁵ RCT (12, 24, 36)	309 (1)	25; NR	Medical records, advertisements, word of mouth	41 [6]	AA; (0.0)	>60% HS diploma or equivalent; 27% part-time or full-time, 71% annual income<\$10,000
Hill (1999) ²⁶ RCT (12)	204 (1)	23; NR	Medical records, advertisements, word of mouth.	39 (range, 22–49)	100% AA; (0.0)	NR; NR
Hovell (1984) ²⁷ Before-and-after (NR)	20 (NR)	NR; NR	Volunteers from HMO	53	80% white, 10% AA, 10% Asian; (35.0)	NR; NR
Krieger (1999) ²⁸ RCT (3)	421 (14)	6; NR	Low-income community settings	Range, 18– ≥65	79.1% AA, 20.9% white; (27.8)	24.3%<HS, 40.7% HS, 35.0% >HS; 66.3% income ≤federal poverty level

Table 1. (continued across)

Setting	Training	CHWs			
		Race/ ethnicity	Education, experience	Supervision	Duties
Urban	Completed YMCA standard training program for volunteers and basic life support training	AA	NR	Nurse practitioner	Counseled on filling and using prescriptions, shopping for and preparing healthy foods, accessing an exercise facility, and smoking cessation; negotiated decisions about participant care
Community-based health care and home visit	By project staff to work with HTN patients	Same as clients	HS; 2 had previous community experience	General direction by staff physician	Facilitated adherence to taking medications and appointment keeping, provided social support, BP measurement, educated on low-salt diet, referrals; arranged transportation
Emergency department	30 hours on hypertension, taking BP measurements	NR	Some previous experience. No work in health-related areas	Community health nurse or educator	Provided high-BP screening, telephone appointment reminders, educational counseling, and referral
Health care and home visits	NR	85% AA	<12 yr	Close supervision, bi-weekly meetings	Provided in-home visits, weekly phone calls & referrals; monitored signs of complications; provided social support; assisted with medical eligibility
Baltimore (inner city)	NR	NR	NR	Nurses	Provided education, monitoring, social support
Rural community-based setting (5 counties)	3 weeks on BP measurement with certification	NR	NR	NR	(Group 1) Health counselors to HTN patients, focused on compliance with both pharmacologic and nonpharmacologic therapy. (Group 2) Developed and led family and church self-help groups
Outpatient center, and at least one annual home visit	NR	NR	NR (CHWs part of health care team in the program)	Nurse and physician	More than one annual home visit, support on health matters, referrals to social services (including job training and locating housing)
Emergency department	NR	100% AA	NR	NR	Recruited participants, tracked enrollees, made home visits
Hospital	BP and adherence measurement, interviewing, and counseling by a nurse and psychologist in three 2-hour sessions	NR	HS graduates, and college students	Nurse	(Intervention group) Measured BP, followed missed appointments by phone, referrals, education
Community settings	100 hours training in hypertension, CVD, stress, certified in BP measurement	86% AA	NR	NR	Provided education, BP measurement, referrals, transportation, child care, appointment reminders, follow-up on visits

(continued on next two pages)

Table 1. (continued)

Author (year) ^{ref} Study design/ follow-up (mo)	Client, n/ CHW, (n)	Quality (attrition) Clients (%); CHWs (%)	Recruitment of participants	Participants		
				Age, years (mean) [SD]	Race/ ethnicity; (% female)	Education, years/ HS; income
Levine (1990) ^{29,36,37} RCT (96)	56,000 community; 1100 young males (1)	NR; NR	Emergency room/community	53 (median)	AA; (NR)	10 yr (mean), YBM=10 yr, for community=7 yr; 40% unemployment, poor
Levine (2003) ³⁰ RCT (40)	789 (NR)	0; NR	Randomly assigned to > or < intensive intervention	54.2	AA; (61.9)	57.8% <HS, 39.8% HS/some college, 2.4% college graduate; annual family income: 7.5% (none), 58.8% (<\$10,000), 9.6% (\$10,000– \$14,999), 10.0% (>\$15,000), 7.7% (refused), 6.9% don't know
Morisky (1985) ^{31,34,35,38} RCT (multifactorial) (12, 24, 60)	400 (1)	0; NR	Randomly selected from clinic settings	54 (median)	91% AA; (70.0)	8 yr schooling (mean); \$4250 (median)
Morisky (2002) ³² RCT (6, 12)	1367 (NR)	NR; NR	Randomly selected from clinic settings	53.5	77% AA, 21% Hispanic (self-identified); (59.2)	49% <HS, 40% HS diploma; >50% (<\$5000/yr), 37% (\$5000– \$14,000/yr)

