QUERI

Evidence Brief: Effectiveness of Intensive Primary Care Programs

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PREFACE

Quality Enhancement Research Initiative's (QUERI) Evidence-based Synthesis Program (ESP) was established to provide timely and accurate syntheses of targeted healthcare topics of particular importance to Veterans Affairs (VA) managers and policymakers, as they work to improve the health and healthcare of Veterans. The ESP disseminates these reports throughout VA.

QUERI provides funding for four ESP Centers and each Center has an active VA affiliation. The ESP Centers generate evidence syntheses on important clinical practice topics, and these reports help:

- develop clinical policies informed by evidence,
- guide the implementation of effective services to improve patient outcomes and to support VA clinical practice guidelines and performance measures, and
- set the direction for future research to address gaps in clinical knowledge.

In 2009, the ESP Coordinating Center was created to expand the capacity of QUERI Central Office and the four ESP sites by developing and maintaining program processes. In addition, the Center established a Steering Committee comprised of QUERI field-based investigators, VA Patient Care Services, Office of Quality and Performance, and Veterans Integrated Service Networks (VISN) Clinical Management Officers. The Steering Committee provides program oversight, guides strategic planning, coordinates dissemination activities, and develops collaborations with VA leadership to identify new ESP topics of importance to Veterans and the VA healthcare system.

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INTRODUCTION

Improving the healthcare of Americans with multiple chronic conditions is one of the top aims of the U.S. national healthcare research agenda. One of the driving forces behind this objective is the disproportionately high concentration of healthcare expenditures that are attributed to this population. The 2009 Medical Expenditure Panel Survey (MEPS) found that the sickest 10 percent of patients account for 65 percent of all health expenses for the U.S. population (from July 2012 meeting of the National Advisory Council for Healthcare Research and Quality, which focused on trends in healthcare costs and the concentration of medical expenditures).[1] Further, the MEPS identified a number of chronic conditions that most influence high levels of expenditures, including heart disease, cancer, mental disorders, chronic obstructive pulmonary disease (COPD) and diabetes.

Potentially preventable readmissions are among the disproportionately high concentration of healthcare expenditures attributed to the sickest 10 percent of patients. In their June 2007 report to Congress, the MedPAC (Medical Payment Advisory Commission) estimated that 75 percent of Medicare readmissions are potentially preventable.[2]

Potentially preventable hospitalizations have been linked to discontinuity of primary care.[3] In a 1984 randomized trial, elderly male Veterans who saw a different physician at each visit had a statistically significantly higher rate of emergent hospital admissions and longer average length of stays than those who saw the same primary care doctor at every visit.[3]

Since the 1980's, the problem of high-risk patients with frequent hospital admissions has persisted despite dramatic changes in the practice environment. One important change is the redesign of primary care. The Veterans Health Administration (VHA) Primary Care Program Office is implementing a Patient Aligned Care Teams (PACT) model at all primary care sites, in which continuous care is delivered by interdisciplinary teams who serve as the first point of contact for a broad range of fully-integrated health services and community resources. The VA's PACT model and other Patient-Centered Medical Home (PCMH) models are based on earlier innovations such as the Chronic Care Model, the Idealized Design of Clinical Office Practices, and Clinical Microsystems. They seek to implement primary care that is continuous, comprehensive, efficient, patient-driven and team-based.[4,5] The PCMH models are not primarily aimed at patients who are at high risk of hospital admission, although most include reducing hospitalizations and emergency room use among their secondary aims. In the VA PACT, for example, hospital care and specialized services are provided outside of the PACT, while coordinators focus on smoothing hand-offs between care settings including those involving VA and non-VA providers. A recent Agency for Healthcare Research and Quality (AHRQ) systematic review of 19 comparative studies found that implementation of these models had no effect on hospital admissions (RR 0.96; 95% CI 0.84-1.10), but it reduced emergency room visits (0.81, 0.67-0.98) and modestly improved staff and patient experiences.[6]

Disease management and care coordination programs have also sought to improve the quality and delivery of care to patients with high-cost chronic illnesses. The U.S. Congressional Budget Office (CBO) issued a brief report (January 2012) on the effects of 34 Medicare demonstration projects on disease management and care coordination programs, and cited the following approaches as helpful in reducing hospital admissions: (1) use of team-based care, especially

those with larger teams that include pharmacists; and (2) the smoothing of transitions between a primary care provider and a specialist.[7] However, a recent AHRQ review of nurse-led case management programs for adults with medical illnesses and complex care needs found no effect on rates of hospitalization and a variable effect on emergency room use.[8] The nurse-led interventions encompassed patient self-management education, health status monitoring, and coordination of care, typified by the Medicare Coordinated Care Demonstration (MCCD).

From the viewpoint of caring for frequently hospitalized patients, the rise of hospitalism also poses a challenge to continuity of care. David Meltzer, MD, PhD, Associate Professor of Medicine and Director of the Hospitalist Program at the University of Chicago Medicine, has studied the changing medical workforce in the United States and found that the trend toward increased medical specialization has had the unintended consequence of increased fragmentation of primary care.[9] One of the key challenges for the primary care system in meeting the complex needs of high-risk patients with multiple chronic conditions is adapting to the increased demands of collaborating with a larger number of associated healthcare providers within a decentralized, fee-for-service healthcare delivery system which does not pay for or facilitate communication or coordination among providers.[7]

Some would say that we have reached a point where we have to decide if we should continue to invest in programs with an increased need for coordination or in different models that reduce the need for coordination in the first place. Applying team theory literature,[10] Dr. Meltzer has said "if you're spending all of your time coordinating, you should change the product."[11] For example, Dr. Meltzer has proposed a 'comprehensive care physician model,' to reduce the need for coordination between the primary care and hospitalist settings. In this model, a physician with expertise in both inpatient medicine and primary care leads an interdisciplinary team that carries a panel of approximately 200 frequently hospitalized patients, who they will treat both inside and outside of the hospital.[11] The Centers for Medicare & Medicaid Services (CMS) have funded a demonstration of this program at the University of Chicago. Others focus on reducing the need for coordination and handoffs between primary care and specialty care. From this viewpoint, admissions from primary care could be reduced through accelerated consults or direct access to intense short stay and complex diagnostic unit services.

The persistence of high inpatient utilizers despite the spread of case management and PCMH models has led to interest in 'intensive primary care' models. For example, a new round of CMS-funded demonstration projects focus on intensive models for patients at high risk of using inpatient resources.[12] In their Research Brief published by the National Institute for Health Care Reform, Yee et al. proposed a taxonomy for categorizing 'High-Intensity Primary Care' programs, also sometimes called 'Ambulatory Intensive Care Units,' which use PCMH-based approaches to managing the sickest, highest-cost patients.[13] In a 'freestanding' model, ongoing care is fully transferred from patients' regular primary care physicians to a dedicated clinic that exclusively or chiefly provides high-intensity primary care to a select group of patients. In contrast, in a 'practice-based' model, patients continue to receive care from their regular primary care physician, but are offered additional, high-intensity services, often managed by a care coordinator. In a hybrid model, care is temporarily shifted from the patients' regular primary care physicians to a dedicated clinic, and returned once their conditions stabilize. These approaches,

which involve physician-led, team-based discussion and coordination that serve as the source of primary care, were excluded from the two AHRQ reviews mentioned earlier.

As part of the PACT model initiative, the Health Delivery Committee is proposing to develop a primary care intensivist model that deploys well-trained interdisciplinary teams that identify and proactively manage Veterans at highest risk for hospital admission and death. The goal of the model is to reduce emergency department and urgent care utilization, hospitalizations and mortality among complex, high-risk patients.

For healthcare system decision-makers, evidence is only one of many different factors taken into account. If a health system waits until there is traditional hard and fast evidence on the effectiveness of a new healthcare model, they would always be 10 years out of date. However, decision-makers do need to consider the findings of the best available research and the strength and applicability of that evidence.

This report was produced in response to the Health Delivery Committee's request for an evidence brief to assist with their evaluation of the effectiveness of existing intensive primary care programs involving multimodal interventions delivered by interdisciplinary teams. An evidence brief differs from a full systematic review in that the scope of work is more narrowly defined and the traditional review methods are streamlined in order to synthesize evidence within a shortened timeframe. An evidence brief cannot capture the actual day-to-day program operations of evolving programs. While decision-makers can benefit from knowing about the best available research and the strength and applicability of that evidence, an evidence brief cannot encompass the full range of policy options or novel programs, many of which have not been evaluated in formal studies.

