Title

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Abstract

Health Coaching Intervention to Improve Chronic Disease Outcomes Following an Emergency Department Visit: A Randomized Clinical Trial

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Background. Barriers to accessing primary care and socioeconomic factors are associated with higher emergency department (ED) visit rates. Health coaching has improved linkage to primary care in post-hospitalization settings and improved health outcomes in clinic settings among low-income patients with chronic conditions. However, health coaching has not been tested in the ED.

Objective. To determine if a health coaching intervention changes health care utilization and patient-reported outcomes following an emergency department visit among patients with diabetes or hypertension.

Methods. This study was a 2-arm, single-blinded randomized controlled trial where participants were recruited from a single-site, urban ED. Participants randomized to the intervention arm received 6-months of health coaching after an ED visit, while the control arm received usual care in the ED. We compared self-reported number of ED visits, number of primary care visits, and change in physical health, mental health, patient activation, and medication adherence between intervention (n=10) and control (n=21) arms at 3 months.

Results. At 3 months, there was no statistically significant difference in number of ED visits (0.96 vs. 0.90 visits, p=0.91) or primary care visits (1.2 vs. 1.4 visits, p=0.63) detected between intervention and control groups. In addition, there was no statistically significant difference in change in physical health (-4.7 vs. +0.66, p=0.18), mental health (-8.2 vs. +1.3, p=0.061), patient activation (0 vs. +2.5, p = 0.28), or medication adherence (-0.1 vs. +1.05, p = 0.078) between study arms.

Conclusions. While no statistically significant differences in health care utilization or patient-reported outcomes were found between study arms at 3 months, further research is necessary to determine the effects of the intervention with a larger sample size at 6 months.

Trial Registration. ClinicalTrials.gov identifier: NCT02386540

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Part 1:

Health Coaching to Improve Patient Outcomes Following an Emergency Department Visit: A Literature Review.

I. INTRODUCTION

Health coaching has resulted in improved health outcomes and linkage to primary care in diverse populations of low-income patients. While not a disease-specific intervention, health coaching has been best studied among patients with diabetes or hypertension in clinic-based and hospital-to-home models. This paper will first begin by reviewing the literature on health coaching in medical settings. Next, I will explore how barriers to accessing primary care contribute to non-urgent ED use, and then consider the role of primary care and the ED in the health care system. From there, I will examine community and individual level factors that drive non-urgent ED use, and then consider how health coaching is particularly suited to address patient-identified enabling factors such as having a usual source of care, insurance, transportation, food, and housing. By reviewing each of these areas, I hope to highlight a potential gap in the literature: an evaluation of an ED-initiated health coaching program which addresses patient-identified barriers to care, including unmet medical and social needs, among individuals who may have limited access to the health care system.

II. HEALTH COACHING

Definition and Role

Health coaching is a promising intervention for improving the health of individuals with chronic diseases. While there is not a clear consensus on the definition of health coaching in the literature, for the purposes of this review, health coaching will be defined as "helping patients gain the knowledge, skills, tools and confidence to become active participants in their care so that they can reach their self-identified health goals"[1]. Many types of people can fulfill the role of a health coach, including nurses, social workers, medical assistants (MAs), health professions students, community health workers or "promotores," health educators, community members, or even other patients[1]. When another patient who is currently experiencing the same condition, or who has experienced it in the past, serves as a health coach, this role is referred to as a peer health coach.

While a variety of individuals can serve as a health coach, Bennett and Coleman suggest that the health coaching role involves the following five components[1], though much variation exists in practice. First, health coaches provide patients with self-management support, which involves teaching concrete skills used in the everyday management of chronic conditions as well as problem-solving skills, health information, and support. Second, health coaches serve as a "bridge" between health care providers and patients by checking for understanding of the treatment plan. Also, the health coach is often matched to their patients based on factors such as race, ethnicity, language, gender, or age, which is intended to foster a connection based on shared identity or language-concordance which may not be present between the patient and their other medical providers. While it is common practice in health coaching studies to pair patients with health coaches with as many common demographic characteristics as possible, it is not yet clear from previous studies if certain shared demographic characteristics or life experiences provide an additional intervention effect beyond the techniques employed in health coaching. Third, health coaches assist patients with navigating the complex health system. Fourth, health coaches provide patients with emotional support. Finally, health coaches provide continuity over time between visits or across health care settings. Altogether, health coaches can potentially add to the support a patient receives, with a focus on individual needs and goals.

Theoretical Frameworks

Health coaching interventions are frequently informed by at least one individual level behavior change theory, such as self-efficacy, the transtheoretical model, or social cognitive theory[2]. The first of these theories, self-efficacy, refers to the belief that an individual can exert control over their motivation and behavior in a given situation[3,4]. Bandura suggested that self-efficacy is a critical predictor of whether or not a behavior change will occur. The transtheoretical model (TTM) or stages of change theory, conceptualizes behavior change as a process that occurs over time where individuals move through a series of stages including precontemplation, contemplation, planning, action, and maintenance[5]. However, there have been challenges to TTM, such as the idea that individuals may not pass through all stages and may in fact skip through some[6]. In addition, a major limitation of both self-efficacy and TTM is that these theories do not address the influence of the social and environmental context in which behavior change occurs. Social cognitive theory (SCT), previously known as social learning theory (SLT), hypothesizes that a behavior is determined by a combination of expectancies and incentives, where expectancies can be environmental cues, belief that a behavior will result in a particular outcome, or self-efficacy[4]. SCT begins to address the social context of behavior change but, like self-efficacy and TTM, does not fully address the influence of environmental factors on the individual. Nonetheless, these individual-level behavior change theories frequently form the theoretical basis of health coaching interventions in the literature.

Models

Three distinct models of health coaching have emerged in medical settings: a telephone-based peer health coaching model, a clinic-based "Teamlet Model", and a "hospital-to-home" model:

(1) Telephone-based peer health coaching model

Several early health coaching interventions involved peer health coaching primarily via the telephone. In this model, a peer who has successfully managed the same medical condition serves as the health coach, and the majority of the health coach and patient interaction occurs via the telephone. In some interventions, designated as reciprocal peer support studies, two patients with the same health condition are paired together with neither designated as the health coach.

Trials of telephone peer health coaching interventions have resulted in both positive and negative results. A randomized controlled trial (RCT) of a clinic-based reciprocal peer health coaching program at a Veterans Affairs (VA) health facility for men with diabetes found a significant decrease in hemoglobin A1c (HbA1c) at six months among those in the peer health coaching group as compared to those receiving nurse case management[7]. There was no significant difference in blood pressure, self-reported medication adherence, or diabetes-specific distress between groups. Another RCT of a peer health coaching program for African American veterans with diabetes in which participants were predominantly male also showed a significant decrease in HbA1c among a telephone peer mentor group as compared to usual care[8]. However, an RCT with three arms comparing telephone support from a peer, telephone support from a diabetes specialist nurse coach, and usual care for patients with diabetes recruited from general practices in the United Kingdom found no significant difference in HbA1c, self efficacy, or diabetes-related problems at six months[9]. Limitations of this study include limited generalizability to other settings because minority ethnic groups were underrepresented and baseline diabetes distress was low in all groups. In addition, peer support in this intervention involved supporting physician-driven rather than patient-driven goals, as compared to the two

previous telephone-based peer health coaching studies[7,8], which demonstrated a positive result using patient-driven goals[10].

(2) Clinic-based "Teamlet Model"

Another model of health coaching is the clinic-based "Teamlet model", which was developed by Dr. Bodenheimer at San Francisco General Hospital (SFGH) Family Health Center in 2006. The "teamlet" includes a physician and health coach, who is either a medical assistant (MA) or health worker trained in self-management support and chronic conditions. Patients receive a pre-visit with a language-concordant health coach which includes medication reconciliation and agenda setting based on the patient's priorities. Next, the physician sees the patient in a typical visit. Then, the health coach returns for a post-visit with the patient, during which the health coach checks for understanding and acceptance of the treatment plan. Also during the post-visit, the health coach develops an action plan with the patient that involves patient-identified goals, identifies barriers to achieving those goals, and proposes possible solutions. After the appointment, the health coach follows up with phone calls to support the patient's action plan.

Health coaching interventions using the "Teamlet Model" have resulted in improved health outcomes for patients with diabetes. A prospective cohort study of patients with type 2 diabetes and/or hypertension receiving the "Teamlet Model" of health coaching found significant improvement in four out of five process outcomes, including body mass index (BMI) measured, self-management plan made, and LDL measured, with trends towards improvement in clinical outcomes such as HbA1c, blood pressure, and LDL[11]. Randomized controlled trials have provided stronger evidence for the impact of health coaching. An RCT of a of clinic-based peer health coaching program serving low income patients in San Francisco resulted in a significant decrease in HbA1c among patients with poorly controlled diabetes[10]. However, there was no significant difference in LDL, systolic blood pressure, or BMI. Secondary data analysis revealed that the intervention was most beneficial to patients with a low level of medication adherence and self-management support at baseline[12]. There was no effect modification by demographic (education, race/ethnicity) or psychosocial (depression, health literacy, social support) patient characteristics[12]. Another clinical trial of a clinic-based health coach program that adapted Bodenheimer's "Teamlet Model" for Chinese Americans with diabetes used MAs as health coaches and found no significant difference in mean HbA1c between intervention and control[13]. However, there was a significantly greater percentage of individuals with a well-controlled HbA1c at six months in the intervention group compared to the control when using a larger sample size which did not exclude individuals based on how long after baseline the HbA1c test was obtained[13]. Overall, these studies demonstrate the potential of health coaching to improve health outcomes for diabetic patients.

