

Draft Systematic Review

Number xx

Home-Based Primary Care Interventions

Prepared for:

Agency for Healthcare Research and Quality
U.S. Department of Health and Human Services
540 Gaither Road
Rockville, MD 20850
www.ahrq.gov

This information is distributed solely for the purposes of pre-dissemination peer review. It has not been formally disseminated by the Agency for Healthcare Research and Quality. The findings are subject to change based on the literature identified in the interim and peer-review/public comments and should not be referenced as definitive. It does not represent and should not be construed to represent an Agency for Healthcare Research and Quality or Department of Health and Human Services (AHRQ) determination or policy.

Contract No.

Prepared by:

Investigators:

AHRQ Publication No. xx-EHCxxx
<Month Year>

This report is based on research conducted by an Evidence-based Practice Center (EPC) under contract to the Agency for Healthcare Research and Quality (AHRQ), Rockville, MD (Contract No. xxx-xxx-xxxxx). The findings and conclusions in this document are those of the authors, who are responsible for its contents; the findings and conclusions do not necessarily represent the views of AHRQ. Therefore, no statement in this report should be construed as an official position of AHRQ or of the U.S. Department of Health and Human Services.

The information in this report is intended to help health care decisionmakers—patients and clinicians, health system leaders, and policymakers, among others—make well informed decisions and thereby improve the quality of health care services. This report is not intended to be a substitute for the application of clinical judgment. Anyone who makes decisions concerning the provision of clinical care should consider this report in the same way as any medical reference and in conjunction with all other pertinent information, i.e., in the context of available resources and circumstances presented by individual patients.

AHRQ or U.S. Department of Health and Human Services endorsement of any derivative products that may be developed from this report, such as clinical practice guidelines, other quality enhancement tools, or reimbursement or coverage policies may not be stated or implied.

This report may periodically be assessed for the currency of conclusions. If an assessment is done, the resulting surveillance report describing the methodology and findings will be found on the Effective Health Care Program Web site at www.effectivehealthcare.ahrq.gov. Search on the title of the report.

This document is in the public domain and may be used and reprinted without permission except those copyrighted materials that are clearly noted in the document. Further reproduction of those copyrighted materials is prohibited without the specific permission of copyright holders.

Persons using assistive technology may not be able to fully access information in this report. For assistance contact EffectiveHealthCare@ahrq.hhs.gov.

None of the investigators have any affiliations or financial involvement that conflicts with the material presented in this report.

Suggested citation: <Authors>. <Home-Based Primary Care Interventions>. <Report Series Name in Title Caps No.> <#>. (Prepared by the <EPC Name> Evidence-based Practice Center under Contract No. <##>.) AHRQ Publication No. XX-EHCXXX-EF. Rockville, MD: Agency for Healthcare Research and Quality. <Month Year>. www.effectivehealthcare.ahrq.gov/reports/final.cfm.

Preface

The Agency for Healthcare Research and Quality (AHRQ), through its Evidence-based Practice Centers (EPCs), sponsors the development of systematic reviews to assist public- and private-sector organizations in their efforts to improve the quality of health care in the United States. These reviews provide comprehensive, science-based information on common, costly medical conditions, and new health care technologies and strategies.

Systematic reviews are the building blocks underlying evidence-based practice; they focus attention on the strength and limits of evidence from research studies about the effectiveness and safety of a clinical intervention. In the context of developing recommendations for practice, systematic reviews can help clarify whether assertions about the value of the intervention are based on strong evidence from clinical studies. For more information about AHRQ EPC systematic reviews, see www.effectivehealthcare.ahrq.gov/reference/purpose.cfm

AHRQ expects that these systematic reviews will be helpful to health plans, providers, purchasers, government programs, and the health care system as a whole. Transparency and stakeholder input are essential to the Effective Health Care Program. Please visit the Web site (www.effectivehealthcare.ahrq.gov) to see draft research questions and reports or to join an e-mail list to learn about new program products and opportunities for input.

We welcome comments on this systematic review. They may be sent by mail to the Task Order Officer named below at: Agency for Healthcare Research and Quality, 540 Gaither Road, Rockville, MD 20850, or by email to epc@ahrq.hhs.gov.

Richard G. Kronick, Ph.D.
Director
Agency for Healthcare Research and Quality

David Meyers, M.D.
Acting Director
Center for Evidence and Practice Improvement
Agency for Healthcare Research and Quality

Stephanie Chang, M.D., M.P.H.
Director, EPC Program
Center for Evidence and Practice Improvement
Agency for Healthcare Research and Quality

Christine Chang, M.D., M.P.H.
Task Order Officer
Center for Evidence and Practice Improvement
Agency for Healthcare Research and Quality

Acknowledgments

The authors gratefully acknowledge the following individuals for their contributions to this project: <Acknowledgments>.

Key Informants

In designing the study questions, the EPC consulted several Key Informants who represent the end-users of research. The EPC sought the Key Informant input on the priority areas for research and synthesis. Key Informants are not involved in the analysis of the evidence or the writing of the report. Therefore, in the end, study questions, design, methodological approaches, and/or conclusions do not necessarily represent the views of individual Key Informants.

Key Informants must disclose any financial conflicts of interest greater than \$10,000 and any other relevant business or professional conflicts of interest. Because of their role as end-users, individuals with potential conflicts may be retained. The TOO and the EPC work to balance, manage, or mitigate any conflicts of interest.

The list of Key Informants who participated in developing this report follows:

<Name>
<Place>
<City>, <ST>

Technical Expert Panel

In designing the study questions and methodology at the outset of this report, the EPC consulted several technical and content experts. Broad expertise and perspectives were sought. Divergent and conflicted opinions are common and perceived as healthy scientific discourse that results in a thoughtful, relevant systematic review. Therefore, in the end, study questions, design, methodologic approaches, and/or conclusions do not necessarily represent the views of individual technical and content experts.

Technical Experts must disclose any financial conflicts of interest greater than \$10,000 and any other relevant business or professional conflicts of interest. Because of their unique clinical or content expertise, individuals with potential conflicts may be retained. The TOO and the EPC work to balance, manage, or mitigate any potential conflicts of interest identified.

The list of Technical Experts who participated in developing this report follows:

<Name>
<Place>
<City>, <ST>

<Name>
<Place>
<City>, <ST>

Peer Reviewers

Prior to publication of the final evidence report, EPCs sought input from independent Peer Reviewers without financial conflicts of interest. However, the conclusions and synthesis of the scientific literature presented in this report does not necessarily represent the views of individual reviewers.

Peer Reviewers must disclose any financial conflicts of interest greater than \$10,000 and any other relevant business or professional conflicts of interest. Because of their unique clinical or content expertise, individuals with potential non-financial conflicts may be retained. The TOO and the EPC work to balance, manage, or mitigate any potential non-financial conflicts of interest identified.

The list of Peer Reviewers follows:

<Name>
<Place>
<City>, <ST>

<Name>
<Place>
<City>, <ST>

Home-Based Primary Care Interventions

Structured Abstract

Objectives. To assess the evidence about the effectiveness of home-based primary care (HBPC) interventions for adults with serious or disabling chronic conditions.

Data sources. Articles from January 1998 to December 2014 were identified from searches of Ovid MEDLINE, CINAHL, Clinical Trials.gov, the Cochrane Database of Systematic Reviews, and by reviewing reference lists and searching gray literature databases.

Review methods. We included randomized controlled trials (RCTs) and observational studies of HBPC that included home visits by a primary care provider, longitudinal management, and the provision of comprehensive care. The quality of studies was assessed, data extracted, and results summarized qualitatively.

Results. We identified 4,282 citations and reviewed 210 full text articles. A total of 18 studies reported in 19 articles were included. Two were RCTs while 17 were observational studies.

Clinical outcomes evidence was limited to studies that reported no significant improvement in function or mortality. For these the strength of evidence was low and there was insufficient evidence about symptoms.

HBPC had a positive impact on patient and caregiver experience, including satisfaction, quality of life, and caregiver needs, but the strength of evidence for these outcomes was low.

The strongest evidence (moderate) was that HBPC reduces hospitalizations and hospital days (length of stay). The potential to reduce emergency and specialty visits was supported by low strength of evidence, while no or unclear effects were identified on hospital readmissions, nursing home days, and costs (all low strength of evidence). Evidence about the impact of HBPC on nursing home admissions was insufficient.

In studies that reported on the impact of patient characteristics, moderate evidence indicated frail or sicker patients are more likely to benefit from HBPC. No identified studies assessed the impact of organizational characteristics on the effectiveness of HBPC.

The service included in the HBPC interventions studied varied widely. We were unable to identify any constellation of services associated with better outcomes. We did identify four studies that evaluated the addition of specific services. Combining palliative care and primary home care visits increased the likelihood of death at home (low strength of evidence) while the evidence was insufficient for adding caregiver support or transitional care to HBPC.

Conclusions. The evidence suggests that HBPC has a positive but limited impact on patients. Future research is needed that focuses on the content and organizational context of programs so that differences across programs can be identified and the experience of studied programs replicated by others. Additional research is also needed about which subgroups of patients benefit most from HBPC.

Contents

Introduction	1
Background and Objectives	1
Scope and Key Questions	3
Analytic Framework	4
Methods	6
Inclusion/Exclusion Criteria	6
Literature Identification and Data Analysis	7
Results	9
Literature Searches.....	9
Identification of Included Studies	9
Effectiveness of HBPC Interventions	12
Key Question 1. Among adults with chronic conditions that are serious or disabling, what are the effects (positive and negative) of home-based primary care interventions on a) health outcomes, b) patient and caregiver experience, and c) utilization of services?	12
Key Question 1a. Impact on health outcomes	12
Key Question 1b. Impact on patient and caregiver experience	13
Key Question 1c. Impact on utilization of services	13
Key Question 2. How do the effects of home-based primary care interventions differ across patient characteristics and organizational characteristics?	19
Key Question 2a. Patient characteristics.....	19
Key Question 2b. Organizational characteristics.....	19
Key Question 3. Which characteristics of home-based primary care interventions are associated with effectiveness?	20
Discussion	24
Limitations	27
Applicability	28
Challenges and Implications for Future Research	29
Conclusions	30
References	31
Abbreviations and Acronyms	34

Tables

Table 1. Defining characteristics of home-based primary care models for this review	3
Table 2. Inclusion and exclusion criteria	6
Table 3. Key characteristics of included studies.....	11
Table 4. Effectiveness of home-based primary care interventions (KQ1): Primary results by level of study quality for individual studies	15
Table 5. Components of home-based primary care reported.....	21
Table 6. Summary of evidence	24

Figures

Figure 1. Analytic framework for home-based primary care interventions.....	4
Figure 2. Study flow diagram	10

Appendixes

Appendix A. Home-Based Primary Care Extended Methods Section

Appendix B. Included Studies

Appendix C. Excluded Studies

Appendix D. Included and Excluded Studies Criteria

Appendix E. Evidence Table

Appendix F. Quality Ratings

Appendix G. Strength of Evidence

Introduction

Background and Objectives

The aging of the population,^{1,2} along with the increasing number of people with chronic illnesses³ and multimorbidity,⁴ are changing health care. The motivation for many health care reform efforts is that chronically ill, frail, and disabled patients may not be best served by the current common model of care,^{5,6} which is mostly delivered in office and hospital settings and may involve a disparate and disjointed array of providers.