SCOPE

The objective of this evidence brief is to evaluate the effectiveness of interdisciplinary, multi-component intensive primary care programs in reducing mortality and hospital use among patients identified at highest risk for hospital admission and death while still in the ambulatory care setting.

The Evidence-based Synthesis Program (ESP) Coordinating Center investigators and representatives of the Health Delivery Committee Workgroup worked together to identify the population, intervention, comparator, timing, setting and study design characteristics of interest. The Health Delivery Committee Workgroup approved the following eligibility criteria to guide this review:

- ***P****opulation*: Patients identified as high risk for hospital admission and/or death, regardless of whether or not there was a disease-specific focus, such as heart failure.
- ***I****nterventions*: Multi-component, interdisciplinary intensive primary care programs.
- ***C****omparator*: Usual care (without the utilization of an intensive primary care program).
- ***O****utcomes*: All-cause mortality, hospitalization, emergency department use, hospital days.
- ***T****iming*: Studies that include a follow-up period of more than 30 days.
- ***S****etting*: Ambulatory setting.
- ***S****tudy design*: Systematic reviews, controlled clinical trials, observational studies.

METHODS

We searched for systematic reviews, controlled clinical trials, and observational studies in PubMed (1946 through September 5, 2012), CINAHL (1981 through September 5, 2012), the Cochrane Central Register of Controlled Trials® (3rd quarter 2012), and the Cochrane Database of Reviews of Effects (3rd quarter 2012), using standard search terms (for full search strategy, see Supplemental Materials). Additional citations were identified from reference lists, hand searching, and consultation with content experts. We also searched for unpublished information about additional intensive primary care programs from various gray literature sources (see Appendix A for results and list of sources). We limited the search to articles involving human subjects and available in the English language.

Study selection was based on the eligibility criteria described above. Titles and abstracts and full-text articles were first reviewed by one investigator with methodological expertise and a proportion of the first reviewer's decisions were then checked by a second senior investigator with clinical content expertise. There was a high level of agreement and all disagreements were resolved using consensus.

We used predefined criteria to rate the internal validity of all individual studies. Risk of bias of controlled clinical trials was assessed using the Cochrane Collaboration's tool and judged as low, unclear or high.[14] We rated the internal validity (quality) of controlled observational studies as good, fair or poor, using methods of the Drug Effectiveness Review Project (DERP) and based on the adequacy of the patient selection process; completeness of follow-up; adequacy of outcome ascertainment; use of acceptable statistical techniques to minimize potential confounding factors; and whether the duration of follow-up was reasonable to capture investigated events.[15] We abstracted data from all included studies on population, intervention, comparator, and timing characteristics and results for each included outcome. All data abstraction and internal validity ratings were first completed by one reviewer and then checked by another. All disagreements were resolved using consensus.

We graded strength of evidence based on the guidance established for the Evidence-based Practice Center Program of AHRQ.[16] This approach incorporates four key domains: risk of bias (includes study design and aggregate quality), consistency, directness, and precision of the evidence. It also considers other optional domains that may be relevant for some scenarios, such as a dose-response association, plausible confounding that would decrease the observed effect, strength of association (magnitude of effect), and publication bias. Strength of evidence is graded for each key outcome measure and ratings range from high to insufficient, reflecting our confidence that the evidence reflects the true effect. Brief information on our assessments for all included controlled studies is provided in Table 3.

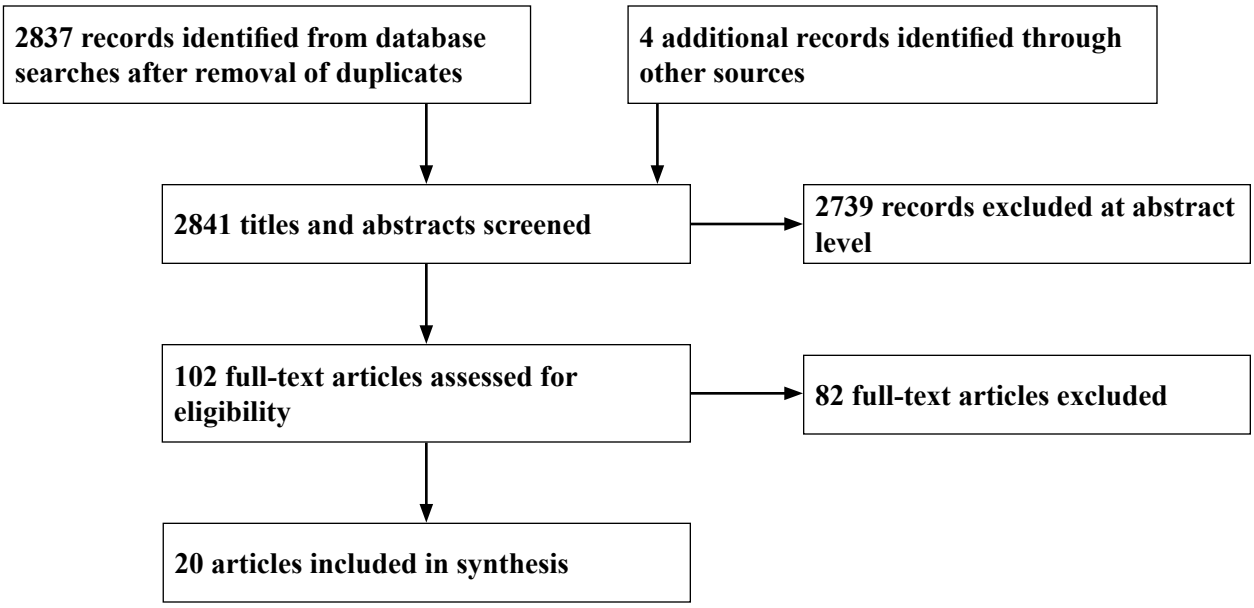
We used a hierarchy of evidence approach, where the best evidence was the focus of our synthesis. As such, randomized controlled trials (RCTs) and controlled observational studies were preferred over uncontrolled observational studies. To organize our synthesis, we aimed to group studies based on similarities in patient selection methods (e.g., previous hospitalizations, elderly, disability level, etc.) and/or types of high-intensity primary care models (e.g., primary care transferred to freestanding clinics; high-intensity services added to existing primary care practice; home-based; comprehensive care physician model, etc.). Special attention was paid to the applicability of the study populations in comparison to the target high-risk Veteran and military population. To determine the appropriateness of meta-analysis, the risk of bias of the studies and their heterogeneity in design, patient population, interventions, and outcomes were considered.

RESULTS

OVERVIEW

Figure 1 provides details on the results of study selection. The primary reason for exclusion at the full-text level was that the model was not multimodal, but instead focused on a single aspect of care, such as case management or telehealth. A full listing of all studies excluded at the full-text level and the reasons for their exclusions is provided in the supplemental materials.

Figure 1. Literature Flow Chart



Although we originally sought to rely on evidence from existing high-quality systematic reviews, we did not find any with a focus similar enough to the interests of this review to provide useful information to the requestors. While we searched for studies of patients at high risk of hospital admission and/or death, regardless of whether or not there was a disease-specific focus, such as heart failure, we only found studies of heart failure and chronic obstructive pulmonary disease-specific populations that used traditional disease management models that involved increased patient education and follow-up and aimed at general improvement in the quality of care.[17-24] Although these studies *mentioned* primary care provider involvement, it was limited to attempts to improve communication and ensure reinforcement of information. Because all other non-heart failure conditions were managed as usual by primary care providers, with no crossing of traditional practice boundaries, we excluded these studies from this review.

We included seven randomized controlled trials of intensive primary care programs (in nine publications).[25-33] We also included 13 observational studies.[34-46] All but two[39,41] were uncontrolled before-after studies that did not assess the potential impact of any concurrent events on the outcomes of interest and did not assess whether any observed changes exceeded what would be naturally expected over time. Due to these serious limitations, it is impossible to attribute

causation from these uncontrolled studies. Therefore, we focused only on the findings of the two controlled observational studies.[39,41] Characteristics (Table 1), results (Table 2) and internal validity and strength of evidence ratings (Table 3) of the controlled studies are summarized in the tables at the end of this report. A table of the complete internal validity ratings of the controlled trials is provided in the supplemental materials. Tables of characteristics and results of the uncontrolled studies are also provided as supplemental materials.

