Using an Established Telehealth Model to Train Urban Primary Care Providers on Hypertension Management

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The objective of this study was to determine whether a videoconference-based telehealth network can increase hypertension management knowledge and self-assessed competency among primary care providers (PCPs) working in urban Federally Qualified Health Centers (FQHCs). We created a telehealth network among 6 urban FQHCs and our institution to support a 12-session educational program designed to teach state-of-the-art hypertension management. Each 1-hour session included a brief lecture by a university-based hypertension specialist, case presentations by PCPs, and interactive discussions among the specialist and PCPs. Twelve PCPs (9 intervention and 3 controls) were surveyed at baseline and immediately following the curriculum. The mean number of correct answers on the 26-item hypertension knowledge questionnaire increased in the intervention group (13.11 [standard deviation (SD)]=3.06) to 17.44 [SD=1.59], $P<.01$) but not among controls (14.33 [SD=3.21] to 13.00 [SD=3.46], $P=.06$). Similarly, the mean score on a 7-item hypertension management self-assessed competency scale increased in the intervention group (4.68 [SD=0.94] to 5.41 [SD=0.89], $P<.01$) but not among controls (5.28 [SD=0.43] to 5.62 [SD=0.67], $P=.64$). This model holds promise for enhancing hypertension care provided by urban FQHC providers. *J Clin Hypertens (Greenwich).* 2012;14:45–50. ©2011 Wiley Periodicals, Inc.

Hypertension affects approximately 30% of adults in the United States[1] and is the leading cause of heart disease, stroke, and kidney failure.[2] Despite efforts to increase awareness and treatment of hypertension, data from the National Health and Nutrition Examination Survey (NHANES) indicate that in 2005 to 2008, more than half of adults with hypertension did not have their blood pressure (BP) under control.[3] Hypertension control in adults is defined as systolic BP (SBP) <140 mm Hg and diastolic BP (DBP) <90 mm Hg among patients with high BP.[4] Although patient factors such as medication noncompliance contribute to lower levels of hypertension control, studies show that many physicians do not follow published guidelines regarding hypertension management.[5,6]

The failure of providers to increase therapy when treatment goals are unmet is termed therapeutic inertia,[7] and lack of physician awareness regarding treatment guidelines is a significant contributor to this phenomenon.[8] In a national survey of primary care physicians, familiarity with Joint National Committee on Prevention, Detection, Evaluation and Treatment of High Blood Pressure (JNC) guidelines for hypertension management was consistently associated with initiating treatment for SBP in older patients and intensifying treatment for mildly elevated SBP and DBP in younger patients.[8] The Institute of Medicine's (IOM's) Committee on Public Health Priorities to Reduce and Control Hypertension recently highlighted the need to ensure that providers adhere to JNC guidelines and treat hypertension appropriately.[7]

Toward that end, the IOM has called for new strategies of continuing education in the health professions, including increased use of theory-based education, collaborative learning among health professionals, and increased utilization of emerging technologies.[9] A professional educational system that incorporates these strategies and holds promise for improving hypertension management is the Extension for Community Healthcare Outcomes (ECHO), which was developed for use in rural populations by Arora and colleagues[10] at the University of New Mexico (UNM). ECHO is based on established educational theories of learning and behavior change.[11–13] In the ECHO model, university-based disease experts use telehealth technology to interact regularly with community-based primary care providers (PCPs) to provide continuing education and to co-manage patients with complex diseases. This approach permits PCPs to present challenging cases and receive advice from experts who are geographically distant. This arrangement enhances the medical knowledge of PCPs, permits patients to continue receiving care from their PCPs, and obviates the need for many referrals to specialist physicians. This is especially important for uninsured and underinsured patients, who often have reduced access to specialty care.[14,15] Given the success that ECHO has achieved in other disease processes,[16] we hypothesized that this model would lead to increased hypertension disease management knowledge, as well as enhanced self-assessed competency in managing hypertension among

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PCPs practicing in urban Federally Qualified Health Centers (FQHCs).