High-quality primary care is comprehensive and serves as the entry into the health care system, provides person-focused (rather than disease-oriented) care over time, addresses all but very uncommon or unusual conditions, and coordinates or integrates care across different types of providers and settings. Primary care is at the center of many health services delivery reform efforts, such as patient-centered medical home models, precisely because primary care provides a usual source of care, encourages relationships with a provider, is more likely to include preventive services, may increase patient satisfaction, and can decrease the use of emergency departments for conditions that are not urgent.⁷⁻⁹

Home-based primary care (HBPC) interventions have roots in the house call and community health outreach practices of the past. Forty percent of physicians made house calls in the 1930s. This fell to less than 1 percent by the 1980s.¹⁰ Today HBPC is a model that combines home-based care for medical needs with intensive management and care coordination, as well as long-term services and supports when needed. HBPC interventions have been proposed as an alternative way of organizing and delivering care that may better address the needs, values, and preferences of chronically ill, frail, and physically or cognitively disabled patients who have difficulty accessing traditional office-based care primary care or other models of care that require office visits.

Developing HBPC interventions is important because of the large and growing number of people who may need this type of care. The American Community Survey conducted by the U.S. Census Bureau estimated that in 2013, 15.4 percent of people in the United States over 65 years (over 6,690,000 people) had independent living difficulties, defined as difficulty doing errands alone such as visiting a doctor's office or shopping because of a physical, mental, or emotional problem.¹¹ According to the Centers for Medicare and Medicaid Services, 3,459,600 people were served by Medicare home health in 2012, and the numbers have been increasing every year.¹² Not everyone with difficulty needs or wants help, and Medicare home health differs from HBPC in that it is usually for a defined period; nevertheless, these numbers suggest that many people could benefit from an expansion of HBPC.

The specific reasons a patient may need HBPC and the potential advantages vary. Functional impairments may make transportation to doctors' offices or clinics challenging, or caregivers may not be available to accompany patients during normal office or clinic hours. In some situations, going to an office may be contraindicated. For example, patients with cognitive deficits may become confused or agitated in unfamiliar surroundings. Providers also obtain better insight into the patient's needs with a home visit, often finding a simple environmental cause or solution for some problems. Patients with complex needs may require frequent monitoring, intense management, or rapid followup that cannot be easily accommodated by an office-based provider; it may be difficult to meet complex care needs when a patient cannot come to an office. Patients at high risk may avoid complications from hospital care (e.g., certain infections, delirium) if hospitalizations can be prevented, averted, or shortened.

Potential benefits of HBPC include: 1) increased access to care for people who have difficulty traveling to outpatient medical offices or for whom going to a medical office is contraindicated—this could include access after hours, weekends, or holidays, more frequent visits, and the ability to be seen sooner; 2) access that includes a range of services, including therapies, pharmacy, and medications management that have the potential to prevent or slow functional and cognitive decline; 3) better understanding of patients’ environments, needs, and constraints that can improve care and ultimately outcomes; 4) decreased hospitalizations and urgent care use when acute incidents are prevented or addressed in the home; 5) better support for and reduced burden on family caregivers; and 6) increased satisfaction. If all these benefits could be realized, HBPC would offer, as one analyst stated, “a win-win for U.S. health care”.¹³

HBPC was developed as a pilot model in the U.S. Department of Veterans Affairs (VA) more than 3 decades ago. It was designed to serve chronically ill veterans by providing effective primary care services as well as long-term care services in the home. The unique aspects of the model were related to its intention to provide “interdisciplinary care that is longitudinal and comprehensive rather than episodic and focused.”¹⁴ While the details can vary across the many different VA medical centers, today’s VA HBPC program includes an interdisciplinary team that provides care in the home to veterans with complex needs for whom clinic-based care is difficult due to function or disease. The VA model has expanded over time to include more mental health services and to facilitate collaboration with other services. In other environments, HBPC has developed based on elements of programs designed for people who are eligible for Medicaid and Medicare (frequently referred to as “dual-eligibles”), home and community-based long-term services and support programs, and physician house call programs.

Interest in HBPC is growing among the general public, health professionals in multiple disciplines, and health care delivery organizations. This is reflected in current policy, practice, and research. HBPC is currently the subject of a major Medicare demonstration project⁷ and even before this demonstration, an increasing number of public and private health systems and plans were beginning to offer HBPC.⁸ HBPC interventions have been the subject of articles in general publications⁹ as well as a topic for policy analyses.¹⁵ Additionally, research studies on HBPC have been summarized in seven systematic reviews.¹⁶⁻²³ This level of interest suggests that HBPC programs are likely to expand in the near future and continue to evolve to incorporate advances in communications, health information technology, and care management applications.

One of the challenges in developing and promoting HBPC has been that there remain important questions about the impact of HBPC. Despite the long experience that some systems have had with HBPC, the effectiveness of HBPC has remained unclear. While HBPC seems a logical solution to some current deficiencies in care for patients with chronic conditions and disabilities, uncertainties remain about potential harms, unintended consequences, costs, and sustainability of this model of care. Studies of HBPC have been limited in several ways (e.g., single site, small-to-moderate sample sizes, variations in the HBPC intervention, and studies spread over more than 2 decades during which the care and policy environments have changed).

While the evidence base examining HBPC programs has expanded in recent years, there are various challenges in synthesizing this literature. An important challenge is that HBPC interventions are not standardized and often differ in terms of what care and services are offered, how frequently these services are available and used, and the resources required to deliver these services. Research articles often do not provide sufficient descriptions of the interventions to allow nuanced analyses of how these differences might impact effectiveness. Moreover, there has been marked variation in the prioritization and reporting of outcomes and a lack of clarity

about which study designs and comparisons will provide the strongest, most useful evidence for future decisions about HBPC. The reviews completed to date have frequently highlighted this lack of detailed information about the intervention and outcomes as a weakness in the evidence base. Additionally, most studies provide little information about the comparison group, which is often simply described as “usual care”. Given that studies of HBPC have been conducted in several countries across a span of over 20 years, it is likely that “usual care” has meant different things, posing a challenge for synthesis across studies. Moreover, HBPC interventions have been used to provide services to populations with different health risks, ranging from generally well elderly to severely disabled patients, and HBPC interventions have stated goals that span from preventing falls to providing palliative care.

Given these differences, questions remain about which outcomes best match the different goals of different versions of HBPC and which outcomes are most important to different patients.²⁴ The objectives of this review are to summarize the effects of HBPC interventions on a variety of outcomes and to examine how these effects vary by patient, organizational, and intervention characteristics. We re-examined the literature with a narrower focus (we excluded prevention and well elderly outreach) than was used in some prior reviews and with the goal of examining this literature in the context of current policy issues.

Scope and Key Questions

In order to clarify the scope and purpose, HBPC interventions for this review are defined as requiring the four characteristics described in Table 1. These defining characteristics underscore how HBPC interventions differ significantly from other innovative care models such as Hospital at Home (short term for acute need), Program of All-inclusive Care for the Elderly (PACE) (integrated primary and long-term care services, not usually home-based), and Patient-Centered Medical Homes (essentially outpatient, office-based), each of which contain some, but not all of these characteristics.

Table 1. Defining characteristics of home-based primary care models for this review

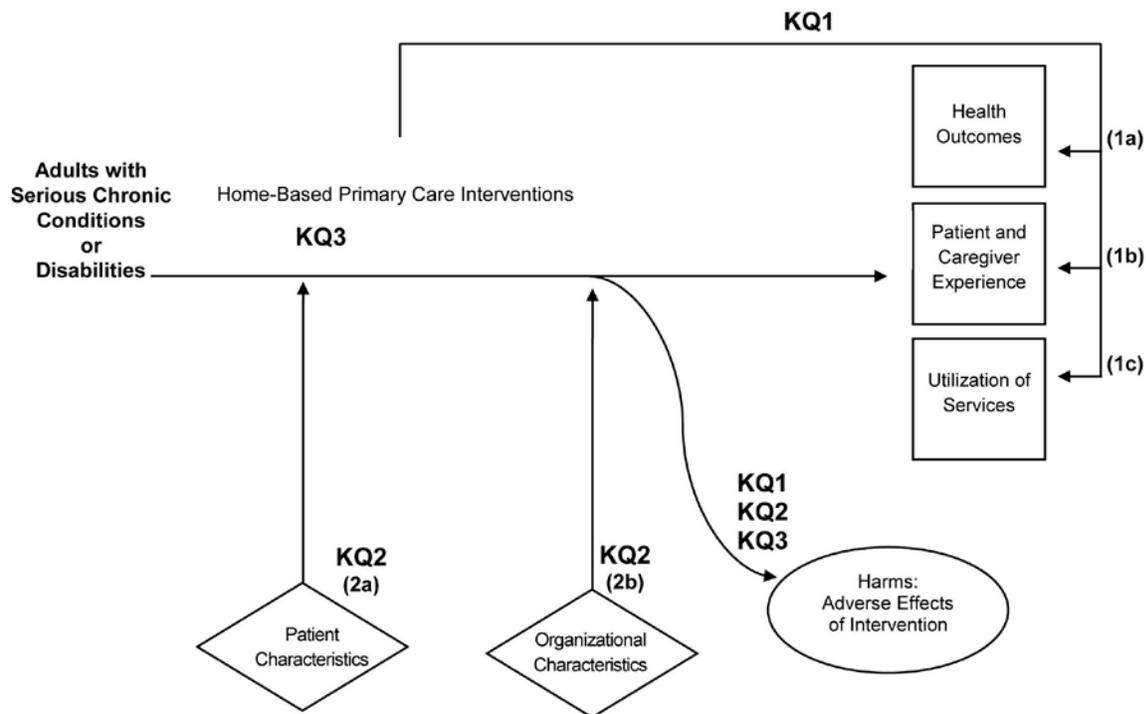
Required for this Review	Optional	Excluded
1. Visits by a primary care provider Visits by a physician, nurse practitioner, or physician assistant.	Additional visits Nurses, physical therapists, social workers, counselors, etc.	Other models that do not include primary care home visits Telephone call care only or nurse (or other provider) care only.
2. Visits to a patient’s home Home is defined as any noninstitutional setting where the patient resides. It can include adult homes or senior housing.	Following patient across care setting In hospital management and short-term post-acute rehabilitation.	Patients in institutions Patients who live in nursing homes, prisons, or long-term care hospitals.
3. Longitudinal management The intention is to provide care for an indefinite period until admission to an institution, change in status, or death.	Not applicable.	Short term One-time home visits or assessments, hospital at home models in which care is provided for an acute need and patient returns to previous primary care, or transitional care for a short defined period (e.g., 30 to 90 days post-hospitalization, or 14 day after surgery).

Required for this Review	Optional	Excluded
<p>4. Comprehensive primary care Includes medical care for, and the management of, chronic conditions and disabilities, preventive care, and environmental assessments.</p>	<p>Inclusion of additional services such as mental health services or palliative care Assessment and management of serious mental illnesses including depression. Integration of palliative care or hospice with home-based primary care.</p>	<p>Single condition care or single topic risk assessments Fall risk assessments, programs that target a single condition such as congestive heart failure.</p>

The analytic framework used to guide this report is shown below (Figure 1). The analytic framework illustrates the scope of this review, including the target population, interventions, comparison, and outcomes, and represents the interrelationships that are included in our Key Questions and that were examined in this review.

