

Telephone Care Management To Improve Cancer Screening among Low-Income Women

A Randomized, Controlled Trial

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Background: Minority and low-income women receive fewer cancer screenings than other women.

Objective: To evaluate the effect of a telephone support intervention to increase rates of breast, cervical, and colorectal cancer screening among minority and low-income women.

Design: Randomized, controlled trial conducted between November 2001 and April 2004.

Setting: 11 community and migrant health centers in New York City.

Patients: 1413 women who were overdue for cancer screening.

Intervention: Over 18 months, women assigned to the intervention group received an average of 4 calls from prevention care managers and women assigned to the control group received usual care. Follow-up data were available for 99% of women, and 91% of the intervention group received at least 1 call.

Measurements: Medical record documentation of mammography, Papanicolaou testing, and colorectal cancer screening according to U.S. Preventive Services Task Force recommendations.

Results: The proportion of women who had mammography increased from 0.58 to 0.68 with the intervention and decreased

from 0.60 to 0.58 with usual care; the proportion who had Papanicolaou testing increased from 0.71 to 0.78 with the intervention and was unchanged with usual care; and the proportion who had colorectal screening increased from 0.39 to 0.63 with the intervention and from 0.39 to 0.50 with usual care. The difference in the change in screening rates between groups was 0.12 for mammography (95% CI, 0.06 to 0.19), 0.07 for Papanicolaou testing (CI, 0.01 to 0.12), and 0.13 for colorectal screening (CI, 0.07 to 0.19). The proportion of women who were up to date for 3 tests increased from 0.21 to 0.43 with the intervention.

Limitations: Participants were from 1 city and had access to a regular source of care. Medical records may not have captured all cancer screenings.

Conclusions: Telephone support can improve cancer screening rates among women who visit community and migrant health centers. The intervention seems to be well suited to health plans, large medical groups, and other organizations that seek to increase cancer screening rates and to address disparities in care.

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Higher screening rates for breast, cervical, and colorectal cancer could reduce cancer mortality rates substantially (1–4). Current cancer screening rates are particularly disappointing among ethnic minorities and individuals with low socioeconomic status (5, 6) who often present with late-stage diagnoses (7) and have high mortality rates (8, 9).

Interventions to increase cancer screening have shown limited sustainability and effect on health care disparities. A previous study showed that an office systems approach, which used a medical record flowsheet and practice teamwork, increased screening rates by 20% to 33% in small rural community practices (10); however, a similar intervention was less effective in larger urban practices (11). An office intervention in low-income settings in Florida increased mammography use and home fecal occult blood testing at 12 months (12), but rates decreased substantially after research support ended (13).

Use of the telephone to support cancer screening is well documented (14–18), but interventions have typically addressed a single form of cancer screening. In some settings, telephone infrastructures to support childhood immunization (19) and patients with chronic illnesses (20–23) already exist. These infrastructures could add screening

support for patients who are already enrolled, or they could expand services to others while making minimal additional demands on primary care practices (24). This paper reports the results of a randomized, controlled trial that tested the effect of centralized telephone care management on cancer screening rates among women 50 to 69 years of age who obtained care at community and migrant health centers in New York City.

METHODS

Settings

Federally qualified community and migrant health centers provide comprehensive community-oriented pri-

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Appendix Table
Conversion of figure and tables into slides

Context

Minority and low-income women have low screening rates for cancer.

Contribution

In this trial from 11 community and migrant health centers in New York City, 1413 women overdue for cancer screening were randomly assigned to receive a telephone-based intervention (delivered by 8 prevention care managers) or usual care. The intervention included information about breast, cervical, and colorectal cancer and motivational and logistical support for obtaining screening. Within 18 months, the screening rates for all 3 forms of cancer increased more with telephone support than through usual care.

Implications

Telephone support delivered by trained personnel can improve cancer screening rates among some minority, low-income women.

—The Editors

mary care to over 12 million patients nationally (25) and are uniquely positioned to deliver cancer screenings to underserved and minority populations. We sought participation from 15 of the 21 community and migrant health centers in New York City because of their anticipated ability to provide sufficient patients for the study and their affiliations with tertiary care facilities that conduct mammography and colorectal screening and provide follow-up services for abnormal test results. Of these 15 sites, 2 were involved in competing research projects, 2 had few patients who were likely to be eligible and therefore served as pilot sites, and the remaining 11 participated.

Clinical Directors Network, a practice-based research network in New York City, was responsible for recruiting clinicians, practices, and women and for implementing the intervention and evaluation. The project was approved by the Committee for the Protection of Human Subjects at Dartmouth College, by the institutional review board at Clinical Directors Network, and by all relevant bodies responsible for reviewing research at participating community and migrant health centers.

Patients**Recruitment**

Women were approached by research assistants during routine visits to the centers or were referred by a clinician. Research assistants explained the study and obtained written informed consent from women who agreed to participate. Women were compensated \$15 for participating in an interview whether or not they met eligibility criteria.

Eligibility

Eligible women were 50 to 69 years of age, were overdue for at least 1 cancer screening according to their med-

ical records, were patients of the center for at least 6 months, and had no plans to move or change health centers within 15 months. We excluded women whose primary language was not English, Spanish, or Haitian Creole and those who were acutely ill or currently receiving cancer treatment. After we obtained consent, a research assistant reviewed patient medical records to confirm eligibility. Mammography and Papanicolaou tests that were performed within the past year were seen as evidence of breast and cervical cancer screening, respectively, whereas reports of home fecal occult blood testing within the past year, sigmoidoscopy within the past 5 years, or colonoscopy within the past 10 years were seen as evidence of colorectal cancer screening. Women whose charts indicated that they were up to date on all 3 cancer screenings were excluded. We also excluded women with unresolved abnormal screening results (for example, positive results on home fecal occult blood testing; mammography results that were categorized as American College of Radiology level 0, 4, or 5; and certain Papanicolaou test results) and notified their physicians of these findings.