Clinic-based health coaching interventions have also demonstrated improved health outcomes among patients with hypertension. An RCT of a peer and staff-based health coaching program for low-income African American patients with uncontrolled hypertension found no significant difference in change in 4-year coronary heart disease (CHD) risk, but did find a significant decrease in systolic blood pressure[14]. Also, an RCT of a clinic-based health coaching program serving low-income patients in San Francisco using employed health coaches found no significant difference in systolic blood pressure in patients with poorly controlled hypertension in a health coaching home medication titration group versus health coaching alone[15]. However, when the data were re-analyzed as a before-and-after study, there was a significant association

between the number of health coach encounters and reduction in SBP suggesting a dose effect[15]. These studies suggest that health coaching has the potential to improve systolic blood pressure control in patients with poorly controlled hypertension in a dose-dependent manner.

(3) "Hospital-to-home" transition model

A third health coaching model, The Care Transitions intervention, focuses on supporting and empowering patients and caregivers in the transition from hospitalization to home[1,16]. It involves "four pillars": supporting medication management, developing a personal health record "owned" by the patient and carried between settings, establishing follow-up care, and educating patients on "red flags" related to their health[16]. In this model, the Care Transitions coach is a nurse or social worker who initially meets with the patient during hospitalization, then conducts a home visit and follow-up phone calls[1]. During the home visit, the coach and patient form an action plan based on patient-identified goals, perform medication reconciliation, develop a personal health record, and role-play to build confidence in interacting with health care providers.

Randomized trials of the transition model have demonstrated improvement in health outcomes and changes in health care utilization. In one RCT of adults 65 years or older, participants received a transition intervention which included "tools to promote cross-site communication", encouragement to take an active role, and a "transition coach"[16]. Compared to the control group, participants in the intervention group had significantly lower rehospitalization rates at 30 and 90 days, lower rehospitalization rates due to the condition that caused the index hospitalization at 90 and 180 days, and lower mean hospital costs at 180 days[16]. Another RCT using a transition model paired hospitalized patients with a health coach for a minimum of 14 days after hospitalization until the first post-hospital primary care visit, where participants were low-income adults (ages 18 to 64) with at least one chronic condition[17]. Compared to the control group, intervention patients were significantly more likely to complete a primary care follow-up visit within two weeks. While intervention patients were as likely as the control group to have one readmission within 30 days, they were significantly less likely to have multiple readmissions [17]. In addition, intervention patients had a significant improvement in mental health and patient activation (as measured by the validated Patient Activation Measure scale[18]) relative to controls, with no significant differences between groups in change in physical health or medication adherence. Together, these studies suggest that health coaching provided during a post-hospital transition period has the potential to improve patient-centered health outcomes, linkage to primary care, and rates of rehospitalization in a cost-effective manner.

In summary, health coaching has been best studied in patients with diabetes and hypertension. Health coaching interventions in diverse populations of low-income patients have resulted in improved health outcomes such as HbA1c in diabetes[7,10,13] and systolic blood pressure in individuals with hypertension[14,15], as well as improved linkage to primary care and mental health in patients with at least one chronic illness[17]. The following sections will examine the factors that drive non-urgent ED use, and then consider how health coaching is particularly suited to address patient-identified barriers to care that influence non-urgent ED use.

III. BARRIERS TO ACCESSING PRIMARY CARE CONTRIBUTE TO NONURGENT EMERGENCY DEPARTMENT (ED) USE

In the United States, ED visit rates increased by 23% from 1997 to 2007[19]. In California, an increase in ED visits from 2005 to 2011 was driven by non-injury visits, such as chronic conditions, infections, or non-specific symptoms, as opposed to injury visits[20]. Approximately 37% of all emergency department (ED) visits in the US are for non-urgent conditions[21]. A non-urgent ED visit is often defined as an ED encounter "for conditions which a delay of several hours would not increase the likelihood of an adverse outcome."[21] A qualitative study at an academic medical center examining reasons for non-urgent ED use by insurance status found that individuals with private or public insurance primarily report infrastructure barriers to accessing primary care as a main reason for non-urgent ED use. Infrastructure barriers included factors such as clinic wait time, appointment wait time, clinic hours, and challenges related to finding a primary care provider due to geography or lack of new patient openings. In contrast, uninsured individuals mainly cite insurance, income, and transportation barriers to accessing primary care as reasons for non-urgent ED use[22]. Analysis of a national cross-sectional study, the National Health Interview Survey (NHIS), from 1999 to 2009 revealed that barriers to timely primary care were associated with higher ED utilization for patients with Medicaid or private insurance, where barriers included the following factors: unable to get through on telephone, unable to obtain appointment soon enough, long wait in the physician's office, limited clinic hours, and lack of transportation. Furthermore, Medicaid beneficiaries in this study were more likely to use the ED compared to those with private insurance with the same number of barriers to timely primary care[23]. A cross-sectional analysis of the 2011 NHIS examined reasons for ED use among discharged patients including medical acuity versus access issues[24]. Having a medical acuity issue was defined as answering yes to at least one of the following statements: only hospital could help, advised by health provider to go to ED, or problem too serious for doctor's office or clinic. Access issues were defined as answering yes to at least one of the following statements: did not have another place to go, doctor's office or clinic not open, ED is the closest provider, or ED is usual place to get care. Among the patients who reported no medical acuity issue, 84.2% had at least 1 access issue[24]. A recent systematic review suggested that previous attempts to change the pattern of increasing rates of non-urgent ED use may have failed because they did not address the underlying cause: systems barriers to accessing primary care[21,25]. Non-urgent ED use reflects a problem at the level of the health care system, as opposed to the level of individual behavior, where structural forces create a system in which going to the ED represents a rational choice in order to obtain access to the health care system.

IV. PRIMARY CARE MATTERS BECAUSE THERE ARE BENEFITS TO INDIVIDUALS, POPULATIONS, AND POSSIBLY HEALTH SYSTEMS.

Individuals

Access to primary care has important consequences for individuals, populations, and health systems. On an individual level, people receive health benefits when they have a usual source of care that is a specific primary care provider, as compared to having a usual source of care that is a particular place such as a clinic, or having no usual source of care[26]. Individuals with a primary care provider are more likely to receive appropriate preventive care, more likely to have their problems and needs recognized, and more likely to have accurate diagnoses as compared to

individuals who have a particular place of usual care or no usual source of care[26]. Individuals whose usual source of care is a specific provider are also more likely to have fewer diagnostic tests, fewer prescriptions, fewer hospitalizations, fewer visits to the ED, and lower costs of care[26]. Individuals whose usual source of care is a particular place, but not an specific provider, receive partial benefits as they are more likely to receive preventative care, keep appointments, have fewer hospitalizations, and lower costs as compared to individuals with no usual source of care[26]. These benefits are associated with the four main features of primary care, which include serving as a first contact to the health system, providing care focused on the whole person rather than a specific disease over time, providing comprehensive care, and providing coordinated care[26]. While an individual may receive the same services at an emergency department as compared to a clinic setting, that individual would likely be missing out on the potential benefits of primary care associated with its four key characteristics, including having a relationship with a provider over time[26]. Among patients with chronic diseases such as diabetes or hypertension, having a primary care provider influences disease control: Patients who do visit the ED and who also have a primary care provider have significantly better diabetes control even after adjusting for social and demographic factors[27], and individuals without a primary care provider are more likely to present to the ED for severe, uncontrolled hypertension[28,29]. Altogether, these studies demonstrate that there are potential health benefits for individuals associated with the key features of primary care.

Populations

On a population level, primary care supply, defined as the number of primary care physicians per 100,000 members of the population, has an impact on health disparities between population subgroups. In the US, studies have shown that having enough primary care physicians in a given region is associated with reduced health disparities for factors such as race and socioeconomic status[30]. Thus, an adequate supply of primary care physicians "is associated with a more equitable distribution of health in populations"[30]. Of course, access to primary care is just one factor that influences health disparities. The CDC estimates that only 10% of early deaths are due to shortfalls in medical care, so even if everyone received timely and error free medical treatment, early mortality would be minimally reduced[31]. Other domains, which are not independent from one another, are estimated to provide much greater contributions to early mortality, including genetic predisposition (30%), social circumstances (15%), environmental exposures (5%), and behavioral patterns (40%)[31]. Nonetheless, primary care supply is one factor that influences health care disparities.

The primary care supply within a given community also shows patterns of association with ED use. A study analyzing characteristics of communities associated with greater ED visits among Medicaid enrollees over an 18-month period from 2003-2004 in Oregon found that communities with higher ratios of primary care capacity (calculated as total visits available/estimated visits needed) had fewer ED visits, even after adjusting for differences in enrollee characteristics[32]. In addition, communities that were closer to hospitals (<10 minutes vs. >30 minutes drive) had significantly more ED visits[32]. Furthermore, a study of primary care practice characteristics within a Medicaid managed care organization found lower rates of ED utilization among patients in practices with more evening hours (>12 hours/week) and higher rates of ED utilization for patients in practices where physicians had a greater ratio of patients seen per hour[33]. These studies suggest that ED visits vary based on both supply of primary care physicians and characteristics of available primary care practices.

Health Systems

On a health systems level, the cost of managing care in the ED can be more than in other locations. It has been estimated that 13.7 to 27.1% of ED visits could theoretically be managed at retail clinics or urgent care centers resulting in a cost savings of $4.4 billion annually to the health system[34]. However, this study makes several major assumptions, including that patients know which problems can be addressed in each setting, and have affordable access to these services in place of the ED. While ED costs account for 2-6 percent of all health care spending, the greater potential for cost savings actually lies in the ED's increasing role as a doorway to in-patient admissions because hospitalizations account for 31 percent of health care spending[35–39].