Only two studies involved Veteran and military populations.[31,33] The majority of the remaining studies involved mostly elderly, non-White females. Only one controlled study selected patients entirely based on high utilization of inpatient services, requiring at least two prior hospital admissions per year in the 12 to 18 months prior to recruitment.[32] The remaining studies selected patients who were at least moderately disabled in activities of daily living;[25,26,30,31,33] aged above 64,[25] 65,[27-29] or 75;[39] had income below 200 percent of federal poverty level;[28,29,39] and/or who met nursing home eligibility criteria.[41]

Among the included programs evaluated in controlled studies, four used practice-based models where additional high-intensity services are added to ongoing care from their regular primary care physician,[27-29,32,39] two used a freestanding model where ongoing care was transferred from the patients' regular primary care physicians to dedicated clinics that exclusively provide high-intensity care to a select group of patients,[25,26,41] and three were home-based.[30,31,33] We did not pool any data across studies because of the heterogeneity in design, patient population, interventions, and outcome assessment methods.

We did not find any published studies of other types of high-intensity primary care programs, such as Dr. Meltzer's comprehensive care physician model or Dr. Sanjeev Arora's Project ECHO (Extension for Community Healthcare Outcomes). Our search of gray literature sources identified unpublished information about the following additional intensive primary care programs, which are summarized in Appendix A: After Discharge Management of Low Income Frail Elderly (AD-LIFE), AtlantiCare Special Care Center Ambulatory Intensive Care Unit, Boeing Intensive Outpatient Care Program (IOCP), CareMore, HealthCare Partners Comprehensive Care Centers, UNITE HERE Health Center Special Care Center, University of New Mexico Health Sciences Center Project ECHO.

HOME-BASED MODELS

Main Findings

- Home-based care models (3 RCT's; N = 2454)
    - This evidence is the most applicable to Veteran/military populations, as two of the three RCTs enrolled mostly White men from VA medical centers.
    - The risk of bias of the individual studies is unclear to high, and the strength of the overall body of evidence is moderate.
    - Reductions in hospital admission, hospital days, and emergency department use outcomes were inconsistent.

Detailed Analysis

The primary criterion for entry into all three studies of home-based care models was at least moderate impairment in activities of daily living.[30,31,33] Among the three randomized controlled trials of home-based models, two[31,33] examined VA Team-Managed Home-Based Primary Care (TM/HBPC), while the third evaluated a primary home care intervention in Stockholm, Sweden that recruited patients from a county general hospital.[30] Together, these trials provided moderate-strength evidence that home-based intensive primary care models do not consistently statistically significantly reduce mortality, hospitalizations, hospital days, or emergency department use.

The first of the trials of VA TM/HBPC involved a six-month follow-up of 233 patients from the Hines VA Hospital in Illinois.[33] The second trial involved a 12-month follow-up of 1,966 patients across 16 VA medical centers.[31] In both trials, patients were primarily White men in their late sixties or early seventies. Mean Katz activity of daily living impairments were 4.5 out of a possible score of 6 in the single-center trial and 3.2 in the multi-center trial. Information about medical, psychiatric, and cognitive comorbidities was limited in both trials. In the single-center trial, 15 percent had heart disease, 13 percent had respiratory disease, and 8 percent had cerebrovascular disease. In the multi-center trial, 55 percent had any heart failure or COPD and the mean score on the Short Portable Mental Status Questionnaire was 7, indicating moderate cognitive impairment. The VA TM/HBPC model provides a comprehensive array of services in the home setting and the disciplines encompassed by the home care teams typically involve physicians, nurses, social workers, dietitians, physical and mental health therapists, pharmacists and health technicians.

The Swedish trial involved a single center, established within the Serafen Primary Care Center in Stockholm, and followed 255 patients over six months.[30] The patients' mean age was 81 years, 31 percent were male and race was not reported. Patients were dependent in a mean of 2.4 personal activities of daily living according to the Katz index and were dependent in a mean of 6.0 instrumental activities of daily living according to another unvalidated index. Patients had a mean of 4.3 medical diagnoses and 22 percent had primary cardiovascular disease, but rates of other specific comorbidities were not provided. A mean score of 22.2 on the MMSE (Mini-Mental State Examination) indicates that this sample was characterized by only mild cognitive impairment and only 6 percent had any psychiatric disorders. Rate of prior hospitalization was not reported. The key feature of the intervention program was that the care was exclusively home-based, delivered by an interdisciplinary team comprised of project and team physicians, a secretary, district nurse, physiotherapist, occupational therapist, and a nurse assistant. Patients in the standard care group received continued treatment in an acute or long-stay hospital, followed by standard district nurse-administered care at home.

No trial found a statistically significant reduction in mortality. Only the Swedish trial found a statistically significant reduction in hospitalizations, hospital days, or emergency department use.[30] When survivors (N=183) and decedents (N=66) were analyzed separately, there was a statistically significant reduction in long-term hospital days over six months in the survivor group, but not in the decedent group.[30] However, the risk of bias of the Swedish trial was high due to the significantly higher rate of medical diagnoses in the intervention group (4.5 compared with 3.9; P=0.003). Thus, we gave more weight to the findings from the higher quality, larger, multi-center trial of VA TM/HBPC, which provided moderate-strength evidence of no significant reduction in mortality or hospitalizations, hospital days, or emergency department use.[31]

PRIMARY CARE TRANSFERRED TO FREESTANDING CLINIC

Main Findings

- Free-standing clinic models (1 RCT/1 observational study; N=7814)
    - The risk of bias of the individual studies was unclear and the strength of the body of evidence was moderate.
    - Both studies found statistically significant reductions in hospital admission.
    - Applicability to the high-risk Veteran/military population is unclear. Both studies enrolled mostly elderly females. Race was 50 percent White in the PACE (Program of All-inclusive Care for the Elderly) study and not reported in the SIPA study (French acronym for System of Integrated Care for Older Persons).

Detailed Analysis

Two studies of freestanding clinic models targeted elderly populations, with mean ages of 80 years[41] and 82 years.[25,26] The characteristics, internal validity, main findings and the strength of the evidence of each study are described in detail below, but together these studies provide moderate-strength evidence that freestanding clinic models statistically significantly reduce odds of acute hospitalization by 48 percent (OR 0.52; 95% CI, 0.33 to 0.82)[25,26] and any hospital use by 84 percent (OR 0.16; P=0.01; 95% CI not reported).[41]

The observational study was conducted in the United States and compared two-year hospital use among enrollees of the PACE model to a comparison group of similarly frail community-dwelling older adults from the Medicare Current Beneficiary Survey (MCBS). The comparison group was selected using propensity score matching on a variety of variables, including sociodemographics, need for long-term care, need for acute care, prior hospital use, market factors, geographic factors, historic variables, and mortality.[41] This study involved a national, population-based sample of patients receiving care across a variety of urban and rural settings. Mean demographics after matching were age of 80 years, 74 percent female and 53 percent White. Half of patients had three or four limitations in activities of daily living and just over half had dementia (55%) and no prior hospitalization use (56%). Medical comorbidities were not reported. The PACE model fully integrates the financing and delivery of all acute and long-term services into single, full-service medical clinics across the U.S. Care management is provided collectively by a team of interdisciplinary staff, comprised of primary care physicians, nurse practitioners, onsite and home health nurses, social workers, occupational/physical therapists, dietitians, health workers, recreation therapists, and transportation workers. The comparison group was a nationally representative Medicare population whose care characteristics would be expected to reflect a broad range of Medicare-benefitted services. To minimize potential between-group differences in important patient characteristics, this study used propensity-score matching, as well as regression analysis to adjust for additional market, geographic and historical factors that could not be matched. However, this study still had an unclear risk of bias, primarily due to concerns about the validity of event ascertainment. The events were not well-defined, there was no mention of blinding of ascertainers, and no information was provided about the general reliability of the data sources. Because of the unclear risk of bias, the strength of the evidence from this study is moderate. The results of this study suggest that the PACE model effectively reduces any hospital use and number of days in the hospital per month (Table 2).