Analytic Framework

Figure 1. Analytic framework for home-based primary care interventions



A document containing the draft Key Questions was developed during Topic Refinement and was available for public comment via the AHRQ Effective Healthcare website from August 15, 2014 to September 05, 2014. The comments received helped us identify areas that required more explanation and reorganization in order to clarify our intentions for the systematic review.

The following are the Key Questions we sought to answer with this review.

Key Question 1. Among adults with chronic conditions that are serious or disabling, what are the effects (positive and negative) of HBPC interventions on:

- a. Health outcomes
- b. Patient and caregiver experience
- c. Utilization of services

Key Question 2. How do the effects of HBPC interventions differ across:

- a. Patient characteristics (including, but not limited to: reason for HBPC, type and number of diagnoses, level of physical and cognitive function, caregiver availability, and demographics)
- b. Organizational characteristics (including, but not limited to: ownership organizational structure, payment structure, leadership, and staffing patterns of the practice or health system providing HBPC)

Key Question 3. Which characteristics of home-based primary care interventions are associated with effectiveness (including, but not limited to, use of teams, composition of teams, use of technology, frequency of visits, and types of visits/services)?

Methods

We performed the systematic review in accordance with the Evidence-based Practice Center (EPC) Methods Guide.²⁵ Input from experts was invited during protocol development; the final protocol is posted for the public on the Agency for Healthcare Research and Quality (AHRQ) Web site: <http://effectivehealthcare.ahrq.gov/>. The protocol is also registered in the PROSPERO database under registration number: CRD42015016714. For detailed descriptions of the review methods, see Appendix A and the protocol on the AHRQ Website.

Inclusion/Exclusion Criteria

The criteria for inclusion and exclusion of studies were designed to identify studies that answer the Key Questions; the criteria are based on the population, intervention, comparator, outcome, timing, and setting (PICOTS), which were developed as part of the topic refinement and included in the protocol for this review. The PICOTS are summarized in Table 2 and they were translated into our inclusion and exclusion criteria for the review. The included and excluded studies are listed in Appendix B and Appendix C, and the criteria are detailed in Appendix D.

Table 2. Inclusion and exclusion criteria

	Include	Exclude
Population	Adults with chronic illnesses or disabilities.	Children with special needs. Adults assessed for a single risk factor or condition. Healthy elderly.
Intervention(s)	HBPC as defined above in Table 1.	Care models that do not include the four required characteristics. Examples of excluded care: preventive home visits, single visit home assessments, single purpose visits (fall risk assessments), care for a single condition, short-term home-based care such as hospital at home programs.
Comparator(s)	Any other model of primary care.	Services that are not primary care.
Outcomes	Health care outcomes. Patient and caregiver. Experience. Utilization of services.	None
Timing	Longitudinal care, expected to continue until change in status. A specific time period for followup was not required for a study to be included.	Short-term, time-limited home-based care such as hospital at home programs.

	Include	Exclude
Setting(s)	Patients' homes, broadly defined. United States or other developed countries.	Institutions such as nursing homes or prisons. Countries with extremely different economies and/or health care systems.
Study Design	RCTs. High-quality observational studies including: comparative cohort studies and time series. Pre/post studies with or without a comparison group. Program reports and evaluations.	Descriptive studies. Case series or reports. Nonsystematic reviews. Journalistic reports.
Publication Type	Peer reviewed journals. Gray literature (if the study meets all other criteria).	Editorials or commentaries.

We included studies that evaluated the effect of home-based primary care (HBPC) interventions, including randomized controlled trials (RCTs), observational studies (comparative cohort studies and time series), pre/post studies with or without a comparison group, program reports, and evaluations. We included this broad range of study designs in order to obtain a comprehensive understanding of the current state of evidence about HBPC. Purely descriptive studies such as case series and case reports and journalist articles were excluded. Studies were not excluded based on a specific comparator or outcome; however, the comparators and approach to measuring the outcomes were considered as part of the assessment of the quality and risk of bias assessment of an individual study and influenced the assessment of the strength of evidence.

Systematic reviews were not included, but their included studies lists were used to identify individual studies to assess for inclusion in our review. English-language abstracts of non-English-language articles were reviewed and evaluated in terms of whether they would significantly add to the body of literature.

Literature Identification and Data Analysis

A research librarian searched multiple electronic databases, including Ovid MEDLINE, CINAHL, Clinical Trials.gov, and the Cochrane Database of Systematic Reviews for articles published between January 1995 and December 2014. Additional studies were identified from reviewing reference lists of the included studies and systematic reviews, as well as Scientific Information Packets and expert suggestions. Gray literature was identified by searching the New York Academy of Medicine gray literature database and the Web sites of organizations that may fund or produce research evaluating HBPC.

Two investigators reviewed each abstract and full-text article to determine inclusion eligibility. Any disagreements were resolved by consensus. A record of studies included is in Appendix B and those excluded at the full-text level with reasons for exclusion are included in Appendix C. The searches will be updated while the draft report is posted for public comment and peer review. Literature identified from the updated search will be assessed following the

same process of dual review. If any pertinent new literature is identified for inclusion in the report, it will be incorporated before the final submission of the report.

After studies were selected for inclusion, data were abstracted by one team member and verified for accuracy by a second team member. The evidence tables with the abstracted data are included in Appendix E.

Predefined criteria were used to assess the quality of individual RCTs and observational studies. A detailed description of the assessment is included in Appendix F. Individual studies were rated as “good,” “fair,” or “poor” by two investigators independently, with disagreements resolved by consensus. Studies rated “good” are considered to have low risk of bias and valid results. Studies rated “fair” are susceptible to some bias, though not enough to invalidate the results. Studies rated “poor” have significant flaws that imply biases of various types that may invalidate the results. We did not exclude studies rated as being poor in quality *a priori*, but poor-quality studies were considered to be less reliable than higher-quality studies when synthesizing the evidence, particularly if discrepancies between studies of differing quality were present.

Using a hierarchy-of-evidence approach, the best evidence available was the focus of synthesis for each Key Question. If high-quality evidence was not available, lower-quality evidence was used, and while underscoring the issues making it lower quality, we assessed and stated whether the inclusion of lower-quality studies would change the conclusions.

Qualitative syntheses were conducted because the studies were too heterogeneous to create a meaningful combined estimate with meta-analyses.

The strength of evidence for each Key Question and outcome (Appendix G) was assessed using the criteria described in the AHRQ Methods Guide.²⁵ Initial assessments were made by one researcher, then the entire team reviewed these and differences were resolved by consensus. This approach was possible given that this was a small review. The strength of evidence was assigned an overall grade of “high” (confident that the estimate of effect lies close to the true effect for this outcome), “moderate” (moderately confident that the estimate of effect lies close to the true effect for this outcome), “low” (limited confidence that the estimate of effect lies close to the true effect for this outcome), or “insufficient” (no evidence, we are unable to estimate an effect, or we have no confidence in the estimate of effect for this outcome).

Applicability considers the extent to which results from a study or a body of evidence can be used to answer the questions of interest. Variability in the studies or studies with unique attributes may limit the ability to generalize the results to other populations and settings. For this review we considered whether applicability is affected by the characteristics of the patient populations (e.g., demographic characteristics, reason for receiving home-based care, primary condition or disability, or presence of comorbidities) and the setting of the study (e.g., geographic location and practice context).

Results

Literature Searches

The search and selection of articles are summarized in the study flow diagram (Figure 2). There were 4,282 citations identified at the title and abstract level. Of these, 210 articles appeared to meet inclusion criteria and were selected for full-text review. Following review at the full-text level, a total of 18 studies met the inclusion criteria (Appendix B). Primary reasons for exclusion of the articles reviewed at the full-text level were wrong intervention types such as telephone care only, temporary post surgery care, or visits by a social worker or home care nursing only (Appendix C).

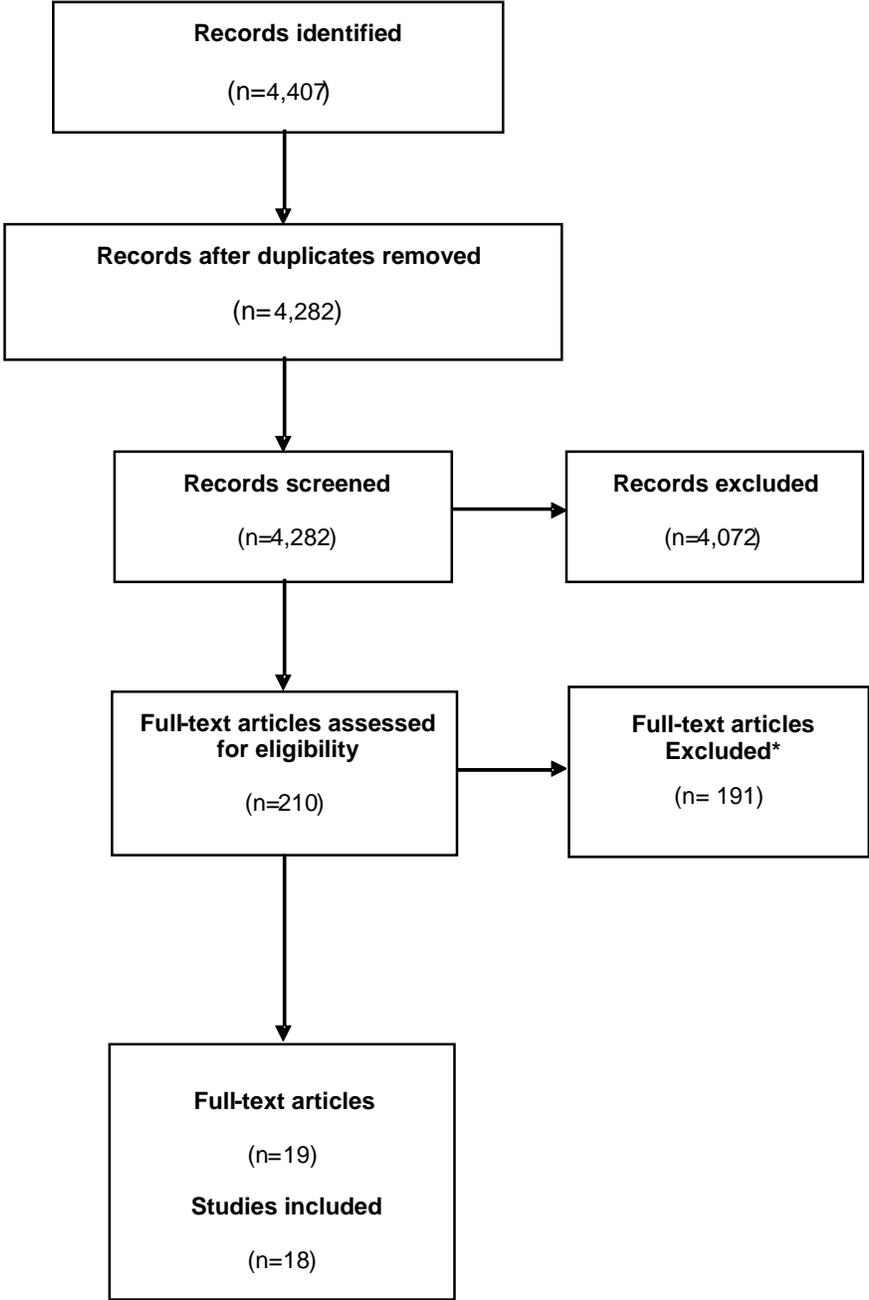
Identification of Included Studies

The study flow diagram represented in Figure 2 documents how many studies were identified in the search and reviewed at each stage. The triage and review process resulted in the inclusion of 18 studies reported in 19 articles.²⁶⁻⁴⁴

Two of the 18 studies were randomized controlled trials (RCTs).^{32,35} As many of the most applicable search terms were broad, at the triage stage most of the abstracts excluded were of studies that were clearly not about home-based primary care (HBPC). These included studies about other models of care, such as medical homes, as the indexing in literature databases for these studies includes similar terms. At the full-text review level, most of the excluded studies were about interventions that did not meet our inclusion criteria. For example transitional care or hospital at home programs, which are by definition time limited care models, do not meet our stated definition of HBPC. Another group of excluded publications were articles that contained descriptions of programs but did not include an evaluation component.