Another way of looking at how much could potentially be saved if non-urgent ED visits were shifted to primary care is to look at the marginal cost of an ED visit, or the change in cost of care as the number of ED visits are decreased[40]. Some have argued that since EDs are "already built, staffed, and ready for calamities", routine care can be delivered with minimal additional cost in the downtime[41]. In a widely cited study examining data from six Michigan hospitals during a two-year period, Williams found an average marginal cost of $88 for all outpatient ED visits ($24 for non-urgent, $67 for semi-urgent, and $148 for urgent visits)[42]. Williams concludes that marginal cost is low, and this finding is supportive of the idea of economies of scale in the ED[42,43].

Looking at 280 California hospitals over a seven-year period, Bamezai et al. came to a different conclusion than Williams: there is higher marginal cost of outpatient ED visits than generally expected, on the order of $295 (nontrauma) or $412 (trauma), both in 1998 US dollars[43]. Bamezai et al. concluded that there is no evidence for economies of scale in the ED because labor, a variable cost, makes up the largest proportion of total costs[43]. Similarly, an earlier cross-sectional study by Granneman et al. in 1981 found the marginal cost of outpatient ED visits to be $260 (nontrauma) or $425 (trauma), inflated to 1998 US dollars[43,44]. When inflated to 1998 US dollars, Williams' estimate of $91 for the average outpatient ED visit appears much lower than the estimates of Bamezai et al. ($295) and Granneman et al. ($260), both for nontrauma outpatient ED visits[43]. Furthermore, Williams' estimate includes physician costs when Bamezai and Granneman's estimates do not[42,43] However, one limitation of Bamezai et al.'s analysis is that outpatient ED visits are defined as those that do not result in hospital admission, even though some of these visits may have been urgent, which may result in an overestimation of marginal cost[45,46]. Further research is needed in order to elucidate the marginal cost of non-urgent ED use[46], especially given that is not yet clear how ED demand may have changed following the implementation of the Patient Protection and Affordable Care Act (ACA).

Another important consideration is the financial pressures on hospital EDs. Many hospital EDs have expanded in response to increasing ED demand, so they may have little financial incentive to discourage emergency department use among privately and publicly insured patients[47]. While there are clear individual and population-level benefits to access to primary care, shifting non-urgent ED use to primary care settings by increasing access may not necessarily result in significant cost savings.

V. ROLE OF THE ED IN THE HEALTH CARE SYSTEM

While the proportion of people eligible for insurance coverage has expanded with the implementation of the ACA since 2010, the ED is still the only place in the health care system in which every single person is guaranteed health care. Passage of the Emergency Medical

Treatment and Active Labor Act (EMTALA) by Congress in 1986 was originally intended to prevent "patient dumping" from private to public hospitals[48,49]. Since then, EMTALA has guaranteed that any person who comes to the ED and requests care for a medical condition must be provided with an appropriate medical screening examination regardless of financial ability to pay or insurance status[48]. Furthermore, if a patient is found to have an emergency medical condition, the ED must stabilize the patient or, if unable to stabilize, transfer the patient to another location with capacity to provide the correct services. Finally, EMTALA mandates that hospitals with specialized services accept transfers so long as they have the capacity[48]. In the context of non-urgent ED care, this means that all individuals who are able to go to an ED are guaranteed a medical screening exam for any condition. Furthermore, there is a general understanding by the public that all people will receive care in the ED. In fact, a qualitative study of reasons for non-urgent ED use found that patients of low SES perceived hospital care, as "less expensive, more accessible, and of higher quality than ambulatory care"[50]. The passage of EMTALA, combined with the public's general understanding of the ED, means that the ED serves an important public health function. In fact, Garrison suggested that "the distribution of reasons patients visit the ED could serve as a barometer for the surrounding community of its inhabitants' health status and patterns of care"[51]. As the doorway to the health system, non-urgent ED use serves as an opportunity to address barriers to care and unmet medical or social needs in patients who may otherwise have limited access to the health care system.

VI. COMMUNITY AND INDIVIDUAL LEVEL FACTORS INFLUENCE ACCESS TO CARE

One widely used model for understanding the factors that influence access to care is the Andersen Model of Health Care Utilization, which has undergone many revisions over the years including adaptations to describe access in safety net populations[52–55]. This model hypothesizes that access is determined by a combination of factors at the individual and community level. At the community level, determinants of access include the characteristics of the safety net population, public policy support for the safety net, the low-income population, public policy support for the low-income population, and the broader health care market and services available in a given area. At the individual level, determinants of access include: "predisposing factors" or demographic characteristics, one's position within existing social hierarchies, and beliefs; "enabling factors" or resources which help facilitate or impede access to care such as having a usual source of care, insurance, income, or transportation; and "need" which is a combination of one's perceived and evaluated health status. Together, determinants at the community and individual level influence potential access, which is often conceptualized as having a usual source of care, as well as realized access, or actual use of health care services. Finally, realized access (as well as community and individual determinants) influences health outcomes, such as effective and efficient access. The most recent version of the Andersen model adds the process of medical care, or the "behavior of the provider interacting with patients in the delivery of medical care" as an outcome of access, which in turn influences future access[53]. This model offers a helpful starting point in considering the complex factors that influence access in order to work towards a potential point for an optimal health coaching intervention.

In the Andersen Model of Health Care Utilization adapted by Davidson et al., the safety net population is further divided into three broad groups: the uninsured, Medicaid beneficiaries, and vulnerable populations[55]. While Davidson et al. define vulnerable populations as "those who are

economically disadvantaged and whose social or health characteristics increase their risks and need for assistance," an alternate definition might include describing vulnerable populations as individuals who are experiencing structural vulnerabilities. Structural vulnerability results from the interaction between one's position within existing social hierarchies and structural forces at the level of institutions and policies[56]. Positionality is based on "assumed or attributed status (including health-related deservingness, normality, credibility, intelligence, imputed honesty), as well as socioeconomic and demographic attributes (gender, social class, race, sexuality, citizenship status)."[56] Additional attributes might include education level, health literacy, limited English proficiency, living conditions, financial status, physical and cognitive ability, and many more. Structural vulnerability acts to "position individuals differentially within specific political, economic and institutional sites in ways that affect health and long-term life chances."[56] Experiences of structural vulnerability affect both an individual's health and opportunities for health care such as access to the health care system. Using this definition of structural vulnerability may allow further incorporation of historical, political, economic, and social forces into the interaction between community and individual determinants of access in the Andersen model.

VII. PREVIOUS ED INTERVENTIONS HAVE TARGETED ENABLING FACTORS

Enabling Services During the Index ED Visit

One approach employed in previous interventions aiming to reduce non-urgent ED use and increase access to primary care has involved incorporating enabling services, or non-clinical services that improve access to care and health outcomes, into ED care. Enabling services can include services such as "case management, referrals, translation/interpretation, transportation, eligibility assistance, health education, environmental health risk reduction, health literacy, and outreach."[57] An observational study of a triage-referral intervention, where ED patients were triaged by a trained nurse and those found to have non-urgent conditions received referrals rather than treatment, found that over 15% of ambulatory patients were referred elsewhere with no significant adverse events[58]. Although 79% of referred patients reached for phone follow-up were able to receive care elsewhere within two days, the study did not assess participants' future health care utilization[58]. In a randomized controlled trial of a case-management intervention for uninsured patients visiting the ED, case managers helped each patient pick a primary care provider during the ED visit and facilitated setting up a follow-up visit[59]. This intervention aimed to decrease perceived barriers to accessing primary care such as wait time and difficulty getting an appointment with a provider. This study demonstrated that participants were significantly more likely to have a primary care contact after the ED intervention as compared to the control group, however there was no significant difference in number of inpatient admissions or ED visits following the intervention. Another example of an intervention which provided enabling services during the ED visit asked adults presenting to the ED for non-urgent conditions at an urban safety-net hospital if they would be willing to be seen in the primary care clinic instead of the ED and, if so, navigators escorted patients to the clinic[29]. This quasi-experimental study found the intervention group had a significantly greater rate of at least one primary care follow-up appointment within one year as compared to a comparison group, but no significant difference in the number of ED visits in a one-year period. The latter two studies serve as examples of previous ED-based interventions that have had some success in increasing primary

care visits by decreasing perceived barriers to primary care on a short-term basis. However, neither approach resulted in any significant effect on ED visits.

Enabling Services After the Index ED Visit

Other interventions to decrease non-urgent ED use and increase access to primary care have examined the effects of incorporating enabling services after the ED visit. A retrospective cohort study of African American patients on Medicaid with diabetes, hypertension, or both paired patients seen in the ED with a community health worker (CHW), who was a volunteer living in the same geographic community[60]. The CHW worked with patients to link them to primary care, monitor self-management behaviors, help with Medicaid eligibility, and provide social support. This study found a significant 38% reduction for mean ED visits for a one-year period after enrollment compared to a one-year period before enrollment (1.49 vs, 0.93; $p = 0.02$). Also, there was a significant decrease in ED admissions to the hospital, total hospital admissions, and Medicaid reimbursements one year after initial contact with the CHW. Major limitations of this study included lack of a comparison group and selection bias, especially due to the incentive of providing free health care. A more recent quasi-experimental study paired uninsured or low SES patients with a CHW who had strong cultural and linguistic ties to the patient population and was trained in peer counseling[61]. The CHW demonstrated how to navigate the medical system, addressed barriers to accessing primary care, and provided referrals to community resources. The intervention group had a significant decrease in ED visits for primary care-related concerns during a 1-year period after the intervention, but no change over a 2-year period. Limitations included selection bias due to lack of randomization. Furthermore, while the program included a cost-effectiveness component, charges were used rather than costs and the analysis only examined the impact on one hospital rather than the health system. Despite methodological limitations, both of these interventions used enabling services after the index visit and achieved a short-term decrease in ED visits.

