

# Reduced Mortality: The Unexpected Impact of a Telephone-Based Care Management Intervention for Older Adults in Managed Care

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**Objective.** This analysis evaluated mortality over 24 months for Medicare managed care members who participated in the Care Advocate Program (CA Program) designed to link those with high health care utilization to home- and community-based services.

**Data Source.** Secondary data from the CA Program, part of the California Health-Care Foundation's Elders in Managed Care Initiative.

**Study Design.** Randomized-control trial in which participants ( $N = 781$ ) were randomly assigned to intent-to-treat (ITT) and control groups. ITT group received telephonic social care management and 12 months of follow-up. Various multivariate analyses were used to evaluate mortality risk throughout multiple study periods controlling for sociodemographic characteristics, health status, and health care utilization.

**Population Studied.** Older adults (65+) enrolled in a Medicare managed care plan who had high health care utilization in the previous year.

**Principal Findings.** ITT group had a significantly lower odds of mortality throughout the study ( $OR = 0.55$ ;  $p = .005$ ) and during the care management intervention ( $OR = 0.45$ ;  $p = .006$ ), whereas differential risk in the postintervention period was not statistically significant. Other significant predictors of mortality were age, gender, three chronic conditions (cancer, heart disease, and kidney disease), and emergency room utilization.

**Conclusions.** Findings suggest that the care advocate model of social care management affected mortality while the program was in progress, but not after completion of the intervention phase. Key model elements accounted for the findings, which include individualized targeting, assessment, and monitoring; consumer choice, control, and participant self-management; and bridging medical and social service delivery systems through direct linkages and communication.

**Key Words.** Mortality, chronic care, consumer choice, home- and community-based services, social care management

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About 125 million Americans live with one or more chronic conditions, a number that is expected to increase dramatically over the next several decades (Anderson and Horvath 2002). Among people aged 65 and older, most health care spending (96 percent) is for the treatment and management of chronic disease (Kane 1998). Although those with chronic conditions benefit from comprehensive support and continuity of care (Rothman and Wagner 2003), health care tends to be fragmented across different settings, with variations in eligibility, regulations, management, financing, and reimbursement. Described by the Institute of Medicine (2001) as a “nightmare to navigate,” these “siloeed” services make it difficult for those with chronic conditions to obtain the care they need.

Although managed care offers the promise of improved coordination and delivery of chronic care (Kane 1998), studies of the experience of older adults suggest disappointing health outcomes (Ware et al. 1996) and consumer satisfaction (Landon et al. 2004; Pourat, Kagawa-Singer, and Wallace 2006). Nevertheless, several promising practices have emerged. For example, the Program of All-Inclusive Care for the Elderly (PACE) that integrates acute and long-term care has demonstrated reduced utilization of hospitals and nursing facilities, high satisfaction, and improved quality of life (Nadash 2004; Friedman et al. 2005). A Kaiser Permanente program in Colorado offering prevention, education, and comprehensive management of acute and primary care improved patient satisfaction and reduced health care utilization (Kane 1998). Project IMPACT, which treated depressed older adults using education, patient support, and a multidisciplinary team significantly reduced depression and improved patient satisfaction (Unutzer et al. 2002). These findings suggest that outcomes improve when managed care offers patient-oriented, flexible chronic care services that promote consumer autonomy and choice in health care decision making (Davis et al. 1995). Interventions not specific to managed care that promote education, choice, and control include web-based access to health and social care information (Shugarman, Nishita, and Wilber 2006), “cash and counseling” type programs that provide eligible consumers greater discretion in purchasing chronic care services (e.g., per-

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sonal care) with professional decision-making support (Benjamin 2001), and comprehensive geriatric assessment (Kane and Kane 2000). While web-based approaches have yet to be systematically evaluated, cash and counseling programs have improved satisfaction and cost-effectiveness compared with agency directed models of personal care support (Phillips and Schneider 2002) and geriatric assessment has reduced nursing home placement compared with usual care (Phibbs et al. 2006).