groups ranging from 4% to 46% over 6 to 24 months. In one of these RCTs,³⁰ patients receiving one CHW home visit and those receiving six such visits did equally well in achieving significant³⁰ BP control over a 40-month period. In another of these four RCTs, the participants in the CHW group were twice as likely to achieve BP goals as those in the comparison group.¹⁹ In one of the two before-and-after studies, monitoring of BP by CHWs was associated with a significant decrease in diastolic BP of 7 mmHg²⁷; in the other, >90% of the patients had their BP under control at 12 months and 79% to 90% had it under control at 18 months.²⁴ Finally, one RCT did not find any difference between CHW and control groups at 12 months.²⁶

Two studies tried to distinguish the effect of CHWs from the effects of other team members or of other educational components. In one, a time-series study by Bloom et al.,²⁰ the authors found that patients assigned to either CHWs or nurse practitioners (NPs) had their BP under control in equal numbers at 24 months, but those assigned to CHWs were more likely to be on medications than those assigned to NPs (86% vs 70%). In the other study, in which Morisky et al.^{31,34,35,38} used a multicomponent, multifactorial design (a strong de-

sign that allows for both the control of threats to internal validity and the identification of the effects of separate components of the study), one intervention arm tested a single home visit by a CHW to educate family members and promote their support for encouraging positive behavioral changes in hypertensive patients ($n=400$). At 12 months, this strategy was as effective in reducing BP as were the other treatment strategies: a 15-minute educational interview in the clinic and a support group led by a social worker.³⁴ Versus the control group, participants in the CHW intervention group had improved BP at 12 months ($p<0.01$)³⁴ and at the 5-year follow-up ($p<0.01$).³¹ At the 2- and 5-year follow-ups, BP control, appointment keeping, and weight control were significantly improved or maintained only by patients in the CHW intervention.³¹ Additionally, Morisky et al.³⁸ reported a 17.6% (standard error 7.1 percentage points) 5-year mortality rate for the CHW arm, versus 30.2% (standard error 8.3 percentage points) for the control group. Morisky et al.³⁸ also found that there were strong correlations among adherence to medication, keeping appointments, and BP control through a 5-year follow-up period in the CHW group.

Table 1. (continued across)

Setting	CHWs				
	Training	Race/ ethnicity	Education, experience	Supervision	Duties
Urban	BP screening, educational counseling, monitoring, follow-up, and outreach services	AA	No background in health care	NR	Provided BP screening, educational counseling, monitoring, follow-up, and outreach services
Urban	3 mo BP measurement standards, certified by Johns Hopkins University and MD State Health Department	AA	NR	Nurses and community-based advisory board	Surveyed households, provided community outreach and patient education, linked people to care, monitored and coordinated other services necessary for BP control (e.g., obtaining insurance), transportation
Urban	NR	AA	NR	NR	Educated patients and family members/other peers of patients in keeping patients compliant with appointments, adherence to medication, and self-care
Urban	Trained and certified in BP measurement and monitoring; interview skills, dealing with patient barriers to treatment and medication protocols	NR	NR	NR	Educated on lifestyle characteristics (e.g., diet, exercise), conducted home visits, interviews, corrected misconceptions, reinforced treatment adherence, and involved family in treatment regimens

AA, African American; BP, blood pressure; CAD, coronary artery disease; CBC, community-based care; CHW, community health worker; CHD, coronary heart disease; EPC, enhanced primary care; F, female; HMO, health maintenance organization; HS, high school; M, male; mo, months; NA, not available; NR, not reported; RCT, randomized controlled trial; YBM, young black men; yr, years.

