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## Continuity of Nursing Care in Home Health: Impact on Rehospitalization among Older Adults with Dementia

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### Abstract

**Background:** Home health care (HHC) is a leading form of home- and community-based services for persons with dementia (PWD). Nurses are the primary providers of HHC; however, little is known of nursing care delivery and quality.

**Objectives:** To examine the association between continuity of nursing care in HHC and rehospitalization among PWD.

**Research Design:** This is a retrospective cohort study using multiple years (2010-2015) of HHC assessment, administrative, and human resources data from a large urban **not-for-profit** home health agency.

**Subjects:** This study included 23,886 PWD receiving HHC following a hospitalization.

**Measures:** Continuity of nursing care was calculated using the Bice and Boxerman's method, which considered the number of total visits, nurses, and visits from each nurse during an HHC episode. The outcome was all-cause rehospitalization during HHC. Risk-adjusted logistic regression was used for analysis.

**Results:** Approximately 24% of PWD were rehospitalized. The mean continuity of nursing care score was 0.56 (SD=0.33). Eight percent of PWD received each nursing visit from a different nurse (no continuity), and 26% received all visits from one nurse during an HHC episode (full continuity). Compared to those receiving high continuity of nursing care (3<sup>rd</sup> tertile), PWD receiving low (1<sup>st</sup> tertile) or moderate (2<sup>nd</sup> tertile) continuity of nursing care had an **adjusted odds ratio of 1.33 (95% CI: 1.25-1.46) and 1.30 (95% CI: 1.22-1.43)** respectively for being rehospitalized.

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**Conclusion:** Wide variations exist in continuity of nursing care to PWD. Consistency in nurse staff when providing HHC visits to PWD is critical for preventing rehospitalizations.

### Keywords

home health care; continuity of care; rehospitalization; nursing; dementia; older adults

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## INTRODUCTION

Improving care quality is a top priority in the United States and many other countries. A desired aspect of quality care is continuity of care. While there has not been a unanimous definition of continuity of care, it is widely agreed that continuity of care includes three essential aspects: continuity in the relationship between patient and provider; continuity in patient information for care (e.g., patient history, current conditions, socio-demographic characteristics); and continuity in care delivery and patient management.<sup>1</sup> Given these features and the complex social and care needs of persons with dementia (PWD), continuity of care can be of particular value to caring for this vulnerable population. Continuity of care can also be of particular value to home- and community-based services, such as home health care (HHC) because of its decentralized and intermittent care delivery model.

Different from institutional care, HHC is delivered at a recipient's home via intermittent visits from an interdisciplinary team of providers, primarily nurses. Each visit is usually provided by an individual HHC provider. Over the past decade, HHC has become a leading source of care for homebound older adults, particularly persons with dementia (PWD) and/or significant cognitive impairment.<sup>2</sup> In 2018, over 5 million Medicare beneficiaries received HHC, including 1.2 million with an official diagnosis of Alzheimer's disease and related dementias.<sup>3</sup> About one-third to nearly half of HHC admissions were for post-acute care following a hospitalization.<sup>4,5</sup> Nurses are the primary providers of HHC.<sup>6</sup> In a study using data from one large urban home health agency, researchers reported 66% of HHC services to PWD were provided by nurses.<sup>7</sup> The demand for HHC in PWD is expected to grow rapidly because of population aging, PWD's preference for "Aging in Place" as long as possible, and health policies incentivizing home- and community-based services.<sup>8</sup> Nonetheless, there are rising concerns about the quality and outcomes of HHC for PWD, mainly due to lack of empirical evidence about HHC delivery and its impact on patient outcomes sensitive to PWD.<sup>9,10</sup>

To promote quality and outcomes of HHC, several national initiatives and policies were launched in the past two decades, including the Home Health Compare program,<sup>11</sup> home health value-based purchasing model (HHVBP),<sup>12</sup> and patient-driven groupings model (PDGM).<sup>13</sup> The Home Health Compare program was first launched in 2003 with the aim of providing information to the public for comparing performance of home health agencies when seeking HHC. The HHVBP model, part of the overall shift from volume to value-based care within the U.S. health care system, was first implemented among agencies in nine geographically representative states on January 1, 2016. It incentivizes home health agencies to improve care quality and efficiency by adjusting payments based on quality performance relative to peer agencies in the same state. An expansion of this program is

planned for 2022. The PDGM is another effort to shift away from volume-driven HHC, where patient characteristics, needs, and goals are at the center when determining payment. Under increasing regulatory scrutiny, home health agencies face great pressure to find effective approaches for improving care delivery and quality.