Table 3 provides detail on the key characteristics of the 18 included studies. The most common study design is retrospective pre-post studies with no comparison group. Most of the studies were conducted in the United States (15 studies) with seven of these conducted in the U.S. Department of Veterans Affairs (VA). In addition, most studies were conducted in a single medical center or care delivery organization (e.g., one VA medical center or one health plan, not several or nationwide). All studies reported multiple outcomes; however, the most commonly studied was the impact of HBPC on hospitalizations.

Figure 2. Study flow diagram



*The specific excluded study reasons are listed in Appendix C.

Table 3. Key characteristics of included studies

Key Characteristic	Number of Studies (Total N=18)	References*
Study Designs		
RCTs	2	32,35
Retrospective cohort	4	26,33,34,36,37
Prospective pre/post	5	38-42
Retrospective pre/post	7	27-31,42-44
Length of Followup		
1 week up to 3 months	1	44
3 months to up to 6 months	2	31,38
6 months to up to 1 year	5	27,35-37,45
1 year or more	7	29,30,32-34,39-41,43
Setting/Location		
VA/United States	7	28-31,34,35,38,39
Non-VA/United States	8	27,29,32,39-44
Denmark	2	26,37
Canada	1	42,43
Sites		
Multiple sites	6	26,28,31,34,35,38
Single site	12	27,29,30,32,33,36,37,39-44
Outcomes (studies can have multiple outcomes)		
Hospitalizations	10	29-35,39,43,44
Hospital bed days	6	28,30,31,34,41,43
Hospital readmission	3	28,35,41
Emergency visits	6	29,30,32,33,39,43
Nursing home admissions	1	44
Nursing home days	2	28,33
Specialty visits	2	29,33
Number of home visits	3	28,29,36,37
Cost of care	6	28,29,33-35,41
Mortality	2	32,33
Function	3	27,32,35
Disease management quality Indicators	1	31
Caregiver outcomes	3	35,38-40
Satisfaction	2	27,31,34,35
Symptoms	3	32,41,42
SF-36	2	32,35
Place of death	3	26,36,37,43
Terminal declaration (certification of terminal status)	1	26

RCT = randomized controlled trial, VA = U.S. Department of Veterans Affairs

* Some studies included multiple publications that were referenced.

Effectiveness of HBPC Interventions

Key Question 1. Among adults with chronic conditions that are serious or disabling, what are the effects (positive and negative) of home-based primary care interventions on a) health outcomes, b) patient and caregiver experience, and c) utilization of services?

Overview of Findings

- Health Outcomes: No significant differences in function or mortality (low strength of evidence) and insufficient evidence about HBPC impact on symptoms.
- Patient and Caregiver Experience: Satisfaction with care, quality of life, and caregiver outcomes were better with HBPC (low strength of evidence).
- Utilization of Services:
 - HBPC reduced hospitalization and hospital days (moderate strength of evidence).
 - Some evidence suggested that numbers of emergency visits and specialty visits are lower with HBPC (low strength of evidence).
 - The current evidence did not indicate HBPC reduces hospital readmissions, and the impact on days in nursing homes and costs were unclear (low strength of evidence).
 - There was insufficient evidence on which to base a conclusion about the impact of HBPC on nursing home admission.
- The only identified study to examine negative unintended consequences or harms reported that no patient or caregiver stated they experienced restriction of services (insufficient evidence).

Key results from the included studies that addressed Key Question 1 are presented in Table 4. This table organizes the study results by outcome and by the quality of the study. Additional information on the results is included in the evidence table in Appendix E. We present all findings, including those from studies we rated as poor quality, in order to comprehensively represent the state of the literature. However, we focus on the high- and moderate-quality studies in our summary and conclusions.

Key Question 1a. Impact on health outcomes

Few studies focused on health outcomes (Key Question 1a), perhaps because the patients serviced by HBPC programs are predominately older, frail people with multiple chronic conditions and disabilities. Unlike studies of other health care interventions, most HBPC studies did not report mortality. While we would not want HBPC to increase mortality, it is not clear to what extent death is an avoidable or always negative outcome for this population. Physical function and symptoms are two clinical outcomes that may be more appropriate but were also not frequently studied. A multi-site RCT of HBPC in several VA medical centers found no significant difference in function between HBPC patients and usual care patients.³⁵ Another study in a non-VA HBPC program focused on decreased symptom burden and reported that pain, anxiety depression, and tiredness were reduced three weeks after HBPC enrollment and maintained at the lower levels at 12 weeks after enrollment.⁴²

Key Question 1b. Impact on patient and caregiver experience

Three studies included measures of satisfaction or quality of life. In the two RCTs of HBPC, most caregiver outcomes favored the HBPC group and the patients experienced a statistically significant improvement in health-related quality of life.^{32,35} In a study that focused on caregiver burden and needs, caregivers of patients in a HBPC program reported a decrease in unmet needs 9 months after enrollment and a decrease in caregiver burden.⁴² Two poor-quality studies reported satisfaction at one point in time for HBPC patients only.^{27,31}

The only study we identified that explicitly raised the issue of potential harms examined whether HBPC had a negative impact on patient or caregiver experience. In patient and caregiver interviews from one center that supplemented quantitative analysis of HBPC cost, Edes et al. reported that none of the patient or caregivers had experienced any restriction on services since enrolling in HBPC.³⁴

Key Question 1c. Impact on utilization of services

HBPC impact on health care costs and the utilization of other services was the most frequently reported outcome in the research identified. These studies provided the evidence available to address Key Question 1c. Several studies reported the impact on hospitalizations (admissions, readmissions, and hospital days), emergency visits, nursing home admissions, or nursing home days. Studies also included costs as a means of measuring utilization. Fewer studies reported on the expected increase in primary care home visits. These are in the evidence table (Appendix E).

Reducing hospitalization is an important and frequently stated priority for HBPC interventions based on the idea that high-quality primary care and the ability to address urgent matters should provide the means to avoid or at least reduce hospitalizations. Four high-quality studies^{30,32,33,34} reported on hospital admissions or hospital days. Three reported that hospitalization decreased with HBPC, while one study reported an increase (from 700 to 740 per 100) that was not statistically significant.³² One fair-quality study reported a 7.8 percent increase in hospitalizations but did not report a statistical test.⁴⁶ The remaining fair- and poor-quality studies all reported reduction in hospitalization though some were not significant or did not include a statistical test. Based on a similar rationale, emergency visits are expected to be fewer for patients in HBPC programs. All six studies that examined emergency visits reported reductions ranging from 10 to 48 percent; however, one³⁰ of the three^{30,32,33} good-quality studies reported that the reduction was not statistically significant (18.5% decrease, $p=0.26$).

Another intended benefit stated by HBPC programs is that it may reduce the need for skilled nursing facility (SNF) care. Three studies reported positive effects: one high-quality study reported 27 percent fewer SNF days ($p=0.001$).³³ A fair-quality study found statistically significant fewer admissions,⁴⁴ while a poor-quality article that was more of a program report than a research study reported an 89 percent reduction in nursing home days and no statistical test.²⁸

Costs are often used as indication of utilization of care. In studies of HBPC, the goal is to document whether the expected reduction in costs occurs, or at least that costs shift from hospital and emergency care to primary and home-based long-term care. The two studies rated high quality both calculated that HBPC lowered costs significantly.^{33,34} Medicare costs declined from \$50,977 to \$44,455 for participants in a Washington, D.C., HBPC program.³³ However, there was a significant reduction in overall cost only in the highest frailty category, and not in medium or low frailty groups. Risk adjusted calculations including all VA HBPC patients reported an

average reduction of 28.1 percent in costs for 6 months of HBPC enrollment.³⁴ Contrary to these findings, two studies with moderate risk of bias^{29,35} found substantial increases (22.7% and 12.1%) in charges and costs respectively.

Counsell et al.³² assessed recognition of geriatric conditions and used the Assessing Care of Vulnerable Elders (ACOVE) metrics to assess quality of care. With the exception of visual impairment, geriatric conditions were more commonly identified in the Geriatric Resources for Assessment and Care of Elders (GRACE) intervention patients (p-values all 0.01 or less). In general health care metrics, primary care visits occurred within 6 weeks of a hospital discharge for 83 percent of intervention patients versus 54 percent of controls (p<0.001), medication lists were provided, and advance care planning documents were more commonly addressed in the intervention patients (p<0.001).

Table 4. Effectiveness of home-based primary care interventions (KQ1): Primary results by level of study quality for individual studies

Key Question Outcome	Study Quality: Good	Study Quality: Fair	Study Quality: Poor
KQ1a: Health Outcomes			
Function	ADLs: No significant difference (Counsell, 2007) ³²	No significant difference (Hughes, 2000) ³⁵	21% improvement in ADLs no statistical test reported (Anetzberger, 2006) ²⁷
Symptoms		Reduction in moderate to severe symptom burden % symptom free Pain 3 weeks: 25%, 12 weeks: 27.08% Depression 3: weeks 57.8%, 12 weeks: 50% Loss of Appetite: 3 weeks 20.69%, 12 weeks: 24.49% Anxiety 3 weeks: 58.62%, 12 weeks: 59.26% Tiredness 3 weeks: 45.10%, 12 weeks: 47.5% All p-values: p<0.01 (Ornstein, 2013) ⁴²	
Mortality	7% 24 months HBPC vs. 7.8% controls p=0.64 No significant difference (Counsell, 2007) ³² Mortality during followup period HBPC (40%) Controls (36%) Hazard ratio = 1.06, p=0.44 (De Jonge, 2014) ³³		
KQ1b: Patient and Caregiver Experience			
Satisfaction	No patient or caregiver reports of restrictions on services (Edes, 2014) ³⁴	Patient satisfaction Terminal patients: no significant difference Nonterminal patients: HBPC group significantly better with 5 to 10 point increases in 5 of 6 dimensions (Hughes, 2000) ³⁵	94% would recommend program to others no statistical test reported (Anetzberger, 2006) ²⁷ 98% rate care as "excellent" or "good" no statistical test reported (Cooper, 2007) ³¹