Significant improvements in other outcomes were noted; for example, Hill et al.²⁵ found a decrease in left ventricular mass (at 36 months) among African-American male patients receiving CHW visits and major support on health issues. Becker et al.¹⁹ reported significant (beneficial) changes in the distribution of the Framingham risk score for coronary risk events for participants that were assigned to a CHW group. Becker et al.¹⁹ suggested that the outstanding results of the CHW group may well have been mediated by the intervention CHW who facilitated the navigation of systems necessary to make changes in risk factors (e.g., by showing how to shop and prepare healthy foods, access exercise facilities, and fill prescriptions) and gained the trust of the participants. Two RCTs,^{25,28} one comparison study,²¹ and one before-and-after study²² reported improvements in healthcare utilization and systems outcomes, including more-appropriate use of the emergency department,^{21,22} reduced admissions to the hospital through the emergency room,²⁵ cost savings,²² a larger proportion of participants having a

physician or nurse for hypertension care,^{25,28} a higher number of appropriate follow-up visits,²⁵ greater responsiveness of providers to patients' needs,²¹ and increased participation of CHWs in planning meetings.²¹ Two studies that addressed patient satisfaction found that the competency of the CHWs and the social support they provided were very important to the participants^{23,32} (Table 2). Finally, Morisky et al.³² noted that both the availability of social support and satisfaction with it were positively related to treatment compliance.

Additionally, it is notable that significant results were reported by studies using the nurse or an NP-CHW team approach.^{19-21,28}

Quality of the Studies

The quality of the studies included in this review varied. Important characteristics of participants were reported in most cases, but descriptions of the characteristics of the CHWs were often incomplete. Among the eight

Table 2. Hypertension-related outcomes

Author (year) ^{ref}	Participant satisfaction	Participant awareness and behavior outcomes and satisfaction	Physiologic measures and health outcomes	Healthcare system outcomes
Becker (2005) ¹⁹	NR	% taking antihypertensive agents (↑): CBC=17, EPC=9 ($p<0.0001$); % taking lipid-lowering agents (↑): CBC=32, EPC=7 ($p<0.0001$); % current smokers (↓): CBC=-6, EPC=-3 ($p<0.0001$); % used card to fill prescriptions: CBC=74, EPC=34 ($p<0.0001$); % participation in free YMCA exercise—CBC: 20, EPC:0 ($p<0.0001$). Modest, nonsignificant improvement of diet and exercise in CBC group	CBC group was 2 times more likely to achieve blood pressure (95% CI=1.4–3.9) and LDL cholesterol goals (95% CI=1.1–4.2); ↓ %FRS for total CHD: [CBC vs EPC=25.5 vs 3.3 ($p<0.0001$)]; ↓ % FRS CHD risk among nondiabetic siblings: [CBC vs EPC=27.4 vs 2.3 ($p<0.0001$)]; ↓ CHD global health risk for CBC compared to no ↓ in EPC ($p<0.0001$)	
Bloom (1987) ²⁰	NR	Those assigned to CHWs were more frequently on medications than those assigned to NP (86% vs 70%)	At T1 58.4% and at T3 78.3% had controlled BP. Mean SBP and DBP difference 7.7 mmHg (T=5.06, $p<0.001$); 2.84 mmHg (T=3.65, $p<0.001$). Of 40% improvement, 10% was attributed to physician care, 30% to counseling	NR
Bone (1989) ²¹	NR	Significant improvement in CHW (19%, $p<0.001$) group at follow-up >2 yr. Patients not keeping follow-up recontacted with 7% improvement ($p<0.001$). Total improvement in appointment keeping 26%	NR	↑ provider responsiveness to patients' needs; ↑ BP service hours and ↓ fees for BP follow-up visits; CHWs included in the emergency department staff's annual planning meetings
Fedder (2003) ²²	NR	NR	NR	Healthcare utilization: ↓ ER visits 38% (p value NR); ↓ admissions through the ER 53% ($p=0.02$); no significant relationship between age, gender, number of CHW contacts, and outcomes
Felix-Aaron (2002) ²³		Aspects of CHW care rated important: CHW knows job, keeps client alive, gives information on HBP, shows respect, speaks understandably, pays attention	NR	NR
Frate (1985) ^{24,33}	NR	NR	At 12 mo, 92% ($n=222$) of clients managed by CHWs achieved BP ctrl ($p<0.0001$); 90% ($n=211$) clients achieved BP ctrl in 16 CHW-led self-help groups. At 18 mo, significant BP ctrl ($p<0.0001$) for three CHW interventions	Healthcare utilization: at 12 mo >300 people who were unaware of being HTN or uncontrolled who were enrolled

Table 2. (continued)