One strategy that has the potential to improve the quality of HHC but remains understudied is continuity of care. In a study of Medicare fee-for-services PWD, researchers reported an association between lower continuity of physician visits and higher health care utilization.<sup>14</sup> In the HHC setting, a handful of studies have examined continuity of HHC overall or of nursing care in particular and have suggested its potential for reducing patient psychosocial and behavioral issues,<sup>15</sup> improving patient satisfaction,<sup>16</sup> reducing risk of acute care use (hospitalization and emergent care), and promoting physical function.<sup>17</sup> These studies have focused on the general HHC population and not on PWD. There is therefore a necessity to examine continuity of nursing care among HHC recipients with dementia and its impact on their outcomes.

The purpose of this study was to determine the association between continuity of nursing care and risk for rehospitalization among HHC recipients with dementia and/or significant cognitive impairment. We hypothesized that higher level of continuity of nursing care is associated with lower risk for rehospitalization. Findings from this study can inform policymakers and executives and managers of home health agencies in planning effective and efficient care delivery.

## METHODS

### Design and Setting

This is a retrospective cohort study that analyzed multiple years (2010-2015) of data from a large urban **not-for-profit** home health agency. This study was approved by the Institutional Review Boards at the authors' institution and the participating agency.

### Data Sources

Three HHC datasets were used, including patient assessment data – the Outcome and Assessment Information Set (OASIS), administrative data, and human resources data. OASIS is a standardized data collection tool for assessing and comparing HHC quality and patient outcomes. It is mandatory for all Medicare-certified home health agencies to collect and submit OASIS data if they request reimbursement for services provided to Medicare and Medicaid beneficiaries. During an HHC episode, which is defined as all the care received between a formal admission and discharge, a patient can be assessed multiple times using OASIS, including at least the initial assessment at HHC admission and an assessment at HHC discharge, transfer to an inpatient facility or other institutional care setting (e.g., nursing homes), or death. The admission assessment is the most comprehensive one where HHC providers collect data on patient socio-demographics, clinical diagnoses and comorbidities, functional status, and other health conditions. HHC providers also assess a patient's living arrangement and caregiving availability. In this study, we used patient information collected at the admission assessment for risk adjustment in analysis. All

OASIS data, including those in 2015, were deidentified and structured in version C format by the participating agency staffs before it was delivered to our research team.

The administrative and human resources datasets included details of care provided to each patient in each visit throughout an HHC episode. More specifically, these datasets allowed us to identify the duration (hours) of each visit, the provider of the visit (e.g., nurse, physical or occupational therapist, HHC aides, etc.), and the unique identification number assigned to each provider. Linking these two datasets to OASIS, we were able to determine the levels of continuity of nursing care and intensity of HHC during an episode.

## Sample

Our study sample included older adults ( $\geq 65$ ) who had a documented diagnosis of dementia or significant cognitive impairment and were admitted to the partner HHC agency following a hospitalization. Patients with significant cognitive impairment were identified based upon assessment using four OASIS items. These same items have been used by other researchers for identifying PWD in OASIS data to address underdiagnosis of dementia.<sup>18,19</sup> Specifically, we considered a person having significant cognitive impairment if he/she was rated for any of the following conditions: 1) current cognitive function - “considerable assistance in routine situations or totally dependent” (M1700); 2) frequency of confusion - “constantly or daily” (M1710); 3) memory deficit - “significant memory loss so that supervision is required” (M1740\_1); and 4) impaired decision making - “failure to perform usual ADLs or IADLs” (M1740\_2). For individuals who had more than one HHC episode, only their most recent episode was selected. Using patient’s most recent episode of care and a combination of medical diagnosis of dementia and OASIS assessment items brought us several advantages, including 1) maximizing our ability to identify PWD and/or significant cognitive impairment, 2) avoiding inter-person dependence in statistical analysis, and 3) increasing time relevance. Finally, we excluded individuals who received only one nursing visit during an episode because their “perfect” continuity of care could bias our measure of continuity of nursing care. The final analytic sample included 23,886 participants.

## Measures/Variables

**Continuity of nursing care**—We used the method employed by Bice and Boxerman to measure the continuity of nursing care during an HHC episode.<sup>20</sup> This method considered the total number of nursing visits during an HHC episode, the number of visits by each nurse, and the number of nurses providing visits. A higher score indicates better continuity of nursing care, with 0 indicating each visit provided by a different nurse (no continuity) and 1 indicating all nursing visits provided by the same nurse (full continuity) during an HHC episode.