The Care Advocate Program (CA Program), the focus of this article, bridged medical and social care delivery systems using telephone-based care management to coordinate health and long-term care services for chronically ill older adults. Part of the Program for Elders in Managed Care Initiative, the CA Program was designed to improve care for managed care members by helping them link to noninsured home- and community-based services (HCBS) and reconnect with health plan services when needed. An evaluation using a randomized control trial found that the intent-to-treat group (ITT) had reductions in utilization of insured medical services, with no change in satisfaction and a decrease in retention (Shannon, Wilber, and Allen 2006). The evaluation also found an unexpected reduction in mortality (Wilber and Shannon 2003). The goal of this analysis is to systematically examine and test this unexpected result.

Attempts to identify mortality risk have revealed its complexity, as multiple factors may be involved including sociodemographic characteristics, presence and severity of disease, mental and physical impairments, health service utilization, and health care service delivery structures (Wolinsky, Johnson, and Stump 1995; Crimmins 2004; Seeman et al. 2004). Researchers have postulated that community-based care management in partnership with medical services could reduce mortality outcomes if goal-focused treatment protocols and targeting strategies were grounded in empirical data on mortality risk (Schore, Brown, and Cheh 1999; Miller and Weissert 2000). However, the effectiveness of these models to affect mortality outcomes is mixed. Several programs in which care management was a central component resulted in reduced mortality (Chatterji et al. 1998; Shapiro and Taylor 2002; Albert et al. 2005). Other studies found that community-based medical interventions with a care management component had improved outcomes such as decreased incidence of heart disease (Luepker et al. 1996), improved care of chronic conditions (Bodenheimer, Wagner, and Grumbach 2002), and greater self-management of chronic diseases (Lorig et al. 2001), with no reductions in mortality. Similarly, studies of medically focused models in managed care and hospital settings linked with social care systems showed improvements in

geriatric assessment in emergency rooms (Miller et al. 1996), and reductions in inpatient hospital days (Leveille et al. 1998), nursing home placement (Fischer et al. 2003), and health care costs (Boult et al. 2000), but no reductions in mortality.

### *CA Program Model*

The CA Program offered telephone-based care management to older adults with high health care utilization enrolled in a Medicare managed care health plan. A health care utilization algorithm, described below in the Methods section, was created to identify members who had multiple needs based on health care utilization in the previous year. The CA Program used master's level social work care managers called "care advocates" geographically located in and employed by two community-based social service agencies. These agencies had no prior or ongoing financial relationship with the health plan or the four participating medical groups beyond the externally funded project. Standardized instruments and protocols and monthly coordination meetings were used to ensure uniformity across sites (Wilber et al. 2003; Shannon, Wilber, and Allen 2006). The term "care advocate" was used to denote the role of educator, consultant, and coach (Kunkel, Duffy-Durham, and Scala 2000), and to emphasize consumer choice and a mutual partnership toward identified goals.

To identify immediate and long-term service needs, care advocates completed an 83-item psychosocial and functional assessment with participants, which was used to discuss options and link participants to HCBS not covered by the health plan's insured services. Examples of HCBS referral types were in-home care, nutrition, home safety, transportation, noninsured adaptive equipment, and supportive services. Care advocates also referred participants back to their medical group via the primary care physician (PCP) to access insured services such as specialist referrals and durable medical equipment (for a discussion of service use, see Alkema, Reyes, and Wilber 2006). Participants received a call within 1 week of assessment and monthly follow-up calls during the 12-month intervention period to monitor progress, offer support and coaching, and provide additional HCBS information. Care advocates encouraged willing and able participants and family members to contact suggested HCBS providers to make their own care arrangements, assisting them as needed, and following up to ensure that the linkage was established. Participants were further encouraged to contact the care advocate with any questions, crisis issues, or need for consultation. Upon completion of

Figure 1: Care Advocate Model



the 12-month study period, participants received additional community referrals to ensure an ethical termination.