Author (year) ^{ref}	Participant satisfaction	Participant awareness and behavior outcomes and satisfaction	Physiologic measures and health outcomes	Healthcare system outcomes
Hill (2003) ²⁵	NR	For HTN meds compliance, CHW group and ctrl group: significant improvement ($p<0.001$). CHW group 26% higher rate of improvement in medication compliance	At 36 mo, controlled BP including CHW group vs ctrl group 44% vs 31% ($p=0.045$). Mean SBP/DBP change: CHW group was $-7.5/-10.1$ mmHg, ctrl group $+3.4/-3.7$ mmHg. Left ventricular mass in CHW group vs ctrl group was 274 g vs 311 g ($p=0.004$)	Proportion of men reporting having a physician or nurse for HTN care among MI \uparrow ($p<0.05$).
Hill (1999) ²⁶	NR	77% completed follow-up. Follow-up appointments not significantly different between groups	At 12-mo follow-up, SBP and DBP were not statistically different from zero for both CHW (I) and ctrl (UC) groups	Entry into care and remaining in care remained at low rates
Hovell (1984) ²⁷	NR	CHW counseling \uparrow mean medication adherence (69% to 84%)	Monitoring by CHWs associated with change (-10 mmHg in SBP and -7 mmHg in DBP ($p<0.05$). Decrease in DBP significant ($p<0.01$)	NR
Krieger (1999) ²⁸	NR	Appointment keeping: \uparrow in CHW group 39.4% vs usual care [95% CI=14%–71%; $p=0.001$]	NR	Follow-up: μ in IG by 39.4% [95% CI=14%–71%, $p=0.001$]
Levine (1990) ^{29,36,37}	NR	Community HTN awareness: \uparrow from 65% to 80% ($p<0.01$); for YBM HBP awareness: \uparrow 44% to 65% ($p<0.05$)	BP ctrl YBM in community 12% to 40% ($p<0.01$; $p<0.05$). 5-yr community results (combined IG including CHW) \uparrow BP ctrl (38% to 79%); HTN-related hospitalization: \downarrow 30%; mortality from uncontrolled HTN \downarrow 65% ($p<0.01$)	NR
Levine (2003) ³⁰	NR	NR	BP ctrl: both CHW (MI) (16% to 36%) and ctrl (LI) (18% to 34%) ($p<0.01$)	NR
Morisky (1985) ^{31,34,35,38}	NR	Appointment keeping (2-yr follow-up) in CHW group significantly higher vs ctrls ($p<0.001$); \uparrow medication compliance (53% with mean compliance score of 0.876) vs ctrls (39%, mean compliance score of 1.932) $t=3.7$; $p<0.01$)	For CHW group vs ctrl group, all-cause life table mortality rate per 100=12.9 vs 30.2 ($p<0.05$); HTN-related mortality rate per 100=8.9 vs 19.0 ($p<0.01$); deviation from ideal WT significant \uparrow in all IG (5 yr); for CHW IG, BP ctrl \uparrow 26% vs 51% CG ($p<0.001$). For WT \uparrow 22% CHW group vs ctrls; 68% vs 46% were within 4.5 kg of their ideal WT ($p<0.001$)	NR
Morisky (2002) ³²	Social support and satisfaction with social support positively related to compliance ($r=-0.11$, $p<0.004$)	Hispanic patients had significantly higher rates of appointment keeping compared to AAs at 6 mo (56% vs 49%) and at 12 mo (54% vs 46%) follow-ups ($p\leq 0.01$)	CHW counseling group (6 mo) \uparrow 13% BP ctrl (maintained at 12 mo) with 46% under ctrl ($p\leq 0.01$) (12 mo). Hispanic patients significantly higher proportion BP ctrl vs AA and other ethnicities ($p<0.05$)	NR

AA, African Americans; CBC, community-based care; CG, control group; CHD, coronary heart disease; CHW, community health worker; CI, confidence interval; ctrl, control; DBP, diastolic blood pressure; EPC, enhanced primary care; ER, emergency room; FRS, Framingham risk factor; HBP, high blood pressure; HTN, hypertension/hypertensive; I, intervention; LDL, low-density lipoprotein; LI, less intensive; MI, more intensive; mo, months; NP, nurse practitioner; NR, not reported; SBP, systolic blood pressure; T, time; T1, Time 1; T3, Time 3; UC, usual care; WT, weight; yr, years; YBM, young black males.

