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Hospitalization Among Medicare-Reimbursed Skilled Home Health Recipients

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Abstract

This article presents a summary and critique of the published empirical evidence between the years 2002 and 2011 regarding rehospitalization among Medicare-reimbursed, skilled home health recipients. The knowledge gained will be applied to a discussion regarding ACH among geriatric home health recipients and areas for future research. The referenced literature in MEDLINE, PubMed and Cochrane databases was searched using combinations of the following search terms: home care and home health and Medicare combined with acute care hospitalization, rehospitalization, hospitalization, and adverse events and limited to studies conducted in the United States. Twenty-five research studies published in the last eight years investigated hospitalization among patients receiving Medicare-reimbursed, skilled home health. Empirical findings indicate telehomecare can reduce hospitalizations and emergency room use. The identification of risk factors for hospitalization relate to an elder's sociodemographic, clinical and functional status that can be identified upon admission and interventions taken in order to reduce hospitalizations. Disease management, frontloading nurse visits, the structure of home health services and OBQI are also among the interventions identified to reduce hospitalizations. However, the body of evidence is limited by a paucity of research and the over reliance on small sample sizes. Few published studies have explored methods that effectively reduce hospitalization among Medicare-reimbursed skilled home health recipients. Further research is needed to clarify the most effective ways to structure home health services to maximize benefits and reduce hospitalization among this chronically ill geriatric population.

Keywords

acute care hospitalization; hospitalization; home health; skilled home health; geriatric; Medicare-reimbursed home health

Introduction

The Centers for Medicare and Medicaid (CMS) began publicly reporting outcome indicators for home health agencies in 2004. Unlike other national quality indicators, one outcome has

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not improved—acute care hospitalization (ACH). ACH is the hospital admission rate for Medicare beneficiaries receiving skilled home health benefits and its reduction is seen as a way to improve quality and reduce health care cost.¹ Nearly 20% of all Medicare beneficiaries discharged from hospitals are rehospitalized within 30 days and 34% are rehospitalized within 90 days.¹ Hospitalization costs incurred by Medicare recipients in general exceeded 534 billion dollars in 2008.² Preventing ACH as a quality indicator has been and continues to be a major national objective as hospitalization leads to increased costs for payers and leaves geriatric patients at great risk for adverse events during and after hospitalization.^{3–5}

In 2004, the average national ACH rate was 28%,⁶ which equated to more than 1 million home health episodes resulting in an unplanned hospitalization. Medicare expenditures for unplanned and potentially preventable hospitalizations may be as high as US\$17 billion a year.⁷ Despite the varied efforts of individual home health agencies, and a small number of researchers, the present national average ACH rate is 29%).⁸ While some hospitalizations may be unavoidable due to advancing patient age, chronic illness, and comorbid conditions, it is widely accepted that many hospitalizations are preventable and that home health agencies, through careful assessment and well-designed interventions, can prevent unnecessary hospitalizations among geriatric patients receiving skilled home health.⁹

In addition to contributing to the already rising health care costs, ACH increases the potential for medical errors^{4,10} and reduces quality of life for patients and their caregivers through psychological distress and reduced functional status.^{11–14} ACH also results in negative consequences for home health agencies as well. These consequences include increased paperwork requirements, the risk of losing patients to other home health agencies on discharge from the hospital,³ and a higher ACH rate as reported on Home Health Compare, where CMS publicly reports home health quality measures.

ACH is a result of many complex issues both within and outside the home health agency's control. A reasonable ACH rate for geriatric patients receiving skilled home health is unknown but it is evident from the wide variation in the geographic pattern of agency risk-adjusted rates across the country that opportunities exist to prevent unnecessary ACH. Currently, risk-adjusted ACH rates range between 22% and 38% with a national average rate of 29%.⁸ Despite the 7-year effort to reduce hospitalization for elderly home health recipients, ACH remains at an all-time high.

In 1967, Congress enacted the Medicare Home Health Benefit making home health a federally funded benefit on a fee-for-service basis with no quality oversight and potentially unlimited utilization.¹⁵ Since enactment, the home health industry has undergone important changes that continue to influence service provision today. In response to the rapid expansion of home health utilization in the late 1980s and 1990s, Congress passed the Balanced Budget Act in 1997, which contained a major Medicare reform for the home health industry—implementation of the Home Health Prospective Payment System (HHPPS).¹⁶ HHPPS, implemented in 2000, restructured home health reimbursement from a cost-based, fee-for-service system to a 60-day prospective payment determined by the Outcomes Assessment Information Set (OASIS).¹⁶