Figure 1 illustrates key elements of the CA Program model, building on Wagner's Chronic Care Model (Wagner, Austin, and Von Korff 1996) and the WHO's Innovative Care for Chronic Conditions Framework (World Health Organization 2005). These included efforts to target the intervention to a high-utilizing Medicare managed care population, comprehensive assessment and linkages to HCBS and medical services, timely monitoring and support, a consumer-center approach to care, and support for self-management.

## METHODS

### *Data Source*

We followed 781 participants from March 2000 to June 2003 using the health plan's administrative utilization and retention data to evaluate characteristics associated with mortality during a 24-month study period. This period reflects the rolling enrollment process for the 12-month intervention and 12-month postintervention study periods. Inclusion criteria were: a member of one of the four contracted medical groups, aged 65 or older, enrollment in the Medicare managed care plan for at least 1 year, and scored four or more (scale of 0–11) on the health care utilization algorithm. The algorithm, developed from a

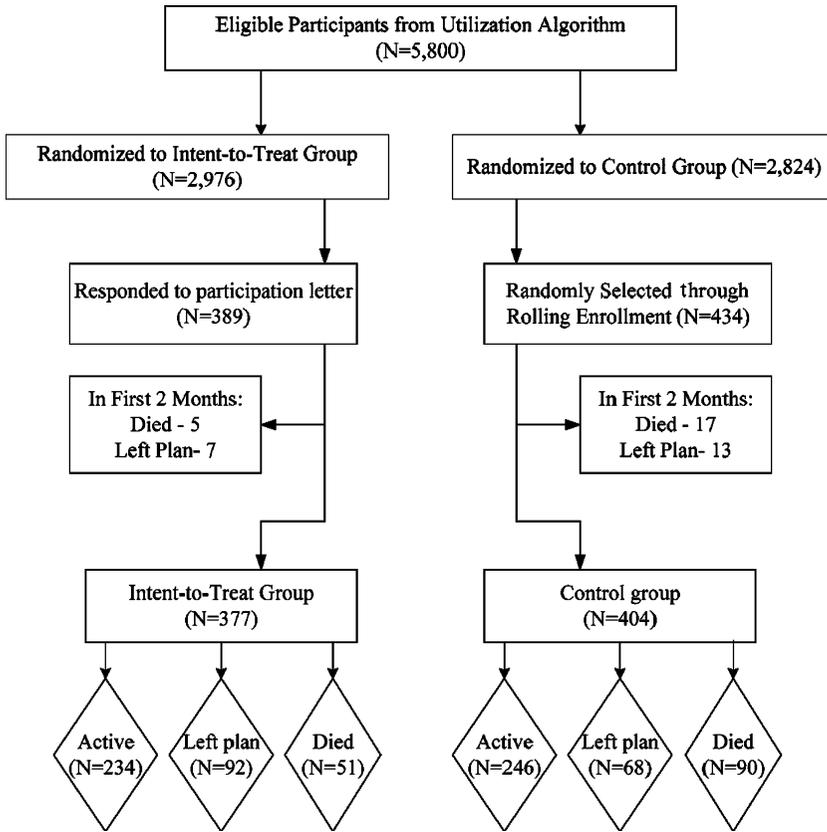
literature review and analyses of the health plan's utilization data, included hospitalizations and emergency room visits in the previous year, number of current medications, and age 85 and older (Wilber et al. 2003). Possible scores which ranged from 4 to 11 were calculated on four areas: (1) *Hospitalizations in previous year* (one hospitalization = 1 point; two or more = 2 points); (2) *Emergency visits in previous year* (one visit = 1 point; two or more = 2 points); (3) *Number of medications* (one to two medications = 1 point; three to four medications = 2 points; five or more medications = 3 points); and (4) *Age 85 and older* (4 points). Nursing home residents and those enrolled in similar studies were excluded. Researchers were blinded to the identities of the participants as all data were encrypted and analyzed in the aggregate. Institutional review boards of the health plan, two social service agencies, and the research partners approved the study.