**Rehospitalization**—In OASIS, patient hospitalizations for any reason during an HHC episode were recorded. Given that we only included patients admitted to HHC for post-acute care following a hospital discharge, a hospitalization was considered a rehospitalization in this study.

When reporting the reasons for a hospitalization, HHC skilled providers relied on their own knowledge of the hospitalization. In OASIS data, providers had three options to report the reason(s) for a hospitalization. They could select: 1) the clinical condition(s) from 19 listed conditions (e.g., heart failure, respiratory problem), 2) “other than above reasons” if they knew the reason but the reason was not among the 19 specified conditions, and 3) “reason unknown” if they did not have the information to specify the cause.

**Covariates**—We included patient characteristics and measures of HHC intensity as covariates because these factors could affect the risk for rehospitalization.

Included patient characteristics were socio-demographics, clinical, functional and other health-related variables, and living arrangement and caregiving. Socio-demographic characteristics included age, sex, race/ethnicity, and insurance type. Clinical and other health-related variables included history of multiple hospitalizations or falls, polypharmacy, frailty, overall health status, pain, pressure ulcer, surgical wound, urinary incontinence, shortness of breath, anxiety, and comorbidities. Functional status was measured based on the rating of 8 items on daily activities of living (ADLs), and a composite score was calculated to reflect the overall functional status.<sup>21</sup> Living arrangement indicated whether a patient lived alone or not. Caregiving was considered received if a patient received daily assistance with ADLs/IADLs from informal caregivers.

We measured care intensity to reflect the amount of HHC received by PWD. Care intensity was calculated as the total number of care hours during an episode divided by the length of the episode in days and then multiplied by 7. This measure indicated the weekly number of care hours received by PWD. During an HHC episode, PWD can receive care from skilled HHC providers, such as nurses and occupational/physical therapists, and assistance from home health aides. We therefore measured intensity of nursing care, non-nursing skilled HHC (HHC provided by skilled providers other than nurses), and home health aide assistance respectively.

### Statistical Analysis

We first described the characteristics of the study sample using standard descriptive statistics, including means and standard deviations (SD) for continuous variables and frequency and percentage for categorical variables. We then compared the differences in patient characteristics between those rehospitalized and those did not by using analysis of variance and Chi-square tests. Reasons for rehospitalization were also explored for a better understanding of rehospitalization from HHC. Finally, we employed risk-adjusted logistical regression to examine the effect of continuity of nursing care on the risk of rehospitalization when controlling for patient characteristics and HHC intensity. We also conducted sensitivity analysis by applying the risk-adjusted model only to patients who were medically diagnosed with dementia. All analyses were conducted within Stata version 14.0 (StataCorp LP) with the statistical significance set at  $p < 0.05$ .

## RESULTS

Table 1 presents the characteristics of study sample at admission to HHC and the intensity of HHC for PWD. On average, PWD were 82 years old (SD=8.50). Approximately 64% were female and 39% were White. Medicare was the payer for 72% of PWD. In the past 12 months, 40% had at least two hospitalizations, and 21% had two or more falls or any fall with injury. Polypharmacy ( $\geq 5$  medications) presented in 76% of the sample. Twenty-two percent had ongoing high risk(s) or serious progressive conditions, 25% had a pressure ulcer or surgery wound, and roughly half (48%) had shortness of breath. Approximately one-third had pain daily/all the time (35%) or some level of anxiety (38%). The majority had urinary incontinence (62%) or at least two comorbidities (82%). Thirty-nine percent lived alone, and 96% received some assistance in ADLs and/or IADLs from caregivers.

Approximately one in four (24%) older adults with dementia were rehospitalized from HHC. Compared to those without rehospitalization, PWD that were rehospitalized from HHC were more likely to be male and White and have Medicare as the payer; they were also more likely to have a history of multiple hospitalizations, take 5 or more medications, be frail, and have ongoing high risk(s) or serious progressive conditions, pain daily or all the time, presence of pressure ulcer and urinary incontinence, shortness of breath, anxiety daily or all the time, and multiple ( $\geq 3$ ) comorbidities (Table 1).