METHODS

Design

This was a prospective cohort study with a comparison group. The medical directors of 6 FQHCs on Chicago's South Side were approached about participating in a program designed to train PCPs regarding the treatment of a common, complex disease with high morbidity and high mortality. A consensus was reached that we should focus on uncontrolled hypertension and that the initial goals of the program were to enhance PCP knowledge and self-assessed competency in treating hypertension. Longer-term goals were to ensure that patients with hypertension reached their target BPs and that PCPs successfully managed a higher proportion of their own patients and therefore referred fewer patients to hypertension specialists. We report on the initial goals of this project. All 6 medical directors agreed to encourage their PCPs to participate in the program. Each health center received telehealth equipment, including a large-screen monitor, a video camera, an omnidirectional microphone, and broadband internet connectivity. A videoconference room with similar equipment was created at our institution. The institutional review board of the University of Chicago approved this study.

The intervention consisted of ECHO sessions conducted every other week between November 2010 and April 2011. Each session followed the same format and began with a 20-minute lecture by the university-based hypertension specialist (GB). Topics covered during the 12-session curriculum included: (1) how and when to measure BP; (2) impact of salt intake on BP; (3) definition and management of resistant hypertension; (4) how to use combination therapy; (5) how to optimize medication adherence; (6) kidney disease as a cause of secondary hypertension; (7) screening for secondary hypertension; (8) hypertension treatment in the elderly; (9) hypertension therapy and pain medication; (10) pseudopheochromocytoma; (11) special considerations for hypertension treatment among African American patients; and (12) avoiding drug interactions.

Following each lecture, PCPs presented cases of patients with uncontrolled hypertension despite intensive pharmacologic therapy. Included in each presentation were the patient's age, race/ethnicity, BP readings, renal function as measured by estimated glomerular filtration rate, and antihypertensive medications. The hypertension specialist asked follow-up questions as needed and then discussed various aspects of each case, including the factors most likely to contribute to treatment failure, potential additional tests, and changes in pharmacotherapy to maximize hypertension control. One or 2 cases were typically presented during each videoconference. The presenting PCPs, as well as the other PCPs, often asked follow-up questions so that the verbal exchanges typically included most ECHO session attendees. The PCPs also reported on BP responses among previously discussed cases. A social worker was present at each videoconference to help with social service needs, including recommending pharmacies that dispense low-cost or generic medications.

Setting and Population

The 6 participating FQHCs are all located on Chicago's South Side and vary in distance from one half mile to 10 miles from the university (Table I). Nine PCPs from the 6 FQHCs agreed to participate in the twice-monthly 1-hour sessions. The PCPs were primarily physicians but 2 were physician assistants who cared for their own patients. Table II lists demographics of the participating providers. Three PCPs agreed to serve as control patients.

Instruments

All patients completed 2 questionnaires. The first was Carter's 26-item hypertension management questionnaire, which is based on Carter and colleagues' validated 35-item questionnaire.[18] Carter suggested we use the shorter version because 9 of the items in the original questionnaire had low discrimination scores (Carter BL, personal communication, June 6, 2007). Discrimination refers to how well a question differentiates participants who know the material from those who do not. Removing the 9 items with low discrimination scores reduced the test burden on the patients (Table III). Participants and controls also completed a 7-item hypertension management self-assessed competency scale adapted from Arora and colleagues'[10] hepatitis C management self-efficacy scale. Scores on this Likert-type instrument ranged from 1="none or no skill at all" to 7="expert." Patients were asked to rate their competence in 7 areas: (1) ability to identify patients who should be screened for hypertension; (2) ability to identify suitable candidates for treatment for hypertension; (3) ability to assess severity of kidney disease in patients with hypertension; (4) ability to treat patients with hypertension and manage side

TABLE I. FQHC Site Characteristics

FQHC	Physicians, No.	Physician Assistants, No.	Patients, No.	Annual Visits, No.
1	22	10	7094	26,066
2	30	2	8339	19,551
3	3	0	1221	4,900
4	12	5	9056	27,075
5	9	3	11,462	35,535
6	7	1	4600	13,761
Totals	83	19	41,772	126,688

Abbreviation: FQHC, Federally Qualified Health Center.