VIII. HEALTH COACHING INTERVENTION SHOULD TARGET PATIENT-IDENTIFIED ENABLING FACTORS

While community factors at the level of the primary care system should also be addressed through additional interventions, a health coaching program has the potential to improve access to primary care and reduce non-urgent ED use by focusing on patient-identified enabling factors. Enabling factors are resources that facilitate access to care, and may include but are not limited to having a usual source of care, insurance, transportation, and access to food and housing.

Usual Source of Care

Individuals who do not have a usual source of care, especially those without insurance or who are publicly insured with Medicaid, are more likely to have a greater proportion of their outpatient visits at the ED[62]. A cross-sectional study analyzing 2013 NHIS data for patients with at least one ED visit in the past 12 months found that patients without a usual source of care were 1.5 to 2 times more likely to use the ED because of an access barrier as compared to those with a usual source of care even after adjusting for insurance status[63].

Other studies have cautioned that having a usual source of care may be necessary, but not sufficient, to improve access. First, infrastructure barriers such as appointment wait time or inability to get through on the telephone may still prevent access to one's usual source of care[64].

Second, patient satisfaction may also play an important role in realized access to primary care. A national cross-sectional study of adults found that those who reported lower satisfaction with their usual source of care were significantly more likely to have had a non-urgent ED visit[65]. Furthermore, a recent national cross-sectional study found that patients who rated the quality level of their usual source of care as low or intermediate had higher odds and predicted probability of non-urgent ED care costs as compared to patients reporting high quality care [66]. Improving both access to and satisfaction with a usual source of primary care may be essential to reducing non-urgent ED use[65].

Insurance

In California, ED visit rates for adults under 65 years increased from 2005 to 2011, with a significant increase in ED visit rate for individuals with Medicaid as compared to those with private or no insurance[67]. This change may reflect reduced access to primary care and is supported by the additional finding of increasing rates of ED visits for ambulatory-care sensitive conditions (ACSCs) among those with Medicaid[67]. Ambulatory-care sensitive conditions are medical conditions, such as diabetes and hypertension, where the likelihood of hospitalization and ED visits may be reduced or prevented by timely access to primary care[68]. Like patients with Medicaid, uninsured patients in California also had an increasing rate of ED visits for ACSCs, whereas the privately insured did not[67].

During the same time period in California, a different pattern in ED visit rates was observed among adults versus children by insurance status[69]. Among children under eighteen-years-old, the largest increases in ED visits rates in California from 2005 to 2011 were among those with private insurance or no insurance, whereas the fastest growing rate of ED visits for adults was among those with Medicaid[69]. This finding suggests that different factors may influence ED use in adults and children, and therefore policy changes like insurance expansion may also affect these populations differently[69].

While barriers to accessing primary care vary with insurance status among adults, it is not clear if non-urgent ED utilization varies with insurance status. Studies have found there is not a significant difference in non-emergent ED visits between uninsured vs. privately insured or public vs. privately insured[70] and that uninsured individuals are equally likely to be triaged as non-urgent when visiting the ED as compared to those with Medicaid or those with private insurance[71]. Nonetheless, insurance is cited by uninsured patients visiting the ED as one of the major barriers to accessing primary care, which contributes to their non-urgent ED use[22]. Furthermore, within the category of adults, there has been a significant decrease in ED visit rate among young adults ages 19-25 relative to a comparison group ages 27-29 since the passage of the ACA in 2010[72]. The decrease in ED visit rate was mostly explained by decreases among women, weekday visits, non-urgent conditions, and conditions that can be treated in other settings, suggesting that young adults affected by this policy change may have been able to obtain non-urgent medical care in other settings than the ED leading to a more efficient use of health services[72].

Transportation

Patients are more likely to visit the ED if they experience transportation barriers to accessing care. Lack of transportation is one of several timely access barriers associated with higher ED utilization for patients with Medicaid or private insurance[23]. Patients with at least one non-emergent visit over a two-year period are more likely to report difficulty getting to their usual source of care as compared to individuals without any ED visits[70]. Patients who do have a usual

source of care, but travel more than one hour to reach their usual source of care, are more likely to visit the ED for multiple non-emergent problems as compared to those who travel less than one hour[70]. In addition, those with at least one non-emergent ED visit are more likely to be driven to their usual source of care by someone else as compared to those without any ED visits[70]. Since most clinics are open during business hours, the patient or the individual driving the patient may not be able to miss work without loss of pay or even potentially jeopardizing their employment to attend an appointment during the day at their usual source of care instead of the ED[73]. In some cases, patients may not have transportation or another individual who can provide a ride. Kangovi et al.'s hospital-to-home health coaching study described one case of a patient without transportation who reported waiting until his health declined and then calling an ambulance[17]. Finally, transportation is cited by both insured and uninsured patients alike as a barrier to accessing primary care, which contributes to non-urgent ED use[22].

Access to Food and Stable Housing

A cross-sectional study of low-income adults in the US found housing instability and food insecurity were each independently associated with postponing needed medical care, postponing medications, increased ED use, and increased hospitalizations[74]. In addition, a cross-sectional study of adults presenting to a single ED found that food insecurity was associated with increased episodes of hypoglycemia reported by diabetic patients[75]. Similarly, a cross-sectional study of adults presenting to a single ED found that food insecurity was significantly associated with patients needing to make choices between buying medicine or food, which sometimes leads to hospitalizations or ED visits according to patients' reports[76]. While housing insecurity and food insecurity were not specifically cited by patients presenting to the ED in a qualitative study of reasons for non-urgent ED use[22], "these competing life demands may lead to delays in seeking care and predispose to acute care."[74]

In summary, patient-identified enabling factors, such as usual source of care, insurance, transportation, and access to food and stable housing, are a potentially modifiable point of intervention which may influence primary care and ED use. Health coaching offers an opportunity to address these enabling factors. For example, a hospital-to-home health coaching model for adults of low SES improved linkage to primary care follow-up and mental health through an intervention that supported patient-identified goals related to psychosocial support, insurance, medication costs, transportation, housing, and food[17]. In addition to improving health outcomes and linkage to primary care, health coaching may also influence patient satisfaction with a primary care provider. A randomized controlled trial of a clinic-based health coaching program for low-income patients with diabetes, hypertension, or hyperlipidemia found that patients who received health coaching had significantly greater improvements in measures of satisfaction and trust in their primary care provider as compared to patients receiving usual care[77]. Health coaching has the potential to address patient-identified enabling factors that influence health and access to care in a collaborative manner that builds trust and satisfaction.

IX. GAP: ED TO PRIMARY CARE TRANSITION MODEL

Randomized controlled trials of clinic-based models provide evidence that health coaching improves health outcomes for patients of low SES with diabetes[7,10,13] and hypertension[14,15] in outpatient settings. Furthermore, a hospital-to-home health coaching model for adults of low SES

has been shown to improve linkage to primary care follow-up[17] and reduce hospitalization rates while controlling costs[16]. One gap in the literature that remains is the implementation and evaluation of a health coaching transition model initiated in the emergency department (ED) rather than in an in-patient or clinic setting. There is some evidence that enabling services provided by a CHW or patient navigator during and after the index ED visits is associated with a short-term decrease in ED utilization[60,61]. However, the roles of CHWs or patient navigators in these studies have been different from that of a health coach. A health coach focuses on supporting patient-identified goals and enabling factors, which may influence health as well as access to care.

X. RESEARCH QUESTION

This study is a randomized controlled trial to determine if a health coaching intervention initiated in the ED at Alameda Health System's Highland Hospital can improve post-ED health outcomes among low-SES patients with hypertension or diabetes. Specifically we will examine the following questions: (1) Is an ED-initiated health coaching intervention associated with a change in the number of ED visits among the intervention group compared to the control? (2) Is an ED-initiated health coaching intervention associated with a change in primary care visits, quality of life, patient activation, or medication adherence among the intervention group compared to the control?

These questions will be addressed through a randomized controlled trial, where participants in the intervention arm will receive health coaching for six months following an initial ED visit and participants in the control arm will receive usual care in the ED. In the intervention arm, participants are paired with a health coach by preferred language and work together one-on-one to create and implement an action plan in order to achieve health-related goals identified by the patient, such as access to social support, self-management support, assistance navigating the health care system, and resources (ex. food, housing, transportation, etc.). This intervention aims to improve access to primary care and the self-reported health of participants. Outcomes include ED visits, primary care visits, physical and mental health[78], patient activation[18], and medication adherence[79]. If successful, this program could serve as a new, ED-initiated health coaching model, which utilizes trained community members to provide individualized self-management support and address social determinants of health influencing post-ED outcomes.

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Part 2:

Health Coaching Intervention to Improve Chronic Disease Outcomes Following an Emergency Department Visit: A Randomized Clinical Trial

INTRODUCTION

Between 1997 and 2007, the total number of annual emergency department (ED) visits increased by 23%, an amount almost double the expected increase based on population growth alone[1]. Adults with Medicaid as the source of payment contributed to the majority of this increase, and among this population there was a significant increase in ED visit rates for ambulatory-care sensitive conditions suggesting that barriers to accessing primary care may play a role in increased ED utilization[1]. Although the majority of the increase in ED utilization from 1997 to 2007 occurred among adults with Medicaid, uninsured patients are receiving an increasing proportion of their ambulatory care in ED settings due to decreased access to primary care[1–3]. Patients who face barriers to accessing primary care may miss out on the benefits associated with its longitudinal nature. Individuals with a primary care provider (PCP) are more likely to receive appropriate preventive care, have their problems and needs recognized, be accurately diagnosed, have fewer diagnostic tests, receive fewer prescriptions, have fewer hospitalizations, incur lower care costs, and report higher satisfaction as compared to individuals with no usual source of care[4].