Table 1 also shows HHC services to PWD. Half of PWD had an HHC episode of 36 days or less (interquartile range, 23-36). On average, PWD had a continuity of nursing care score of 0.56 (SD=0.33), including 8% receiving each visit from a different nurse (score=0, no continuity) and 26% receiving all visits from the same nurse (score=1, full continuity). The intensity of total skilled HHC was 1.91 hours (SD=1.03) per week, including 1.22 hours (SD=0.88) of nursing care and 0.69 hours (SD=0.66) of non-nursing skilled care (e.g., physical or occupational therapy). Additional to skilled HHC, 42% of PWD received assistance from home health aides ( $9.32 \pm 19.32$  hours per week overall or  $22.57 \pm 11.86$  hours per week among those who received home health aide assistance). PWD who were rehospitalized received more nursing care and home health aides assistance, and they received a lower level of continuity of nursing care and less non-nursing skilled care.

In this study, we found that 73% of the 5,752 rehospitalizations had a known reason (Appendix A), of which, 2,460 (or 59%) were caused by at least one of the 19 listed conditions. Among all rehospitalizations, the three most commonly identified reasons were infections (9%), respiratory problem except respiratory infection (7%), and heart disease (6%).

Table 2 presents the distribution of patient characteristics and care intensity by continuity of care. Differences were observed in patient race/ethnicity, insurance payer, polypharmacy, frailty, functional status, presence of pressure ulcer/wound, urinary incontinence, shortness of breath, comorbidities, living conditions (live alone vs. not), and length of HHC episode across levels of continuity of nursing care. Continuity of nursing care was negatively associated with intensity of nursing care ( $P=0.000$ ) while it was positively associated

with intensity of non-nursing skilled care ( $p=0.000$ ). PWD that received moderate level of continuity of care (2<sup>nd</sup> tertile) received the highest intensity of home health aide assistance.

Estimates of the impact of continuity of nursing care on rehospitalization from **risk-adjusted logistic regression are summarized in** Table 3. PWD receiving low continuity (1<sup>st</sup> tertile) or moderate continuity (2<sup>nd</sup> tertile) of nursing care had 1.33 and 1.30 times the odds of being rehospitalized during HHC, compared to those receiving high continuity of nursing care (3<sup>rd</sup> tertile). Our sensitivity analysis that only included persons with a documented diagnosis of dementia demonstrated the same significant relationship between continuity of nursing care and rehospitalization (Appendix B).

## DISCUSSION

This study is one of the first to provide empirical evidence illustrating continuity of nursing care in home health and its relationship to rehospitalizations among PWD. Our study has several important findings: 1) increased continuity of care led to reduced risk for rehospitalization even after controlling for clinical risk factors and intensity of HHC; 2) higher visit intensity was associated with lower continuity; and 3) infections, respiratory problems, and heart diseases were the three most common reasons for rehospitalization from HHC among post-acute PWD.

Findings from this study highlight the importance of improving continuity of nursing care during HHC for reducing rehospitalizations among PWD. Nurses provide the vast majority of HHC,<sup>7</sup> which is expected to increase further under the new payment model – the Patient-Driven Groupings Model (PDGM) that started in January 2020.<sup>13</sup> While improving continuity of nursing care is important to every HHC patient, such improvement can be more critical to PWD. Having the same person delivering care could increase trust and reduce confusions for patients and their families. PWD present complex behavioral and psychological symptoms of dementia often on top of multiple chronic conditions. Timely recognition and proper management of changes and progression in dementia symptoms are pivotal for the quality of life and health outcomes of PWD. However, this can be difficult without continuity in patient information – one essential aspect of continuity of care. Familiarity (e.g., with people, environment, and activities) is also essential when caring for PWD. In the case of HHC for PWD, assigning the same nurse for each visit to PWD can improve his/her knowledge of patients, from their socio-demographic backgrounds to clinical conditions, life style, interpersonal relationship, and social network. In the National Institute on Aging's Health Disparities Framework,<sup>22</sup> those data are highlighted as critical factors to determine or influence the health of an individual, including PWD.