Key Question Outcome	Study Quality: Good	Study Quality: Fair	Study Quality: Poor
SF-36 Quality of Life	<p>SF-36 scores at 24 months Improvements for intervention patients compared with usual care in 4 of 8 scale</p> <p>General health (0.2 vs. -2.3), p=0.045 Vitality (2.6 vs. -2.6), p=0.001 Social functioning (3.0 vs. -2.3), p=0.008 Mental health (3.6 vs. -0.3), p=0.001 Also in the Mental Component Summary (2.1 vs. -0.3), p=0.001 (Counsell, 2007)³²</p>	<p>Quality of Life Terminal patients in HBPC group had significantly better scores in 6 of 8 SF-36 subscales Nonterminal: no significant difference (Hughes, 2000)³⁵</p>	
Caregiver Outcomes		<p>Caregiver Most caregiver outcomes favor the treatment group HBPC group improved in HR-QOL p<0.05 (Hughes, 2000)³⁵</p>	<p>Change in % needing assistance baseline to 9 months, p-value Transportation: 19.7, p=0.001 Daily chores: 26.8, p <0.001 Change in Caregiver Burden baseline to 9 months Physical burden: 1.90, p=0.006 Total burden: 3.84, p=0.017 (Ornstein, 2009)⁴⁰</p>
Key Question 1c: Utilization of Services			
Hospitalizations	<p>43.7% decrease in hospitalizations (Chang, 2009)³⁰</p> <p>Hospital admission rates per 1000 patients (700 [n=474] vs. 740 [n=477]), p=0.66 (Counsell, 2007)³²</p> <p>HBPC 9% fewer hospitalizations, p=0.001 Hospitalization cost \$17,805 vs. \$22,096 p=0.001 (De Jonge, 2014)³³</p> <p>VA+Medicare hospital admissions per 100 patient-months 25.5% decrease (95% CI -26.5 to -24.5) p<0.001 (Edes, 2014)³⁴</p>	<p>7.8% increase in hospitalizations No statistical test reported (Beck 2009)⁴⁶</p> <p>Change pre to post HBPC 59.5% reduction in Hospital admissions, p<0.001 (Rosenberg, 2012)⁴³</p> <p>Patients with ≥1 hospitalization Before enrollment 110 (61%) After enrollment 178 (38%), p<0.001 (Wajnberg, 2010)⁴⁴</p> <p>7.9%, p=0.07 (relative reduction in the proportion of HBPC patients admitted in the first 6 months, not sustained at 12 months) (Hughes, 2000)³⁵</p>	<p>27% reduction in hospital admissions No p-values reported for any of the above results (Cooper, 2007)³¹</p> <p>84% decrease in hospitalizations Pre: 822; post: 135 No statistical test reported (North, 2008)³⁹</p>

Key Question Outcome	Study Quality: Good	Study Quality: Fair	Study Quality: Poor
Hospital bed days/Length of stay	49.9% decrease in total number of days in hospital, p=0.001 (Chang, 2009) ³⁰ VA+Medicare hospital days 36.5% decreased In a high risk for hospitalization group, (95% CI -37.6 to -35.4) p<0.001 (Edes, 2014) ³⁴	Length of stay 6.5 days pre; 6.45 days during intervention p=0.09 (Ornstein, 2011) ⁴¹ 61.7% reduction in Hospital days p=0.004 (Rosenberg, 2012) ⁴³	59% reduction in hospital bed days no statistical test reported (Beales, 2009) ²⁸ 69% reduction in hospital days No p-values reported for any of the above results (Cooper, 2007) ³¹
Hospital readmissions		11%, p=0.06 (relative reduction in mean number of readmissions at 6 months not sustained at 12 months) 22%, p=0.03 (relative reduction in mean number of readmissions at 6 month in the subgroup with severe disability) 22% relative decrease in readmissions per patient for HBPC at 6 months, p=0.03, not significant at 12 months (Hughes, 2000) ³⁵ Admissions that generated at least one 30-day readmissions 16.6% pre; 15.7% during intervention p=0.71 (Ornstein, 2011) ⁴¹	21% reduction in 30-day hospital readmission No statistical test reported (Beales, 2009) ²⁸
Emergency Department Visits	18.5% decrease, p=0.26 (Chang, 2009) ³⁰ 2-year ED visit rate per 1000 Intervention group 1445 [n=474] vs. 1748 [n=477], p=0.03 (Counsell, 2007) ³² 10% fewer ED visits p=0.001 (De Jonge 2014) ³³	14.7% decrease in ED visits no statistical test reported (Beck 2009) ⁴⁶ 9.8% reduction ED visits, p=0.66 (Rosenberg, 2012) ⁴³	48% decrease ED Visits Pre: 166; post: 86 No statistical test reported (North, 2008) ³⁹
Nursing Home Admissions		Patients with ≥ 1 SNF admissions Before enrollment 63 (35%) After enrollment 33 (18%), p=0.001 (Wajnberg, 2010) ⁴⁴	

Key Question Outcome	Study Quality: Good	Study Quality: Fair	Study Quality: Poor
Nursing Home Days	27% fewer SNF days, p=0.001 (De Jonge, 2014) ³³ No difference in SNF days p=0.68 (Edes 2014) ³⁴		89% reduction in nursing home bed days no statistical test reported (Beales, 2009) ²⁸
Specialty Visits	23% fewer specialty visits, p=0.001 (De Jonge, 2014) ³³	Specialty Care Before: 1,100; after: 696 No statistical test reported (Beck, 2009) ⁴⁶	
Cost	Total Medicare costs during 2-year followup \$44,455 vs. \$50,977, p=0.001 Cases have lower cost for hospital, physician and SNF and higher costs for skilled home health care and hospice than controls. Overall cost differences significant only in cases vs. controls in the highest frailty category. (De Jonge 2014) ³³ Total average cost per patient 6 months before: \$19,234 6 months during HBPC: \$13,822 Total VA+MC costs per patient 28.1% reduction (95% CI -29.2 to -27.1) p<0.001 13.4 absolute reduction in cost when compared to non-HBPC. Most significant cost saving in highest Hierarchical condition category (Edes, 2014) ³⁴	22.7% increase in mean total charges No statistical test reported (Beck 2009) ⁴⁶ Total costs: 12.1% higher for HBPC, p=0.005 (Hughes, 2000) ³⁵ Net revenue, \$, median (IQR) 9,753 (7,945–14,684) 10,807 (8,174–15,832) p<0.001 Direct care costs, \$, median (IQR) 3,245 (1,977–5,834) 3,699 (2,389–6,703) p<0.001 Indirect cost, \$, median (IQR) 666.5 (399–1,199) 740 (466–1,355) p<0.001 Contribution to margin, \$, median (IQR) 5,658 (3,308–8,408) 5,940 (3,543–9,034) p=0.34 Revenue and Costs increased resulting in a nonsignificant impact (Ornstein, 2011) ⁴¹	2002 24% decrease in mean total cost of care (from \$38K to 29k) No statistical test reported (Beales, 2009) ²⁸

ADL = activities of daily living, ED = emergency department, HBPC = home-based primary care, IQR = interquartile range, SNF = skilled nursing facility, VA = U.S. Department of Veterans Affairs

Key Question 2. How do the effects of home-based primary care interventions differ across patient characteristics and organizational characteristics?

Overview of Findings

- Patient characteristics: Four studies reported outcomes by patient subgroups. While the subgroups were defined differently in each study, the patients who were more frail, sick or at higher risk benefited from HBPC more than those who were less frail or ill.
- Organizational characteristics: No studies were identified

Key Question 2a. Patient characteristics

Four studies divided the patient population by severity of illness or frailty and examined results across subgroups:

- Counsell, 2007³² predefined a group of patients with a high probability of readmission over 4 years ($p \geq 0.4$) and found that both ED use and hospital admissions were significantly lower in this subgroup in the HBPC group than this subgroup in the usual care group during the second year of the intervention.
 - ED visits in the second year (848 [n=106] vs. 1314 [n=105], $p=0.03$)
 - Hospital admission rates (396 [n=106] vs. 705 [n=105], $p=0.03$)This differs from the overall study results in which the difference in hospital admissions was not significant.
- De Jonge, 2014³³ conducted a case-control study in which HBPC patients were matched to patients in usual care and found that total Medicare costs during the average 2-year followup period were significantly less for the HBPC patients (\$44,455 vs. \$50,977, $p=0.01$). When the participants were divided in to three groups based on a frailty index, the difference was significant only at the highest level of frailty (HBPC 58,689 vs. usual care 76,827; $p<0.001$).
- Hughes, 2000³⁵ divided patients based on whether they were terminal or nonterminal and found that results differed for these two groups. HBPC improved health-related quality of life in the terminal group and patient satisfaction in the nonterminal group.
- Edes, 2014³⁴ reviewed projected VA and Medicare costs for Veterans newly enrolled in HBPC and compared these projected costs to actual costs for Veterans enrolled and not enrolled in HBPC. Examining this result for patients divided by risk scores revealed that the magnitude and proportion of the reduction in costs were largest for the patients with the highest risk scores.
- While the patient subgroups were defined differently in each of these studies, the findings were consistent. Those patients who are more frail, more ill, terminal or in higher risk categories benefit more from HBPC interventions.

Key Question 2b. Organizational characteristics

We did not identify any studies that examined organizational characteristics. Nevertheless these results suggest that HBPC interventions are most potent in reducing costs and acute care for the more frail populations of patients.

The evidence base was limited for Key Question 2 and HBPC programs used different criteria for patient enrollment and thus cared for patients with mortality rates ranging from 7 percent³² to 40 percent.³³

Key Question 3. Which characteristics of home-based primary care interventions are associated with effectiveness?

Overview of Findings

- Combinations of components of HBPC Interventions: There is wide variation in the services provided as part of HBPC interventions. In the evidence presently available there is not an apparent pattern of services associated with effectiveness.
- Adding services: Four studies examined the impact of adding services to HBPC. Two studies found that combining palliative care and primary care visits increased the likelihood that patients would die at home (low strength of evidence).

HBPC is delivered with a spectrum of services. At minimum, it requires a primary care provider willing to tackle the logistics and time investment of home-based care. Additionally, if the HBPC is team-based, it requires an organization with the capacity to assemble and support the team. HBPC can consist of a mosaic of services, many of which could be provided separately or in various combinations. Furthermore, the value added by a combination of services may be more than the sum of the value added by each individual service. The result is that answering Key Question 3 about what characteristics of HBPC interventions are associated with effectiveness is challenging.

Given this, we attempted to address Key Question 3 in two ways: first by examining the components of the HBPC programs in the included studies and then by searching for and including any research that isolated a potential component of HBPC.

Table 5 lists each of the included studies and indicates which of several components are reported as part of the HBPC intervention. We grouped these components into categories. This approach was not based on any definitions or requirements for HBPC and it is limited to the information that is available in the published study reports. If a service is or is not listed here for a specific study it does not mean that the service definitely was or was not provided, only that it was listed or not listed in the article.

In describing the components of HBPC across studies, Table 5 illustrates the variation across HBPC programs, even among those that met our stringent inclusion criteria (see Table 2). Our definition of HBPC does not include transitional care, preventive single visits, short-term care, or programs that provide care for a single condition. But we did include heterogeneous programs, as we did not require specific components of HBPC to be provided. While we did require that a physician (MD or DO), nurse practitioner (NP), or physician assistant (PA) actually make home visits, we did include models where an additional physician may be involved or responsible for care but does not make home visits. For example, in the GRACE model³² a NP and a social worker make regular home visits to conduct assessments and provide care, but another primary care provider and a consulting geriatrician may be involved in care planning without making home visits.