TABLE II. Demographics of Intervention Group Primary Care Providers

	Total (N=9)
Mean age, y (SD)	33.10 (4.28)
Women, No.	7
Physicians, No.	7
Internal medicine	4
Family medicine	3
Physician assistants, No.	2
Mean years in practice (SD)	6.78 (10.49)
Race/ethnicity, No.	
White	3
African American	1
Latino	1
Asian/Pacific Islander	2
East Indian	2
Attended US professional school, No.	8

Abbreviation: SD, standard deviation.

TABLE III. Characteristics of the Hypertension Management Questionnaire

Number of Questions	Topic
10	Hypertensive Rx in patients with a coexisting illness
7	Side effects of antihypertensive medications
4	Hypertensive Rx in patients without a coexisting illness
2	Diagnostic criteria for hypertension
2	Goal BP in patients with a coexisting illness
1	Hypertension Rx in pregnancy

Abbreviations: BP, blood pressure; Rx, medical therapy.

effects; (5) ability to educate clinic staff about patients with hypertension; (6) ability to educate and motivate patients with hypertension; and (7) ability to assess and manage psychiatric comorbidities in patients with hypertension.

Data Collection

A luncheon was held at each participating FQHC prior to the first ECHO session. Following the luncheon, participants and controls anonymously completed both questionnaires. Within 2 weeks of completion of the final ECHO session, luncheons were again held at each participating FQHC and the 2 surveys were completed by the same participants and controls.

Analysis

The average number of correct scores on the 26-item hypertension management questionnaire was calculated for the participants and controls before and after the 12-session curriculum. For the 7-item self-assessed competency scale, total scores were divided by 7 to obtain an average rating (range, 1–7) for each participant at baseline and follow-up. Confidence intervals (95%) were calculated for the preintervention and postintervention difference in mean scores for knowledge and self-assessed competency. In the intervention group, 2-tailed paired *t* tests were used to compare preintervention knowledge and self-assessed competency with postintervention knowledge and self-assessed competency, respectively. In separate analysis, the same strategy was used to compare preintervention and postintervention scores in the control group. Significance was set at $P=.05$. Data were analyzed using SPSS version 17.0 (IBM Corporation, Somers, NY).

TABLE IV. 26-Item Hypertension Management Knowledge Questionnaire

	Baseline Mean Score (SD)	Follow-up Mean Score (SD)	95% CI	*P* Value (2-Tailed)
Intervention (n=9)	13.11 (3.06)	17.44 (1.59)	1.81–6.85	<.01
Control (n=3)	14.33 (3.21)	13.00 (3.46)	−2.77 to 0.10	.06

Abbreviations: CI, confidence interval; SD, standard deviation.

RESULTS

Knowledge of Hypertension Management

Neither the intervention nor the control group scored well at baseline on the 26-item hypertension knowledge test, with both groups answering approximately half of the questions correctly (Table IV). Analysis indicates their mean baseline scores were not statistically different ($P=.60$). When tested at the conclusion of the 12-session curriculum, the intervention group demonstrated a significant increase in the mean knowledge test score (13.11 [standard deviation (SD)=3.06] to 17.44 [SD=1.59], $P<.01$) while the control group demonstrated a trend toward a decline in the mean knowledge test score (14.33 [SD=3.21]) to 13.00 [SD=3.46], $P=.06$).

Self-Assessed Competency of Hypertension Management

Both the intervention and control groups rated themselves at baseline as relatively competent in managing hypertension, with a mean score of 4.68 of 7 among the intervention group and 5.28 of 7 among the control group (Table V). The difference in mean baseline

TABLE V. 7-Item Hypertension Management Self-Assessed Competency Scale

	Baseline Mean Score (SD)	Follow-up Mean Score (SD)	95% CI	*P* Value (2-Tailed)
Intervention (n=9)	4.68 (0.94)	5.41 (0.89)	0.26–1.21	<.01
Control (n=3)	5.28 (0.43)	5.62 (0.67)	−2.37 to 3.05	.64

Abbreviations: CI, confidence interval; SD, standard deviation.

scores was not significant (P=.17). Following the hypertension curriculum, the mean self-assessed competency score increased significantly to 5.41 of 7 (P<.01). The mean score in the control group also increased, although not significantly, to 5.62 of 7 (P=.64).