Our study underlines the high risk for rehospitalization among HHC recipients with PWD. We found that nearly one in four PWD were rehospitalized during their post-acute HHC. This finding echo results from previous research and highlights the need for effective programs to reduce rehospitalizations from HHC.<sup>9</sup> Special attention should be paid to detecting and managing symptoms and signs of infections (including respiratory infections), other respiratory problems, and heart disease. These three conditions were the most frequently specified reasons for rehospitalization among our study population. Our finding

is similar to that in previous research on cause of hospital care utilization. In a study using a national sample of Medicare beneficiaries with dementia, the researchers reported that infections, including bacterial pneumonia and urinary tract infection, were the most common cause of potentially avoidable hospitalizations.<sup>23</sup> In another study among a national sample of HHC patients in general, researchers found that 17% of unplanned hospitalizations were due to infections.<sup>24</sup> It should also be noted that we might have underestimated the number of rehospitalizations caused by infections due to missing information in OASIS. To our knowledge, no study in the U.S. has reported the reasons for rehospitalization among HHC recipients with dementia. Future studies using national data with more complete diagnostic information for hospitalization are warranted in order to inform effective HHC practice.

Another important finding from this study is the negative relationship between continuity and intensity of nursing care. One possible explanation is that nursing care can be provided more efficiently when the same nurse is sent to visit a patient each time, as the nurse can have a comprehensive knowledge of the patient and his/her conditions and needs. As a result, PWD may need fewer nursing care hours during an HHC episode. Another possible explanation of our finding is that the receipt of higher intensity of nursing care (i.e., more nursing hours or more nursing visits) can result in more challenges to achieving continuity in care. Though we measured intensity of nursing care as nursing care hours, previous research has shown that nursing care hours and nursing care visits are highly positively correlated.<sup>7</sup> While adjusting various covariates in our analysis, we might have missed some important variables reflecting patients' levels of clinical severity. Sicker PWD are at a significantly higher risk for negative health outcomes and often require more visits. More visits in turn expose PWD to greater likelihood of having more providers, which makes continuity more difficult. Thorough examinations are warranted to **analyze** the relationship between intensity and continuity of nursing care.

This study has several limitations. First, despite the inclusion of various covariates in our analysis, it is possible that we have missed some important measures of PWD clinical severity (such as variables reflecting the time since first diagnosis and/or severity of dementia), which could have limited our explanation of the findings. Second, we focused only on nursing care and did not examine continuity in other types of skilled HHC. However, given the relatively small number of visits from other skilled HHC providers, continuity of care may not apply, and other measures reflecting the quality of non-nursing skilled care should be considered. Third, the method we used to measure continuity of care has its advantages; however, it is challenging when interpreting it for direct implication in clinical practice. Future studies should explore other methods. Fourth, though other researchers have also included persons with significant cognitive impairment based upon clinical assessment items in OASIS when studying PWD in HHC setting, there is a need of research to validate this approach. Fifth, reasons were not specified for many rehospitalizations because of data limitations in OASIS. Researchers should consider linking OASIS to hospital claims data when studying hospitalization and rehospitalization from HHC.

Findings from this study have implications for nursing practice and management, health policy, and research. Our findings suggest that efforts are needed to improve the continuity



of nursing care. One way to do so is to enhance care coordination. Indeed, with the implementation of the PDGM, care coordination has become more critical in the success of business for home health agencies. Better care coordination can improve scheduling nurses' visits to HHC patients. Another way to improve scheduling visits is the adoption of new technologies with real-time data input. In HHC, nurses and other providers deliver care in patients' homes, which involves frequent commuting. Minimizing travel time through real-time data input could reduce time-consuming commuting between patient homes and thus counter a barrier to providing care with a high level of continuity.

A hybrid care model of in-person and telehealth visits could be another potential solution to achieving high continuity of care, by letting nurses provide virtual patient visits during what otherwise would have been time spent traveling to a patient's home. Supports from policymakers is critical to achieve this. In March 2020, in response to the COVID-19 pandemic, Congress passed the Coronavirus Aid, Relief, and Economic Security (CARES) Act, which created emergency authority to significantly expand telehealth use for Medicare covered visits.<sup>25</sup> The first Interim Final Rule issued by CMS following the CARES Act further specified the rules of using telehealth in HHC. It ruled that Medicare-certified home health agencies could deliver virtual patient services if those services were incorporated into a patient's plan of care and did not replace necessary in-home visits.<sup>26</sup> Because Medicare home health reimbursement is episode-based rather than visit-based, a home health agency could provide virtual visits but would not receive an explicit payment for them. Recognizing the growing vital role of HHC in providing care to homebound patients, the Home Health Emergency Access to Telehealth (HEAT) Act was introduced in the U.S. Senate in October 2020 with an aim to firmly establish Medicare coverage for HHC telehealth visits during the current pandemic and future public health emergencies.<sup>27</sup> Future research that examines appropriate utilization, effectiveness and quality of telehealth in HHC would be of unique value for policymaking. Future research is also warranted to explore the mechanism of decision making in continuity of care, including barriers and facilitators, as well as to establish a business case for improving continuity of care in HHC.