The randomized trial was conducted in Montréal and allocated 656 patients to the SIPA project and 653 to usual care. It was carried out in two public community home-care organizations in Québec.[25,26] Mean follow-up was 572 days. Patients' mean age was 82 years, 29 percent were male and race was not reported. Mean number of functional limitations performed with difficulty was 3.7. Mean number of chronic diseases was 4.9, but rates of specific medical comorbidities were not reported. A minority of patients had cognitive problems (31% had a score ≥ 3 on the Short Portable Mental Health Status) or depressive symptoms (13% had a score of ≥ 10 on the Geriatric Depression Scale). No information on prior hospitalizations was provided. In the SIPA program, full clinical responsibility was shifted to interdisciplinary teams who coordinated and delivered care from a dedicated SIPA center, including liaising with patients' regular family physicians. Key features of SIPA include comprehensive geriatric assessment upon intake; case management; maintenance of clinical responsibility both inside and outside of the hospital; care based on evidence-based, interdisciplinary protocols; and 24-hour on-call service. The interdisciplinary team was comprised of case managers, community nurses, social workers, occupational therapists, physiotherapists, homemakers, staff family physician, consultant pharmacists, and community organizers. The study publications did not specify who led the interdisciplinary team or the particular role of the case manager. The usual care group was offered usual home care services including nursing, rehabilitation, physician, personal, and social services but with limited time and availability and essentially no case management. Patients in the SIPA program had 48 percent lower odds of acute hospitalizations (95% CI, 0.33 to 0.82), but their mortality rate, hospital days and ER visits were not significantly different compared to the control group. The strength of this evidence was downgraded to moderate primarily because of unclear risk of bias due to our uncertainty about whether incomplete data were adequately handled (1% in SIPA group compared with 7% in control discontinued intervention).

INTERDISCIPLINARY TEAM ADDED TO REGULAR PRIMARY CARE (PRACTICE-BASED MODELS)

Main Findings

- Practice-based models (3 RCTs/1 observational study; N=1275)
    - The risk of bias of the individual studies was generally high and the strength of the body of evidence was generally low.
    - The only evidence of significant reductions in hospitalization and/or emergency room outcomes for practice-based models comes from a randomized trial of 951 patients that evaluated the Geriatric Resources for Assessment and Care of Elders (GRACE) model and found reduced hospitalizations in year two in a high-risk subgroup (N=226) and reduced ER visits in year two in the overall and high-risk groups.
    - At baseline, the target population in GRACE was poor and had low access to services. Additional social work and case management services may have more impact in this setting than in the VA primary care setting, in which frequently admitted patients may already have these services.

Detailed Assessment

Among the four clinic-based, practice-based models, three targeted elderly high-risk populations aged either 65 years or above[27-29] or aged 75 years or above,[39] whereas the fourth targeted

patients of any age (mean of 51 years) with a high utilization of inpatient services.[32] The models were heterogeneous in terms of their interdisciplinary team staffing and the key components of the interventions. Likewise, the usual care characteristics were either variable[28,29,32] or not described.[27,39] The patient populations were heterogeneous in terms of their gender (proportion of males ranged from 24% to 52%), race (proportion of Whites ranged from 31% to 97%) and prevalence of diabetes (range, 26% to 51%) and heart failure (range, 13% to 15%). Patient populations also differed in their risk of mortality. In the randomized trial of Primary Intensive Care (PIC), which targeted younger patients with high inpatient service utilization, the all-cause mortality rate in the control group was 10 percent over the 12 months of follow-up,[32] whereas in the two trials with 24 months of follow-up, all-cause mortality in the control group ranged from 8 percent[28,29] to 17 percent.[27] All-cause mortality in the control group of the observational study was 5 percent, but whether this difference is clinically meaningful is unclear as the mean follow-up period was not described and the control group patients were preferentially selected because they were deemed to be at lower risk of hospital admission.[39]

The risk of bias of these studies was generally high, primarily due to significant imbalances in important patient characteristics at baseline. That, coupled with their limited precision due to small sample sizes, renders their evidence to be of generally low-strength. No study found any statistically significant differences between the intervention and control groups in all-cause mortality; in most cases likely due to their small sample sizes with limited statistical power.[27,32,39]

Only one study found a statistically significant reduction in any hospitalization or emergency room visit.[28,29] This was the randomized trial of the GRACE model of primary care, which was evaluated in 951 low-income seniors across six community-based health centers in Indianapolis, Indiana.[28,29] The majority of patients were women (76%) and Black (59%), with a mean age of 72 years. Just under half of patients were living alone, and mean scores on measures of both basic and instrumental activities of daily living suggested many patients were having at least a little to a lot of difficulty. In terms of medical comorbidities, 81 percent had hypertension, 34 percent had diabetes, 22 percent had chronic lung disease, and 13 percent had heart failure. The mean number of hospitalizations in the prior six months was 0.2. Few patients had significant depression or dementia. One of the key features of the GRACE model is that it is practice-based, meaning that it is fully integrated into patients' existing primary care providers' practices. Participating primary care practices employ a GRACE support team, consisting of an advanced practice nurse and social worker, who collaborate with the primary care physician and the interdisciplinary team to develop and implement individualized care plans. The control group received usual care, with access to all standard primary and specialty care services. In addition to the primary analysis of the full sample of 951 patients, preplanned secondary analyses were conducted in a subgroup of 226 patients who were at high-risk of hospitalizations (PRA [Probability of Repeat Admission] score of 0.4 or higher). For hospitalizations per-1000 patients, there was a statistically significant reduction in year two in the high-risk subgroup (396 compared with 705; P=0.03), but not for the full sample (Table 2). For emergency department visits, there were statistically significant reductions both in the full sample (643 compared with 841; P=0.01) and the high-risk subgroup (848 compared with 1314; P=0.03). For the full sample, the strength of evidence was downgraded to moderate due to the unclear risk of bias resulting from uncertainty about use of adequate allocation concealment methods and the significantly lower rate of county medical assistance use in the GRACE intervention group at baseline (83.7% compared with

89.0%; *P*=0.02). However, for the subgroup of high-risk patients, the strength of evidence was further downgraded to low, due to our complete uncertainty about the comparability of baseline characteristics between the GRACE and control groups. As baseline characteristics were not provided for the high-risk subgroup, we can't rule out that potential differences in patient characteristics may have mediated the positive effect of the GRACE intervention on hospital utilization outcomes.

LIMITATIONS

The lack of a standard taxonomy for describing models of intensive primary care in the literature made this topic particularly difficult to search for. Although we attempted to use an exhaustive list of search terms, our search may have missed some relevant studies. The applicability of the evidence on the clinic-based models to the highest risk Veteran population is unclear as the study samples were comprised mostly of females who were 72 years of age and older. The study settings were largely limited to urban locations, and they do not provide much information about the effectiveness of such intensive primary care programs in other healthcare environments. It was impossible to distinguish the effects of specific model components, such as composition of the interdisciplinary team, due to limitations in the descriptions of the programs and their heterogeneity.

Additionally, there are some general methodological limitations of this Evidence Brief associated with streamlining the traditional systematic review methods in order to synthesize the evidence within a shortened timeframe of two months. One main limitation is that the findings of this review relate to a narrower range of outcomes than may be of interest to broader audiences of healthcare providers and policymakers. Within the given timeframe, we could only adequately evaluate a limited number of effectiveness outcomes including mortality, hospitalizations, hospital days and emergency room use. Additionally, we must acknowledge the potential biases that may have been introduced by excluding studies published in languages other than English, and from generally employing only one reviewer for the majority of study selection and assessment of overall strength of evidence. Brief or rapid review methodology is still developing and there is not yet consensus on what represents best practice.