Design

Eligible, consenting women were grouped by center, duration of enrollment at their center (≤ 12 months or > 12 months), and the number of cancer screenings that they had received at recommended intervals (0 or 1 screening or 2 screenings). The New York–based research assistant assigned women in each group to receive the intervention or usual care by using sealed randomization forms that were produced by Dartmouth College staff with a computer-based random-number generator. Patients were informed of their group assignment individually by telephone.

At time of consent, all women received the publication titled *Put Prevention into Practice Personal Health Guide* (26), which contained information regarding recommended preventive services. Women who were assigned to the usual care group received a single telephone call during which trial staff answered questions about preventive care, informed women of their usual care status, advised them to obtain needed preventive care from their primary care clinician, and thanked them for their participation.

Women who were assigned to the intervention group received a series of telephone support calls from a trained prevention care manager who was monitored to ensure quality and consistency. In much the same way that patient navigators guide women through the health care system during cancer treatment (27), prevention care managers facilitated the screening process for each woman by addressing barriers that prevent or delay receipt of cancer screenings. Prevention care managers received 7 hours of training, including an overview of the U.S. Preventive Services Task Force guidelines (28–30); a review of barriers to breast, cervical, and colorectal cancer screenings; and detailed explanations of the targeted screenings. Additional

Table 1. Baseline Characteristics of 11 Participating Community Health Centers*

Variable	Community Health Center											Mean Value (SD)	Range
	A	B	C	D	E	F	G	H	I	J	K		
Total visits in past year, <i>n</i>	46 448	49 000	73 094	102 185	155 349	41 017	28 215	165 952	55 976	125 117	42 053	80 401 (48 933)	28 215–165 952
Primary language of patients, estimated %													
English	85	25	30	55	80	80	25	50	65	10	40	49.5 (25.7)	10–85
Spanish	12	70	50	43	19	12	35	30	30	90	40	39.2 (23.9)	12–90
Other	3	5	20	2	1	8	40	20	5	0	20	11.3 (12.4)	0–40
Primary care physicians at center, <i>n</i>													
Total	8	8	5	13	6	13	8	14	5	29	7	10.5 (6.9)	5–29
Family practitioners	0	4	0	2	3	1	8	1	1	5	5	2.7 (2.5)	0–8
General internists	5	0	5	4	2	5	0	9	3	7	1	3.7 (2.9)	0–9
Nurse practitioners and physicians' assistants	3	4	0	7	1	7	0	4	1	17	1	4.1 (5.0)	0–17
Part-time clinicians	0	0	0	2	0	9	2	5	0	2	1	1.9 (2.8)	0–9
Mean clinician-years in practice at community health center	6.4	2.5	4.7	10.8	3.6	5.1	5.1	12.9	1.3	3.6	4.4	5.5 (3.5)	1.3–12.9

* Clinicians indicated the number of years they had been in practice at their community/migrant health center. All remaining data were derived from each center's clinical director.

training included role-playing telephone calls during which the managers used the intervention scripts. Thereafter, logs were reviewed in monthly meetings to ensure fidelity to the intervention.

The 8 prevention care managers were women, and most were college graduates. Their assignments were determined by patient language needs. Each care manager focused most of her work on patients from 1 or 2 sites while supporting smaller numbers of patients from other sites; contact with clinicians was limited.

During the first call with a patient in the intervention group, the prevention care manager answered questions about the health guide and confirmed or updated screening dates found in the woman's medical record. She next determined how ready the woman was to act on each screening (31) and worked with the woman to prioritize overdue screenings. The prevention care manager then provided motivational support, responding to each participant's specific barriers to screening by using a structured script that was developed through an earlier series of interviews with women (32). Some participants had been advised during office visits with their clinicians to undergo screening; those who had not received such recommendations were sent a written recommendation from their clinician. Women who reported that they had difficulty communicating with their physician were sent brightly colored patient activation cards that listed overdue screenings, which they could share with their clinician at their next appointment. Care managers also scheduled appointments, provided accurate information about screenings over the tele-