The HHPPS provides a financial incentive for home health agencies to limit the amount of care provided in each 60-day episode and has led to a dramatic reduction in the number of visits^{15,17–19} and length of stay in home health.^{16,20–22} Prior to HHPPS, Medicare home health recipients received an average of 65 visits per home health admission.¹⁵ In 1998, in preparation for the HHPPS implementation, Medicare beneficiaries received an average of only 31.6 visits per home health admission and 14.1 skilled nursing visits.²³ The most recent data available indicate that in 2008 Medicare beneficiaries received an average of 21.6 visits per home health admission, with 11.8 visits from skilled nursing.²⁴ This represents a 32% overall reduction in the number of home health visits and a 16% reduction in skilled nursing visits since HHPPS implementation. A retrospective study of national data indicates that since HHPPS implementation, Medicare patients are 2.9 times more likely to be discharged from home health within the first 60 days of admission than Medicare patients who received services in prior years.¹⁹ Moreover, the average length of Medicare home health episodes decreased 37% after HHPPS implementation from 106 to 69 days.²³ Two recent analyses of national samples of Medicare-reimbursed beneficiaries indicate average home health length of stay is approximately 44²⁵ to 45 days.²⁶ Madigan further reports that 85% of home health beneficiaries completed home health services within one episode while less than 5% required more than one episode.²⁵ Thus, the reduction in average number of visits and home health length of stay could be major contributing factors in rising ACH rates.

The Outcomes Assessment Information Set (OASIS) was mandated for use by all Medicare-certified home health agencies in 1999 to be completed on admission, discharge, transfer, death at home, and change in condition for all Medicare and Medicaid beneficiaries. The OASIS is a comprehensive tool designed to collect nearly 100 items related to a home health recipient's functional status, clinical status, and service needs. Select indicators on the OASIS are used to assign patients into a Home Health Resource Group for each 60-day home health episode, which then determines the reimbursement rate under HHPPS.

In addition to serving as the basis of HHPPS, OASIS is the cornerstone of two quality improvement programs initiated by CMS. Introduced in 2002, Outcomes-Based Quality Improvement (OBQI) is a voluntary, continuous quality improvement process where home health agencies use patient outcomes, made available by CMS, to determine the impact of the care they provide and implement change where outcomes are poor. The OBQI program benchmarks individual agency data to allow agencies to compare themselves not only to their standing from the prior year but also against agencies across the country. CMS's second home health quality improvement initiative, Home Health Compare, was introduced in 2004. This initiative makes national benchmarking data available to the public via CMS's web site (www.medicare.gov). Outcome data are available on all Medicare-certified home health agencies. Publicly reporting patient outcome data promotes quality by encouraging competition between home health agencies based on the effectiveness of the care they provide as evidenced by patient outcomes.²⁷

Despite these targeted quality initiatives, hospital admissions continue to climb. The costs associated with ACH impart a tremendous burden on society; thus, the generation of evidence to prevent admissions is crucial to the reduction of health care costs and to prevent

further decline among the elderly population. This article will contribute to the home health literature by providing a critique and synthesis of published empirical evidence between the years 2002 and 2010 regarding hospitalization among geriatric recipients of Medicare-reimbursed, skilled home health. It will also illuminate important gaps in knowledge and identify opportunities for future research.

Method

A review of the literature was conducted in which Medline, PubMed, and the Cochrane Library were searched using combinations of the following search terms: home care, home health and Medicare combined with acute care hospitalization, rehospitalization, hospitalization, and adverse events. The search was limited to research published in English between 2002 and June of 2011. The year 2002 was chosen as a starting point because CMS introduced OBQI to home health agencies in 2002, causing ACH to be a primary focus of quality improvement efforts. Thus, a search beginning in 2002 was deemed most likely to capture timely research on this topic. All studies included in this analysis were conducted in the United States as home health outside the United States lacks the structure, assessment, and reporting mechanisms that are present in home health provided within its borders. The reference lists of articles were also examined for additional studies. Articles were selected if hospitalization among patients receiving Medicare-reimbursed, skilled home health was studied. Studies where the intervention did not include skilled, Medicare reimbursed home health were excluded. Articles were entered into a table of evidence, summarized, and critiqued based on intervention, study design, sample size, and significant findings. See appendix for the table of evidence.