### *Procedures*

Figure 2 shows the enrollment and study process. Due to concerns about burdening controls and raising expectations for those who would continue to receive usual care, the eligible population ( $N = 5,800$ ) was randomized to ITT ( $N = 2,976$ ) and control ( $N = 2,824$ ) groups before assessment. An a priori power analysis indicated that a sample of 786 participants would be sufficient to conduct subanalyses with the four participating medical groups on the original study variables. We used a rolling enrollment process where potential ITT participants were randomly drawn from the study group and invited to participate via a mailed letter asking permission to contact them by telephone. As ITT subjects entered the study, controls were randomly selected from those in the usual care group. Recruitment was ongoing until an adequate sample was obtained ( $N = 823$ ). Comparisons of ITT and controls at baseline found one significant difference: those in the ITT group had greater utilization of PCPs. To ensure further that the enrollment process did not introduce bias into the study, the ITT and control groups were compared with the larger eligible study population using baseline data and propensity scores. With the exception of higher PCP use among the ITT Group, no unique differences were found that would indicate a sampling bias (Shannon, Wilber, and Allen 2006).

Care advocates contacted consenting members in the ITT group and proceeded with the intervention process described above. Seven participants died and five left the health plan within the first 2 months and were removed from the mortality analysis to ensure proper dosing of the care management intervention, which resulted in an ITT group of 377. A control group of 434

Figure 2: Care Advocate Program Participant Flowchart



members was randomly selected into the analysis from the eligible pool during the rolling enrollment to ensure that control members were alive at onset. In the first 2 months, 17 members died and 13 left the health plan, resulting in a final control group of 404. The control group received “usual and customary care” from the health plan, which included medical group case management services designed to triage and address members’ health related issues, and facilitate access to insured health plan services (e.g., insured durable medical equipment).

*Measures*

The dependent variable, incidence of mortality (died = 1) during the 24-month study period, was reported on a monthly basis from the health plan’s

retention data. Independent variables included sociodemographic factors, health status, and health care utilization. Sociodemographic factors included age, gender, and county of residence. Age was a continuous variable; gender was coded as female. County of residence, a dichotomous variable, was included because benefits differed slightly in the two counties (Los Angeles and Orange) where participants resided. Baseline measures of health status and health care utilization were extracted from member records. Health status included the presence of 10 diagnoses (cancer, chronic obstructive pulmonary disease [COPD] and pneumonia, diabetes, fractures, heart disease, hypertension, kidney disease, osteoarthritis, prostate cancer, and stroke) and the algorithm score (4–11). Given that few scored over 7, values of 7–11 were collapsed to 7+ to normalize the distribution. Health service use included PCP, medical specialist, and emergency room use as dichotomous variables (use = 1) and number of visits in each category. Hospitalization involved two dichotomous variables: one admission and two or more admissions.

### *Sample*

Table 1 reports bivariate data ( $N = 781$ ) including baseline indicators and the outcome variable of interest, mortality. The mean age was 83, about two-thirds were female, the majority resided in Orange County, and the average algorithm score was five. Compared with the control group, the ITT group had significantly higher rates of hypertension ( $p = .034$ ), osteoarthritis ( $p < .001$ ), and use of PCP ( $p < .001$ ). The ITT group had significantly lower mortality rates than the control group over the total study period (14 versus 22 percent) and during the 12-month intervention (6 versus 12 percent), but not in the postintervention period (8 versus 10 percent).

### *Analysis*

We used logistic regression to evaluate the impact of the CA Program on mortality using the *Statistical Package for the Social Sciences* (SPSS), version 11. Independent variables included sociodemographics, health status, and dichotomous variables of health service utilization. During the study, 160 participants left the health plan, with nearly 58 percent of this subset enrolled in the ITT group ( $\chi^2 = 6.86$ ;  $p = .009$ ). Attrition can threaten validity and potentially bias results if, for example, those who left the plan were in worse health than those who remained in the study. This scenario is possible, as previous research has suggested that older adults may leave managed care for Medicare fee-for-service due to exacerbated chronic conditions that ultimately

Table 1: Characteristics of Care Advocate Program Sample (N = 781)