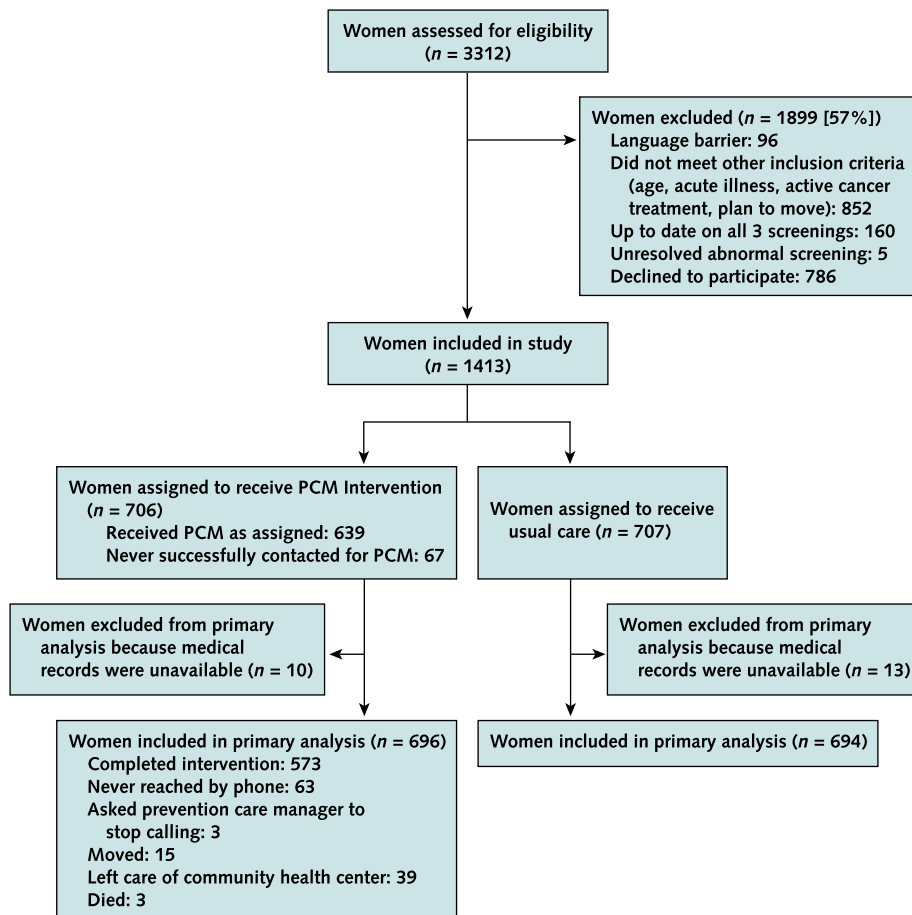
phone and by mail, prompted women with appointment reminder calls and letters, provided directions to screening facilities, and helped women to find a means of transportation to appointments.

During subsequent calls, which continued for 18 months or until the patient was up to date for all screenings, the prevention care manager asked about future appointments and screenings the patient had received since the last call. The manager then responded to new and ongoing barriers for remaining overdue screenings.

Only clinicians, not care managers, were responsible for ordering screenings at all but 2 centers, which permitted care managers to mail home fecal occult blood test kits directly to women who were willing to perform this test.

Evaluation

Descriptive data on the centers were gathered from surveys that were completed by clinicians and clinical directors. Outcome data were based on reviews of patient medical records, which were conducted at least 3 months after the intervention period to allow for the time lag between receipt of a service and the availability of documentation. Data included patient demographic characteristics, screening dates and results, chronic illnesses, height, weight, smoking status, and personal and family history of cancer. Data regarding patient ethnicity were primarily collected during the screening interview (33) and supplemented with medical record documentation. Median household annual income was estimated by using U.S. Census Bureau data for each woman's ZIP code (34).

Figure. Flow of study participants through recruitment, eligibility assessment, randomization, intervention, and outcome analysis.

PCM = prevention care management.

Each independent chart abstractor received 4 hours of initial training in medical record review and was given a manual containing coding definitions. Practice reviews were conducted on charts of consenting but ineligible women. Reviewers were blinded to study hypotheses and to group assignment, and reviews were monitored for quality control. Medical records were requested 4 times before they were considered unavailable.

A woman was considered up to date at baseline for mammography, Papanicolaou testing, and home fecal occult blood testing if the screening had been completed within the 18 months preceding consent; the woman was up to date at follow-up if she received these screenings during the 18-month intervention period. This interval provided a 6-month grace period for home fecal occult blood testing (on the basis of the U.S. Preventive Services Task Force's annual recommendation) (30) and is the midpoint of the Task Force's mammography recommendation of every 1 to 2 years (28). Although the Task Force recommends Papanicolaou testing at least every 3 years following a series of normal annual tests (29), shorter intervals

are often recommended on the basis of a woman's risk factors and patient-physician discretion; the 18-month interval is again within this range.

A woman was also considered up to date for colorectal cancer screening if she had received a colonoscopy within the past 10 years or a barium enema or sigmoidoscopy within the past 5 years. Up-to-date status was assessed at the consent date for baseline and at the end of the intervention period for follow-up. A woman who had had total hysterectomy was considered up to date for cervical cancer screening after the date on which the hysterectomy was performed. When medical record data were recorded, no attempt was made to distinguish between screening and diagnostic tests.

Prevention Care Management Process Evaluation

During the intervention, prevention care managers kept paper logs in which they recorded details of their interactions with the participants, including their readiness to act, barriers to screening that were identified, and any

actions that were taken. Data from these logs were entered either in Study Manager (an online database that complies with Health Insurance Portability and Accountability Act guidelines) or a locally maintained Microsoft Access database.

Adverse Events

Potential adverse events included patient dissatisfaction with any aspect of the study or failure to ensure follow-up of abnormal screening results. A committee to monitor data safety reviewed all patient withdrawals, deaths, and unresolved abnormal results as they became known and ensured their resolution. Three patients in the intervention group asked to receive no additional follow-up calls. Three patients died during the study of causes not related to the study and with no other adverse events reported.

Statistical Analysis

All women who were randomly assigned to receive the intervention and whose charts could be located were included in the intervention group for analysis whether or not they were successfully reached by the prevention care manager. Our primary outcome was screening status at follow-up for each of the 3 forms of cancer. Analysis was based on the intention-to-treat principle. Binary variables were analyzed by using chi-square tests, and continuous variables were analyzed by using Student *t*-tests. To ensure that our findings were robust, we calculated outcomes for the unadjusted model; a model adjusted for only up-to-date screening status before randomization; and a model adjusted for up-to-date screening status before randomization and other covariates, including patient age, body mass index, income, primary language, chronic diseases, and insurance (35).