In conclusion, our study underscores the importance of improving continuity of nursing care to PWD in reducing risk for rehospitalization. To improve continuity of nursing care, home health agencies need to make an investment in care coordination and adoption of technologies for scheduling visits. Policymakers may consider expanding the coverage of telehealth visits in HHC to replace some in-person visits, which can reduce providers' time spending on commuting to patient's home, in order to improve continuity of care. Further research may also examine continuity of care within other patient populations receiving HHC to understand if there are disparities in HHC delivery.

## Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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**Table 1.**

Characteristics of older adults with dementia in home health care following hospital discharge

	Overall (n=23,886) N (%)	Rehospitalized (n=5,752) N (%)	Not rehospitalized (n=18,134) N (%)
Age (Mean, SD)	82.34 (8.50)	82.37 (8.72)	82.33 (8.43)
Male ***	8521 (35.67%)	2,165 (37.64%)	6356 (35.05%)
Race **			
White	9251 (38.73%)	2334 (40.58 %)	6917 (38.14 %)
Black	5571 (23.32%)	1342 (23.33%)	4229 (23.32%)
Hispanic	7166 (30.00%)	1638 (28.48%)	5528 (30.48 %)
Other	1898 (7.95%)	438 (7.61%)	1460 (8.05%)
Insurance ***			
Medicare	17110 (71.63%)	4287 (74.53%)	12823 (70.71%)
Medicaid	979 (4.10%)	160 (2.78 %)	819 (4.52 %)
Dual	3284 (13.75%)	896 (15.58%)	2388 (13.17%)
Other	2513 (10.52%)	409 (7.11%)	2104 (11.60 %)
Multiple hospitalizations (>=2) in the past 12 months ***	9588 (40.14%)	2862 (49.76%)	6726 (37.09%)
History of falls (>=2 falls or any fall with an injury) in the past 12 months	4935 (20.66%)	1143 (19.87%)	3792 (20.91 %)
Taking 5 or more medications ***	18208 (76.23%)	4583 (79.68%)	13625 (75.14 %)
Presence of frailty indicators ***	8223 (34.43%)	2215 (38.51 %)	6008 (33.13 %)
Functional status (Mean, SD) ***	3.73 (2.04)	4.24 (2.10)	3.57 (2.00)
Overall status ***			
No or temporary high health risk(s)	18542 (77.63%)	4044 (70.31%)	14498 (79.95%)
Fragile with ongoing high risk(s) or serious progressive conditions	5344 (22.37%)	1708 (29.69%)	3636 (20.05%)
Pain daily/all of the time ***	8335 (34.89%)	2119 (36.84%)	6216 (34.28%)
Presence of pressure ulcer ***	2765 (11.58%)	1111 (19.32%)	1654 (9.12%)
Surgery wound	3319 (13.90%)	762 (13.25%)	2557 (14.10%)
Presence of urinary incontinence ***	14778 (61.87%)	3955 (68.76%)	10823 (59.68%)
Shortness of breath ***			
No short of breath	12454 (52.14%)	2,793 (48.56%)	9661 (53.28%)
walking >20 feet	5417 (22.68%)	1214 (21.11%)	4203 (23.18%)
moderate/minimal exertion or at rest	6015 (25.18%)	1745 (30.34%)	4270 (23.55%)
Anxiety ***			
None of the time	14810 (62.00%)	3495 (60.76%)	11,315 (62.40%)
less often than daily	4729 (19.80%)	1096 (19.05%)	3633 (20.03%)
Daily or all the time	4347 (18.20%)	1161 (20.18%)	3186 (17.57%)
Number of comorbidities ***			
0	864 (3.62%)	123 (2.14%)	741 (4.09%)