Barriers to accessing primary care are associated with higher ED utilization,[5,6] an association that has remained consistent from 1999 to 2009[7]. Over the same time period, the prevalence of barriers to timely primary care has increased among US adults, especially for those with at least one ED visit in a year[7]. Among patients discharged from the ED in 2011 who reported no medical acuity issue as a reason for ED use, 84.2% reported at least one access issue[8]. Reasons for non-urgent ED use among the insured include infrastructure barriers such as appointment and clinic wait time, clinic hours, and challenges related to finding a primary care provider (PCP), while uninsured individuals cite insurance, income, and transportation barriers[9]. Among low-income adults, socioeconomic factors such as housing instability and food insecurity are also each independently associated with postponing needed medical care, postponing filling prescriptions for medications, increased ED use, and increased hospitalizations, suggesting that these competing demands may contribute to delays in seeking care which cause patients to present later in an acute care setting[10].

Although long-term policy changes are needed to increase the capacity of the primary care infrastructure[9], strategies to complement long-term solutions such as ED-based patient navigators or community health workers (CHWs) may help to address the medical and social needs of vulnerable populations[8]. Health coaching offers one potential approach to increase access to primary care while addressing unmet medical or social needs for patients of low socioeconomic status (SES). Health coaches are trained peers, CHWs, or health care employees who provide self-management support, patient navigation, emotional support, and continuity, while "bridging the gap" between patients and their providers[11]. A key component of health coaching involves developing an action plan to support patient-identified goals, which can range from implementing a behavioral change[12] to accessing resources such as social support, insurance, low-cost medications, transportation, housing, or food[13]. Clinic-based health coaching interventions for low SES populations have been shown to significantly improve health outcomes in patients with diabetes[14–16] and hypertension[17]. Among adults 65 years or older, health coaching beginning during hospitalization and continuing into the post-hospitalization period has resulted in significantly lower rehospitalization rates at 30 and 90 days and lower mean hospital costs at 180 days[18]. For adults under 65 with at least one chronic condition, health coaching during and after hospitalization has resulted in significantly greater linkage to primary

care, fewer multiple hospital re-admissions, and greater improvements in mental health and patient activation among patients of low SES with one or more chronic conditions[13].

While previous health coaching interventions have demonstrated the potential to improve patient outcomes in clinic-based[14–17] and post-hospitalization settings[13,18], to our knowledge health coaching has not yet been applied to the post-ED setting. This study is a randomized controlled trial to determine if a six-month health coaching intervention initiated in the ED at Alameda Health System-Highland Hospital can improve post-ED health outcomes among adults of low SES with hypertension or diabetes. We hypothesized that this intervention would result in fewer ED visits, greater numbers of primary care visits, and improved physical health, mental health, patient activation, and medication adherence. Since data collection for the six-month study is in progress, this thesis will examine changes between baseline and three months for the subset of patients who were enrolled on or before May 20, 2015.

METHODS

Study Design. This study was a 2-arm, single blinded, randomized controlled trial (RCT) of a health coaching intervention. The study was approved by the institutional review boards of the University of California Berkeley and Alameda Health System. The original health coaching initiative was funded by a grant from the Robert Wood Johnson Foundation. This trial, unrelated to the grant, was funded by a grant from Andrew Levitt Center for Social Emergency Medicine.

Study Setting and Population. This study was conducted at the ED of Alameda Health System-Highland Hospital, an urban ED with an emergency medicine residency program located in Oakland, CA. The annual ED census is over 90,000 patients[19]. The ED patient population is approximately 45% black, 30% Hispanic, 20% white, and 5% other races or ethnicities[20]. Most patients (85%) have public insurance, while 10% are uninsured, and 5% are privately insured.[20] Eligible ED patients (1) had a diagnosis of diabetes, hypertension, or both; (2) were at least 18 years old; (3) spoke English or Spanish; (4) lived in a stable place of residence; (5) could be reached via cell phone or home phone; (6) planned to reside in Alameda County for the next year; and (7) had at least one of the following factors which may indicate difficulty accessing primary care: (a) continuous medication gap of at least 1 month during the last year, (b) at least 1 visit to the ED in the last year not including the index ED visit; or (c) no visits to a primary care provider in the last year. Patients were excluded if they were (1) medically unstable; (2) unable to provide informed consent due to a serious emotional or neurologic condition; (3) documented to have alcohol or drug use during an ED visit within the last year without also participating in a drug or alcohol treatment program; (4) already enrolled in a diabetes or hypertension management program or study; (5) admitted to the hospital from the ED; (6) currently under an involuntary psychiatric hold; or (7) currently incarcerated. One of the original exclusion criteria, life expectancy of less than one year was removed on March 24, 2015 because providers found it difficult to assess this criterion objectively.

Patient Enrollment. Health coaches were present in the ED between the hours of 9 AM to 9 PM on weekdays and 9 AM to 3 PM on Saturdays. During ED shifts, health coaches screened the electronic medical record (EMR) for ED patients with a diagnosis of diabetes, hypertension, or both. After conducting an initial screening using the EMR and consulting with a medical provider, health coaches approached patients in their rooms to provide a previously developed

ten-minute health education session on diabetes and hypertension, which is a component of usual ED care. A hospital language-interpreter was utilized if needed. After providing health education, health coaches introduced the research study and conducted further eligibility screening. If patients were eligible and willing to participate, health coaches obtained written informed consent. Health coaches then selected a sealed packet from the research office, which had been previously randomized. A member of the study team (O.A.) not involved in outcomes assessment assigned each packet to the control or intervention arm in a 2:1 ratio respectively using a computer-generated randomization algorithm with permuted block design and variable block sizes.[21] Uneven allocation in favor of the control group was chosen based on health coach program capacity and in anticipation of a greater loss to follow-up among the control group. Allocation was concealed from health coaches until the moment of assignment. After unsealing the packet and revealing group assignment, health coaches collected demographic and baseline survey measures. Patient recruitment began on February 6, 2015. Only baseline and 3-month surveys for a subset of patients enrolled on or before May 20, 2015 were used for purposes of this thesis. Data collection for the larger study will continue until a target sample size of 300 participants is reached.

Procedures. Participants in the control arm received usual care in the ED, including a ten-minute health education session provided by a health coach. Control participants received up to $25 in gift cards to Safeway ($10 at enrollment and $5 mailed after each completed follow-up survey).

In addition to usual care, participants assigned to the intervention arm received six months of health coaching provided by the Alameda County Health Coach Program (ACHCP). The ACHCP was developed by members of the study team (J.G. and B.P.). Individuals selected to be health coaches were young adults with at least a high school diploma or equivalent who represent the diverse patient population served by Highland Hospital. Coaches are from backgrounds underrepresented in medicine and most have an interest in pursuing a career in the health professions. Health coaches were employed part-time and received over 180 hours of training in topics such as motivational interviewing, self-management support for individuals with diabetes or hypertension, advocacy, and patient navigation. Intervention participants were paired with a language-concordant health coach. Participants could also request to be paired with a health coach of a preferred gender.

Health coaches initially established contact by calling the participant within one week of enrollment and setting up an initial home visit. During the home visit, health coaches used a semi-structured interview guide to understand individual needs and goals, and then collaborated with participants to develop an action plan. Action plans included a specific goal, a plan to achieve this goal, and confidence level in reaching this goal[12]. To carry out the action plan, health coaches interacted with participants by text, phone, or meeting in-person at a participant's home or mutually agreed upon location. If a participant did not have health insurance, health coaches assisted with applying for coverage. In addition, if a participant did not have a primary care provider (PCP) or experienced barriers to accessing their usual source of care, health coaches assisted participants in establishing and accessing a PCP. Health coaches also offered to accompany participants to health care visits and to access community resources (e.g. social services, food pantries, support groups, etc.) as related to the participant's action plan. Participants in the intervention arm did not receive monetary compensation or a gift card.

The ACHCP employed nine health coaches part-time and one program coordinator full-time. Health coaches were initially supervised by a senior health coach or the program coordinator. Health coaches were observed regularly and received feedback from one of the principal investigators (B.P.) or the program coordinator. In addition, health coaches attended weekly team meetings to discuss progress, problem-solve challenges, and receive on-going training.

Baseline Measures. Health coaches collected the following data at enrollment: age, gender, housing type, years at current residence, preferred language, marital status, race/ethnicity, education level, employment status, household income[22,23], diabetes status, hypertension status, years since diagnosis[24,25], insurance, unmet need or delayed health care[26], usual source of care[24,25], number of ED visits in the last month and year[24,25], and number of primary care visits in the last year[24,25]. Baseline data also included the 12-Item Short Form Health Survey (SF-12v2)[27], the Patient Activation Measure (PAM)[28], and the Morisky Medication Adherence Scale (MMAS-8)[29].

Outcome Measures. The prespecified primary outcome was number of ED visits within 3 months of the index ED visit, ascertained by self-report. Self-reported data was collected in order to capture visits at any ED location. The number of ED visits was used to determine the proportion of patients with any return ED visit, the proportion of patients with multiple return ED visits, and the proportion of patients with a decrease in ED visits.