To account for clustering by site, we used standard logistic regression, models that used Pearson residuals to correct for overdispersion, random-effects models, models with site as a fixed effect, and models that used the Huber–White estimate of variance. Although all models were similar, we report CIs derived from the Huber–White estimate of variance because these were the widest and therefore the most conservative. Results for the primary outcome are reported with 95% CIs. A *P* value of 0.0167 (0.05/3 to account for the 3 cancer screening outcomes) was used to indicate statistical significance.

To account for women whose medical records could not be found and who were therefore considered to have withdrawn from the study, we reanalyzed the data while assuming the worst-case scenario. That is, we assumed that all women receiving usual care who had missing charts were overdue at baseline and up to date at follow-up and that all women receiving the intervention who had missing charts were up to date at baseline and overdue at follow up. In determining sample size, we assumed that the proportion of women screened differed by 0.1 for each of the 3 primary tests with a power of 0.8; to correct for multiple

comparisons, we assumed a type I error of 0.0167 (0.05/3). By assuming a withdrawal rate of 20%, we needed a sample size of 1400 women. Statistical analysis was performed by using Stata, version 9.0 (Stata Corp., College Station, Texas).

Role of the Funding Source

This work was supported by the National Cancer Institute (R01 CA-87776). The funding source had no role in the design, conduct, or reporting of the study.

Table 2. Characteristics of Women by Study Group

Variable	Intervention Group (n = 696)	Usual Care Group (n = 694)
Mean age (SD) at consent, y	58.1 (5.3)	58.1 (5.2)
Primary language, n (%)		
Spanish	446 (64.1)	427 (61.5)
English	249 (35.8)	264 (38.0)
Haitian Creole	1 (0.1)	3 (0.4)
Marital status, n (%)		
Married/cohabiting	178 (25.6)	185 (26.7)
Single/divorced/widowed	446 (64.1)	447 (64.4)
Unknown	72 (10.3)	62 (8.9)
Insurance, n (%)*		
Medicaid	553 (79.5)	543 (78.2)
Medicare	143 (20.5)	135 (19.5)
Employer/other	63 (9.1)	67 (9.7)
No insurance	36 (5.2)	36 (5.2)
Unknown	10 (1.4)	9 (1.3)
Years receiving care at community health center before consent, n (%)		
<3	201 (28.9)	195 (28.1)
≥3	471 (67.7)	479 (69.0)
Unknown	24 (3.4)	20 (2.9)
Smoking status, n (%)		
Current	112 (16.1)	132 (19.0)
Former	89 (12.8)	92 (13.3)
Never	450 (64.7)	438 (63.1)
Unknown	45 (6.5)	32 (4.6)
Body mass index		
Mean (SD), kg/m ²	32.0 (6.8)	32.1 (7.4)
Underweight, n (%)	5 (0.7)	2 (0.3)
Normal, n (%)	84 (12.1)	75 (10.8)
Overweight, n (%)	194 (27.9)	185 (26.7)
Obese, n (%)	351 (50.4)	362 (52.2)
Unknown, n (%)	62 (8.9)	70 (10.1)
Medical history, n (%)		
Baseline cancer history	36 (5.2)	33 (4.8)
Hysterectomy	187 (26.9)	208 (30.0)
Comorbid condition, n (%)		
Asthma	222 (31.9)	205 (29.5)
Hypertension	489 (70.3)	496 (71.5)
Hyperlipidemia	261 (37.5)	290 (41.8)
Diabetes	250 (35.9)	276 (39.8)

* Women could carry more than 1 type of insurance.

Table 3. Proportion of Women Up to Date for Cancer Screening*

Measurement Period	Intervention Group (n = 696)	Usual Care Group (n = 694)	Difference (95% CI)†
Mammography			
Baseline, %	58	60	-0.02 (-0.07 to 0.03)
Follow-up, %	68	58	0.10 (0.05 to 0.15)
Change from baseline (CI), percentage points	0.10 (0.05 to 0.15)	-0.02 (-0.08 to 0.02)	0.12 (0.06 to 0.19)
Papanicolaou test			
Baseline, %	71	70	0.01 (-0.04 to 0.06)
Follow-up, %	78	70	0.08 (0.03 to 0.12)
Change from baseline (CI), percentage points	0.07 (0.03 to 0.11)	0.00 (-0.03 to 0.05)	0.07 (0.01 to 0.12)
Any colorectal screening			
Baseline, %	39	39	0.00 (-0.05 to 0.05)
Follow-up, %	63	50	0.13 (0.08 to 0.18)
Change from baseline (CI), percentage points	0.24 (0.20 to 0.29)	0.11 (0.08 to 0.16)	0.13 (0.07 to 0.19)
Up to date for 1 or more screening			
Baseline, %	86	86	0.00 (-0.03 to 0.04)
Follow-up, %	91	87	0.04 (0.01 to 0.08)
Change from baseline (CI), percentage points	0.05 (0.02 to 0.08)	0.01 (-0.02 to 0.04)	0.04 (0.00 to 0.08)
Up to date for 2 or more screenings			
Baseline, %	61	61	0.00 (-0.06 to 0.05)
Follow-up, %	75	62	0.13 (0.08 to 0.18)
Change from baseline (CI), percentage points	0.14 (0.10 to 0.18)	0.01 (-0.04 to 0.05)	0.13 (0.00 to 0.08)
Up to date for 3 screenings			
Baseline, %	21	22	-0.01 (-0.06 to 0.03)
Follow-up, %	43	30	0.13 (0.07 to 0.20)
Change from baseline (CI), percentage points	0.22 (0.18 to 0.27)	0.08 (0.04 to 0.12)	0.14 (0.08 to 0.20)

* This analysis is based on unadjusted rates.