CONCLUSIONS

- No program evaluated in this review statistically significantly reduced mortality.
- No program evaluated in this review reported any statistically significant unintended harms. Only one small controlled observational study with high risk of bias reported a clinically significantly higher rate of all-cause mortality in the intervention group (15% compared with 5%), but the difference was not statistically significant due to the small sample size (N=59).
- Evidence from home-based models is most applicable to Veteran/military populations, but found inconsistent reductions in hospitalization, hospital days and emergency department use outcomes.
- The best evidence of the effectiveness of any intensive primary care program comes from the PACE (Program of All-Inclusive Care for the Elderly) model, which uses a free-standing clinic approach and statistically significantly reduced two-year hospital use and days in hospital per month. However, patients in this study were mostly women in their eighties and it is unclear how applicable this evidence is to the target high-risk Veteran/military population.
- The only model that specifically focused on patients with high utilization of inpatient services was the Primary Intensive Care (PIC) model. But, the best evidence available to evaluate this model was low strength as it was limited to one randomized trial of 96 patients with a high risk of bias and it did not find statistically significant reductions in hospitalizations, hospital days or emergency department use.
- The best evidence of the effectiveness of practice-based models comes from the GRACE program, which found a statistically significant reduction in emergency room visits per-1,000 patients in year two. However, the study sample was mostly Black women in their seventies who had a broad range of baseline predicted risk of hospitalization and a lower level of social and clinical services than many (but not all) VA patients. Therefore, it is unclear how applicable this evidence is to the target high-risk Veteran/military population.

TABLE 1. CONTROLLED STUDIES: CHARACTERISTICS

Author Year Care model name Study design Setting Sample size Follow-up	Key patient selection criteria	Role of regular primary care physician	Interdisciplinary team staffing	Key features	Usual care characteristics	Risk: Prior health service use (e.g., hospitalizations, home health, respite, etc.)	Other risk indicators: Functional capacity, comorbidities, etc.	Key patient characteristics
Beland 2006[25]/ Bergman 1997[26] SIPA (System of Integrated Care for Older Persons) RCT Public community organizations responsible for home care in the province of Quebec N = 1309 19 months	Frail elderly: Aged ≥ 64 years; community dwelling; ≥ moderate disability (score ≤ -10 on SMAF scale)	Patients were encouraged to continue to see their own physician	Case managers, community nurses, social workers, occupational therapists, physiotherapists, homemakers, staff family physician, consultant pharmacists, community organizers	• Comprehensive geriatric assessment upon intake • Case management • Care based on evidence-based interdisciplinary protocols • 24-hour on-call service • Maintained clinical responsibility and accountability inside and outside of hospital • SIPA family physicians offered $200 per patient in addition to usual fee-for-service payments to compensate for time communicating with team • SIPA family physicians each cared for between 1-10 patients • Visit frequency NR	Offered usual home care services including nursing, rehabilitation, physician, personal, and social services but with limited time and availability and essentially no case management	NR	# of chronic diseases: 4.9 Functional limitations (# performed with difficulty): 3.7	82 years 29% male Race NR Medical comorbidities NR Cognitive problems (% with 3+ on SPMSQ): 31% Depressive symptoms (% with 10+ on GDS): 13%
Coleman 1999[27] Chronic Care Clinic RCT Ambulatory clinic in a large staff-model HMO in western Washington State (Group Health Cooperative) N = 169 24 months	Care transitions program, plus age, lower functional status, cognitive impairment: Aged ≥ 65 years; each practice selected top 36 patients with highest Risk Scores based on validated computer-based predictive index (Coleman 1998)	Continue to provide all care	Nurse, pharmacist, social worker	• Half-day visits with team every 3-4 months, including pharmacist consultations and self-management group session • Use of systematic health status assessment approach • Panel size of 19 • Compensation NR	NR	44% hospitalized in prior year Mean risk score: 0.54	Chronic Disease Score: 7.7 vs 7.3	77 years 52% male 97% White 51% diabetes HF NR COPD NR HTN NR Psychiatric, cognitive comorbidities NR

Author Year Care model name Study design Setting Sample size Follow-up	Key patient selection criteria	Role of regular primary care physician	Interdisciplinary team staffing	Key features	Usual care characteristics	Risk: Prior health service use (e.g., hospitalizations, home health, respite, etc.)	Other risk indicators: Functional capacity, comorbidities, etc.	Key patient characteristics
Counsell 2007[29] GRACE (Geriatric Resources for Assessment and Care of Elders) RCT 6 community-based health centers affiliated with Wishard Health Services, a university-affiliated urban healthcare system serving medically indigent patients in Indianapolis, Indiana N = 951 24 months	Poverty: Age ≥ 65 years; income < 200% of federal poverty level	• Contribute to care plan development • Collaborate with support team to implement care plan • Employ GRACE support team members	Geriatrician, pharmacist, physical therapist, mental social worker, community-based services liaison	• In-home assessment and care management provided by an NP and social work team • Individualized care plan development with multidisciplinary input • Protocol-driven care • Integrated electronic medical record • Web-based care management tracking tool • Integration with affiliated pharmacy, mental health, home health, and community-based and inpatient geriatric care services • Minimum of 1 in-home follow-up visit and 1 telephone or face-to-face contact per month with support team •Panel size NR •PCP not directly compensated for involvement, but credited in annual performance review	Access to all existing primary and specialty care services: Outpatient geriatric assessment and multispecialty center, inpatient ACE unit and consult service, skilled nursing facility, physician house call program, psychiatric care	Hospitalizations in past 6 months (mean): 0.2	Living alone: 47%	72 years 24% male 41% White 81% HTN 34% diabetes 13% HF 22% chronic lung disease Depression (PHQ-9 score ≥ 10): 11% Dementia (SPMSQ score ≤ 5): 1%
Hughes 1990[33] VA HBPC RCT Hines VA Hospital, Illinois N = 233 6 months	Need intensive assistance: ≥ 2 ADL impairments	Not described	Physician, nurse, social worker, physical therapist, dietician, health technicians	Comprehensive, continuous care to patients at home; visit frequency; panel size; compensation NR	Customary care; including use of Medicare or other community home care	VA hospital use in past 6 months: 49% Non-VA hospital use in past 6 months: 28%	Katz ADL impairments (mean): 4.5	68 years % male NR 78% White Heart disease: 16% Respiratory diseases: 13% Cerebrovascular disease: 9% Psychiatric, cognitive comorbidities NR

Author Year Care model name Study design Setting Sample size Follow-up	Key patient selection criteria	Role of regular primary care physician	Interdisciplinary team staffing	Key features	Usual care characteristics	Risk: Prior health service use (e.g., hospitalizations, home health, respite, etc.)	Other risk indicators: Functional capacity, comorbidities, etc.	Key patient characteristics
Hughes 2000[31] VA HBPC RCT 16 VA medical centers N = 1966 12 months	Need intensive assistance, plus multiple comorbidities: (1) ≥ 2 ADL impairments OR terminal illness prognosis; OR (2) homebound with primary diagnosis of CHF or COPD; OR (3) outpatients or nursing home residents with same diagnoses, plus hospitalization within past 3 months	Transferred to HBPC physician and medical team until discharge from the program	Social workers, dietitians, therapists, pharmacists, health technicians	• Integrated networks • Systematic screening • Emphasis on continuity of care • Management across organizational boundaries • Provide 24-hour contact for patients • Visit frequency, panel size, compensation NR	Access to any VA-sponsored services, except HBPC and non-VA postacute services	89% hospitalized in past 6 months Mean days of index admission: 31	Katz ADL impairments (mean): 3.2 82% reside with caregiver 36% of patients had a high score on Smith Comorbidity Index	70 years 96% male 64% White 55% had any CHF or COPD; diabetes NR Mental status (mean score on SPMSQ): 7.1
Jiwa 2002[39] Observational Single general practitioner practice in a market town in Nottinghamshire, UK; average deprivation level (Jarman score -4.26) N = 59 Follow-up period not specified	Poverty: Age ≥ 75 years; income < 200% of federal poverty level	Unclear; once a patient was referred to the wider primary care team, a nominated general practitioner or nurse undertook regular visits or telephone calls to patient	General practitioner, dietician, physiotherapist, occupational therapist, district nurse, social worker	• Enhanced support by a multidisciplinary team; specific details not described	NR	34% social service involvement	32% admitted to hospital 1/1998-9/2000	83 years 26% male Race NR Diabetes: 17% Cerebrovascular disease: 12% Ischemic heart disease: 17% Chronic obstructive airways disease: 13% Congestive cardiac failure: 14% Dementia: 15%
Melin 1995[30] RCT St. Görans, a county general hospital, and the Serafen Primary Care Center in Stockholm, Sweden N = 249 6 months	Need intensive assistance: Medically stable, but chronically ill, and dependent in 1-5 Katz ADLs	Not described	Project physician, primary care physician, secretary, district nurse, physiotherapist, occupational therapist, nurse assistant	• Physician-led home healthcare • Assessment of each patient's needs for medical, functional and social care in the home • Weekly interdisciplinary care-planning conference • Visit frequency, panel size, compensation NR • 24-hour telephone service	Continued treatment in an acute or long-stay hospital, followed by standard district nurse-administered care at home	NR	Katz ADL impairments (mean): 2.4 Instrumental ADLs (mean): 6.0 Medical diagnoses (mean): 4.3	81 years 31% male Race NR Primary cardiovascular disease: 22%; others NR Folstein MMSE (mean): 22.2 Psychiatric disorders (mean): 5.6