Findings

Two hundred eighteen articles were reviewed. Of these, 25 studies were found eligible and were organized into 2 themes: (a) Identification of High-Risk Factors Associated with ACH and (b) Tools and Approaches to Reduce ACH. Overall, 11 studies were retrospective, and 14 were prospective. Only 9 of the 25 studies included in this review were randomized controlled trials, 7 of which had sample sizes of greater than 100. Six of the 11 retrospective studies performed a secondary analysis of OASIS data collected by one individual agency.^{3,28-32} Only three studies were conducted on national OASIS data sets involving large sample sizes.^{25,33,34} Two observational studies did not report a sample size.^{35,36} Last, three of the 25 studies included in this analysis were conducted at the same large, urban home care agency in New York City making the generalizability of these studies limited to the region studied.^{29,30,32}

Identification of High-Risk Factors Associated With ACH

Nine of the 25 published studies reviewed investigated the risks associated with hospitalization of geriatric patients receiving Medicare-reimbursed, skilled home health. ACH patient risk factors were categorized according to the domains of sociodemographic characteristics, clinical history, and functional status.²⁹ The sociodemographic characteristics associated with ACH are women of white or Hispanic racial/ethnic background, either dually eligible (Medicare/Medicaid) or receiving Medicaid only benefits;

referred to home health from a hospital or skilled nursing facility; lacking informal caregivers; living alone, or receiving little to no help with IADLs from primary caregivers.^{29,30} Home health episodes of care who began with a resumption of care rather than a start of care were more likely to require hospitalization.³³ Furthermore, 78.8% of patients with a history of hospitalization within the 30 days prior to the home health episode were more likely to be readmitted ($P < .001$).³⁰ Setting prior to home health is one of the select indicators on the OASIS used to assign patients into a Home Health Resource Group for each 60-day home health episode, which then determines the reimbursement rate under HHPPS.

Clinical risk factors included patients with chronic conditions—in particular heart failure (HF), human insufficiency virus (HIV) or acquired immune deficiency syndrome (AIDS), diabetes mellitus (DM) with a wound or renal failure, chronic skin ulcers, difficulty breathing, depression, and chronic obstructive pulmonary disease (COPD).^{29,30} Hospitalized patients were more likely to have four or more secondary diagnoses (3.8, SD 1.13 compared to 3.4, SD 1.22) as well as a pressure or stasis ulcer, urinary incontinence, a urinary catheter, require assistance with medication management, depression, dyspnea, and more than five medications.^{29,30} While the hospitalization rate is similar for depressed versus nondepressed patients, time to hospitalization has been found to be less (8.4 days after SOC) for depressed patients than nondepressed patients (19.5 days).³¹ Eighty percent of all ACHs were due to acute exacerbations of a chronic illness.³⁷

Functional status risk factors included requiring assistance with ADLs and IADLs and needing assistance to take their medications.^{29,30,31} Home health recipients with an OASIS functional score of 2 or greater are more likely to be hospitalized than those with a lower score.³ Thus, the OASIS functional score could be used to identify patients at greater risk for ACH as well. Two studies investigated a home health agency's profit status as a risk factor for hospitalization using data from the CMS Home Health Compare web site.^{38,39} Both studies found that patients in for-profit home health agencies were more likely than those in nonprofit agencies to have a hospitalization.

In conclusion, findings reported in these studies corroborate one another and suggest that it is possible for home health agencies to identify patients at risk for hospitalization and more effectively target home health services to prevent a hospital admission. However, all nine studies were retrospective and findings may not be generalizable as two of the nine studies were conducted at the same home health agency in New York.^{29,30} Bowles and Cater performed a secondary analysis on a small sample size ($N = 147$) from one home health agency³ and Fortinsky et al included OASIS data from Ohio-based agencies only but did utilize a large sample size ($N = 922$).³⁷ Only one study utilized national OASIS data but only patients with a diagnosis of CHF were included ($N = 145\ 191$).²⁵ One profit status study used Home Health Compare data for Michigan agencies only³⁸ while the other linked the 2007 National Home and Hospice Care Survey data to Home Health Compare.³⁹ Neither study utilized CMS-owned data to determine profit-status' risk of hospitalization.

Tools and Approaches to Reduce ACH

Telehomecare—The number of telehomecare programs implemented nationwide and the number of peer-reviewed publications on the subject have increased over the past 5 years.⁴⁰ Although chronic wound patients have been included, the most frequent use of telehomecare in tandem with skilled home health has been among patients with diabetes, chronic obstructive pulmonary disease (COPD), and heart failure (HF). Telehomecare is an emerging tool where technology such as wired and wireless weight scales, blood pressure monitors, and video technology are placed in patient homes and transmit data to the home health agency via the patient's telephone line, cable Internet, or 4G connections. Many believe that telehomecare improves quality of care through increased monitoring and assists in preventing hospitalization as patient instability can be identified sooner. The Institute of Medicine considers the implementation of information technology to hold "... enormous potential for transforming the health care delivery system" (p. 5).¹⁰ Nevertheless, despite its growing use, telehomecare is not yet a standard of care among skilled home health agencies in managing the chronically ill.