DISCUSSION

Studies show that FQHC patients, who are often uninsured or underinsured, have reduced access to specialist care. In a national survey of 439 FQHCs, medical directors indicated that they rarely had difficulty in obtaining specialty care for Medicare or privately insured patients. In contrast, the directors reported significant difficulty in obtaining specialty care for uninsured patients and those with Medicaid insurance. They also reported that approximately 25% of visits to FQHCs required medically necessary referrals.[14] New strategies are therefore needed to enhance the access of uninsured and underinsured patients with complex chronic diseases to state-of-the-art care.[19] At the same time, new approaches are also needed to increase PCP compliance with published hypertension management guidelines.[7] Our use of the ECHO model among urban FQHCs attempted to address both of these needs.

Consistent with our hypotheses, we found that our 12-session ECHO intervention was associated with increases in hypertension management knowledge and self-assessed hypertension management competency among intervention PCPs. In contrast, no significant changes in either category were noted among control PCPs. These results cohere with studies of the UNM-based ECHO intervention. For example, Arora and colleagues[10] documented increases in self-efficacy in the care of patients with hepatitis C virus (HCV) among 25 community-based PCPs who participated in HCV-oriented ECHO sessions. Arora and colleagues[10] also found that more than 80% of community-based PCPs who participated in at least 6 months of HCV-oriented ECHO sessions reported a moderate to high degree of learning in several domains of HCV management.

Various strategies have been used to train PCPs on appropriate pharmacologic and nonpharmacologic methods of hypertension management. In one study, PCPs received detailed training on hypertension guidelines, as well as feedback on attainment of target BPs among their patients.[20] Compared with patients cared for by providers in the control group, those cared for by the intervention group were more likely to reach their target BP (56.8% in the intervention group vs 52.5% in the control group, P=.03) at 1 year of follow-up. In addition, BP control in the intervention group was attained 2 months earlier on average and therapeutic inertia occurred significantly less often in the intervention group.

In another study, six 4-hour interactive conferences were held at various locations on the East Coast of the United States.[21] These conferences combined didactic training, case-based discussions, question and answer sessions, and the use of an emerging technology (an audience response system). Topics reviewed at the conference included: (1) effectiveness of various drug classes as they relate to different patient populations; (2) Seventh Report of the JNC (JNC 7) hypertension guideline recommendations for patients with compelling indications; (3) benefits and limitations of the Framingham and Reynolds risk scores as they relate to cardiovascular risk assessment in women; (4) rationale for hypertension disparities in African Americans and management considerations in this population; (5) managing elderly patients with isolated systolic hypertension; and (6) strategies to improve adherence to antihypertensive regimens. Conference participants (n=588) and nonparticipants (n=50) were surveyed regarding each of the topics covered and analysis revealed that participants were more likely than nonparticipants to choose evidence-based answers in response to questions related to: (1) JNC 7 guideline recommendations; (2) appropriate pharmacologic therapy in patients with compelling indications, including the elderly and those at risk for stroke; and (3) strategies to improve adherence to medication regimens.

A third intervention utilized internet-based training, self-monitoring, and quarterly feedback reports to physicians, as well as weekly group meetings and monthly telephone counseling of patients regarding weight loss, diet, exercise, and reduced sodium intake.[22] For the 2 internet-based training modules, the first focused on JNC 7 guidelines and the second emphasized strategies to encourage lifestyle modifications among hypertensive patients. Eight primary care practices (32 physicians) were randomized to the intervention or control groups. In addition, 574 patients within these practices were randomized to the intervention or control groups. A nested 2×2 randomized controlled study design was used. At 6 months, the mean SBP of patients in the physician intervention group did not differ from the mean SBP of patients in the physician control group. However, a significant reduction in SBP was noted in the patient intervention compared with the patient control group. When the physician and patient interventions were combined, the result was an even larger reduction in mean SBP, suggesting synergy between the physician and patient interventions. However, these SBP differences did not persist at 18 months.

As with our intervention, each of these interventions emphasized physician training. Two of the interventions also provided clinical feedback to physicians,[20,22] while one emphasized case-based learning.[21] Two also used technology-based learning tools, including an audience response system[21] and internet-based training modules.[22] All of the interventions attained success, although one measured provider outcomes[21] while the other 2 measured BP among patients.[20,22] Our results add to the options of strategies that can be used to

improve physician knowledge regarding hypertension management and/or enhance BP control among hypertensive patients.