Prespecified secondary outcomes included primary care visits and patient-reported health outcomes. Number of primary care visits within 3 months of the index ED visit was collected by patient self-report and used to determine the proportion of patients with an increase in primary care visits. Self-reported data was collected to account for visits at any primary care location. Number of ED visits resulting in hospitalization within 3 months of the index ED visit was collected by self-report. The mean change in self-rated mental health and physical health between baseline and 3 months was measured using the licensing instructions of the 12-Item Short Form Health Survey (SF-12v2)[27]. The answer for each SF12v2 item was entered into a score calculator, which calculated a Physical Component Summary score and Mental Component Summary score ranging from 0 to 100. The mean change in patient activation between baseline and 3 months was measured using the licensing instructions of the Patient Activation Measure (PAM)[28]. The answer for each PAM item was entered into a score calculator, which calculated a PAM score ranging from 0 to 100. The mean change in medication adherence was measured using the licensing instructions of the Morisky Medication Adherence Scale (MMAS-8)[29]. The answer to each item was assigned a value, and a score was determined by summing the values of all answers.

Research assistants, who were blinded to group assignment and hypotheses, used standardized interview guides to collect follow-up outcomes by phone at approximately 1-month, 3-months, and 6-months after enrollment. Only baseline and 3-month surveys were used for the purposes of the analysis for this thesis. Research assistants completed a minimum of seven calls before patients were considered lost to follow-up.

Analysis. Frequencies and means of baseline demographic characteristics and outcome measures were compared between study arms using a t-test or Wilcoxon-Mann-Whitney test for continuous variables and a chi-square test or Fisher's exact test for categorical variables.

We performed an intention-to-treat analysis based on initial study arm assignment. Only complete cases (defined as providing at a minimum the number of ED visits since baseline at the 3-month phone call) were used for analysis. The frequencies and means of baseline demographic characteristics and outcome measures were compared between participants lost to follow-up versus participants that remained in the study using a Wilcoxon-Mann-Whitney or t-test for continuous variables and a chi-square test or Fisher's exact test for categorical variables.

Among the complete cases, the number of ED and primary care visits between baseline and 3 months were adjusted for the number of days between baseline and 3-month calls. The number of ED visits from baseline to 3 months was compared between the intervention and control groups using a Wilcoxon-Mann-Whitney test. Similarly, the number of primary care visits from baseline to 3 months was compared between the intervention and control groups using a Wilcoxon-Mann-Whitney test.

In order to determine the proportion of patients with a change in ED visits from 3 months before the index ED visit as compared to the first 3 months of the intervention, the number of ED visits occurring 3 months before the start of the intervention was estimated two ways: 1) dividing the number of ED visits in the last year reported at baseline by four, or 2) multiplying the number of ED visits in the last month reported at baseline by three. The number of primary care visits occurring 3 months before the start of the intervention was estimated by dividing the number of primary care visits reported in the last year at baseline by four. The proportion of patients with an increase in primary care visits, the proportion of patients with a decrease in ED visits, the proportion of patients with any ED visits, and the proportion of patients with multiple ED visits were all compared between the intervention and control groups using chi-square tests.

The mean SF-12 physical health component score, mean SF-12 mental health component score, mean patient activation score, and medication adherence score were compared between the intervention and control groups using a t-test or Wilcoxon-Mann-Whitney test.

RESULTS

Study Patients. Out of 615 patients screened for eligibility, 484 were found to be ineligible because they did not meet inclusion criteria. Among the 131 eligible individuals, 60 (45.8%) declined to participate and 71 (54.2%) enrolled. Thirty-seven participants completed a 3-month follow up with a retention rate of 52%. Similar percentages of intervention and control participants completed a 3-month follow up (43.5% vs. 56.3%, p-value =0.31).

Among the 37 participants completing a 3-month follow-up, the mean age was 52.8 years (Table 1). Forty-six percent of participants were female. Most identified as Black or African-American (46.0%) or Hispanic or Latino (35.1%). Sixty-four percent had a yearly income under $10,000. Nearly all participants were insured with MediCal (56.8%), Medicare (18.9%), or private insurance (5.4%), or were enrolled in a county program for health care services (16.2%). Thirty-

five percent of participants reported delaying needed medical care within the last year and 22.9% reported having unmet medical needs. The 2 study arms were similar for all baseline characteristics except the intervention group had a higher median number of years at current residence (8.5 years vs. 3.0 years; p=0.046) and a higher SF-12 physical health component score (46.7 vs. 38.3; p=0.032).

Thirty-one out of 71 individuals enrolled were lost to follow-up at 3-months. Two participants discontinued the intervention. One cited limited time due to a new job as a reason for discontinuing the intervention and the other did not provide a reason. One control participant discontinued the study and did not provide a reason. Participants who were excluded from the analysis because they were lost to follow up (N=31) or discontinued the study (N=3) were similar in all baseline characteristics to those who remained in the study except participants excluded from analysis were more likely to have answered yes to the question "Was there any time during the past 12 months when you put off or postponed getting medical care you thought you needed?" (60.6% vs. 36.1%, p-value =0.042) (Table 3 in Appendix).

Figure 1. CONSORT diagram of participant flow.

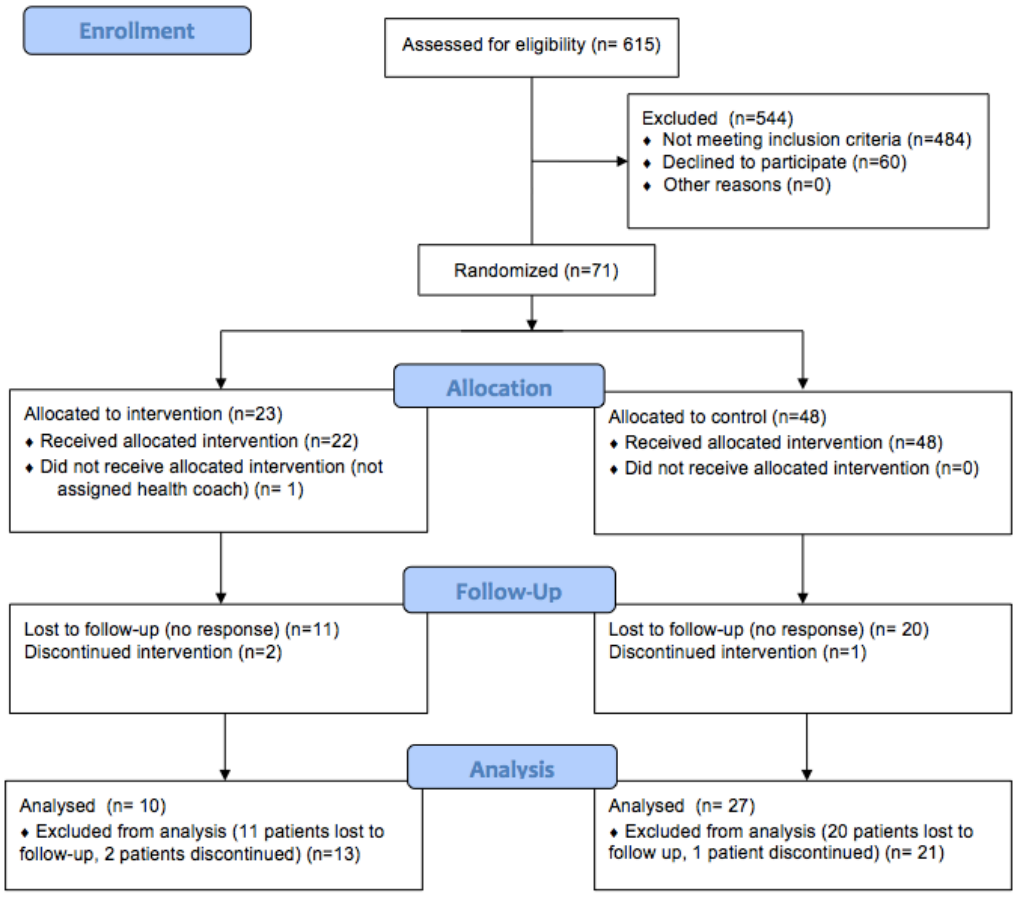

Table 1. Baseline demographic characteristics of participants who completed a 3-month follow-up.