Six of the 8 published telehomecare studies included in this analysis were randomized controlled trials,^{41–46} and two were observational studies.^{36,47} Five randomized controlled trials demonstrated that patients who receive telehomecare require less hospitalization and fewer emergency room (ER) visits.^{36,41–44} One study reported fewer HF-related hospitalizations in the telehomecare group (13 vs. 24; $P < .001$) with shorter lengths of stay in home health compared to the usual care group (49.5 vs. 105 days; $P < .001$).⁴¹ Another found that diabetics in the usual home health group were 3.2 times ($P = .02$) more likely to require continued home health after 60 days and were 6.2 times ($P < .001$) more likely to be hospitalized compared to the telehomecare group.⁴² Further research by the same team involving HF patients demonstrated that telehomecare patients had a somewhat lower probability of being hospitalized but was not clinically significant.⁴³ However, ER use was less after 60 days compared to patients receiving usual home health (22% vs. 30%, $P = .05$). The differences between groups are less prominent at 120 days where 36% of the control group versus 30% of the telehomecare group required ER use ($P = .22$). Another study involving HF patients found hospitalization was reduced from 38% to 6% and the mean number of in-home nursing visits required per 60-day episode decreased from 20 to 9 visits.³⁶ A study of HF, COPD, and chronic wound care patients found 42% of patients who received usual home health were admitted to a hospital or nursing home within 6 months compared to only 15% ($P = .055$) for telehomecare patients.⁴⁴

Conversely, not all telehomecare interventions found significant differences in hospitalizations and ER visits.^{45–47} But, despite no effect on hospitalization and ER use, one study reported the telehomecare group received significantly less in-home nursing visits compared to the usual home health group (5.8/month telehomecare vs. 8.2/month usual care; $P < .001$) while achieving similar outcomes.⁴⁷ One study did not target any one specific disease population and utilized a small sample size ($N = 37$),⁴⁵ whereas another utilized a larger sample size ($N = 166$) of HF patients.⁴⁷ Bowles, Holland, and Horowitz's randomized controlled trial involving diabetic and HF patients used a larger sample size ($N = 303$) but showed no difference in hospitalization between usual care, telephone, or telehomecare

groups after adjusting for diagnosis.⁴⁶ This study also utilized an evidence-based disease management protocol for both HF and diabetes but telehomecare was the intervention tested.

In summary, due to variations in study designs, interventions, populations studied, and sample sizes, making generalizations is difficult. However, most published studies show that telehomecare can positively affect geriatric home health outcomes, including reduced hospitalizations, ER visits, and home health agency costs through reduced length of stay in home health and number of nurse visits. The positive outcomes, however, might be only temporary as they may lose their effect after 60 days postintervention.⁴³ It should be noted, that in the majority of the above studies, intervention patients received more care than usual home health patients, making the impact of telehomecare from the additional care received difficult to discern.

Disease management—Three of the 25 articles included in this analysis evaluated disease management protocols implemented in Medicare-reimbursed, skilled home health. Disease management protocols provide a standard approach to caring for patients with specific diseases. All three studies were observational,^{35,47,48} but one employed a historical control to establish prior number of visits and ACH rate.⁴⁷

These three studies showed a reduction in ACH and the number of in-home nursing visits for HF and diabetic patients. All three focused on HF patients^{47,48} but one also employed a disease management protocol for diabetic patients.³⁵ One study reported that the ACH rate for diabetic patients was reduced 51% and the ER use was reduced by 17.5%.³⁵ HF patients showed a 5.1% reduction in ACH and a 50% reduction in ER use. Another study reported a reduction in ACH from 80% to 11.7% while providing a reduced number of in-home nursing visits (12.4 to 7.24).⁴⁹ Gorski reported a 35% reduction in ACH, after 9 months, by implementing a standardized protocol and telephone follow up as well.⁴⁷

Disease management protocols show promise as a tool for reducing ACH but protocols utilized in these studies do not appear to be evidence based and differ greatly in their approach. One protocol consisted of a core group of nurses caring for HF patients, and a structured home and telephone visit guide.⁴⁹ Another protocol implemented included diabetic and HF patients and employed the use of telehomecare while relying heavily on licensed practice nurses to visit patients who reported to a disease management nurse for the overall management of each patient.³⁵ It should be noted that this model also led to a 10% increase in agency costs but did achieve drastically reduced hospitalization and ER utilization. Finally, another study utilized a core group of nurses overseen by a master's prepared registered nurse specializing in HF.⁴⁸ In addition, two of the 3 studies employed small sample sizes $N = 51$ ⁴⁸ and $N = 22$ ⁴⁹ and one did not report a sample size.³⁵ Furthermore, all three studies were published in the same journal and did not provide *P* values.