	<i>Intent-to-Treat</i> (N = 377)		<i>Control</i> (N = 404)		<i>t-Test</i>	$\chi^2$	<i>p-Value</i>
	<i>N</i>	<i>% or Mean (SD)</i>	<i>N</i>	<i>% or Mean (SD)</i>			
Baseline							
Sociodemographics							
Age in years (65–100)		82.98 (7.12)		83.66 (7.36)	1.31		.191
Female	244	64.7%	266	65.8%		0.108	.742
LA County resident	169	44.8%	163	40.3%		1.686	.194
Health status							
Cancer	91	24.1%	89	22.0%		0.489	.484
COPD & pneumonia	141	37.4%	132	32.7%		1.917	.166
Diabetes	81	21.5%	65	16.1%		3.736	.053
Fractures	49	13.0%	45	11.1%		0.636	.425
Heart disease	231	61.3%	231	57.2%		1.353	.245
Hypertention	265	70.3%	255	63.1%		4.509	.034
Kidney disease	16	4.2%	14	3.5%		0.320	.572
Osteoarthritis	134	35.5%	91	22.5%		16.117	<.001
Prostate cancer	39	10.3%	43	10.6%		0.019	.892
Stroke	85	22.5%	69	17.1%		3.682	.055
Algorithm score (4–7)		5.12 (1.11)		5.07 (1.03)	– 0.588		.577
Algorithm breakdown						3.582	.167
Low (4 points)	156	41.4%	155	38.4%			
Moderate (5–6 points)	167	44.3%	204	50.5%			
High (7+ points)	54	14.3%	45	11.1%			
Health service utilization							
Primary care physician							
Used at all	369	97.9%	369	91.3%		16.309	<.001
Mean # of visits (0–34)		7.88 (5.48)		6.91 (5.17)	– 2.536		.011
Specialist							
Used at all	325	86.2%	328	81.2%		3.585	.058
Mean # of visits (0–61)		6.46 (7.48)		5.95 (7.57)	– 0.934		.351
Emergency room							
Used at all	95	25.2%	114	28.2%		0.907	.341
Mean # of visits (0–7)		0.39 (0.80)		0.51 (1.06)	1.700		.090
Hospitalization							
Used at all	122	32.4%	127	31.4%		0.077	.782
2+ admissions	45	11.9%	51	12.6%		0.085	.770
Outcome							
Mortality							
Died during total study	51	13.5%	90	22.3%		10.091	<.001
Died during intervention	21	5.6%	49	12.1%		10.280	<.001
Died postintervention	30	8.0%	41	10.1%		1.133	.287

increase mortality risk (Ware et al. 1996). To examine the impact of leaving the health plan, we first tested for differences of those who left between the ITT and control groups finding higher PCP use for the ITT group ( $p = .018$ ), with utilization rates for both groups that mirrored the larger sample (see Appendix A). We also compared those who left during the study period with those who stayed in the study and with those who died (see Appendix B). Compared with those who remained, those who left were significantly younger, had higher rates of diabetes, higher numbers of PCP visits, higher hospital utilization, and were more likely to be residents of Los Angeles County (Los Angeles residents had experienced benefits changes during the study). The predominant reason reported (71 percent) for leaving the health plan was to enroll in another Medicare managed care option (Wilber and Shannon 2003). To further understand the impact of those who left on the study outcomes, we compared those who left with those who died during the 24-month period. Those who died were significantly older, had less hypertension and osteoarthritis, more diabetes and kidney disease, and greater emergency room utilization than those who left the plan. Moreover, an analysis comparing mortality risk between the ITT and control groups excluding those who left the plan did not substantially change the results in the analyses below (see Appendix C). Based on this information, we retained those who left the plan in all analyses and controlled for all variables where differences existed.