RCTs, only one²⁵ reported blinding of the assessor. Randomization methods were reported in only six studies,^{19,25,28,30–32} and concealment of allocation was reported in just one.²⁵ On the other hand, most studies involving two or more groups described comparability of the comparison groups at baseline.^{19,25–28,30–32} Participants' attrition from the study was reported in seven studies,^{19,20,25,26,28,30,31} and ranged from 5.7% (at 3 months)²⁸ to 40.3% (at 5 years).³¹

Discussion

In this review the authors identified an emerging literature on the effectiveness of CHWs in the care of people with hypertension. Despite heterogeneity in the study designs, amount of training, goals of the interventions, and settings, the authors found a consistent trend in positive outcomes for BP along with improvements in mortality, healthcare utilization, and systems outcomes.

Nemcek et al.⁹ identified three outcomes relevant to culturally competent CHW care: improved healthcare utilization, risk reduction, and satisfaction with CHW care. Various studies in this review provide support for the idea that these outcomes can be attained in the context of a supportive relationship with participants. CHWs facilitated appropriate use of health care and self-management behavior (i.e., by improving adherence to appointment keeping and hypertension treatment), improved BP control, and other positive health outcomes. Not only did seven of eight high-quality RCTs report positive outcomes, but so also did all six of the studies with less rigorous designs, demonstrating that less costly, practice-based interventions can bring about important changes for community members.

The roles of patient education and counseling and the provision of various services that the authors found in this review are consistent with those identified for CHWs in various other fields, including diabetes.^{12,13} Some of the roles and the successes achieved appear to be similar to those of nurses who have provided educational interventions aimed at hypertension control,^{39–42} and suggest an efficient strategy for bringing about enhanced treatment and sustained BP control for targeted racially or ethnically diverse, high-risk populations. Allen and Scott⁴³ are also in agreement that studies involving multidisciplinary teams that include nurses and CHWs appear to be a successful strategy for improving BP outcomes. While trained laypeople cannot perform in the same capacity as professional nurses and health educators, with appropriate training and supervision they can successfully contribute to the care of community members with hypertension, as demonstrated by many of the studies reviewed.

Limitations

This review has several important limitations. First, the reporting and assessment of each intervention study was limited to published data; in many cases, details of the studies were not described. This was particularly true for the education of the CHWs, their training, experience, and supervision, as well as their attrition rates. Future studies should better describe these characteristics.

Second, because the studies reviewed had heterogeneous designs, variable quality, potential threats to internal validity, and unknown external validity, the applicability of these results to other settings or to broader populations cannot be predicted. Although most participants were members of underserved communities in the United States, participants were generally selected by either the researcher or provider or were self-selected.

Factors for Success of Interventions Involving CHWs

Numerous factors appear to have contributed to the success of interventions to control hypertension (HTN) that involved CHWs: the innate helping qualities of the CHWs; the recruitment of CHWs who shared demographic and cultural characteristics and were drawn from the same communities as the participants; training and supervision by nurses, physicians, and health educators; and the building of community capacity that resulted in a community of care for people with hypertension. The results confirm one of the shared strengths of CHWs: the ability to effectively work with community members (often through social networks), regardless of the setting.¹³ These observations are supported by the Institute of Medicine,⁴⁴ which has recognized the value of CHWs as community resources with the potential to serve various roles, and which recommends supporting CHWs as members of comprehensive, multidisciplinary teams. CHWs who worked in the community at large were able to identify with their clients and provide culturally appropriate education and services (especially to community members lacking health insurance and access to mechanisms for measuring their BP or medicines to treat it if elevated).^{25,28} The strong multifactorial design of one multicomponent intervention made it possible to isolate the effect of CHWs on patient outcomes: this RCT^{31,34} and one other RCT²⁸ study were included in a recent review⁴⁵ on treatment for hypertension and, on the basis of rigorous criteria, recognized as effective interventions. There was also a time-series study²⁰ that attempted to distinguish the effect of CHWs from that of other team members.

Motivating adherence to healthy lifestyles and treatment regimens is a major problem for patients with

high blood pressure. The authors found that the ongoing social support given by CHWs had a positive effect on study participants. Relationships between social supports, social networks, and health outcomes are basic concepts in health education and applies to the CHW model.⁴⁶ At least two of the studies in this review reported that the social support and building of trust provided by CHWs were instrumental to the success of their projects.^{19,31}

The number of positive outcomes in high-risk populations is encouraging. For example, in four studies in this review that focused exclusively on African-American men living in inner-city Baltimore, Bone and Mamon,²¹ Hill et al.,^{25,26} and Levine and Bone²⁹ found that significantly more of the men remained in care after being recruited and educated by CHWs. Becker et al.¹⁹ suggested that the significant improvements seen in their high-risk African-American patients in Baltimore, may have been partially mediated by the efforts of the CHW, who was trusted by the study participants and who served as a culturally sensitive system navigator.