Table 5. Components of home-based primary care reported in each study

Study	Personnel			Planning				Provided Care						
	Primary care provider	Social workers	Other providers	Assessment	Coordination	Team meetings	Referrals	Caregiver support	After hours and weekend coverage by HBPC (not ED, hospital providers)	Medication management	Inpatient coordination	Education/coaching/counseling	Medical tests (X-ray, blood, EKG)	Terminal care/palliative care
Aabom, 2006 ²⁶	Physician													✓
Anetzberger, 2006 ²⁷	Physician, NP			✓	✓		✓	✓		✓		✓		
Beales, 2009 ²⁸	Physician, NP or PA	✓	✓	✓	✓		✓							
Beck, 2009 ⁴⁶	Geriatrician	✓	✓	✓	✓	✓			✓				✓	
Chang, 2009 ³⁰	NP		✓	✓	✓		✓	✓	✓	✓		✓	✓	
Cooper, 2007 ³¹	NP or PA	✓		✓		✓								
Counsell, 2007 ³²	Physicians do not do visits; NP does	✓		✓	✓	✓								
De Jonge, 2014 ³³	Physician, NP	✓	✓		✓	✓			✓		✓			
Edes, 2014 ³⁴	Physician, NP, or PA	✓	✓	✓	✓	✓		✓		✓				
Hughes, 2000 ³⁵	Physician	✓	✓		✓	✓	✓		✓		✓			
Neergaard, 2009 ³⁷	Physician		✓						✓					✓
Nichols, 2011 ³⁸	Physician, NP or PA		✓					✓				✓		
North, 2008 ³⁹	NP	✓	✓		✓	✓	✓							
Ornstein, 2009 ⁴⁰	Physician, NP	✓		✓	✓			✓	✓					

Study	Personnel			Planning				Provided Care						
	Primary care provider	Social workers	Other providers	Assessment	Coordination	Team meetings	Referrals	Caregiver support	After hours and weekend coverage by HBPC (not ED, hospital providers)	Medication management	Inpatient coordination	Education/coaching/counseling	Medical tests (X-ray, blood, EKG)	Terminal care/palliative care
Ornstein, 2011 ⁴¹	Physician, NP		NP specifically for transition	✓			✓	✓		✓		✓		
Ornstein, 2013 ⁴²	Physician, NP	✓	✓	✓	✓		✓		✓		✓			✓
Rosenberg, 2012 ⁴³	Physician		✓	✓	✓	✓			✓		✓		✓	
Wajnberg, 2010 ⁴⁴	Physician		✓	✓									✓	

ED=emergency department, EKG = electrocardiogram, HBPC = home-based primary care, NP = nurse practitioner, physician = MD or a DO; PA = physician assistant;

✓ = components included in the study

Other than a core of assessment and coordination HBPC intervention were variable. Without obvious grouping of components of HBPC programs, it is difficult to compare outcomes across groups and make assertions about what intervention composition or components are associated with positive outcomes.

The second approach we used to answer this Key Question was to include studies that examined a specific potential component of HBPC. We identified four studies that examined three different services that could be added to HBPC: caregiver support, transitional care, and palliative/end-of-life care.

- In a translational study, staff at 24 HBPC programs at VA medical centers in 15 states added an evidence-based caregiver support program, Resources for Enhancing Alzheimer's Caregiver Health (REACH), to existing HBPC programs. Caregivers were evaluated at baseline and after 6 months. This study found reductions (statistically significant) in participant ratings of burden, depression, impact of depression on daily life, caregiver frustrations, and troubling dementia behaviors; there was no significant change in general health, health behaviors, safety, social support, and care giving difficulties.³⁸
- Another study embedded a nurse practitioner-led transitional care program into a long-standing HBPC program. While qualitative data indicated that staff was satisfied with the program, hospital length of stay and readmissions did not decline. Other factors resulted in patients with a higher (sicker) case mix, and overall the program did not significantly contribute to or subtract from the financial margin.⁴¹
- Two studies conducted in Denmark examined the relationship between palliative care and primary care home visits. The first study followed all cancer deaths in a region in 1997-1998 and found that primary care home visits were inversely associated with death in the hospital. As the number of home visits made by the primary care provider increased, the likelihood the patient would die in the hospital decreased.²⁶ The second study was reported in two articles.^{36,37} This study also relied on death records and administrative data to identify cancer patients who died in a 9-month study period and obtained data on primary care home visits and place of death. The authors surveyed the primary care physicians to obtain information about the physician's relationship with the patient and family and additional services provided. This study found that there was a strong association between primary care home visits and home death (prevalence ratio=4.3, 95% CI 1.2 to 14.9) and that when physician made three or more home visits the likelihood of home death increased significantly. Other variables related to the physician such as extent of prior patient knowledge or whether they gave the patient their private phone number were not significant. The involvement of community health nurse in care as well was the only other significant factor.

These studies are interesting and are an addition to the literature. However, they do not offer a head-to-head comparison of potential components or sufficient information to know if a component will be beneficial in the context of a different HBPC programs.

Discussion

Our review identified a small number of studies of home-based primary care (HBPC) despite our broad search. This is due in part to the fact we applied a strict definition of HBPC that required that primary care be delivered in the patient’s home and that the care be longitudinal and comprehensive and we only included studies that met these criteria.. This focused our review on programs that provided primary care at home, and thus excluded programs that added services on to office-based primary care. The study designs and quality of the studies varied from randomized controlled trials (RCTs) and large observational studies to studies that were program descriptions or evaluations that included some data. The majority of the observational studies did not include comparison groups. Our review differs from earlier reviews that included interventions that were one-time, that added home care to office-based primary care that conducted short-term preventive assessment home visits or models that were for a limited period. Examples that we excluded but that in earlier reviews include transitional care, hospital-at-home, or diversion programs that allowed acute care to be delivered in a patient’s home.⁴⁷⁻⁴⁹ In fact, the mixing of these types of interventions and HBPC has been one of the problematic aspects of prior reviews. Another recently-published systematic review of HBPC for homebound older adults defined HBPC as we did but limited outcomes to hospital, emergency department (ED), and nursing home use²¹ while we included a broad range of outcomes.

Overall the body of evidence was thin (Table 6 and Appendix G) and the variation in populations and interventions along with the limited number of high-quality studies made it difficult to draw expansive, comprehensive conclusions about HBPC. Nevertheless, we did identify areas where HBPC seems effective (Key Question 1).

Table 6. Summary of evidence

Outcomes by Key Question Number of Studies: Quality Rating	Summary of Findings*	Strength of Evidence	Comments on Strength of Evidence
KQ1a. Health outcomes			
<i>Function</i> 2 RCTs: 1 Good, 1 Fair 1 Obs: Poor	No significant difference In 2 RCTs no significant functional differences. 1 poor-quality observational study reported improvement	Low	Findings were inconsistent and the estimates were imprecise
<i>Symptoms</i> 1 Obs: Fair	—	Insufficient	1 study (n=140) with relatively short-term followup (3 weeks)
<i>Mortality</i> 1 RCT: Good 2 Obs: Good	No significant difference	Low	Study designs and measurement differ such that confidence in stability of finding is low
KQ1b. Patient and caregiver experience			
<i>Satisfaction</i> 1 RCT: Fair 2 Obs: 2 Poor	Satisfaction results are positive	Low	Limited confidence in findings. No comparison group in 2 poor-quality studies; higher satisfaction in only a subgroup in the moderate-quality RCT

Outcomes by Key Question Number of Studies: Quality Rating	Summary of Findings*	Strength of Evidence	Comments on Strength of Evidence
KQ1b. Patient and caregiver experience (continued)			
<i>SF-36 Quality of Life</i> 2 RCTs: 1 good, 1 Fair	Significant improvement in some scales (4 of 8 in one study; 6 of 8 in another)	Low	Findings are inconsistent within and across studies with improvements in some scales and subgroups and not others
<i>Caregiver Burden/Needs</i> 1 RCT: Fair 1 Obs: Poor	Significant improvements in caregiver outcomes including quality of life and reduced need for assistance	Low	Studies do not control for bias and other influences on results
<i>Negative unintended consequences/harms</i> 1 Obs: Good	—	Insufficient	Good-quality observational study reports lack of negative experience in small number (n=31) of subjects
KQ1c. Utilization of services			
<i>Hospitalization</i> 2 RCTs: 1 Good, 1 Fair 8 Obs: 3 Good, 3 Fair, 2 Poor	Hospitalizations are reduced. 8 of 10 studies report significant reductions in hospitalizations	Moderate	Findings are relatively consistent across studies with different designs and 4 good-quality studies
<i>Hospital bed days</i> 6 Obs: 2 Good, 2 Fair, 2 Poor	Numbers of days in hospital are reduced. 3 studies report statistically significant reductions, 1 finds no difference and 2 report reductions but do not provide a statistical test result	Moderate	Findings are comparatively precise and consistent
<i>Hospital Readmissions</i> 1 RCT: Fair 2 Obs: 1 Fair, 1 Poor	Reductions were either not significant or not maintained over time	Low	Small differences and changes overtime. Findings are inconsistent and imprecise
<i>Emergency Visits</i> 1 RCT: Good 5 Obs: 2 Good, 2 Fair, 1 Poor	Emergency visits may be reduced 2 studies report reductions that are not significant, 4 found significant reductions	Low	Results are inconsistent and studies have important deficiencies in design
<i>Nursing Home Admissions</i> 1 Obs: Fair	—	Insufficient	Single study at 1 site with moderate sample (n=179)
<i>Nursing Home days</i> 3 Obs: 2 Good, 1 Poor	It is unclear if HBPC reduces nursing home days.	Insufficient	Good-quality studies report inconsistent findings (1 significant reduction, 1 no difference)
<i>Specialty Visits</i> 2 Obs: 1 Good, 1 Fair	Specialty visits may be reduced	Low	While results are consistent, they are limited to 2 studies with design limitations
<i>Costs</i> 1 RCT: Fair 5 Obs: 2 Good, 2 Fair, 1 Poor	It is unclear if HBPC reduces costs	Insufficient	Findings are inconsistent with some studies reporting reductions in some patient groups and other studies reporting increases in costs or no difference

Outcomes by Key Question Number of Studies: Quality Rating	Summary of Findings*	Strength of Evidence	Comments on Strength of Evidence
KQ 2a. Patient characteristics			
<i>Severity of illness or frailty</i> 2 RCTs: 1 Good, 1 Fair 2 Obs	Sicker or frailer patients are more likely to have positive outcomes.	Moderate	Studies used different approaches to defining subgroups of patients. Other studies may have been able to but did not report any subgroup findings
KQ 2b. Organizational characteristics	No evidence identified	NA	
KQ 3. Characteristics of HBPC associated with effectiveness			
<i>Caregiver Support</i>	—	Insufficient	Single study in one site
<i>Transitional Care</i>	—	Insufficient	Single study in one site
<i>Primary care home visits and palliative care</i>	Death seems more likely to occur at home when palliative care includes primary care home visits.	Low	Two studies use place of death as outcome and have consistent though imprecise results

Obs = observational study, NA = not applicable, RCT = randomized controlled trial

* Summary of findings not provided as evidence is insufficient to support a conclusion and are indicated by “—”.