† All values in this column are percentage points.

RESULTS

Study Setting, Sample, and Randomization

Baseline characteristics of the centers are described in **Table 1**. Participating centers were located in 4 of the 5 boroughs of New York City and were diverse in size, primary language of patients, predominant primary care specialty, number of nurse practitioners, and number of part-time clinicians.

The **Figure** displays the patient accrual process. Recruitment took place between November 2001 and October 2002. Prevention care managers followed women in the intervention for 18 months after recruitment; all follow-up was complete by April 2004. Of women who were approached and found to be eligible, 64% provided consent. Medical records for 23 women could not be located during the final record review; therefore, these participants were not included in the final analysis but were included in the aforementioned worst-case scenario analysis. The evaluation sample included 696 women in the intervention group and 694 in the usual care group (99% and 98% of those consenting, respectively).

Characteristics of the women in the intervention and usual care groups are provided in **Table 2**. Nearly 63% of women identified their primary language as Spanish, and most were insured through Medicaid or Medicare. Over two thirds of women (68%) had been receiving care from

their health center for at least 3 years. Many women had chronic disease, and more than half were obese. Ethnicity and income are not presented in **Table 2** because ethnicity was unknown for 39% of women and income was inferred from the participants' home ZIP codes. Of those with documented ethnicity, 38% were black and 39% were white. More than one third (34%) of women lived in ZIP codes with a median household income of less than \$25 000, 39% lived in ZIP codes with a median income between \$25 000 and \$40 000, and 27% lived in ZIP codes with a median income of greater than \$40 000.

Intervention Implementation

Of the 696 women assigned to the intervention group, 63 (9%) were never contacted after as many as 8 attempted telephone calls and 2 letters. Of the 633 women who were reached at least 1 time, 60 (9%) received a partial intervention. For women reached by the prevention care manager, the mean number of contacts was 4 (range, 1 to 20 [SD, 2.7]). Within a subsample of women whose calls were timed, initial calls averaged 17 minutes in length (range, 6 to 48 min [SD, 8.5]) and subsequent calls averaged 14 minutes (range, 1 to 62 min [SD, 8.8]).

Intervention Effect

Table 3 provides unadjusted baseline and follow-up screening rates. Covariate adjustment did not change the

estimated intervention effect. Compared with women in the usual care group, more women in the intervention group had had all 3 forms of cancer screenings and more were up to date for 1, 2, or 3 tests at follow-up. As specified in our original design, *P* values for the 3 primary comparisons were less than 0.05/3. Between baseline and follow-up, screening rates in the intervention group increased by 0.10 (17%) for mammography (*P* < 0.001), by 0.07 (10%) for Papanicolaou testing (*P* < 0.001), and by 0.24 (>60%) for any colorectal cancer screening testing (*P* < 0.001). **Table 3** also shows the proportions of women who were up to date for 1 or more, 2 or more, or 3 screenings on the basis of outcome chart reviews. Some participants are indicated to be up to date for all 3 types of screening at baseline, which seems to contradict study exclusion criteria. This apparent discrepancy is primarily attributable to differences between the enrollment process and the outcome assessment process in the time frames involved (12 and 18 months, respectively). The proportion of women who were up to date for all 3 forms of screening increased by 0.22 (105%) in the intervention group (*P* < 0.001). There was no evidence that the intervention's effect varied by site (**Appendix Table**, available at www.annals.org).

Colorectal cancer screening rates and the proportion of women who were up to date for the 3 forms of screening also increased in the usual care group; however, the increase was substantially less than in the intervention group. The New York Department of Health and Mental Hygiene began a major colon cancer screening initiative during our study (36), which may partially explain this increase. By using the previously described worst-case assumptions for women whose charts were not available for review, the intervention's effect on screening rates typically decreased by 0.01 or 0.02 and remained significant for all comparisons except the percentage of women who were up to date for 1 form of screening.

Whereas breast and cervical cancer screening require a single test, colorectal cancer screening can involve several tests and combinations of tests. Home fecal occult blood tests accounted for most of the increase in the intervention group compared with the usual care group. At baseline, 166 (24%) women in the intervention group had received home fecal occult blood tests within the past 18 months compared with 177 (26%) of those in the usual care group. At follow-up, 296 (43%) women in the intervention group had received home fecal occult blood tests in the past 18 months compared with 213 (31%) of those in the usual care group. Colonoscopy rates showed similar increases in both study groups and accounted for most of the remaining women who were up to date for colorectal cancer screening. Barium enema and sigmoidoscopy each accounted for about 2% of colorectal screening for each time point and group.

Table 4 lists the most common forms of support that were provided by care managers. This study was designed

to assess the effect of the omnibus intervention, not of any particular component. However, by documenting the specific types of support provided, we can provide a clearer picture of those types of support that are most needed by this population. Nearly half of the women received either an activation card or a recommendation letter from their physician, and 241 (34.6%) received both. Of those receiving educational material, more than twice as many women received information on colorectal screenings than received materials regarding Papanicolaou testing or mammography. Care managers also directly distributed home fecal occult blood testing cards to 33 women (4.7%).

DISCUSSION

We found that a telephone-based intervention increased screening rates for all 3 types of cancer in this sample. Rates of colorectal cancer screening showed the largest increase, but changes in all 3 rates were clinically meaningful. The increases in mammography and colorectal cancer screening of 0.10 and 0.24, respectively, represent improvements of 17% and 60% over baseline; the lower boundaries of these confidence intervals for change were 0.05 or more. The rate of Papanicolaou testing increased by only 0.07, but this still represents a 10% improvement over baseline.