Of all the CHW studies reviewed, only one did not show any improvements.²⁶ This study was able to recruit participants but lost about 25% of both its intervention and control groups to incarceration, death, or moving to another area. Hill et al.,²⁵ however, followed this study with an enhanced approach that included a physician–nurse–CHW team. With CHWs providing intensive support to the men, the team approach yielded significantly improved outcomes at the 36-month follow-up.

Future Directions for Research and Practice

Numerous gaps in research about CHWs remain, such as the need for testing the applicability of the CHW model in various populations, specifying the system supports needed by CHWs, evaluating patient and provider satisfaction, and assessing optimal performance of CHWs.^{8,12} Various aspects of CHW programs related to policy (e.g., new reimbursement strategies for services and integration into healthcare practice), the issue of credentialing, and the question of sustainability need to be addressed, and these are elaborated elsewhere.⁸ Only two studies in this review shed light on participants' satisfaction with CHW service^{23,32}; clearly, measures of patients' expectations and satisfaction need to be incorporated into future studies. This can be accomplished through the use of functional status tools that measure expectations and satisfaction.⁴⁷ Another area that needs to be examined is the perceived quality of life of participants.

There are still no data on the cost effectiveness of CHW programs. This deficit may be due to methodologic shortcomings as well as an inability to capture some of the effects of CHW programs using conventional approaches for economic evaluation.⁴⁸ For ex-

ample, how does one place a monetary value on the characteristics and actions of laypeople from the community who, in many cases, volunteer to help others?

Lessons learned from research need to be translated into useful guidelines, protocols, and recommendations for practitioners if we are to implement and sustain CHW models to reduce disparities in hypertension. Researchers need to identify the successful components of CHW programs to improve their transferability to various populations. Zuvekas and Nolan⁴⁹ recommend allowing CHWs to enter their services into automated patient database systems, a practice that would help in understanding what CHWs specifically contribute and in measuring the results of interventions.

Specific competencies and skills for CHWs should be identified, which would be based on those identified for the general public health workforce.⁵⁰ A competency might be knowledge of techniques for managing BP, and specific skills could be the ability to accurately take a BP, to show community members how to take their own BP measurements correctly on a home device, how to record BP measurements, and when and how to report the measurements to healthcare providers. Many of the studies in this review relied on the AHA's training guide for measuring BP⁵¹ and on certifying CHWs on BP measurement, but we do not know how other skills were assessed. Guidelines are needed on how often nurses, physicians, or health educators and other professionals need to reinforce and evaluate the competencies and skills of CHWs.

To meet the training needs of practitioners and researchers in cardiovascular health and disease, federal agencies have produced various curricula. These resources include Your Heart, Your Life/Salud para su Corazón⁵² (National Heart, Lung, and Blood Institute [NHLBI]); Honoring the Gift of Heart Health⁵³ (NHLBI and Indian Health Services); and a comprehensive Community Health Workers Heart Disease and Stroke Sourcebook⁵⁴ (Centers for Disease Control and Prevention). These curricula are presented in a common format and provide a standardized, low-literacy, CHW-friendly approach to training CHWs and they can help in assessing contributions of the CHWs after they have been trained. These curricula can be used by community organizations and colleges that offer training; by programs providing community education, screening, and follow-up; and by programs offering patient education classes led by CHWs.

A new role for CHWs may be in programs that plan for disasters, and this role warrants attention by practitioners and researchers. Following the hurricanes in 2005, the Florida Department of Health reported that the greatest need expressed by community members was access to medicines for high BP and for insulin. The department has developed a pilot program using

CHWs to assess which members of the communities would need vital medicines following a disaster.⁵⁵

Conclusion

Community health workers have the potential to contribute to self-management of hypertension and to optimal control of BP by providing social support, education, outreach, and enhanced case management. As community-change agents and trusted peers, CHWs appear to be able to motivate, facilitate, and help empower community members to maintain required behaviors that contribute to their own continuity of care and improved health outcomes. Findings from this review can help community health clinics and other programs as they consider integrating CHWs into the chronic care model^{56,57} of practice.

The findings and conclusions in this paper are those of the authors and do not necessarily represent the views of the Centers for Disease Control and Prevention.

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