Author Year Care model name Study design Setting Sample size Follow-up	Key patient selection criteria	Role of regular primary care physician	Interdisciplinary team staffing	Key features	Usual care characteristics	Risk: Prior health service use (e.g., hospitalizations, home health, respite, etc.)	Other risk indicators: Functional capacity, comorbidities, etc.	Key patient characteristics
Meret-Hanke 2011[41] PACE (Program of All-Inclusive Care for the Elderly) Observational Variety of U.S. urban and rural settings N = 3889 2 years	Need intensive assistance: Nursing home-eligible individuals who are aged ≥ 55 years and live within the programs' catchment areas	Not described	Primary care physicians, nurse practitioners, onsite and home health nurses, social workers, occupational/ physical therapists, dietitians, health workers, recreation therapists, and transportation workers	• Fully integrating the financing and delivery of acute and long-term care services • Services delivered in programs' adult day centers, in enrollees' homes, as well as inpatient settings • Financing integrated through capitated payments • Interdisciplinary teams responsible for managing enrollees' care across all settings • Shared decision-making • Typical staff: enrollee ratio is 60-80:120-150 • Visit frequency NR	NR (control group from Medicare Current Beneficiary Survey)	PACE pre-baseline mean hospital use 1.58 days/month vs 1.04 days/ month	3 or 4 ADL limitations .5 vs .26	80.2 years 27% male 52% White Medical comorbidities NR 55% dementia
Sledge 2006[32] PIC (Primary Intensive Care) RCT Within primary care center of an urban, academically affiliated hospital in northeastern U.S. N = 96 12 months	≥ 2 medical or surgical hospital admissions in prior 12 months; but excluded very highest outliers (total hospital cost > 2 SD's of log-transformed mean, Charlson Comorbidity Index > 5)	Continue to provide care	Primary care provider, psychiatric nurse case manager with advanced practice nursing certifications (APRN) in medical and psychiatric, social worker, psychiatrist, general internist	• Comprehensive interdisciplinary medical and psychosocial assessment • Ambulatory case management for 1 year • Minimum of monthly telephone call from nurse case manager; phone/ pager availability 5 days/week • Panel size of case manager ≤ 21 • Compensation NR	Usual care directed by PCP; on-site psychiatric consultation available by PCP referral	100% ≥ 2 hospitalizations in past year	Charlson score: 1.8	51 years 33% male 31% White 15% CHF 20% COPD 26% diabetes HTN NR 47% any psychiatric disorder, 33% current major depression; substance use disorders (mean AUDIT-PRIME-MD scores) = 2.6

TABLE 2. CONTROLLED STUDIES: RESULTS

Author Year Care model name Study design Setting Sample size Follow-up	Mortality rate	Hospital admission/readmission	Hospital days	ED visits
Beland 2006[25]/Bergman 1997[26] SIPA (System of Integrated Care for Older Persons) RCT Public community organizations responsible for home care in the province of Quebec N = 1309 19 months	Deceased (prior to and after baseline): 19% vs 22%; "SIPA had no effect on mortality" (data NR)	Acute hospitalization ("became alternate level of care"): OR 0.52 (95% CI, 0.33 to 0.82)	Inpatient care: OR 0.93 (95% CI, 0.71 to 1.18)	ED visits: OR 0.92 (95% CI, 0.73 to 1.20)
Coleman 1999[27] Chronic Care Clinic RCT Ambulatory clinic in a large staff-model HMO in western Washington State (Group Health Cooperative) N = 169 24 months	16% vs 17%; NSD	> 1 Hospitalization (% pts): 36.5% vs 34.3%; *adjusted P* = 0.72 Hospital admits (mean/yr): 0.58 vs 0.59; *adjusted P* = 0.91	Hospital days (mean): 6.4 vs 5.4; *adjusted P* = 0.57	Emergency visits (mean/yr): 0.23 vs 0.27; *adjusted P* = 0.73
Counsell 2007[29] GRACE (Geriatric Resources for Assessment and Care of Elders) RCT 6 community-based health centers affiliated with Wishard Health Services, a university-affiliated urban healthcare system serving medically indigent patients in Indianapolis, Indiana N = 951 24 months	Full sample: 7.0% vs 7.0%; *P* = 0.64 High-risk subgroup: NR	Hospital admissions, per-1000: Full sample (cumulative): 700 vs 740; *P* = 0.66 High-risk (cumulative NR): Year 1: 705 vs 798; *P* = 0.60 Year 2: 396 vs 705; *P* = 0.03	Hospital days, per-1000: Full sample (cumulative): 3749 vs 4069; *P* = 0.66 High-risk (cumulative NR): Year 1: 3938 vs 4544; *P* = 0.68 Year 2: 2152 vs 3943; *P* = 0.13	High risk subgroup Year 1: 1098 vs 1149; *P* = 0.79 Year 2: 848 vs 1314; *P* = 0.03 Full sample: Cumulative 2-year per-1000: 1445 vs 1748; *P*=0.03 Year 1: 823 vs 937; *P* = 0.22 Year 2: 643 vs 841; *P* = 0.01

Author Year Care model name Study design Setting Sample size Follow-up	Mortality rate	Hospital admission/readmission	Hospital days	ED visits
Hughes 1990[33] VA HBPC RCT Hines VA Hospital, Illinois N = 233 6 months	NR	NR	Total hospital days: 13.68 vs 13.53; *P* = NS Non-VA hospital days: 2.11 vs 0.82; *P* = 0.10	VA ER visits: 0.76 vs 0.61; *P* = NS Non-VA ER visits: 0.11 vs 0.10; *P* = NS
Hughes 2000[31] VA HBPC RCT 16 VA medical centers N = 1966 12 months	Excluding deaths before discharge: 34.7% vs 34.1%; *P* = 0.08 Including deaths before discharge: 38% vs 37%; *P* = NR	% patients readmitted: Months 1-6: 49% vs 53%; *P* = 0.07 Months 1-12: 61% vs 63%; *P* = 0.35 Mean # readmissions: Months 1-6: 0.8 vs 0.9; *P* = 0.06 Months 1-12: 1.3 vs 1.3; *P* = 0.28	Mean rehospitalization days: Months 1-6: 9.3 vs 9.5; *P* = 0.16 Months 1-12: 14.7 vs 13.3; *P* = 0.95	NR
Jiwa 2002[39] Observational Single general practitioner practice in a market town in Nottinghamshire, UK; average deprivation level (Jarman score -4.26) N = 59 Follow-up period not specified	15% vs 5%; *P-value* = NS	Hospital admissions: 4 vs 7; *P-value* = NS	NR	NR
Melin 1995[30] RCT St. Görans, a county general hospital, and the Serafen Primary Care Center in Stockholm, Sweden N = 249 6 months	26% vs 27%; *P* = NR	NR	<u>Survivors (N = 183)</u> Short-term (days): 24 vs 25; *P* = 0.50 Long-term (days): 16 vs 49; *P* < 0.001 Rehab. hosp. (days): 2 vs 3; *P* = 0.87 <u>Decedents (N = 66)</u> Short-term (days): 149.9 vs 179.9; *P* = 0.93 Long-term (days): 7.4 vs 53.6; *P* = 0.18 Rehab. hosp. (days): 5.4 vs NR; *P* = NR	NR

Author Year Care model name Study design Setting Sample size Follow-up	Mortality rate	Hospital admission/readmission	Hospital days	ED visits
Meret-Hanke 2011[41] PACE (Program of All-Inclusive Care for the Elderly) Observational Variety of U.S. urban and rural settings N = 3889 2 years	Control group = 24.9%, "almost 5 percentage points higher than PACE sample" (data and analysis NR) OR at 2 year follow-up 3.26 *P* < .01 Means: Interval 1: .06 Interval 2: .06 Interval 3: .07 Interval 4: .07	Any hospital use: Adjusted OR 0.16; *P* = 0.01 (95% CI NR)	Days in hospital per month: Weighted mean difference: -0.54; *P* < 0.01 (95% CI NR)	NR
Sledge 2006[32] PIC (Primary Intensive Care) RCT Within primary care center of an urban, academically affiliated hospital in northeastern U.S. N = 96 12 months	6% vs 10%, *P*-value = NR	Mean changes (pre-post): Inpatient admissions: -0.1 vs -0.3, NSD	NR	ED visits: -0.52 vs -0.6; NSD