We found moderate-strength evidence that supports HBPC interventions as a means of reducing utilization of hospital services (Key Question 1c). Most of the identified studies were about utilization and the benefits reported were in the form of the reductions in hospital admissions and the number of the days in the hospital. Low-strength evidence suggested possible reductions in emergency visits and nursing home days (see Table 6). The findings in the studies of costs were inconsistent. Early studies, including a randomized trial, suggested that HBPC increased rather than decreased costs.³⁵ More recent studies^{33,34} have reported savings. This difference may be due to the fact that the more recent studies have measured costs using different methodologies that incorporate risk assessment and include costs across payers.

Given that hospital admissions or readmissions are costly and even potentially dangerous, the focus on utilization is understandable. Also, hospitalizations are an outcome that is relatively easy to measure. When hospitalization cannot be avoided, HBPC may reduce the number of hospital days by assuring that adequate post-hospital care will be available (which may include medical interventions, nursing, and other therapies as needed).

Less evidence was found about health outcomes (Key Question 1a), and what was identified found no significant difference in function or mortality. We found the strength of evidence supporting impact on satisfaction, quality of life, and caregiver outcomes to be low (Key Question 1b). Only one study reported exploring what could be considered a harm or unintended consequence.

We searched for evidence about patient characteristics (Key Question 2a); in cases where subgroups have been analyzed the benefit was either greater or attributable to the frail or ill populations of patients. The available studies investigating outcomes of HBPC used different criteria to define the populations who received HBPC services; however, it appears that the complex patients, at highest risk of hospitalization (sicker) or most frail, have the most potential to benefit. This corresponds to findings and conclusions that suggest a key element of HBPC should be targeting the “right” patients.⁴⁷

The variations we identified in the HBPC interventions that have been studied (Key Question 3) only hint at the possible variations in services patients actually received. For example, some models may include more than one clinician. In one included study, a nurse practitioner made home visits and worked with both a geriatrician who was part of an interdisciplinary geriatrics team and with office-based primary care providers.³² It is possible other providers doing home visits had or could benefit from similar collaborations. Another possibility that was not addressed in our included studies but has been raised in policy discussions and the general press is that technology could permit virtual visits to play a role in HBPC in the future. In order to better understand HBPC, studies are needed that are designed and powered to address these questions.

Limitations

We acknowledge that our review has several limitations. First, though we worked hard to identify all relevant research our search may have missed some. Bibliographic database indexing varies and HBPC is not a major indexing term in the databases we used. To address this limitation, we used combinations of other indexing terms and key word adjacencies. This may not have been sufficient if the intervention studied includes the characteristics we required but did not use our included terms. Additionally, while we did not exclude studies in languages other than English (though we required an English-language abstract), it is possible that in countries other than the United States, where health and social care are organized differently, other terms may have been used to describe research about similar services.

Second, the lack of detailed information on the implementation and content of HBPC interventions and the fact that they are not standardized means that our comparisons and summaries across programs may be flawed. Perhaps the ability of HBPC to customize services to the patient is one of its strengths, but without agreement on core and optional services, it is possible apples are being compared to oranges in some cases. While we attempted to document what services were part of the HBPC interventions in the included studies, our accuracy is limited by what was reported and our interpretation of these reports.

Third, we were not able to assess the intensity, consistency, and quality of care provided. We cannot be sure that in some cases the lack of HBPC effectiveness was related to poor quality. Quality metrics for home-based primary care are only in development. One organization has developed a quality measurement framework, identified domains, and is currently field testing quality indicators, but that effort has its own challenges. For example, 14 of the 36 proposed quality standards could not be mapped to any existing quality standards that experts considered from ambulatory and long-term care.⁴⁸ The work in progress bodes well for the future but the gaps between what is important in HBPC and quality measures currently in use in other settings underscore why it may be difficult to assess HBPC outcomes or which aspects of HBPC improve quality of care.

The focus of our review was limited by ambiguity surrounding the potential outcomes of HBPC and the priorities for these outcomes. We solicited expert input about HBPC and chose to report all the outcomes studied rather than limit the review to specific outcomes. The challenge is that many common clinical outcomes such as mortality or physical function may not be appropriate for the populations served by HBPC. Particularly if HBPC is targeted to frail persons or those with high mortality rates, a major effort will be required to assess metrics of value to patients and their families. Meanwhile, commonly studied outcomes, such as utilization of services (e.g., hospital admissions, ED visits, nursing home days), can be difficult to interpret.

While it may be important that HBPC substitute for rather than supplement other services to offset its cost of the program, what pattern of change in utilization should be expected, or is ideal, is unclear. Specific issues include but are not limited to 1) how quickly should HBPC be expected to have an impact on outcomes such as hospitalizations and ED use (which is important and should be used in determining what the followup period should be for research studies); 2) can changes in utilization be expected to continue to decrease, or should they stabilize as the program matures (which might suggest that that results for newly established HBPC programs might be different than for established programs); 3) do HBPC programs that explicit have as a goal to keep patients out of the hospital have a greater impact on utilization; and 4) do HBPC programs enroll patients who want to avoid hospitalization, potentially introducing selection bias in studies?

Applicability

The applicability of the studies included in this review and our summary apply to similar populations, that is, patients with conditions or disabilities that that make outpatient primary care difficult or less effective. While the most common patients may be home bound elderly, age is not the predominate factor and this model of care could serve patients of various ages.

One consideration is that 7 of the 18 studies were conducted in U.S. Department of Veterans Affairs (VA) settings and the veterans served were predominately male, while the patients in other HBPC interventions were predominately female. In the non veteran population, older male patients are more likely to have a living spouse and may have more access to informal care, although these demographics may be different for veterans.

In discussions of the goals of HBPC the target populations are often described as vulnerable and this vulnerability is not purely medical but needs to be characterized in terms that add social and economic factors. It seems likely that this type of care might be particularly effective for patients in unstable situations that are not entirely the result of medical issues, such as those at risk of homelessness or who have recently lost a spouse. The available evidence does not allow us to say whether HBPC would actually be effective for vulnerable patients.

Another major consideration about applicability relates to the organization settings for HBPC interventions. Based on current evidence we do not know what infrastructure is required to support HBPC. The included studies were conducted in the VA, in health plans, or in academic/health organization collaborations. This appears to reflect the need for both integrated services and the organizational capacity to support a program of care that can be resource intensive and differs in many ways from how office-based primary care is organized. As the authors of one of the included studies points out, “This setting provides ready referrals along with administrative and clerical supports...”²⁷ While it is possible to make some inferences about the types of organizations that could implement HBPC, the research does not address this issue directly; we identified no evidence about the impact of organizational characteristics. While evidence is needed it seems likely that community-based practices and even single primary care practices could provide HBPC, but to do so might require that they establish partnerships to expand their capacity. Other health care reforms that also encourage collaboration and interdisciplinary approaches such as patient-centered medical homes and accountable care organizations may lead to the development of organizational capacity or to a better understanding of the impact of organizational characteristics that would also be applicable for HBPC in the future.

As discussed in the limitations section, the content of HBPC interventions is not standardized and is rarely reported in detail. This makes it difficult to know if the results seen in any study or group of studies can be expected in a different situation in which the HBPC may provide or at least have access to different configurations of services.

Challenges and Implications for Future Research

HBPC is a resource intensive delivery of services that promises more efficient and effective care for patients with extensive needs in a format that may facilitate better quality of care and quality of life. While the research has increased somewhat over time in complexity, from program descriptions to include RCTs and more complex observational design, we still lack evidence about the value of HBPC. There is a growing interest in HBPC, yet available studies do not provide the level of information needed to inform decisions about HBPC implementation and spread.

Specifically, more research is needed that addresses what components of HBPC are linked to effectiveness. As with other complex interventions, a typology services could facilitate a better understanding of HBPC interventions. The ongoing work on quality measures for HBPC is related and may address both what care is delivered and standards for that care as well as outcome metrics. Evaluation of the quality metrics will require additional testing and translational studies.

More complex study designs (such as randomization of sites within systems rolling out HBPC, staggered start designs that add HBPC to different sites at different times, or longer-term followup times) could all add to our understanding of HBPC. In transitional care more complex designs have followed the initial pilot and efficacy studies⁴⁹ and this seems a logical next step for research on HBPC.

Another important area for future research is refining the definition of what patient subpopulations will most benefit, that is, identifying for whom does HBPC either reduce costs or enhance outcomes. Ideally research should include clear, replicable definitions of the target population. Another approach could involve subgroup analyses of studies with less strict inclusion or comparisons of across HBPC implementation with different targeting criteria, although this is likely to require larger studies and more complex analyses.

Additionally, studies of HBPC should widen their focus to include the clinical and experience outcomes important to patients and families. Utilization may be key to feasibility, but the ultimate goal of any care model should be to improve the health and wellbeing of patients. None of the studies we identified asked what was most important to HBPC patients. An effort to identify patient-centered outcomes could inform future research.

The Medicare Independence at Home (IAH) demonstration will provide a wealth of data that may answer some of these questions when the primary results are available and additional analyses are conducted in the future. However, the IAH demonstration will not answer all questions. Expansion of HBPC in public and provider health care delivery organizations that are not the 18 IAH demonstration sites is progressing, and complementary research could be conducted to study additional aspects of HBPC in those environments.

Conclusions

Home-based primary care (HBPC) is a promising model of care delivery for patients with a high level of need who may not be best served by the combination of outpatient and hospital care that predominates in our current system. Current research evidence is generally positive, providing moderate evidence that HBPC reduces utilization of inpatient care, and providing low quality of evidence about its impact on utilization of other health services, clinical outcomes, and patient and caregiver experiences. Our ability to draw any conclusions about what types of patients are best served by HBPC is limited by the small number studies that report any results by patient subgroups, though what is available confirms that HBPC is most beneficial for those patients who are most frail. We were not able to identify any research that directly examined organizational characteristics of health systems, health plans, or practices and how those characteristics might influence the impact of HBPC. While we attempted to document the components of HBPC programs that have been the subject of study and we searched for studies that examined specific services (e.g., caregiver support), there is still insufficient evidence on which to base conclusions about the impact of individual or combinations of services in HBPC.

The more recent studies of HBPC included larger sample sizes and comparison groups, and they incorporated more complex designs and analyses; however, the body of evidence is still comparatively small. The Medicare Independence at Home (IAH) demonstration is likely to provide substantial new evidence when its results are released. However, the demonstration project cannot answer all the relevant questions that remain about HBPC.