These findings have 5 important implications. First, a modest intervention can increase screening rates in a predominantly minority population; this improvement could potentially save lives through earlier detection (2–4), address health care disparities (37), and favorably affect such quality measures as the Health Plan Employer Data and Information Set (38). Second, this study supports the effectiveness and practicality of telephone support for multiple screenings. In a search of randomized, controlled trials that targeted a low-income, minority population or that used the telephone to increase adherence to recommended

Table 4. Types of Support Provided by Prevention Care Managers to Patients*

Type of Support	Patients Receiving Support (n = 696)
Educate and increase awareness, n (%)	
Mail clinician recommendation letter to patient	328 (47.1)
Mail activation card to patient	328 (47.1)
Mail screening test–specific educational material to patient	313 (45.0)
Schedule, remind, and access advice, n (%)	
Schedule screening appointments	148 (21.3)
Provide appointment reminders	208 (29.9)
Call patient	132 (19.0)
Send patient reminder letter	130 (18.7)
Schedule appointment with primary care provider	68 (9.8)
Give patient access advice	16 (2.3)

* All patients assigned to the intervention group are included in this intention-to-treat analysis.

cancer screening intervals, only 6 studies did both (16, 17, 39–42). Of these studies, all reported improved screening rates; however, they only addressed mammography with or without Papanicolaou testing, not colorectal cancer screening. Third, other needed preventive services, such as lipid testing and smoking cessation counseling, could be incorporated into telephone support to increase its value and efficiency. Fourth, a centrally based telephone intervention could be integrated into care management infrastructures that are already established in many managed care and large group practice settings. Fifth, telephone care management could focus on prevention exclusively, or it could be integrated into established management programs for such chronic illnesses as diabetes, asthma, and congestive heart failure (21–23) to avoid the complexity and expense associated with multiple care managers.

Certain strengths should be noted in this practical clinical trial (43, 44). Study participants from 11 heterogeneous health centers had diverse backgrounds, including a high proportion of ethnic minorities who lived in areas with low household incomes. The setting of the community and migrant health center provides a nationwide point of access for many low-income women. The consent rate was high, and few women were lost to follow-up. The rigorous intention-to-treat analysis provides a conservative estimate of the effectiveness of the intervention because 18% of women in this group received either an incomplete intervention or were never reached by the care manager. We provided each enrolled woman (regardless of group assignment) with a brochure that promoted screening (26) and offered her the opportunity to ask questions about it in a subsequent telephone call; these strategies also support a conservative estimate of the intervention's effect compared with typical care.

Study limitations should be noted. The study took place in 1 city among women who frequently visit community and migrant health centers. The applicability of these findings to women in other regions who are not engaged in receiving primary care or who obtain care from hospital clinics or private practice is unknown. Record review as the source of outcome data may miss some screenings. Finally, the long-term effect of the intervention is unknown. Will women continue to need assistance from a prevention care manager to obtain future screenings in a timely fashion? Or will the effect of the intervention be maintained over time, with patients securing screenings on their own without further assistance? These questions require further research.

The next steps are to focus on translation and sustainability of this evidence-based intervention. Future challenges include the identification of real-world infrastructures that can provide a sustainable base for prevention care management. The intervention needs further refinement to increase its efficiency; perhaps call centers and administrative claims data could be used to identify women who need screening and to evaluate their adherence to recommenda-

tions. Furthermore, it is important to expand access to the intervention to other underserved populations, such as women who are not well engaged in primary care.

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References

1. Elmore JG, Armstrong K, Lehman CD, Fletcher SW. Screening for breast cancer. *JAMA*. 2005;293:1245-56. [PMID: 15755947]
2. Levin B, Smith RA, Feldman GE, Colditz GA, Fletcher RH, Nadel M, et al. Promoting early detection tests for colorectal carcinoma and adenomatous polyps: a framework for action: the strategic plan of the National Colorectal Cancer Roundtable. *Cancer*. 2002;95:1618-28. [PMID: 12365008]
3. Schiffman MH, Brinton LA, Devesa SS. Cervical cancer. In: Schottenfeld D, Fraumeni JF, eds. *Cancer Epidemiology and Prevention*. 2nd ed. New York: Oxford Univ Pr; 1996:1090-116.
4. Jemal A, Murray T, Ward E, Samuels A, Tiwari RC, Ghafoor A, et al. Cancer statistics, 2005. *CA Cancer J Clin*. 2005;55:10-30. [PMID: 15661684]
5. Agency for Healthcare Research and Quality. National Healthcare Disparities Report. Rockville, MD: U.S. Department of Health and Human Services; 2003.
6. Cooper GS, Koroukian SM. Racial disparities in the use of and indications for colorectal procedures in Medicare beneficiaries. *Cancer*. 2004;100:418-24. [PMID: 14716780]
7. National Academies Press. Unequal treatment: confronting racial and ethnic disparities in health care. Accessed at www.nap.edu/books/030908265X/html/ on 16 May 2004.
8. U.S. Department of Health and Human Services. Healthy People 2010. Accessed at www.healthypeople.gov/Document/HTML/Volume1/03Cancer.htm#_ednref28 on 2 April 2005.
9. National Cancer Institute. Cancer Health Disparities Fact Sheet. 2003. Accessed at www.nci.nih.gov/cancertopics/factsheet/cancerhealthdisparities on 13 May 2005.
10. Dietrich AJ, O'Connor GT, Keller A, Carney PA, Levy D, Whaley FS. Cancer: improving early detection and prevention. A community practice randomised trial. *BMJ*. 1992;304:687-91. [PMID: 1571644]
11. Dietrich AJ, Tobin JN, Sox CH, Cassels AN, Negron F, Younge RG, et al. Cancer early-detection services in community health centers for the underserved.