## RESULTS

Table 2 reports odds ratios and 95 percent confidence intervals between the ITT and control groups in three models of mortality: died at anytime during the 24-month study period, died during the 12-month intervention period, and died in the postintervention period. All three analyses displayed model significance when controlling for sociodemographic, health status, and health care utilization variables. During the total study period, ITT participants had about half the mortality risk of controls adjusting for other factors (OR = 0.55;  $p = .005$ ). The odds of mortality increased 6 percent with each increasing year of age (OR = 1.06;  $p < .001$ ). Higher risk of mortality was found for those with cancer (OR = 1.69;  $p = .024$ ), heart disease (OR = 1.66;  $p = .028$ ), kidney disease (OR = 4.72;  $p < .001$ ), and at least one emergency room visit (OR = 2.07;  $p = .003$ ). Lower odds of mortality were found among those with fractures (OR = 0.49;  $p = .045$ ), hypertension (OR = 0.40;  $p < .001$ ), and prostate cancer (OR = 0.25;  $p = .004$ ).

Table 2: Adjusted Odds Ratios of Mortality for Care Advocate Program Sample

	<i>Died at All</i> N = 781; Died = 141 OR (95% CI)	<i>Died during Intervention</i> N = 781; Died = 70 OR (95% CI)	<i>Died Postintervention</i> N = 711; Died = 71 OR (95% CI)
ITT group	0.55 (0.36-0.84)**	0.45 (0.25-0.80)**	0.70 (0.40-1.21)
Sociodemographics			
Age in years	1.06 (1.02-1.09)***	1.12 (0.97-1.06)	1.09 (1.04-1.14)***
Female	0.71 (0.45-1.11)	0.53 (0.30-0.94)*	1.03 (0.56-1.93)
LA County resident	1.08 (0.72-1.63)	1.17 (0.68-2.00)	0.99 (0.58-1.71)
Health status			
Cancer	1.69 (1.07-2.67)*	1.29 (0.70-2.39)	1.97 (1.09-3.54)*
COPD & pneumonia	1.25 (0.82-1.90)	0.97 (0.55-1.71)	1.42 (0.82-2.44)
Diabetes	0.98 (0.56-1.74)	1.03 (0.48-2.18)	0.98 (0.46-2.08)
Fractures	0.49 (0.25-.98)*	0.72 (0.30-1.73)	0.41 (0.16-1.06)
Heart disease	1.66 (1.06-2.60)*	0.91 (0.51-1.61)	2.75 (1.41-5.33)**
Hypertension	0.40 (0.26-.62)**	0.31 (0.17-0.55)***	0.60 (0.33-1.09)
Kidney disease	4.72 (2.02-10.99)***	2.15 (0.68-6.80)	5.54 (2.07-14.80)***
Osteoarthritis	0.61 (0.36-1.01)	0.47 (0.22-1.01)	0.74 (0.39-1.41)
Prostate cancer	0.25 (0.10-0.64)**	0.17 (0.04-0.77)*	0.40 (0.13-1.26)
Stroke	1.40 (0.85-2.30)	1.46 (0.74-2.87)	1.26 (0.66-2.41)
Algorithm score	0.91 (0.66-1.25)	1.02 (0.68-1.54)	0.87 (0.57-1.33)
Health service utilization at all			
Primary care physician	1.26 (0.50-3.18)	1.18 (0.35-4.02)	1.22 (0.34-4.33)
Specialist	0.99 (0.55-1.78)	1.06 (0.48-2.33)	0.85 (0.39-1.83)
Emergency room	2.07 (1.28-3.34)**	1.68 (0.83-3.00)	2.30 (1.23-4.30)**
Hospitalization	1.53 (0.94-2.48)	1.78 (0.94-3.37)	1.34 (0.71-2.54)
$\chi^2$ (df = 19)	111.67***	68.31***	71.48***

\* $p < .05$ ;  
 \*\* $p < .01$ ;  
 \*\*\* $p < .001$ .

ITT, intent-to-treat; CI, confidence interval; OR, odds ratio.