	Overall (n=23,886) N (%)	Rehospitalized (n=5,752) N (%)	Not rehospitalized (n=18,134) N (%)
1	3523 (14.75%)	629 (10.94%)	2894 (15.96%)
2	6083 (25.47%)	1249 (21.71%)	4834 (26.66%)
>=3	13416 (56.17%)	3751 (65.21%)	9665 (53.30%)
Live alone	9300 (38.93%)	2205 (38.33%)	7095 (39.13%)
Caregiving/assistance in ADLs or IADLs	22865 (95.73%)	5482 (95.31%)	17383 (95.86%)
Length of home health stay, days (Media, IQR) ***	36 (23-56)	51 (24-78)	34 (23-50)
Continuity of care			
Continuity of nursing care (Mean, SD) ***	0.56 (0.33)	0.52 (0.32)	0.57 (0.34)
Continuity of total skilled home health care (Mean, SD) ***	0.38 (0.23)	0.35 (0.23)	0.39 (0.23)
Intensity of home health care			
Intensity of nursing care (Mean, SD) ***	1.22 (0.88)	1.44 (1.11)	1.15 (0.78)
Intensity of non-nursing skilled care (Mean, SD) ***	0.69 (0.66)	0.56 (0.58)	0.73 (0.68)
Intensity of home health aide assistance (Mean, SD) ***	9.32 (19.32)	10.46 (19.60)	8.96 (19.22)

\* p<0.05,

\*\* p<0.01,

\*\*\* p<0.001

Functional status was based on measures of activities of daily living.

ADLs, activities of daily living; IADLs, instrumental activities of daily living; IQR, interquartile range; SD, standard deviation.

**Table 2.**

Characteristics of older adults with dementia and care intensity by continuity of nursing care

	Continuity of nursing care <sup>†</sup>		
	1 <sup>st</sup> tertile	2 <sup>nd</sup> tertile	3 <sup>rd</sup> tertile
Age (Mean, SD)	82.07 (8.47)	82.52 (8.57)	82.42 (8.45)
Male **	2812 (35.32%)	2780 (34.90%)	2929 (36.8%)
Race *			
White	3047 (38.27%)	3086 (38.74%)	3118 (39.18%)
Black	2008 (25.22%)	1774 (22.27%)	1789 (22.48%)
Hispanic	2359 (29.63%)	2518 (31.61%)	2289 (28.76%)
Other	548 (6.88%)	587 (7.37%)	763 (9.59%)
Insurance ***			
Medicare	5786 (72.67%)	5768 (72.42%)	5556 (69.81%)
Medicaid	329 (4.13%)	297 (3.73%)	353 (4.44%)
Dual	949 (11.92%)	1186 (14.89%)	1149 (14.44%)
Other	898 (11.28%)	714 (8.96%)	901 (11.32%)
Multiple hospitalizations (>=2) in the past 12 months	3221 (40.45%)	3226 (40.5%)	3141 (39.46%)
History of falls (>=2 falls or any fall with an injury) in the past 12 months	1694 (21.28%)	1647 (20.68%)	1594 (20.03%)
Taking 5 or more medications **	6021 (75.62%)	6188 (77.69%)	5999 (75.37%)
Presence of frailty indicators ***	2813 (35.33%)	2808 (35.25%)	2602 (32.69%)
Functional status (Mean, SD) ***	3.76 (2.04)	3.83 (2.05)	2.05 (2.05)
Overall status			
No or temporary high health risk(s)	6190 (77.74%)	6142 (77.11%)	6210 (78.02%)
Fragile with ongoing high risk(s) or serious progressive conditions	1772 (22.26%)	1823 (22.89%)	1749 (21.98%)
Pain daily/all of the time	2796 (35.12%)	2815 (35.34%)	2724 (34.23%)
Presence of pressure ulcer ***	1000 (12.56%)	1060 (13.31%)	705 (8.86%)
Surgery wound *	1118 (14.04%)	1154 (14.49%)	1047 (13.15%)
Presence of urinary incontinence ***	4984 (62.6%)	5102 (64.06%)	4692 (58.95%)
Shortness of breath ***			
No short of breath	4270 (53.63%)	4152 (52.13%)	4032 (50.66%)
walking >20 feet	1806 (22.68%)	1845 (23.16%)	1766 (22.19%)
moderate/minimal exertion or at rest	1886 (23.69%)	1968 (24.71%)	2161 (27.15%)
Anxiety			
None of the time	5008 (62.9%)	4910 (61.64%)	4892 (61.47%)
less often than daily	1549 (19.45%)	1617 (20.3%)	1563 (19.64%)
Daily or all the time	1405 (17.65%)	1438 (18.05%)	1504 (18.9%)
Number of comorbidities ***			
0	326 (4.09%)	235 (2.95%)	303 (3.81%)
1	1289 (16.19%)	1086 (13.63%)	1148 (14.42%)
2	2026 (25.45%)	1968 (24.71%)	2089 (26.25%)