Abbreviations: ADL = Activities of Daily Living, CHF = Congestive Heart Failure, COPD = Chronic Obstructive Pulmonary Disease, ED = Emergency Department, GDS = Geriatric Depression Scale, GRACE = Geriatric Resources for Assessment and Care of Elders, HBPC = Home-based Primary Care, HF = Heart Failure, HTN = Hypertension, N = Number, NP = Nurse Practitioner, NR = Not Recorded, NSD = No Significant Difference, PACE = Program of All-Inclusive Care for the Elderly, PCP = Primary Care Physician, PIC = Primary Intensive Care, RCT = Randomized Controlled Trial, SIPA = System of Integrated Care for Older Persons, SMAF = Functional Autonomy Measurement System, SPMSQ = Short Portable Mental State Questionnaire, VA = Veterans Affairs

TABLE 3. CONTROLLED STUDIES: RISK OF BIAS AND STRENGTH OF EVIDENCE

Author Year (Model Name) Study Design	Risk of Bias	Strength of Evidence Rating
Home-Based (3 RCT's; N = 2454)		
Hughes 2000[31] (VA HBPC) Multicenter RCT	Unclear: Unclear blinding of outcome assessors.	***Moderate: Medium Risk of Bias; Consistent; Direct; Precise***
Hughes 1990[33] (VA HBPC) Single Center RCT	High: Intervention group was younger (66 vs 69; $P = 0.02$), more were retired due to health conditions (67% vs 51%; $P = 0.01$) and more were using non-VA clinics (36% vs 19%; $P = 0.01$).	
Melin 1995[30] RCT	High: Team group had significantly more medical diagnoses (4.5 vs 3.9; $P = 0.003$).	
Free-Standing Clinic (1 RCT, 1 observational study; N = 7814)		
Beland 2006[25]/ Bergman 1997[26] (SIPA) RCT	Unclear: Uncertainty about whether incomplete data were adequately handled (1% in SIPA group compared with 7% in control discontinued intervention).	***Moderate: Medium Risk of Bias; Consistent; Direct; Precise***
Meret-Hanke 2011[41] (PACE) Observational	Unclear: Propensity score matching used, but differences persisted even after matching; but regression used to control for potential additional sources of bias.	
Practice-Based		
Elderly (2 RCT's, 1 observational study; N = 1179)		
Coleman 1999[27] (Chronic Care Clinic) RCT	High: Control patients had higher Chronic Disease Score (CDS) than intervention patients (7.7 vs 7.3; $P = 0.06$).	***High-Risk Group=Low: High Risk of Bias; Inconsistent; Indirect (low applicability); Imprecise*** ***Overall=Moderate: Medium Risk of Bias; Consistency N/A; Indirect (low applicability); Precise***
Counsell 2007[29]/ Counsell 2006[28] (GRACE) RCT	Full sample: Unclear Uncertainty about use of adequate allocation concealment methods and the significantly lower rate of county medical assistance use in the GRACE intervention group at baseline (83.7% compared with 89.0%; $P = 0.02$). High-risk group: High Complete uncertainty about the comparability of baseline characteristics between the GRACE and control groups. As baseline characteristics were not provided for the high-risk subgroup, we can't rule out that potential differences in patient characteristics may have mediated the positive effect of the GRACE intervention on hospital utilization outcomes.	
Jiwa 2002[39] Observational	High: Baseline differences between intervention and control group (e.g., intervention group selected because considered to be at-risk of avoidable hospitalization; control group were not considered to be at risk); inadequate outcome ascertainment; no control for potential confounders.	
Younger Patients with High Utilization (1 RCT; N = 96)		
Sledge 2006[32] (PIC) RCT	High: Intervention group had lower proportion of males (26% compared with 41%), unclear allocation concealment.	***Low: High Risk of Bias; Consistency N/A; Direct; Imprecise***

Abbreviations: GRACE = Geriatric Resources for Assessment and Care of Elders, HBPC = Home-Based Primary Care, N = number, N/A = Not Applicable, PACE = Program of All-Inclusive Care for the Elderly, PIC = Primary Intensive Care, RCT = Randomized Controlled Trial, SIPA = French acronym for "System of Integrated Care for Older Persons," VA = Veterans Affairs

APPENDIX A. ADDITIONAL INTENSIVE PRIMARY CARE PROGRAMS WITHOUT PUBLISHED EVALUATIONS

After Discharge Management of Low Income Frail Elderly (AD-LIFE)

Characteristic	Details
Implementation date	2007
Setting	Summa Health System in Akron, Ohio
Role of regular primary care physician	Primary care physician is paid to participate in a face-to-face office visit during which the nurse case manager presents the care plan to the patient.
Patient population	≥ 65 years old, confirmed or probable dual eligible (Medicare and Medicaid), have at least 1 chronic illness (i.e., chronic obstructive pulmonary disease, diabetes, cerebrovascular accident, coronary artery disease, hypertension, congestive heart failure, osteoporosis, osteoarthritis), and at least 1 impaired ADL or 2 impaired instrumental activities of daily living (IADL), and must be discharged home
Interdisciplinary team members	Geriatrics-certified advanced practice nurse (APN) and nurse case manager (CM)-led. Core team additionally includes a geriatrician, a social worker from the Area Agency on Aging (AAoA), and a geriatrics-certified pharmacist. Extended team experts, who participate as needed, include a psychologist, cardiologist, pulmonologist, endocrinologist, and occupational therapist
Program components	APN contact within 48 hours of discharge. APN and nurse CM perform comprehensive in-home assessment and delineate patient goals of care within 7 days of discharge. Interdisciplinary team generates individualized care plan. Nurse CM facilitates implementation of the care plan with regular and frequent follow-up. Other features include community linkages, effective self-management support, organizational structure, leadership, incentives and resources, evidence-based decision support, improved information systems.
Data on mortality, hospital admission/readmission, hospital days, emergency department visits	Data not yet available. Randomized controlled trial is still ongoing.
Program information	Allen KR, Hazelett SE, Jarjoura D, et al. The after discharge care management of low income frail elderly (AD-LIFE) randomized trial: theoretical framework and study design. *Popul Health Manag.* Jun 2011;14(3):137-142. Wright K, Hazelett S, Jarjoura D, Allen K. The AD-LIFE trial: working to integrate medical and psychosocial care management models. *Home Healthc Nurse.* May 2007;25(5):308-314.

AtlantiCare Special Care Center Ambulatory Intensive Care Unit

Characteristic	Details
Implementation date	2007
Setting	Dedicated clinic in Atlantic City
Role of regular primary care physician	Not described
Patient population	High-risk patients—those with chronic illnesses or socioeconomic issues that contribute to high healthcare usage
Interdisciplinary team members	Two physicians (one who serves as medical director); a registered nurse (RN); a social worker who manages the clinic; and a team of community health workers, known as health coaches, supervised by the RN

Characteristic	Details
Program components	Not described
Data on mortality, hospital admission/readmission, hospital days, emergency department visits	Not described
Program information	http://pweb1.rwjf.org/reports/grr/056351.htm

Boeing Intensive Outpatient Care Program (IOCP), Seattle, Regence BlueShield of Washington

Characteristic	Details
Implementation date	2007
Setting	Three physician groups in Seattle, Washington: Everett Clinic, Valley Medical Center IPA, and Virginia Mason Medical Center
Role of regular primary care physician	Prior PCP maintained in 1 clinic; care transferred to new PCP in other 2 clinics
Patient population	Complex patients identified through claims-based algorithms
Interdisciplinary team members	PCP-led, dedicated RN care manager, specialists
Program components	Individual care plan "executed through intensive in-person, telephonic and email contacts – including frequent proactive outreach by an RN, education in self-management of chronic conditions, rapid access to and care coordination by the IOCP team, daily team planning huddles to plan patient interactions, and direct involvement of specialists in primary care contacts, including behavioral health when feasible."
Data on mortality, hospital admission/readmission, hospital days, emergency department visits	Hospital admissions reduced by 28% over 12 months in 276 patients, compared to a control group of non-participating Boeing-insured that were propensity-score matched based on health spending risk factors. Blog and slides lacked adequate detail to assess validity of methods.
Program information	http://healthaffairs.org/blog/2009/10/20/are-higher-value-care-models-replicable/ http://www.leg.wa.gov/JointCommittees/HRI/Documents/Sept2010/PracticeInnovations.pdf