Characteristic	**Health Coaching**[a] (N=10)	**Usual Care**[a] (N=27)	**Total** (N=37)
Age, mean (SD)	58 (16.3)	50.9 (13.7)	52.8 (14.6)
Female, no. (%)	3 (30.0)	14 (51.9)	17 (46.0)
Years at current residence, mean (SD)	16.8 (19.4)	4.95 (5.2)	8.2 (11.9)
Median (IQR)	8.5 (3.0, 20.0)*	3.0 (1.0, 8.0)*	4 (1, 8)
Speaks Spanish, no. (%)	3 (30.0)	9 (33.3)	12 (32.4)
Marital status, no. (%)			
Married or Life Partner	4 (40.0)	4 (14.8)	8 (21.6)
Single, Divorced, Separated, or Widowed	6 (60.0)	23 (85.2)	29 (78.4)
Race/ethnicity, no. (%)			
Black or African American	4 (40.0)	13 (48.2)	17 (46.0)
Hispanic or Latino	4 (40.0)	9 (33.3)	13 (35.1)
White	1 (10.0)	2 (7.4)	3 (8.1)
Other	1 (10.0)	3 (11.1)	4 (10.8)
Education Level, no. (%)			
Less than high school	1 (10.0)	10 (37.0)	11 (29.7)
High school or equivalent	5 (50.0)	11 (40.7))	16 (43.2)
Some college, college graduate, or higher	4 (40.0)	6 (22.2)	10 (27.0)
Employed, no. (%)	1 (10.0)	3 (11.1)	4 (10.8)
Household income less than $10,000	8 (80.0)	15 (57.7)	23 (63.9)
Disease, no. (%)			
Diabetes	3 (30.0)	6 (22.2)	9 (24.3)
Hypertension	3 (30.0)	14 (51.9)	17 (46.0)
Both	4 (40.0)	7 (25.9)	11 (29.7)
Years with Diabetes, mean (SD)	9.3 (6.5)	8.3 (7.1)	8.7 (6.7)
Median (IQR)	10.0 (4.0, 15.0)	5.0 (3.5, 13.5)	5 (4, 15)
Years with Hypertension, mean (SD)	15.2 (18.0)	5.7 (5.7)	7.9 (10.3)
Median (IQR)	11.5 (2.0, 15.0)	4.0 (1.5, 10.0)	4 (2, 10)
Insurance, no. (%)			
County Pay (HealthPac)	1 (10.0)	5 (18.5)	6 (16.2)
MediCal	5 (50.0)	16 (59.3)	21 (56.8)
Medicare	3 (30.0)	4 (14.8)	7 (18.9)
Uninsured	0	1 (3.7)	1 (2.7)
Private insurance	1 (10.0)	1 (3.7)	2 (5.4)
Delayed health care, no. (%)	3 (30.0)	10 (37.0)	13 (35.1)
Unmet need, no. (%)	2 (25.0)	6 (22.2)	8 (22.9)
Usual care setting, no. (%)			
Clinic, health center, doctor's office, HMO, or hospital outpatient department	6 (60.0)	15 (55.6)	21 (56.8)
Hospital emergency room	2 (20.0)	11 (40.7)	13 (35.1)
None	2 (20.0)	1 (3.7)	3 (8.1)
No. of ED visits in past month, mean (SD)	1.0 (0.82)	1.2 (2.2)	1.2 (1.9)
Median (IQR)	1.0 (0, 2.0)	0.50 (0, 1.0)	1 (0, 1.5)
No. of ED visits in past year, mean (SD)	2.6 (3.4)	3.1 (2.8)	2.9 (3.0)
Median (IQR)	1.5 (1.0, 3.0)	3.0 (1.0, 4.0)	2 (1, 4)
No. of PC visits in past year , mean (SD)	2.5 (2.2)	4.7 (5.4)	4.1 (4.8)
Median (IQR)	2.5 (1.0, 4.0)	2.5 (1.0, 6.0)	2.5 (1, 6)
Self-rated health (SF-12) with range of 0-100, mean (SD)			
Mental component summary score	48.8 (11.9)	42.1 (10.8)	43.8 (11.3)

Physical component summary score	46.7 (8.1)*	38.3 (10.3)*	40.4 (10.3)
Patient Activation Measure with range of 0-100, mean (SD)	61.8 (14.7)	59.1 (12.1)	59.8 (12.7)
Patient Activation Measure level, no. (%)			
Level 1	1 (10.0)	6 (22.2)	7 (18.9)
Level 2	3 (30.0)	5 (18.5)	8 (21.6)
Level 3	4 (40.0)	11 (40.7)	15 (40.5)
Level 4	2 (20.0)	5 (18.5)	7 (18.9)
Medication adherence with range of 0 to 8.0, mean (SD)	5.7 (2.3)	4.7 (2.2)	5.0 (2.2)
Medication adherence level, no (%)			
Low	3 (30.0)	17 (63.0)	20 (54.1)
Medium	5 (50.0)	5 (18.5)	10 (27.0)
High	2 (20.0)	3 (11.1)	5 (13.5)
None	0	2 (7.4)	2 (5.4)

Abbreviations: ED = emergency department; PC = primary care; IQR = interquartile range
[a] Statistically significant differences between control and intervention groups are indicated as follows:
† $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, and *** $p < 0.001$

Table 2. Health care utilization and patient-reported health outcomes by group at 3-month follow-up.

Outcomes	**Health Coaching** N= 10			**Usual care** N=27				
	Baseline	3 months	Change	Baseline	3 months	Change	Difference in change	P-value
Health care utilization								
Number of ED visits [a], mean (SD) Median (IQR)	–	0.96 (1.4) 0 (0, 1.6)	–	–	0.90 (1.3) 0 (0, 1.5)	–	–	– 0.91
Any ED visits since baseline, no (%)	–	4 (40.0)	–	–	13 (48.2)	–	–	0.73
Multiple ED visits since baseline, no (%)	–	4 (40.0)	–	–	10 (37.0)	–	–	0.75
Decrease in ED visits [b], no (%); Method 1: Method 2:	–	6 (60.0) 6 (60.0)	–	–	15 (55.6) 12 (44.4)	–	–	0.81 0.40
Number of PC visits [c], mean (SD) Median (IQR)	–	1.2 (1.2) 1.2 (0, 1.6)	–	–	1.4 (1.5) 1.4 (0, 2.4)	–	–	– 0.63
Increase in PC visits[d], no (%)	–	6 (60.0)	–	–	14 (51.9)	–	–	0.66
Health outcomes								
Mental Component Summary, mean (SD)[e]	48.8 (11.9)	41.1 (11.8)	-8.2 (17.4)	42.1 (10.8)	43.4 (10.6)	+1.3 (11.1)	9.5	0.061
Physical Component Summary, mean (SD) [e] Median (IQR)	46.7 (8.1) –	40.5 (8.2) –	-6.0 (14.7) -4.7 (-10.9, -0.51)	38.3 (10.3) –	37.2 (7.7) –	-1.1 (11.9) +0.66 (-6.1, 7.3)	4.9 5.6	– 0.18
Patient Activation Measure, mean (SD) Median (IQR)	61.8 (14.7) –	61.0 (6.3) –	-0.80 (16.0) 0 (-2.4, 13.6)	59.1 (12.1) –	63.4 (13.3) –	+4.4 (10.8) +2.5 (0, 10.35)	5.2 2.5	– 0.28
Medication adherence, mean (SD) [f]	5.7 (2.3)	5.6 (1.6)	-0.1 (1.8)	4.7 (2.2)	5.8 (1.7)	+1.05 (1.6)	1.15	0.078

Abbreviations: ED = emergency department; PC = primary care; IQR = interquartile range

[a] During 3-month intervention. Adjusted for days since call: [ED visits at 3-month call]/[days elapsed] x 91.2501.

[b] As compared to a 3-month period before the intervention, where baseline ED visits are estimated 2 ways: Method 1: [ED visits 1 year before baseline]/4; or Method 2: [ED visits 1 month before baseline]x3.

[c] During 3-month intervention. Adjusted for days since call: [PC visits at 3-month call]/[days elapsed] x 91.2501.

[d] As compared to a 3-month period before the intervention, where baseline PC visits are estimated as: [PC visits 1 year before baseline]/4.

[e] Health coaching, n = 9, usual care, n=27

[f] Health coaching, n = 10, usual care, n=23

Outcome Measures. Number of days from enrollment to "3-month call" ranged from 56 to 137 days. The median number of days to "3-month call" was greater for the control group as compared to the intervention group, though this difference was not statistically significant (79 vs. 66 days, p=0.08).

The median number of ED visits adjusted for days elapsed was not statistically different at the 3-month call between intervention and control groups (0 visits for both group's visits, p=0.91). The proportion of participants with any ED visits was not statistically different between intervention and control groups (40.0% vs. 48.2%, p = 0.73). Similarly, the proportion of participants with multiple ED visits was not statistically different between intervention and control groups (40.0% vs. 37.0%, p = 0.75). A greater proportion of those in the intervention group had a decrease in ED visits during the study as compared to a 3-month period before the study, though this difference was not statistically significant (Method 1, estimated by dividing the number of ED visits in the last year reported at baseline by four: 60.0% vs. 55.6%, p =0.81; Method 2, estimated by multiplying the number of ED visits in the last month reported at baseline by three: 60.0% vs. 44.4%, p = 0.40). The median number of primary care visits adjusted for days elapsed was not statistically different between intervention and control groups (1.2 vs. 1.4 visits, p=0.63). The proportion of participants with an increase in primary care visits during the study as compared to a 3-month period before the study was similar between intervention and control groups (60.0% vs. 51.9%, p=0.66).

There was no statistical difference between intervention and control groups for change in physical health (-4.7 vs. +0.66, p=0.18), change in mental health (-8.2 vs. +1.3, p=0.061), change in patient activation (0 vs. +2.5, p = 0.28), or change in medication adherence (-0.1 vs. +1.05, p = 0.078).

DISCUSSION

Our results demonstrate that a health coaching intervention provided in the post-ED period did not result in a statistically significant difference in self-reported health care utilization (ED or primary care visits) or change in health outcomes (physical health, mental health, patient activation, or medication adherence) between study arms at 3 months. There are several possible explanations for these findings.

First, there is a lack of adequate statistical power due to small sample size. This thesis examined baseline and 3-month surveys for a subset of patients (N=71) enrolled on or before May 20th, 2015, while data collection for the larger study will continue until a pre-determined target sample size of 300 is reached. We expect to have a full sample size of 300 participants enrolled by September 2016 with data collection completed by May 2017. With a greater sample size, it is possible that the proportion of those with a decrease in ED visits or the proportion of those with an increase in primary care visits may become significant.

Second, three months may not be an adequate time to observe changes in health care utilization or health outcomes as a result of a coaching intervention. Most health coaching

interventions are at least six months in duration[14–18], so perhaps a greater follow-up duration of at least 6 months is needed before significant changes are observed. One notable exception is a health coaching intervention provided in the post-hospitalization period that lasted until the first post-hospitalization primary care visit with a minimum duration of 14 days. Kangovi et al. (2014) found significantly greater linkage to primary care, fewer multiple hospital re-admissions, and greater improvements in mental health and patient activation among intervention patients of low SES with at least one chronic condition[13]. Intervention participants in the study by Kangovi et al. rated social support provided by CHWs and assistance in establishing primary care as the most helpful components of this shorter intervention[13]. Perhaps repeated contacts with a CHW who provides health coaching over a shorter study period may explain why an increase in mental health and patient activation was observed the Kangovi study, but not in our study. While our study examines changes at 1-month, 3-months, and 6-months, only 3-month surveys were used for the purposes of this thesis. Future analysis could examine changes at 1 month and compare these results with the results of Kangovi et al.