Evidence limited to single studies—Five single studies were identified from the literature review that examined the impact of pharmaceutical services,⁵⁰ nonprofessional caregiver type,²⁸ impact of nursing care,³² frontloading,⁵¹ and the use of OBQI to prevent hospitalization.³⁴ A randomized trial comparing HF patients receiving usual home health to

patients receiving usual home health plus standardized services from a clinical pharmacist showed a 17% reduction in HF-related admissions but the study sample was too small to show statistical significance ($N = 77$).⁵⁰ The services provided by the pharmacist included three in-home medication assessments and physician follow-up on behalf of the patient, if necessary. A secondary analysis of one agency's OASIS data demonstrated that ACH rates did not vary based on the presence and type of nonprofessional caregivers.²⁸

Retrospective chart review was conducted to identify deficient nursing care that may have contributed to hospitalization and emergency room visits for diabetic patients.³² Fifty charts of home health recipients who experienced ACH or an emergent event due to hyper or hypoglycemia were reviewed, using a structured review tool, for significant trends. At least one deficiency in nursing care was found on every chart. Overall, researchers reported that 10% of the events could have been prevented, 56% could have been potentially avoidable, and 34% were unavoidable.³²

The impact of pharmaceutical support on the reduction in hospitalization achieved clinical significance but the sample size was too small to show statistical significance.⁵⁰ This study should be replicated using an adequate sample size as the results are promising and could be another tool in reducing ACH among this geriatric population. Aside from the small sample size, McDonald and colleagues included diabetic patients and only one home health agency.³² These findings could be important, however, if it helps to identify a relationship between the provision of care and patient outcomes resulting in the development of evidence-based home health interventions.

Frontloading home nursing visits has been shown to reduce ACH from 39.4% to 16% with fewer overall nursing visits (15.5 vs. 9.5) for HF patients.⁵¹ Frontloading refers to the practice of providing 60% of planned nursing visits in the 1st 2 weeks of the home health episode. There were no significant findings for diabetic patients as a result of frontloading. This study is the only published investigation related to the timing of which home health services are provided. Rosati et al³⁰ reported that 50.1% of all hospitalizations occur within 14 days of admission to home health, 28% of all hospitalizations occur within 15 to 30 days, 13.7% within 31 to 45 days and the final 8.2% occur between 46 and 60 days of home health. These findings indicate the need for targeting home health services particularly within the 30 days of admission to home health as 78% of all hospitalizations have been found to occur within the 30 days of services. No further empirical studies have been published testing the effectiveness of frontloading on HF and other patient populations since the work of Rogers et al in 2007. In addition, there is a large discrepancy between the sample sizes of the two groups studied. The diabetic sample size was considerably smaller ($N = 84$) than that of the HF sample ($N = 245$) possibly indicating that the diabetic sample was too small to show statistical significance.

OBQI is a clinical management and administration intervention that involves collecting, coding, and transmitting data to CMS, which provides each agency with a risk-adjusted patient outcome report comparing the agency's outcomes with its own from the prior period and on a national level.³⁴ The final study in this analysis was conducted via the National Demonstration and the New York Demonstration Trials utilizing the OBQI process to focus

on ACH.³⁴ The National Demonstration Trial involved 157 548 patients admitted over 3 years to 54 voluntary OBQI home health agencies from 27 states as well as 248 621 patients admitted over 3 years to non-OBQI control home health agencies from the same 27 states. The New York State Trial included 105 917 patients admitted over 4 years to 19 OBQI home health agencies throughout New York. Home health agencies participating in the National Demonstration reduced ACH by 22% ($P < .001$) and agencies in the New York Demonstration reduced ACH by 26% ($P < .001$). OBQI techniques included plans of action specific to the individual agency, specific care behaviors implemented by staff, and benchmarking the agency ACH rate. Nonparticipating agencies showed only small changes in ACH during the 2-year trial period (0.3%) in Year 3 and 0.4% in Year 4).

Discussion

Research Gaps and Recommendations for Future Research

Research within skilled home health is clearly in its infancy. Although many of the studies were effective in reducing hospitalization, there is still much more to learn. Thus far, the three most frequently published techniques to reduce ACH are telehomecare, the identification of risk factors found to predispose geriatric home health patients to hospitalization, and disease management protocols. Telehomecare could become a pervasive and effective tool used by home health agencies to reduce ACH and improve the outcomes and quality of life for the geriatric patients they serve. Further research, however, is imperative prior to making that a reality. Rigorous, randomized controlled trials, with adequate sample sizes and distinct interventions are needed to determine the value of this technology and to distinguish its value from other interventions. Telehomecare beyond the home health episode also warrants further investigation as telehomecare's impact has been shown to be reduced after 60 days when the equipment has been removed from the patient's home.⁴³ Furthermore, investigation of the cost-effectiveness of telehomecare by substituting in-home visits with technology instead of in addition to usual care, are vital to determine if telehomecare can reduce ACH without providing additional services.