CareMore, Medicare Advantage Plan HMO

Characteristic	Details
Implementation date	1993
Setting	Dedicated facilities in California, Arizona and Nevada
Role of regular primary care physician	Patients maintain relationships with their regular primary care physicians, with the Care Center providing enhanced wrap-around care when needed
Patient population	Frail population, 20% of patients who account for 60% of costs
Interdisciplinary team members	RN's, medical assistants, social workers, podiatrists, behavioral health professionals and MD 'extensivists'
Program components	MD 'extensivist'-led, "who visit members in the hospital, but also provide pre-operative and post-hospital care"; frequent evaluation and follow-up from a multidisciplinary team; electronic health record system to facilitate communication with CareMore providers and community PCP's.

Characteristic	Details
Data on mortality, hospital admission/readmission, hospital days, emergency department visits	Compared to overall Medicare population, lower hospital readmission rates (13.6% vs 20%) and 63% fewer hospital bed days
Program information	http://www.chcf.org/~/media/MEDIA%20LIBRARY%20Files/PDF/C/PDF%20CINQtrMtngReportJun2012.pdf

HealthCare Partners Comprehensive Care Centers

Characteristic	Details
Implementation date	Not described
Setting	Physician-owned medical group and Independent Practice Association (IPA) serving greater Los Angeles and Orange Counties with 600,000+ members insured through commercial plans, Medicare Advantage and many other Medicare and PPO patients
Role of regular primary care physician	Not described
Patient population	High-risk patients; "the 5% of patients who generate 55% of all hospitalizations"; selection process not described
Interdisciplinary team members	MD/NP/PA, nurses, care managers, social workers, and medical assistants
Program components	Offer longer comprehensive visits and take on role of primary provider; closely integrated into community resources and physician offices.
Data on mortality, hospital admission/ readmission, hospital days, emergency department visits	Compared to pre-enrollment, downward trend in hospital days per 1,000 over 12 months post-enrollment (-18.3% to -24.5%; *P-value* not reported). Sources lacked adequate detail to assess validity of methods.
Program information	http://www.chcf.org/~/media/MEDIA%20LIBRARY%20Files/PDF/C/PDF%20CINQtrMtngReportJun2012.pdf http://www.chcf.org/~/media/MEDIA%20LIBRARY%20Files/PDF/C/PDF%20CINQtrMtngReportOct2011.pdf

UNITE HERE Health Center Special Care Center, New York City

Characteristic	Details
Implementation date	May 2006
Setting	Dedicated clinic in New York City
Role of regular primary care physician	Not described
Patient population	Low-income, largely immigrant population experiencing a high rate of chronic disease
Interdisciplinary team members	140 staff and providers, including 15 bilingual primary care and OB/Gyn providers; 38 part-time physician specialists; 84 bilingual administrative and support staff including 17 patient care assistants, and 6 health coaches
Program components	Team-based care. Assignment of health coach to deliver education and provide close and continuous follow-up. Routine care is streamlined via use of IT resources and increased reliance on well-trained medical assistants. Physicians and nurse practitioners' services reserved for patients' clinical needs.

Characteristic	Details
Data on mortality, hospital admission/readmission, hospital days, emergency department visits	Not described
Program information	http://futurehealth.ucsf.edu/Public/Publications-and-Resources/Content.aspx?topic=UNITE_HERE_Health_Center—Pioneering_the_Ambulatory_Intensive_Caring%20Unit http://www.newyorker.com/reporting/2011/01/24/110124fa_fact_gawande

University of New Mexico Health Sciences Center Project ECHO (Extension for Community Healthcare Outcomes)

Characteristic	Details
Implementation date	In progress; in May 2012 awarded 3-year U.S. Department of Health and Human Services (HHS) Health Care Innovation awards
Setting	Rural and underserved communities in New Mexico and Washington State
Role of regular primary care physician	Not described
Patient population	5,000 high-cost, high-utilization, high-severity patients with multiple chronic diseases
Interdisciplinary team members	Community-based providers and a team of university medical center-based primary care "intensivists" trained to care for patients with multiple chronic diseases
Program components	Weekly telemedicine clinics, conducted in the manner of grand rounds to help increase community-based primary care physicians' capacity to treat and manage complex patients
Data on mortality, hospital admission/readmission, hospital days, emergency department visits	Not applicable, project in process
Program information	http://hscapp.unm.edu/calendar/output/index.cfm?fuseaction=main.release&EntryID=10679

Search Methods:

Phrases:

"Patient care management"
"Patient care team"
"Home care services"
"PACE"
"program of all inclusive care for the elderly"
"team-managed home based primary care"
"intensive primary care"
"home based primary care"
"interdisciplinary home based primary care program"
"Primary care intensivist"
"primary care medical home"
"patient-centered medical home"
"complex care medical home"

"ambulatory intensive care unit"
"intensive outpatient care program"
"coordinated care model"
"chronic care model"
"accountable care organizations"

Sources:

- Google
- Google Scholar
- AHRQ: evidence reports and technology assessments, USPSTF recommendations, and related DEcIDE projects
  http://effectivehealthcare.ahrq.gov/index.cfm/search-for-guides-reviews-and-reports/
  http://www.ahrq.gov/clinic/uspstf/uspstopics.htm
  http://www.ncbi.nlm.nih.gov/books
  https://www.kpchr.org/MMA/system/login.aspx
  http://mc.manuscriptcentral.com/ehc
- NICE Guidelines
  http://guidance.nice.org.uk/
- NHS Evidence
  http://www.evidence.nhs.uk/default.aspx
- Cochrane Reviews and Protocols
  http://www.thecochranelibrary.com/view/0/index.html
- DERP Drug Class Reviews
  http://derp.ohsu.edu/about/final-products.cfm
  http://derp.ohsu.edu/about/draft-products.cfm
- HTA (CRD database): Health Technology Assessments
  http://www.crd.york.ac.uk/CMS2Web/
- VA Products - VATAP, PBM and HSR&D publications
  http://www.hsrd.research.va.gov/research/default.cfm
  http://www4.va.gov/vatap/publications.htm
- NIH Consensus Statement
  http://consensus.nih.gov/previous.htm
  http://consensus.nih.gov/historical.htm
- CDC Community Guide
  http://www.thecommunityguide.org/index.html
- CMS Policies
  http://www.cms.gov/
- CADTH
  http://www.cadth.ca/index.php/en/hta/reports-publications/search
- UBC Centre for Health Services and Policy Research
  http://chspr.ubc.ca/publications
- Institute for Clinical Evaluative Sciences
  http://www.ices.on.ca/

- WHO Health Evidence Network
  http://www.euro.who.int/en/what-we-do/data-and-evidence/health-evidence-network-hen/publications/by-keyword
- ECRI Institute
  https://www.ecri.org/Pages/default.aspx
- Bandolier
  http://www.medicine.ox.ac.uk/bandolier/
- Health Technology Assessment International meta search
  http://www.htai.org/index.php?id=226
- PubMed health
  http://www.ncbi.nlm.nih.gov/pubmedhealth/
- PROSPERO
  http://www.crd.york.ac.uk/prospero/
- Campbell Collaboration
  http://www.campbellcollaboration.org/
- Institute of Medicine
  http://www.iom.edu/
- DoPHER
  http://eppi.ioe.ac.uk/webdatabases/Intro.aspx?ID=2
- Robert Wood Johnson Foundation
  http://www.rwjf.org/

SUPPLEMENTAL MATERIALS

Supplemental Material

The following supplemental materials are available on the ESP website with this Evidence Brief at this link:

1. Search Strategy
2. List of Excluded Studies
3. Controlled Studies: Complete Risk of Bias Assessment
4. Uncontrolled Studies: Characteristics
5. Uncontrolled Studies: Results

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