Third, even with a larger sample size and longer study duration of six months, it is possible that health coaching alone may not result in significant changes in health care utilization or health outcomes among ED patients with diabetes or hypertension. Since barriers to accessing primary care are associated higher ED utilization,[5,6] changes at the level of primary care infrastructure may also be necessary in order to improve access to care. Suggestions to increase the capacity of primary care infrastructure in order to reduce ED use have included increasing the number of primary care providers especially in Health Professional Shortage Areas through scholarships and loan repayment programs[9,31,32], team-based care which incorporates nurse practitioners and physicians assistants as providers of primary care[9,32], expanded hours and locations of primary care practices[9,33], co-locating primary care physicians within the ED[9,34], or embedding care coordinators within primary care practices[35]. Future studies could examine the impact of an intervention that includes changes at the level of primary care infrastructure in combination with health coaching to support individual needs.

While there were no statistically significant differences in the changes in patient-reported health outcomes between study arms, it is interesting to note that all changes were in the negative direction or equal to zero for the intervention group as compared to positive changes observed among the control group. There are several possible explanations for negative changes in outcomes observed among intervention participants. Perhaps health coaching resulted in a shift in awareness among intervention participants by focusing on barriers to achieving health-related goals. Interactions with a health coach may have resulted in greater awareness of existing health problems or challenges, which could influence measures of physical and mental health. Another explanation is that perhaps discussions with a health coach reduced social desirability bias among the intervention group by regularly discussing topics such as barriers to accessing care, challenges in managing chronic conditions, and topics that can be associated with stigma such as mental health or substance use. With less social desirability bias, intervention patients may have felt more comfortable revealing accurate levels of mental health, physical health, patient activation, and medication adherence, resulting in lower levels than

initially reported at baseline. Another possibility is that depending on the content of the action plan, there may be a period of lower self-reported physical and mental health and patient activation among intervention participants as challenges arise during the initial stages of implementing a behavior change or attempting to access resources.

Among the control group, positive changes may potentially be a result of regular contact with research assistants for survey phone calls. Research assistants have anecdotally shared that many participants are eager to share personal stories about health challenges, despite the fact that all survey answers are close-ended. While research interns are blinded to group assignment, it is possible that control group participants received a small benefit from feeling listened to by research interns without the accompanying shift in awareness towards health problems and challenges that intervention participants are experiencing, which would ultimately bias results towards the null. Finally, the intervention group had significantly higher physical health scores at baseline as compared to the control group, so there was less margin for improvement which could also bias results towards the null. Health coaching has been shown to work best for those with low medication adherence and low self-management support at baseline, so perhaps this intervention would be best suited to a targeted subset of patients who have the most to gain from health coaching[36].

Study Strengths. Strengths of this study include that it is the first randomized controlled trial of ED-based health coaching. Also, health coaches received extensive training (>180 hours), mentorship, and experience working in a health care setting. In addition to improving the health of patients, the Alameda County Health Coach Program aims to create jobs that allow young men and women of color to explore career opportunities within the health care field. In fact, since the start of the program in September 2013, four former health coaches have left to begin health professions programs (MD or PA), and four former health coaches have obtained full-time employment in the health care field or at community-based organizations.

Study Limitations. This study has several limitations. First, there was inadequate statistical power due to small sample size that was a subset of the target sample size of 300. Second, we were unable to adjust for the dose of intervention based on days elapsed between enrollment and "3-month" call for secondary outcomes including physical health, mental health, patient activation, and medication adherence. Days to 3-month call ranged from 56 to 137 days, so some participants may have received different doses of the intervention than others. While there was not a significant difference between median days to call in the intervention vs. control groups, there was a trend towards a shorter time to follow-up among the intervention participants (79 vs. 66 days, p=0.08). Third, all data in this study are self-reported so there may be recall bias especially in reporting health care utilization. Fourth, social desirability bias could have influenced participant responses. Finally, this study enrolled patients from one safety-net ED serving a diverse population of low-income patients, so results may not be generalizable to other settings.

CONCLUSIONS

This study found no statistically significant difference in self-reported health care utilization or changes in physical health, mental health, patient activation, or medication adherence at 3 months between health coaching and usual care. Further research is needed to determine if a larger sample size and longer study period may result in significant differences between study arms.

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APPENDIX

Table 3. Baseline demographic characteristics of patients who completed a 3-month follow-up versus those who were excluded from analysis because they were lost to follow-up (N= 31) or discontinued study (N=3) at 3 months.

Characteristic	**Remained in study**[a] (N=37)	**Excluded from analysis**[a] (N=34)	**Total** (N=71)
Age, mean (SD)	52.8 (14.6)	51.4 (11.5)	52.1 (13.1)
Female, no. (%)	17 (46.0)	21 (61.8)	38 (53.5)
Years at current residence, mean (SD)	8.2 (11.9)	6.8 (11.2)	7.5 (11.5)
Median (IQR)	4 (1, 8)	3 (1, 5)	3 (1, 8)
Speaks Spanish, no. (%)	12 (32.4)	8 (23.5)	20 (28.2)
Marital status, no. (%)			
Married or Life Partner	8 (21.6)	6 (17.7)	14 (19.7)
Single, Divorced, Separated, or Widowed	29 (78.4)	28 (82.4)	57 (80.3)
Race/ethnicity, no. (%)			
Black or African American	17 (46.0)	18 (52.9)	35 (49.3)
Hispanic or Latino	13 (35.1)	11 (32.4)	24 (33.8)
White	3 (8.1)	2 (5.9)	5 (7.0)
Other	4 (10.8)	3 (8.8)	7 (9.9)
Education Level, no. (%)			
Less than high school	11 (29.7)	6 (17.7)	17 (23.9)
High school or equivalent	16 (43.2)	12 (35.3)	28 (39.4)
Some college, college graduate, or higher	10 (27.0)	16 (47.1)	26 (36.6)
Employed, no. (%)	4 (10.8)	10 (29.4)	14 (19.7)
Household income less than $10,000	23 (63.9)	13 (44.8)	36 (55.4)
Disease, no. (%)			
Diabetes	9 (24.3)	7 (20.6)	16 (22.5)
Hypertension	17 (46.0)	18 (52.9)	35 (49.3)
Both	11 (29.7)	9 (26.5)	20 (28.2)
Years with Diabetes, mean (SD)	8.7 (6.7)	8.1 (7.6)	8.4 (7.0)
Median (IQR)	5 (4, 15)	6 (1, 17)	5.5 (3, 15)
Years with Hypertension, mean (SD)	7.9 (10.3)	5.8 (5.4)	6.9 (8.3)
Median (IQR)	4 (2, 10)	4 (1, 10)	4 (1, 10)
Insurance, no. (%)			
County Pay (HealthPac)	6 (16.2)	3 (8.8)	9 (12.7)
MediCal	21 (56.8)	25 (73.5)	46 (64.8)
Medicare	7 (18.9)	5 (14.7)	12 (16.9)
Uninsured	1 (2.7)	1 (2.9)	2 (2.8)
Private insurance	2 (5.4)	0	2 (2.8)
Delayed health care, no. (%)	13 (36.1)*	20 (60.6)*	33 (47.8)
Unmet need, no. (%)	8 (22.9)	10 (29.4)	18 (26.1)
Usual care setting, no. (%)			
Clinic, health center, doctor's office, HMO, or hospital outpatient department	21 (56.8)	20 (58.8)	41 (57.8)
Hospital emergency room	13 (35.1)	10 (29.4)	23 (32.4)
None	3 (8.1)	4 (11.8)	7 (9.9)
No. of ED visits in past month, mean (SD)	1.2 (1.9)	1.1 (1.7)	1.1 (1.8)
Median (IQR)	1 (0, 1.5)	0 (0, 1)	1 (0, 1)
No. of ED visits in past year, mean (SD)	2.9 (3.0)	4.0 (5.6)	3.4 (4.4)
Median (IQR)	2 (1, 4)	2 (0, 5)	2 (1, 4)

No. of PC visits in past year, mean (SD)	4.1 (4.8)	2.8 (3.4)	3.4 (4.2)
Median (IQR)	2.5 (1, 6)	2 (0, 4)	2 (0, 4)
Self-rated health (SF-12) with range of 0-100, mean (SD)			
Mental health	43.8 (11.3)	46.7 (13.4)	45.2 (12.3)
Physical health	40.4 (10.3)	43.3 (9.4)	41.8 (9.9)
Patient Activation Measure with range of 0-100, mean (SD)	59.8 (12.7)	58.9 (13.4)	59.4 (12.9)
Patient Activation Measure level, no. (%)			
Level 1	7 (18.9)	4 (12.1)	11 (15.7)
Level 2	8 (21.6)	9 (27.3)	17 (24.3)
Level 3	15 (40.5)	15 (45.5)	30 (42.9)
Level 4	7 (18.9)	5 15.2)	12 (17.1)
Medication adherence with range of 0 to 8.0, mean (SD)	5.0 (2.2)	4.3 (2.1)	4.7 (2.2)
Median (IQR)	5.75 (3, 7)	4 (2.25, 6)	4.9 (2.75, 6.5)
Medication adherence level, no (%)			
Low	20 (54.1)	22 (64.7)	42 (59.2)
Medium	10 (27.0)	10 (29.4)	20 (28.2)
High	5 (13.5)	1 (2.9)	6 (8.5)
None	2 (5.4)	1 (2.9)	3 (4.2)

Abbreviations: ED = emergency department; PC = primary care; IQR = interquartile range

[a] Statistically significant differences between control and intervention groups are indicated as follows: † $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, and *** $p < 0.001$