The identification of ACH risk factors is a major step in reducing hospitalizations but implementation of these findings is lacking in current home health practice. Of great concern are patients who present with multiple ACH risk factors. Risk factors should be used to identify patients at risk for hospitalization, who may require intensified and targeted services to prevent a hospital admission. Investigators should build on the existing literature to design nationally based, randomized controlled trials with adequate sample sizes to test the predictive validity of the identified risk factors in geriatric home health recipients and their effectiveness in preventing admission to the hospital. The two studies investigating home health agency profit status present interesting findings that warrant further investigation on a national level employing CMS-owned data sets such as the OASIS, Home Health Standard Analytic file and Medicare Provider and Analysis Review File.

The field of evidence-based, disease management protocol implementation must be expanded to include geriatric home health. The publication of research conducted using evidence-based disease management protocols in skilled home health services is sparse and requires further study as it shows great potential in reducing ACH. Furthermore,

investigations using large sample sizes are necessary to advance our understanding of the efficient use of protocols in home health and to define the chronic conditions best managed via disease management protocols.

By using OBQI, investigators notably reduced ACH among agencies who implemented this quality improvement process.³⁴ Because this is the only published study investigating OBQI and in light of the rising ACH rate, this study should be replicated. In addition, the frequency with which this technique is routinely applied in home health agencies throughout the country needs to be determined. OBQI has been shown to be effective in reducing ACH; now is the time to verify if this technique is being applied and if the reduction in ACH is sustainable over time.

Recent studies have found that 50% of all hospitalizations occur within 14 to 21 days of admission to home health,^{30,52} making this time period most critical. However, it is not known how to best structure home health services to meet the needs of this chronically ill population and reduce hospitalizations. Only one study has examined the use of frontloading nurse visits.⁵¹ Frontloading has been adopted by many home health agencies as a standard of care for all geriatric patients because of this one study and despite the fact that it was shown to be effective with HF patients only. The preliminary work in this area is promising but further exploration of this practice is imperative to reducing ACH. Geriatric home health science would be further advanced by replicating the frontloading study using a larger sample size and including other chronic illnesses common among this population such as COPD and stroke.

Potentially, the relationship between hospitalization and risk factors is more complex than merely identifying patients at risk for hospitalization. HHPPS was a major restructuring of the home health industry and has thus led to a dramatic reduction in the average length of stay in home health and the number of visits provided.^{20,23} Currently, there is a lack of research evaluating the impact of length of stay in home health and number of nurse visits on hospitalization. These issues are critically important as they may be a significant determinant of hospitalization unaccounted for in past work and the missing link between the risk factors identified on admission and avoiding an unnecessary hospitalization. The costs associated with ACH impart a tremendous burden on society and leaves geriatric patients at great risk for adverse events during and after hospitalization.^{4,5,10} Thus, the generation of evidence to avoid them is fundamental to the reduction of health care costs and home health recipients' safety and quality of life. A clearer understanding of how to target and structure home health services for the chronically ill who are also at risk for hospitalization is essential.

Outside of Medicare-reimbursed home health, investigators have determined additional ways to care for the chronically ill such as the Transitional Care Model,^{14,53-56} Guided Care Model,⁵⁷ and the Care Transitions Model.⁵⁸ In particular, Naylor and her multidisciplinary research team have been testing evidence-based clinical interventions for more than 15 years. Findings from three NIH-funded randomized controlled trials demonstrate improved quality and reductions in hospital readmissions and health care costs among intervention patients compared to control patients receiving Medicare-reimbursed home health services

only.^{14,53–56} While these investigations show innovative and promising work, this analysis is limited to interventions conducted in conjunction with Medicare-reimbursed, skilled home health only. However, Transitional Care research suggests that older adults with multiple chronic and comorbid conditions are particularly vulnerable to delays in service when transitioning between health care settings.⁵⁹ Evidence also exists to show that close follow-up of elderly patients can minimize hospital readmission.^{54,58} It is possible that significant patient deterioration occurs during this gap in services between hospital discharge and admission to home health suggesting that early intervention and admission to home health could reduce deterioration and thus hospitalizations.³⁰ CMS-mandated Conditions of Participation for Home Health Agencies require that an initial assessment visit be conducted within 48 hours of referral or within 48 hours of the patient's return home from an inpatient facility.⁶⁰ Currently, gaps in knowledge exist regarding the impact on the need for hospitalization if and when this condition is violated. Little is known about this period of transition between referral to and the actual start of home health services or the role delayed admission to home health has on ACH. Both could be major factors leading to preventable hospitalizations especially when 50% occur within 14 to 21 days of admission to home health.^{30,52}

Conclusions

Although sparse, there is clear and convincing evidence that hospital admissions can be reduced among the Medicare-reimbursed, skilled home health population but important gaps in knowledge exist. The published research is growing and provides a promising starting place from which to direct future scientific inquiry. With further research that builds on current evidence, researchers will be better prepared to design and test interventions to reduce hospitalization and related costs while improving home health recipients' safety and quality of life.