- A randomized controlled trial. *Arch Fam Med*. 1998;7:320-7; discussion 328. [PMID: 9682685]
12. **Roetzheim RG, Christman LK, Jacobsen PB, Cantor AB, Schroeder J, Abdulla R, et al.** A randomized controlled trial to increase cancer screening among attendees of community health centers. *Ann Fam Med*. 2004;2:294-300. [PMID: 15335126]
 13. **Roetzheim RG, Christman LK, Jacobsen PB, Schroeder J, Abdulla R, Hunter S.** Long-term results from a randomized controlled trial to increase cancer screening among attendees of community health centers. *Ann Fam Med*. 2005;3:109-14. [PMID: 15798035]
 14. **Vernon SW.** Participation in colorectal cancer screening: a review. *J Natl Cancer Inst*. 1997;89:1406-22. [PMID: 9326910]
 15. **Barr JK, Franks AL, Lee NC, Antonucci DM, Rifkind S, Schachter M.** A randomized intervention to improve ongoing participation in mammography. *Am J Manag Care*. 2001;7:887-94. [PMID: 11570022]
 16. **Champion V, Maraj M, Hui S, Perkins AJ, Tierney W, Menon U, et al.** Comparison of tailored interventions to increase mammography screening in nonadherent older women. *Prev Med*. 2003;36:150-8. [PMID: 12590989]
 17. **Crane LA, Leakey TA, Ehrsam G, Rimer BK, Warnecke RB.** Effectiveness and cost-effectiveness of multiple outcalls to promote mammography among low-income women. *Cancer Epidemiol Biomarkers Prev*. 2000;9:923-31. [PMID: 11008910]
 18. **Saywell RM Jr, Champion VL, Skinner CS, Menon U, Daggy J.** A cost-effectiveness comparison of three tailored interventions to increase mammography screening. *J Womens Health (Larchmt)*. 2004;13:909-18. [PMID: 15671706]
 19. **Wood D, Halfon N, Donald-Sherbourne C, Mazel RM, Schuster M, Hamlin JS, et al.** Increasing immunization rates among inner-city, African American children. A randomized trial of case management. *JAMA*. 1998;279:29-34. [PMID: 9424040]
 20. **Friedrich MJ.** Enhancing diabetes care in a low-income, high-risk population. *JAMA*. 2000;283:467-8. [PMID: 10659861]
 21. **Taylor CB, Miller NH, Reilly KR, Greenwald G, Cunning D, Deeter A, et al.** Evaluation of a nurse-care management system to improve outcomes in patients with complicated diabetes. *Diabetes Care*. 2003;26:1058-63. [PMID: 12663573]
 22. **Simon GE, VonKorff M, Rutter C, Wagner E.** Randomised trial of monitoring, feedback, and management of care by telephone to improve treatment of depression in primary care. *BMJ*. 2000;320:550-4. [PMID: 10688563]
 23. **Riegel B, Carlson B, Kopp Z, LePetri B, Glaser D, Unger A.** Effect of a standardized nurse case-management telephone intervention on resource use in patients with chronic heart failure. *Arch Intern Med*. 2002;162:705-12. [PMID: 11911726]
 24. **Yarnall KS, Pollak KI, Ostbye T, Krause KM, Michener JL.** Primary care: is there enough time for prevention? *Am J Public Health*. 2003;93:635-41. [PMID: 12660210]
 25. **Health Resources and Service Administration.** Section 330 Grantees Uniform Data System: Calendar Year 2003 Data. Bethesda, MD: Bureau of Primary Health Care; 2003.
 26. **Agency for Healthcare Research and Quality.** Put Prevention into Practice. Washington, DC: U.S. Department of Health and Human Services; 1997.
 27. **National Cancer Institute.** Patient Navigator Research Program. Accessed at <http://crchd.nci.nih.gov/Navigator/index.htm> on 13 October 2005.
 28. **Humphrey LL, Helfand M, Chan BK, Woolf SH.** Breast cancer screening: a summary of the evidence for the U.S. Preventive Services Task Force. *Ann Intern Med*. 2002;137:347-60. [PMID: 12204020]
 29. **Agency for Healthcare Research and Quality.** Screening for Cervical Cancer: Recommendations and Rationale. 2003. Accessed at www.ahrq.gov/clinic/uspstf/uspstf.htm on 23 May 2005.
 30. **U.S. Preventive Services Task Force.** Screening for colorectal cancer: recommendation and rationale. *Ann Intern Med*. 2002;137:129-31. [PMID: 12118971]
 31. **Prochaska J, DiClemente C.** Toward a comprehensive model of change. In: Miller W, Heather N, eds. *Treating Addictive Behaviours: Process of Change*. New York: Plenum Pr; 1986:3-27.
 32. **Ogedegbe G, Cassells AN, Robinson CM, DuHamel K, Tobin JN, Sox CH, et al.** Perceptions of barriers and facilitators of cancer early detection among low-income minority women in community health centers. *J Natl Med Assoc*. 2005;97:162-70. [PMID: 15712779]
 33. **Winker MA.** Measuring race and ethnicity: why and how? [Editorial] *JAMA*. 2004;292:1612-4. [PMID: 15467065]
 34. **Geronimus A, Bound J, Neider L.** On the Validity of Using Census Geocode Characteristics To Proxy Economic Status. PSC Research Report. Ann Arbor, MI: Population Studies Center; 1993:269.
 35. **McCullagh P, Nelder J.** *Generalized Linear Models*, 2nd ed. London: Chapman and Hall; 1989.
 36. **New York City Health and Hospitals Corporation.** Colonoscopies at City Hospitals Double in 2004; Blacks in NYC Still Have Lowest Screening Rates and Highest Colon Cancer Death Rates. Accessed at www.nyc.gov/html/hhc/html/pressroom/press-release-20050314.shtml on 22 March 2005.
 37. **Woolf SH, Johnson RE, Fryer GE Jr, Rust G, Satcher D.** The health impact of resolving racial disparities: an analysis of US mortality data. *Am J Public Health*. 2004;94:2078-81. [PMID: 15569956]
 38. **National Committee for Quality Assurance.** HEDIS 2005 Summary Table of Measures and Product Lines. Accessed at www.ncqa.org/Programs/HEDIS/HEDIS%202005%20Summary.pdf on 21 February 2005.
 39. **West DS, Greene P, Pulley L, Kratt P, Gore S, Weiss H, et al.** Stepped-care, community clinic interventions to promote mammography use among low-income rural African American women. *Health Educ Behav*. 2004;31:29S-44S. [PMID: 15296690]
 40. **Duan N, Fox SA, Derose KP, Carson S.** Maintaining mammography adherence through telephone counseling in a church-based trial. *Am J Public Health*. 2000;90:1468-71. [PMID: 10983211]
 41. **Rimer BK, Conaway M, Lyna P, Glassman B, Yarnall KS, Lipkus I, et al.** The impact of tailored interventions on a community health center population. *Patient Educ Couns*. 1999;37:125-40. [PMID: 14528540]
 42. **Lantz PM, Stencil D, Lippert MT, Beversdorf S, Jaros L, Remington PL.** Breast and cervical cancer screening in a low-income managed care sample: the efficacy of physician letters and phone calls. *Am J Public Health*. 1995;85:834-6. [PMID: 7646664]
 43. **Tunis SR, Stryer DB, Clancy CM.** Practical clinical trials: increasing the value of clinical research for decision making in clinical and health policy. *JAMA*. 2003;290:1624-32. [PMID: 14506122]
 44. **Glasgow RE, Magid DJ, Beck A, Ritzwoller D, Estabrooks PA.** Practical clinical trials for translating research to practice: design and measurement recommendations. *Med Care*. 2005;43:551-7. [PMID: 15908849]