	Continuity of nursing care <sup>†</sup>		
	1 <sup>st</sup> tertile	2 <sup>nd</sup> tertile	3 <sup>rd</sup> tertile
>=3	4321 (54.27%)	4676 (58.71%)	4419 (55.52%)
Live alone ***	2958 (37.15%)	3183 (39.96%)	3159 (39.69%)
Caregiving/assistance in ADLs or IADLs	7611 (95.59%)	7614 (95.59%)	7640 (95.99%)
Length of home health stay, days (Media, IQR) ***	33 (19-52%)	43 (29-60)	33 (21-52)
Intensity of home health care			
Intensity of nursing care (Mean, SD) ***	1.28 (1.05)	1.26 (0.81)	1.13 (0.75)
Intensity of non-nursing skilled care (Mean, SD) ***	0.66 (0.67)	0.70 (0.65)	0.71 (0.67)
Intensity of home health aide assistance (Mean, SD) ***	8.25 (18.53)	11.02 (20.62)	8.69 (18.62)

\* p<0.05,

\*\* p<0.01,

\*\*\* p<0.001

<sup>†</sup> a higher score indicates a higher level of continuity of nursing care

Functional status was based on measures of activities of daily living.

ADLs, activities of daily living; IADLs, instrumental activities of daily living; IQR, interquartile range; SD, standard deviation.

**Table 3.**

The effect of continuity of nursing care on rehospitalization among home health care patients with dementia

	Odds Ratio	P	95% C.I.
Continuity of nursing care <sup>†</sup> (baseline: 3rd tertile)			
2 <sup>nd</sup> tertile	1.30	0.000	[1.20 - 1.40]
1st tertile	1.33	0.000	[1.23 - 1.44]
Age	0.99	0.000	[0.99 - 0.99]
Male	1.16	0.000	[1.08 - 1.24]
Race/ethnicity (baseline: White, non-Hispanic)			
Black, non-Hispanic	0.86	0.001	[0.79 - 0.94]
Hispanic	0.79	0.000	[0.73 - 0.86]
Other	0.78	0.000	[0.68 - 0.88]
Insurance (baseline: Medicare)			
Medicaid	0.59	0.000	[0.49 - 0.71]
Dual	0.97	0.537	[0.89 - 1.07]
Private/Other	0.56	0.000	[0.50 - 0.63]
Multiple hospitalizations (>=2) in the past 12 months	1.33	0.000	[1.25 - 1.42]
History of falls (>=2 falls or any fall with an injury) in the past 12 months	0.92	0.044	[0.85 - 1.00]
Presence of frailty indicators	1.07	0.056	[1.00 - 1.14]
Taking 5 or more medications	1.04	0.327	[0.96 - 1.13]
Functional status	1.11	0.000	[1.09 - 1.13]
Overall health status, with ongoing high risk(s) or serious progressive conditions	1.25	0.000	[1.16 - 1.35]
Pain daily/all the time	1.03	0.429	[0.96 - 1.1]
Presence of pressure ulcer	1.53	0.000	[1.39 - 1.69]
Presence of surgery wound	0.95	0.252	[0.86 - 1.04]
Presence of Urinary incontinence	1.09	0.030	[1.01 - 1.17]
Shortness of breath (baseline: no short of breath)			
Walking>20 feet	1.05	0.271	[0.96 - 1.14]
Moderate, minimal, at rest	1.18	0.000	[1.10 - 1.28]
Anxiety (baseline: none of the time)			
Less often than daily	0.96	0.310	[0.88 - 1.04]
Daily or all the time	1.05	0.276	[0.96 - 1.14]
Number of comorbidities (baseline: no comorbidities)			
1	1.31	0.014	[1.06 - 1.63]
2	1.50	0.000	[1.22 - 1.85]
3	2.08	0.000	[1.70 - 2.55]
Live alone	1.06	0.088	[0.99 - 1.13]
Caregiving/assistance in ADLs and/or IADLs	0.81	0.006	[0.70 - 0.94]
Intensity of nursing care	1.18	0.000	[1.14 - 1.23]
Intensity of non-nursing skilled care	0.74	0.000	[0.71 - 0.77]
Intensity of home health aide assistance	1.21	0.000	[1.16 - 1.25]



	Odds Ratio	P	95% C.I.
ROC		0.6833	

<sup>†</sup>a higher score indicates a higher level of continuity of nursing care

**ROC, receiver operating characteristic, a statistical indicator of model performance of correctly distinguishing objects of interest (herein rehospitalization).** ADLs, activities of daily living; IADLs, instrumental activities of daily living (IADLs).

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