To reduce hospitalization, findings must be implemented and empirically tested on a larger scale in addition to finding new best practices to reduce this growing problem. The reduction of ACH is an important national goal. With further research, we could narrow the gap in knowledge and implementation and advance the science of avoiding hospitalizations among Medicare-reimbursed skilled home health recipients.

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Appendix: Acute Care Hospitalization Table of Evidence

Identification of patient high-risk factors associated with ACH				
Citation	Intervention	Design	Sample size	Significant findings
Bowles et al. ³	Functional score on OASIS to identify	Retrospective	N = 147 from a primary study	The OASIS functional score (greater or = 2) could be used to identify at-risk

Identification of patient high-risk factors associated with ACH				
Citation	Intervention	Design	Sample size	Significant findings
Rosati et al ²⁹	patients at risk for rehospitalization Identification of rehospitalization predictors	Retrospective	N = 8,035 HH agency in New York	home care patients without having to also use the Pra instrument. Rehospitalization predictors: <i>Sociodemographic Characteristics:</i> women of white or Hispanic racial/ethnic background; either dually eligible (Medicare/Medicaid) or receiving Medicaid benefits. Lacked informal caregiver; living alone; receive little to no help w/IADLs from a primary caregiver <i>Clinical History:</i> chronic conditions—CHF, DM, HIV/AIDS, COPD, chronic skin ulcers, difficulty breathing. More likely to have more secondary diagnoses referred to home health from an inpatient setting including (hospital, skilled nursing facility). <i>Functional Status:</i> require assistance with ADLs, IADLs and taking medicines
Fortinsky et al ³⁷	Identification of rehospitalization predictors	Retrospective	N = 922	Of the 18.3% rehospitalized more than 80% experienced emergency ACH mostly for acute exacerbations of chronic illness. Risk factors for rehospitalization included dyspnea, functional disability, skin/wound problems, DM, high case mix score, guarded rehab prognosis.
Rosati et al. ³⁰	Identification of rehospitalization predictors	Retrospective	N = 46,366	Those more likely to be hospitalized: dually eligible, living alone, history of hosp or emergent care, previous history of hh care; poor functional status; taking > 5 meds and having difficulty managing meds; unhealed pressure or stasis ulcers, urinary incontinence, urinary catheters, shortness of breath, depression, 4 or > diagnosis, CHF, HIV/AIDS, diabetes with a wound, renal failure. 50.1% rehospitalization within 14 days; 15 to 30 days 28%; 31 to 45 days 13.7%; 46 to 60 days 8.2%.
Sheeran, et al ³¹	Identification of rehospitalization predictors	Retrospective	N = 477	Hospitalization rate was similar for depressed versus nondepressed patients but mean time to hospitalization was less (8.4 days after start of care; SOC) for depressed patients than nondepressed patients (19.5 days)
Nuccio, et al ³³	Identification of rehospitalization risk factors	Retrospective	N = 1,906,455	Patients whose episodes of care begin with a resumption of care rather than a start of care are more likely to require hospitalization.
Madigan ²⁵	Characteristics of patients with a primary diagnosis of CHF	Retrospective	N = 145,191 2003 OASIS	73.9% of the population were referred to home health from a hospital; 64% remained at home after dc from hh; 15% were rehospitalized; average loss in home was 44 days. Functional status improved very little in the 44 days.
Haldiman.et al ³⁸	Home health agency profit status' risk on hospitalization	Retrospective	N = 505	Not-for-profit agencies had a lower mean percentage of patients who were admitted to the hospital ($t = 2.01$, $P = .045$).
Decker ³⁹	Home health agency profit	Retrospective	N = 510	For-profit agencies were more likely than not-for-profit agencies to have a