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Appendix Table. Outcome by Study Site*

Test	Site	Patients Up to Date at Follow-up, %		Relative Risk (95% CI)
		Intervention Group	Usual Care Group	
Mammography†				
	A	60.71	67.65	0.90 (0.69–1.17)
	B	75.86	60.00	1.26 (1.02–1.56)
	C	54.05	47.50	1.14 (0.73–1.77)
	D	62.22	60.00	1.04 (0.74–1.46)
	E	66.88	57.14	1.17 (0.98–1.40)
	F	50.00	58.82	0.85 (0.47–1.54)
	G	69.57	57.14	1.22 (0.77–1.93)
	H	73.38	50.00	1.47 (1.22–1.76)
	I	58.70	59.57	0.99 (0.70–1.38)
	J	74.51	68.29	1.09 (0.84–1.42)
	K	78.26	69.57	1.13 (0.80–1.59)
Papanicolaou testing‡				
	A	78.57	70.59	1.11 (0.91–1.37)
	B	81.61	63.53	1.28 (1.06–1.55)
	C	37.84	65.00	0.58 (0.36–0.93)
	D	75.56	75.00	1.01 (0.79–1.29)
	E	81.82	71.43	1.15 (1.01–1.30)
	F	80.00	64.71	1.24 (0.82–1.87)
	G	73.91	61.90	1.19 (0.79–1.81)
	H	86.36	75.32	1.15 (1.03–1.28)
	I	58.70	65.96	0.89 (0.65–1.22)
	J	74.51	70.73	1.05 (0.82–1.36)
	K	91.30	78.26	1.17 (0.91–1.50)
Colorectal cancer screenings§				
	A	73.21	63.24	1.16 (0.91–1.47)
	B	58.62	43.53	1.35 (1.00–1.82)
	C	51.35	57.50	0.89 (0.59–1.35)
	D	66.67	50.00	1.33 (0.92–1.94)
	E	74.03	50.65	1.46 (1.22–1.75)
	F	40.00	35.29	1.13 (0.49–2.62)
	G	56.52	66.67	0.85 (0.53–1.36)
	H	57.79	40.51	1.43 (1.13–1.80)
	I	39.13	55.32	0.71 (0.45–1.10)
	J	76.47	56.10	1.36 (1.00–1.86)
	K	73.91	65.22	1.13 (0.77–1.67)

* This table lists outcomes by site along with estimates of crude and adjusted relative risk by study group for each type of cancer screening. No test of homogeneity is statistically significant.

† Crude relative risk, 1.18 (CI, 1.08–1.28); Mantel–Haenszel combined model, 1.17 (1.08–1.27); test of homogeneity (Mantel–Haenszel)² (10) = 13.180, *P* = 0.2138.

‡ Crude relative risk, 1.10 (1.04–1.17); Mantel–Haenszel combined model, 1.10 (1.04–1.17); test of homogeneity (Mantel–Haenszel)² (10) = 13.432, *P* = 0.201.

§ Crude relative risk, 1.25 (1.14–1.38); Mantel–Haenszel combined model, 1.26 (1.14–1.38); test of homogeneity (Mantel–Haenszel)² (10) = 16.971, *P* = 0.075.