During the 12-month intervention period, the ITT group had lower mortality risk than controls (OR = 0.45;  $p = .006$ ). Lower risk was also found for females (OR = 0.53;  $p = .030$ ), those with prostate cancer (OR = 0.17;  $p = .021$ ), and hypertension (OR = 0.31;  $p < .001$ ). In the postintervention phase, mortality differences between the ITT and control groups were not significant ( $p = .198$ ). Factors that contributed to greater odds of mortality were increasing age (OR = 1.09;  $p < .001$ ), cancer (OR = 1.97;  $p = .025$ ), heart disease (OR = 2.75;  $p = .003$ ), kidney disease (OR = 5.54;  $p < .001$ ), and emergency room utilization (OR = 2.30;  $p = .009$ ).

Given the surprising nature of these results, we sought to verify the findings through several additional strategies (not shown). We tested interaction terms combining study-group membership with age, algorithm score, and emergency room utilization as separate factors, none of which produced significant results. We substituted the continuous form of the algorithm score with dichotomous variables of low (4 points), moderate (5–6 points), and high (7+) health care utilization with high scores as the referent group. These variables were not significant and did not improve the mortality odds. We also used Cox proportional hazard modeling (Allison 1984) and difference-in-difference modeling (Buckley and Yi 2003). Findings (not shown) in these models showed the same reduced mortality risk for the ITT group.

## DISCUSSION

This study examined mortality over 24 months for Medicare managed care enrollees in the CA Program, a social care management intervention. Compared with controls, ITT participants had significantly lower odds of mortality. Although ITT and control differences were significant during the intervention period, the treatment effect disappeared in the 12-month postintervention period. Mortality risk was higher for older participants, males, those with heart disease, kidney disease, and emergency room visits and lower for those with fractures, hypertension, and prostate cancer. Although these latter factors have been shown to increase mortality risk in representative samples (Miller and Weissert 2000), they were less predictive in this sample of high health care utilizers. Previous research suggests that, when controlling for comorbidities, prostate cancer may not decrease life expectancy (Albertsen et al. 1995) and treatment of hypertension can extend life expectancy (Sesso et al. 2003). Given the high PCP use for the sample, it is likely participants received some treatment for these conditions, contributing to a lower mortality risk.

Although decreased mortality for the ITT group was not part of the hypothesized outcomes for the CA Program, this robust result begs an answer to the question of what mechanisms influenced mortality risk differences between groups. Based on the literature, we believe at least four elements of the CA Program Model positively influenced the mortality outcome: (1) individualized assessment and links to appropriate services; (2) consumer choice, control, and participant self-management; (3) ongoing monitoring that provided formal support over time; and (4) bridging medical and social care delivery systems through direct linkage and communication channels.

Individualized assessment and service linkage based on personalized needs and preferences were an important facet of the CA Program. The care advocates' approach toward consumer choice tapped the participant's individual agency through an information/linkage intervention geared toward improving knowledge and decision making about options for community support. To address unmet need by offering concrete services, care advocates directly linked participants to hundreds of different HCBS providers throughout a large geographic area based on consumer choice and service availability. Participants used these referrals at varying levels and times throughout the intervention as they saw fit.

Consumer choice maintained the integrity of the program where participants were able to call on care advocates to provide decision-making support and service-related advice without constraints inherent in the health care and HCBS systems. Literature on the philosophy of consumer choice supports the use of professionals to make recommendations for care needs with the consumer retaining responsibility for the decision to use services (Kane 2001; Squillace and Firman 2002). Participants were empowered to take charge of their care needs by making decisions about resources that could improve their daily lives, tapping a preferred level of professional guidance and support. Based on reports from care advocates, guidance and support were critical as several participants spontaneously reported that they were unaware of specific services and how to access them despite the plethora of older adult information venues in the southern California area. These findings reflect previous research that personal empowerment, coupled with support and control, positively affects physical health and mortality, even when the intervention itself appears relatively modest (Langer and Rodin 1976, 1977).