Identification of patient high-risk factors associated with ACH				
Citation	Intervention	Design	Sample size	Significant findings
	status' risk on hospitalization			risk of hospitalizations after accounting for patient characteristics and model control variables.
Tools and approaches to reduce ACH				
Telehomecare				
Citation	Intervention	Design	Sample size	Significant findings
Benatar et al ⁴¹	Telehomecare plus home care versus usual home care	RCT	N = 216 Heart failure	Fewer HF readmissions with shorter lengths of stay compared with the usual care group Hospitalization charges at 3 months were less in the intervention
Dansky et al ⁴²	Telehomecare plus home care versus usual home care	RCT	N = 163 Diabetics	Control group were more likely to need continued home health care at 60 days (and were more likely to be hospitalized
Schneider ³⁶	Telehomecare plus home care versus usual home care	Prospective Observational	N not reported Heart failure	Rehospitalization rate dropped from 38% to 6%. Number of total visits/60 days decreased from 20 visits to 9
Finkelstein et al ⁴⁴	Telehomecare (3 groups) Usual home care (C); Usual home care plus video visits (V); Usual home care, video visits, and physiologic monitoring (M)	RCT	N = 53	Discharge to inpatient care (hospital, nursing home) within 6 months of study participation was 42% for C subjects, 21 % for V subjects, and 15% for M subjects.
Identification of patient high-risk factors associated with ACH				
Citation	Intervention	Design	Sample size	Significant findings
Hopp et al ⁴⁵	Telehomecare versus usual home care	RCT	N = 37	No significant differences between groups related to hospitalizations or emergency room (ER) visits.
Myers et al ⁴⁷	Telehomecare plus daily phone call and weekly home visit versus usual care	Prospective Observational	N = 166 C Heart failure	Intervention group length of stay (LOS) 39.8 days versus usual care 38.2 days 5.8 visits/month intervention group; 8.2 visits/month usual care No significant difference between groups in rehospitalization No difference in ER utilization between groups
Dansky et al ⁴³	Telemonitoring plus usual care versus Telemonitoring & video visits plus usual care versus usual care	RCT	N = 284 Heart failure	Telemonitoring group had lower probability of ACH statistically significant @ 60 days but not 120 days. Small sample size → low power

Identification of patient high-risk factors associated with ACH

Citation	Intervention	Design	Sample size	Significant findings
Bowles et al ⁴⁶	Telephone intervention plus usual care versus telemonitoring versus usual care only	RCT	N = 303 Heart failure and diabetic	After adjusting for diagnosis and visits, differences between the three groups were nonsignificant Having heart failure and receiving more in-person visits were significantly related to readmission and time to readmission.
	Utilized an evidence-based disease management protocol for heart failure, diabetes or both			Trend for increased risk of readmission for the telephone group compared to Control alone. Previous rehospitalization was a consistent predictor of those who were rehospitalized

Disease management

Citation	Intervention	Design	Sample size	Significant findings
Gorski et al ⁴⁸	Disease management protocol	Prospective Observational	N = 51	Hospitalizations decreased by 35% Cannot discern between phone and protocol intervention
Quinn ⁴⁹	Disease management protocol	Prospective Observational	N = 22 Heart failure	Reduced rehospitalization and number of in-home visits
Peterson– Sgro ³⁵	Disease management protocol with telehealth intervention	Prospective Observational	Sample size not reported	ACH for DM pts reduced by 51 % and ER by 17.5% ACH for HF decreased by 5.1% and ER by 50%

Single studies

Citation	Intervention	Design	Sample size	Significant findings
Triller et al ⁵⁰	Pharmaceutical support plus usual home care versus usual home care	RCT	N = 154	17% reduction in HF related ACH but study sample too small to reach significance Intervention did not significantly improve the combined rate of death or ACH
Cho ²⁸	Secondary OASIS data analysis	Retrospective	N = 9,832	Rehospitalization rates among the elderly did not vary based on the presence and type of nonprofessional caregivers.
McDonald et al ³²	Record review looking for deficient care processes within the home care agency	Retrospective, randomly selected patient records	50 records	Average length of stay 39.1 days; 18.5% readmitted At least 1 deficiency in nursing care processes identified in every chart 10% of emergent events could have been prevented, 56% potentially avoidable, 34% unavoidable.

Citation	Intervention	Design	Sample size	Significant findings
Rogers et al ⁵¹	Frontloading intervention	RCT	IDDM <i>N</i> = 84) CHF <i>N</i> = 246)	CHF: reduced ACH fewer visits DDM: no significant findings
Shaughnessy et al ²⁵	Outcomes-based quality improvement implementation	Quasi-experimental with prospective pre/post and study/control components	National Demonstration <i>N</i> = 57,548 54 home care agencies from 27 states New York demonstration trial <i>N</i> = 05,917 19 hh agencies from New York only Control non-OBQI pts <i>N</i> = 248,621	National Demonstration Trial: reduced ACH by 22% using OBQI NY Demo Trial: reduced ACH by 26% using OBQI Non-OBQI Medicare HHA pts in the demonstration states showed only small changes in ACH (0.3% in year 1 and 0.4% in year 2)

Note: ACH, acute care hospitalization; OASIS, Outcomes Assessment Information Set; COPD, chronic obstructive pulmonary disease; ADL, activities of daily living; IADL, instrumental activities of daily living; CHF, congestive heart failure; RCT, randomized controlled trial; IDDM, insulin-dependent diabetes mellitus; OBQI, Outcomes Based Quality Improvement.

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