References

1. Howden LM, Meyer JA. Age and Sex Composition: 2010 United States Census Bureau. May 2011. <http://www.census.gov/prod/cen2010/briefs/c2010br-03.pdf>.
2. Kinsella K, Wan H. U.S. Census Bureau, International Population Reports, P95/09-1 An Aging World: 2008. Washington, DC: U.S. Government Printing Office; 2009. <http://www.census.gov/prod/2009pubs/p95-09-1.pdf> Accessed November 11, 2014.
3. Federal Interagency Forum on Aging-Related Statistics. Older Americans 2012: Key Indicators of Well-Being. Federal Interagency Forum on Aging-Related Statistics. Washington, DC: Office. USGP; 2012.
4. Salive ME. Multimorbidity in older adults. [Epub ahead of print]. *Epidemiol Rev.* 2013 Jan 31. PMID: 23372025.
5. Coleman K, Austin BT, Brach C, et al. Evidence on the Chronic Care Model in the new millennium. *Health Aff (Millwood)*. 2009 Jan-Feb;28(1):75-85. PMID: 19124857.
6. Kane RL, Preister R, Totten A. Meeting the Challenge of Chronic Illness. Baltimore: Johns Hopkins University Press; 2005.
7. Centers for Medicare & Medicaid Services. Independence at Home Demonstration. <http://innovation.cms.gov/initiatives/independence-at-home/>. Accessed on April 3, 2014.
8. Priority Health. Michigan's first home-based primary care program launches statewide. 2013. <http://www.priorityhealth.com/about-us/press-room/releases/2013/home-based-primary-care>. Accessed on April 2 2014.
9. Rauch J. The hospital is no place for the elderly. *The Atlantic*. December, 2013.
10. Unwin BK, Tatum PE, 3rd. House calls. *Am Fam Physician*. 2011 Apr 15;83(8):925-38. PMID: 21524032.
11. American Community Survey. United States Census Bureau; 2013. <http://www.census.gov/acs/www/>. Accessed on March 31, 2015.
12. Centers for Medicare & Medicaid Services. Research, Statistics, Data & Systems. 2013. <http://www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-Reports/MedicareMedicaidStatSupp/2013.html>. Accessed on March 28, 2015.
13. Rauch J. Opportunity Knocks at Home: How Home-Based Primary Care offers a Win-Win for U.S. Health Care. *Governancy Studies at Brookings*. Washington, DC: The Brookings Institution; 2013. <http://www.brookings.edu/research/papers/2013/12/05-home-based-primary-care-win-win-for-us-health-care-rauch>. Accessed on March 31, 2015.
14. Veterans Health Administration. Home-Based Primary Care Program. Veterans Health Administration Transmittal Sheet. VHA Handbook No. 1141.01. Washington, DC: Department of Veterans Affairs; 2007. http://www.va.gov/vhapublications/ViewPublication.asp?pub_ID=1534. Accessed on August 11 2014.
15. Egan E. VA Home Based Primary Care Program: A Primer and Lessons for Medicare American Action Forum. Washington, D.C.: American Action Forum; November 1 2012. <http://americanactionforum.org/sites/default/files/VA%20HBPC%20Primer%20FINAL.pdf>. Accessed on March 31, 2015.
16. Bouman A, van Rossum E, Nelemans P, et al. Effects of intensive home visiting programs for older people with poor health status: a systematic review. *BMC Health Serv Res*. 2008;8:74. PMID: 18387184.
17. Elkan R, Kendrick D, Dewey M, et al. Effectiveness of home based support for older people: systematic review and meta-analysis. *BMJ*. 2001 Sep 29;323(7315):719-25. PMID: 11576978.
18. Huss A, Stuck AE, Rubenstein LZ, et al. Multidimensional preventive home visit programs for community-dwelling older adults: a systematic review and meta-analysis of randomized controlled trials. *J Gerontol A Biol Sci Med Sci*. 2008 Mar;63(3):298-307. PMID: 18375879.
19. Mayo-Wilson E, Grant S, Burton J, et al. Preventive home visits for mortality, morbidity, and institutionalization in older adults: a systematic review and meta-analysis. *PLoS One*. 2014;9(3):e89257. PMID: 24622676.
20. Meinck M, Lubke N, Lauterberg J, et al. [Preventive home visits to the elderly: systematic review of available evidence]. *Gesundheitswesen*. 2004 Nov;66(11):732-8. PMID: 15562343.
21. Stall N, Nowaczynski M, Sinha SK. Systematic review of outcomes from home-based primary care programs for homebound older adults. *J Am Geriatr Soc*. 2014 Dec;62(12):2243-51. PMID: 25371236.

22. Stuck AE, Egger M, Hammer A, et al. Home visits to prevent nursing home admission and functional decline in elderly people: systematic review and meta-regression analysis. *JAMA*. 2002 Feb 27;287(8):1022-8. PMID: 11866651.
23. van Haastregt JC, Diederiks JP, van Rossum E, et al. Effects of preventive home visits to elderly people living in the community: systematic review. *BMJ*. 2000 Mar 18;320(7237):754-8. PMID: 10720360.
24. Reuben DB, Tinetti ME. Goal-oriented patient care--an alternative health outcomes paradigm. *N Engl J Med*. 2012 Mar 1;366(9):777-9. PMID: 22375966.
25. Chang SM. The Agency for Healthcare Research and Quality (AHRQ) effective health care (EHC) program methods guide for comparative effectiveness reviews: keeping up-to-date in a rapidly evolving field. *J Clin Epidemiol*. 2011 Nov;64(11):1166-7. PMID: 21959053.
26. Aabom B, Kragstrup J, Vondeling H, et al. Does persistent involvement by the GP improve palliative care at home for end-stage cancer patients? *Palliat Med*. 2006 Jul;20(5):507-12. PMID: 16903404.
27. Anetzberger GJ, Stricklin ML, Gauntner D, et al. VNA HouseCalls of greater Cleveland, Ohio: development and pilot evaluation of a program for high-risk older adults offering primary medical care in the home. *Home Health Care Serv Q*. 2006;25(3-4):155-66. PMID: 17062516.
28. Beales JL, Edes T. Veteran's Affairs Home Based Primary Care. *Clin Geriatr Med*. 2009 Feb;25(1):149-54, viii-ix. PMID: 19217499.
29. Beck RA, Arizmendi A, Purnell C, et al. House calls for seniors: building and sustaining a model of care for homebound seniors. *J Am Geriatr Soc*. 2009 Jun;57(6):1103-9. PMID: 19457154.
30. Chang C, Jackson SS, Bullman TA, et al. Impact of a home-based primary care program in an urban Veterans Affairs medical center. *J Am Med Dir Assoc*. 2009 Feb;10(2):133-7. PMID: 19187882.
31. Cooper DF, Granadillo OR, Stacey CM. Home-based primary care: the care of the veteran at home. *Home Healthc Nurse*. 2007 May;25(5):315-22. PMID: 17495561.
32. Counsell SR, Callahan CM, Clark DO, et al. Geriatric care management for low-income seniors: a randomized controlled trial. *JAMA*. 2007 Dec 12;298(22):2623-33. PMID: 18073358.
33. De Jonge KE, Jamshed N, Gilden D, et al. Effects of home-based primary care on Medicare costs in high-risk elders. *J Am Geriatr Soc*. 2014 Oct;62(10):1825-31. PMID: 25039690.
34. Edes T, Kinosian B, Vuckovic NH, et al. Better access, quality, and cost for clinically complex veterans with home-based primary care. *J Am Geriatr Soc*. 2014 Oct;62(10):1954-61. PMID: 25333529.
35. Hughes SL, Weaver FM, Giobbie-Hurder A, et al. Effectiveness of team-managed home-based primary care: a randomized multicenter trial. *JAMA*. 2000 Dec 13;284(22):2877-85. PMID: 11147984.
36. Neergaard MA, Vedsted P, Olesen F, et al. Associations between home death and GP involvement in palliative cancer care. *Br J Gen Pract*. 2009 Sep;59(566):671-7. PMID: 19761666.
37. Neergaard MA, Vedsted P, Olesen F, et al. Associations between successful palliative trajectories, place of death and GP involvement. *Scand J Prim Health Care*. 2010 Sep;28(3):138-45. PMID: 20698730.
38. Nichols LO, Martindale-Adams J, Burns R, et al. Translation of a dementia caregiver support program in a health care system--REACH VA. *Arch Intern Med*. 2011 Feb 28;171(4):353-9. PMID: 21357811.
39. North L, Kehm L, Bent K, et al. Can home-based primary care: cut costs? *Nurse Pract*. 2008 Jul;33(7):39-44. PMID: 18600171.
40. Ornstein K, Smith KL, Boal J. Understanding and improving the burden and unmet needs of informal caregivers of homebound patients enrolled in a home-based primary care program. *J Appl Gerontol*. 2009;28(4):482-503.
41. Ornstein K, Smith KL, Foer DH, et al. To the hospital and back home again: a nurse practitioner-based transitional care program for hospitalized homebound people. *J Am Geriatr Soc*. 2011 Mar;59(3):544-51. PMID: 21391944.
42. Ornstein K, Wajnberg A, Kaye-Kauderer H, et al. Reduction in symptoms for homebound patients receiving home-based primary and palliative care. *J Palliat Med*. 2013 Sep;16(9):1048-54. PMID: 23746230.
43. Rosenberg T. Acute hospital use, nursing home placement, and mortality in a frail community-dwelling cohort managed with Primary Integrated Interdisciplinary Elder Care at Home. *J Am Geriatr Soc*. 2012 Jul;60(7):1340-6. PMID: 22694020.
44. Wajnberg A, Wang KH, Aniff M, et al. Hospitalizations and skilled nursing facility admissions before and after the implementation of a home-based primary care program. *J Am Geriatr Soc*. 2010 Jun;58(6):1144-7. PMID: 20487075.

45. Beales JL, Edes T. Veteran's Affairs Home Based Primary Care. *Clin Geriatr Med.* 2009 Feb;25(1):149-54, viii-ix. PMID: 19217499.
46. Beck AM, Kjaer S, Hansen BS, et al. Follow-up home visits with registered dietitians have a positive effect on the functional and nutritional status of geriatric medical patients after discharge: a randomized controlled trial. *Clin Rehabil.* 2013 Jun;27(6):483-93. PMID: 23258932.
47. Boling PA, Leff B. Comprehensive longitudinal health care in the home for high-cost beneficiaries: a critical strategy for population health management. *J Am Geriatr Soc.* 2014 Oct;62(10):1974-6. PMID: 25294407.
48. Leff B, Carlson CM, Saliba D, et al. The invisible homebound: setting quality-of-care standards for home-based primary and palliative care. *Health Aff (Millwood).* 2015 Jan;34(1):21-9. PMID: 25561640.
49. McCauley K, Bradway C, Hirschman KB, et al. Studying nursing interventions in acutely ill, cognitively impaired older adults. *Am J Nurs.* 2014 Oct;114(10):44-52. PMID: 25251126.

Abbreviations and Acronyms

ACOVE	Assessing Care of Vulnerable Elders
ADL	Activities of daily living
AHRQ	Agency for Healthcare Research and Quality
CI	Confidence Interval
CINAHL	Cumulative Index to Nursing and Allied Health Literature
DO	Osteopathic physician
ED	emergency department
EPC	Evidence-based Practice Center
GRACE	Geriatric Resources for Assessment and Care of Elders
HBPC	Home-based primary care
IAH	Independence at home
MD	Allopathic physician
MEDLINE	Medical Literature Analysis and Retrieval System Online, or MEDLARS Online
NP	Nurse practitioner
OR	Odds ratio
PA	Physician assistant
PACE	Program of All-inclusive Care for the Elderly
PCP	Primary care provider
PICOTS	Populations, Interventions, Comparators, Outcomes, Timing, and Setting
RCT	Randomized controlled trial
REACH	Resources for Enhancing Alzheimer's Caregiver Health
SNF	Skilled nursing facility
VA	U.S. Department of Veterans Affairs