Formal support via the assessment process and monthly telephone call was another potentially powerful component of the intervention. Previous research has demonstrated that vulnerable people with supportive, more extensive social networks have reduced mortality risk relative to those with less extensive

networks (Berkman and Glass 2000). Although studies have focused mostly on informal networks, nonkin (Wolinsky, Johnson, and Stump 1995) and formal care providers such as care advocates play an increasingly important role in the lives of older adults and could provide a protective effect. In this study, participants received ongoing personal contact from care advocates regardless of their HCBS use. Participants accepted regular formal contact and service information without having to acknowledge a particular need for social support.

Even though the individual components described in Figure 1 are supported in the literature, to have had such a substantial effect on mortality we believe that the CA Program as a whole was greater than the sum of its parts. If linkage to services and utilization alone were driving the mortality differential, ITT participants should have maintained a significantly lower mortality risk into the postintervention period, as HCBS use would likely persist beyond the linkage point. However, this was not the case. Paradoxically the Channeling demonstration, an elegant care management program that offered an extensive service menu (Kemper, Applebaum, and Harrigan 1987), had no effect on mortality while another extremely intensive service package actually experienced increased mortality risk among those in the intervention group (Blenkner, Bloom, and Nielsen 1971). In contrast to other well-tested care management programs that offered intensive services, the present model was extremely modest.

In addition to HCBS referrals, care advocates linked participants back to the PCP when potential health care issues arose. This simple connection to medical services may have supported participants by providing ongoing monitoring of their needs in a holistic context and as such, potentially averting a health care crisis. By helping participants bridge the gap between medical care and social care systems (Institute of Medicine 2001) while supporting consumer responsibility and decision making, the CA Program successfully operationalized a model of chronic care support, fitting the pattern of other interventions that reduced mortality risk.

### *Limitations*

Although these findings are encouraging, some limitations must be considered. Due to data constraints, we did not have access to social support, functional data, or HCBS utilization data for the control group outside of scope of this study, so risk analyses could not include these or other variables that might impact the mortality effect. A second concern was the potential self-selection bias within the intervention group. Although there were no significant differences between the groups at baseline with the exception of primary

care use, we conducted two additional analyses to verify our results. First, we compared ITT and controls to the larger eligible study population using socio-demographic, diagnostic, and utilization baseline data. No significant differences were found except in PCP utilization. In addition we used a propensity score methodology to identify a comparison group and tested the findings with this group against the ITT group. Predicted probability scores (PPS), derived from logistic regressions, use observed characteristics of the treatment group to minimize selection bias by controlling for all observed covariates (Braitman and Rosenbaum 2002). We used age, gender, 10 diagnoses based on *International Classification of Diseases, Ninth Revision* codes, number of diagnoses, and health care utilization (dummy variables for PCP, specialist, emergency room, and hospital use). The difference in mortality between the ITT group and this comparison group essentially mirrored the results of the original evaluation ( $t = 2.9, p = .004$ ).

Other limitations included attrition and generalizability. Although 20 percent of the sample left the health plan during the study period, there were no significant differences between the ITT and control groups for those who left beyond PCP use and several additional analyses indicated no particular bias that was not addressed in the multivariate models. With regards to generalizability, the CA Program used only one managed care plan in one geographic area of the country. However, the program used four medical groups contracted with the largest Medicare-risk provider in the United States that, at the time of the study, insured one in six older adults in Medicare managed care. Consequently, generalizability may have been higher than if another Medicare-managed care plan had been used. Future studies should test the intervention in different organizations and locations.

The CA Program was an innovative effort for medical and social care systems to collaborate across professional boundaries to improve HCBS access for Medicare managed care members. The unexpected benefit was decreased mortality risk in the ITT group. Policy implications are apparent for all stakeholders including consumers, loved ones, health care providers, and managed care plans as this model offered a low cost, low-intensity intervention that bridged the chasm separating medical and social care systems.

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## SUPPLEMENTARY MATERIAL

The following supplementary material is available for this article:

Appendix A. Baseline Characteristics of Those Who Left Health Plan ( $N=160$ ).

Appendix B. Baseline Characteristics of Those Who Left Health Plan during Study Compared with Rest of Sample and Died.

Appendix C. Adjusted Odds Ratios of Mortality with Active and Died Only.

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