Although our study has not yet documented improved hypertension control, our intervention may have advantages over others, at least in terms of enhancing physician knowledge regarding hypertension management. First, the ECHO approach is theory-based, utilizing Bandura's social cognitive theory,[23] Vygotsky's[12] situated learning theory, and the communities of practice theory.[12,13] Social cognitive theory argues that in order for individuals to change their behavior, they must have confidence in their ability to perform specific behaviors in a variety of circumstances.[23] In the ECHO model, community providers develop this confidence or self-efficacy when they assume increasing responsibility in delivering best practice care. Our finding of increased self-assessed competency in the intervention group supports this notion.

Situated learning theory posits that optimal learning requires social interaction and collaboration.[12] ECHO achieves this through telehealth technology, which provides learners the opportunity to interact with disease specialists and peers at health centers that serve similar patient populations. Participants therefore learn from discussions regarding their own patients as well as from discussions related to other patients. In addition, hearing and seeing other providers describe similarly challenging cases fosters both interaction and collaboration.

Lave and Wenger's community of practice theory[13] extends Vygotsky's situated learning theory by emphasizing the benefits of creating communities of learners. In the ECHO model, communities of learners are created when PCPs from different settings engage in videoconference discussions. This community, when combined with the disease specialist, becomes a "knowledge network," which fosters learning through iterative collegial interactions. PCPs are mentored by disease experts but they also learn from the feedback and actions of their peers. Participants in our study indicated that they enjoyed the videoconferences, not just because they learned new skills but also because they no longer felt isolated in managing complex patients. In effect, they became members of a community of practice. Perceiving oneself as part of a community may provide a learning benefit above and beyond that afforded by the training described in the other interventions.

Arora and colleagues[17] have shown that the ECHO model permits PCPs to manage complex chronic diseases among rural patients with limited access to specialty care. As a result, continuity of care can be maintained between patients and PCPs, thereby reducing the need for patients to travel to specialty clinics or experience delays in obtaining specialty appointments. We expanded the use of this model by applying it to urban FQHCs, which also care for individuals with barriers to specialty care. Our intervention increased access among FQHC patients to state-of-the-art care via ECHO-trained PCPs without requiring patients to leave their community or medical home.

Limitations

A limitation of this study is the possibility of a type II error in the control group, which was smaller than the intervention group. While there was a trend toward an increased mean score in self-assessed competency in the control group, this change was not statistically significant. A larger number in the control group may have revealed a significant increase. For hypertension management knowledge, there was a trend toward a decrease in mean score in the control group. With a larger number, it is possible this decrease would have been significant. A second limitation of this study was the lack of randomization. Participants and controls self-selected to their respective groups and it is possible that the changes we found can be attributed to selection bias. In addition, regression toward the mean can occur with pre-post study designs, and this phenomenon may have contributed to the lack of changes in knowledge and self-assessed competency in the control group. Finally, we used *t* tests to compare preintervention knowledge and self-assessed competency with postintervention knowledge and self-assessed competency. Such tests assume that the data sampled are from populations that follow a normal distribution. Because our intervention and control group sample sizes are small, this assumption is tenuous and our results should be viewed with some caution.

CONCLUSIONS AND NEXT STEPS

This study utilized an established rural telehealth training model (ECHO) and applied it to an urban setting to increase PCP hypertension management knowledge and self-assessed competency in hypertension. Our intervention partnered a university-based hypertension specialist and social worker with PCPs from 6 urban FQHCs on Chicago's South Side. Because the ECHO model utilizes scalable technology, it offers promise for training PCPs at more than 6 sites at any one time. A priority for our program is to prospectively monitor BP among patients reviewed during the sessions. Comparing the number of referrals that participating PCPs made to hypertension specialists in the year prior to the curriculum to the number of referrals they make in the year following the curriculum is also a priority. In the rural setting, PCPs achieved success in treating patients with HCV that was on par with that attained by university-based hepatologists.[17] Our goal is to demonstrate similar success among urban PCPs who treat patients with uncontrolled hypertension and other complex chronic diseases.

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