

Use of a National Home Health Care Register in Producing Transition Statistics

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Introduction

In the United States over 9000 Medicare certified home health care agencies bring health care services into patients' homes to manage pain, IVs, medications, wounds, post-surgery conditions, etc., or to provide patient/caregiver education. Such agencies are required by federal regulations to collect data elements for all Medicare/Medicaid patients receiving skilled nursing services.

The local agencies are required to submit these data to a state agency for preparation and submission to a federal public domain Outcome and Assessment Information Set (OASIS) managed by the Centers for Medicare and Medicaid Services (CMS, 2011). In the year 2006 alone, data for over 3 million patients with over 100 million patient visits were entered into this data set.

Elements of OASIS were designed to allow measurement of outcomes while adjusting for a large number of relevant patient risk factors that address socio-demographic, environmental, support system, health status, functional status, and health service utilization characteristics. In all, OASIS contains measurements of 12 outcome variables used by Medicare to compare agency performance.

In previous studies, we used OASIS data from agencies in three U.S. states within a quasi-experimental design to assess whether telemonitoring, when added to standard home care, increases cost-effectiveness of service delivery, reduces acute care hospitalization, and increases discharge to the community (Golbeck et al, in press; Hansen et al, in press). We concluded that decreased rehospitalizations are needed to offset telemonitoring costs in rural populations with already low skilled nursing utilization, and we found evidence that home telemonitoring does reduce rehospitalizations.

In this study, we examined the stochastic structure of home health care utilization outcomes. These included emergent care, hospitalization, facility stay, and discharge to the community. Our stochastic process framework makes transparent some of the statistical complexities and idiosyncrasies inherent in the information available to agencies from the OASIS data set.

A Stochastic Process Model for Home Care

A patient is enrolled in home care when requiring skilled nursing or therapy services and he/she is confined to the home (**H**). A home care patient experiences emergent care (**E**) when instability in his/her medical condition requires an unscheduled visit to the physician, urgent care center, or emergency room. S/he experiences an acute care hospitalization (**A**) when admitted to a hospital with a stay longer than 24 hours. S/he is placed for a 'stay' in a nursing home, rehabilitation facility, or inpatient hospice facility (**S**) when needing short-term therapy services, respite, or hospice care.

A home care patient experiences a discharge to the community (**C**) when released from home care for reasons other than an acute care hospitalization, a nursing home or rehabilitation facility placement. S/he experiences an 'other' discharge (**O**) when ending home care for any reason other than discharge to the community. The latter could include 'placement' (as opposed to short term 'stay') in a nursing home, rehabilitation facility, or inpatient hospice facility when needing long-term therapy services, respite, or hospice care. It could also include death or geographical relocation.

In terms of the stochastic model, the patient starts out in **H**. There are four transient states: **H**, **E**, **A**, and **S**. There are two absorbing states: **C** and **O**. Figure 1 shows the paths that an enrolled home care patient may travel among these states.

A newly enrolled home care patient may travel one of five paths. The patient may remain at home for the duration of their home care and be discharged to the community without ever experiencing any emergent care visits, acute care hospitalizations, or facility stays (**H**→**C**). This is the most favorable path that a home care patient may travel. The patient may also have an 'other discharge' without ever experiencing any emergent care, hospitalizations, or facility stays (**H**→**O**). Otherwise the patient experiences a next event that is an emergent care visit (**H**→**E**), an acute care hospitalization (**H**→**A**), or a facility stay (**H**→**S**).

A patient who experiences a facility stay may transition to any state in the model (**S**→**H**, **S**→**E**, **S**→**A**, **S**→**C**, **S**→**O**). A patient in emergent care may not be discharged directly to the community, but may transition to any of the other states in the model (**E**→**H**, **E**→**A**, **E**→**S**, **E**→**O**). A patient in acute care hospitalization may not be discharged to the community, nor be placed in emergent care, but may transition to any of the other states in the model (**A**→**H**, **A**→**S**, **A**→**O**). There is no restriction on the number of transitions among the transient states that a home care patient may experience.

OASIS Data Structure

In this study, we use the stochastic process model for home care described above to examine and illuminate the transition information available to home care agencies from the Outcome and Assessment Information Set (OASIS). In order to accomplish this, we need to describe OASIS assessment periods, OASIS variables relevant to states in the stochastic model, OASIS ordered triplets, and how these triplets relate to transition paths in the stochastic model for home care.

Assessment periods. OASIS contains information on the patient at start of home care and at follow-up (resumption of care, transfer, and discharge) from two kinds of assessments. Comprehensive assessments are taken face-to-face at start of home care, resumption of home care following acute care hospitalization, and discharge from home care. Mini-assessments are not face-to-face and are taken upon transfer from home care to any acute care hospitalization.

The period between start of care and the first follow-up assessment, or between two follow-up assessments, will be called an assessment period. A home care patient has one or more records in the OASIS database, depending on the number of assessment periods. Data from these OASIS assessments are made available to agencies via Tally Report software.

Variables relevant to states in the stochastic model. These data contain three variables relevant to states in the stochastic model for home care. Variables include ‘any emergent care’ (**E**), ‘acute care hospitalization’ (**A**), and ‘discharge to the community’ (**C**). All are available on the Outcomes Tally Report. Each is coded ‘1’ if the event is present, and ‘0’ if the event is absent. There are no specific variables in the OASIS database for facility stay or ‘other’ discharge. However visits to these states may on occasion be deduced from the database in ways that we describe below.

Ordered triplets. It will be convenient here to discuss the three variables as an ordered triplet (**E,A,C**). Patients have an ordered triplet for each assessment period, i.e., for each record in the database. The eight possible outcomes for the set of 3 binary variables on each patient record are shown in the first column of Table 1.

Transition paths. Information about the transition paths in the stochastic process model for home care produced by the values of these 3 binary variables is shown in the second column of Table 1. Note that in no case do we know the number of transitions to a facility stay, as there is no variable corresponding to facility stay in the OASIS database. Also note that we know whether a patient transitioned to any emergent care, but we do not know how many times there was a transition, in a given assessment period.

It is not possible for the patient to be discharged to the community directly from the hospital. Therefore two of the eight possible outcomes, namely the triplet (0,1,1) corresponding to the path $H \rightarrow A \rightarrow C$, and the triplet (1,1,1) corresponding to the same path but with one or more emergent care visits (i.e., $H \rightarrow E^{\wedge} \rightarrow A \rightarrow C$), are not possible. Any observed triplets with these values are indications of data errors.

Since a hospitalized patient will not be discharged to the community, there are two possible outcomes for a hospitalized patient in a given assessment period, namely the triplets (0,1,0) and (1,1,0). If a patient has the triplet (0,1,0) at the final assessment, then s/he has followed the path $H \rightarrow A \rightarrow O$ which indicates a hospitalization followed by an ‘other’ discharge; otherwise s/he has followed the path $H \rightarrow A \rightarrow H$, which indicates a hospitalization followed by resumption of home care, and will have another assessment period. If a patient has the triplet (1,1,0) at the final assessment, then s/he has followed the paths $H \rightarrow E^{\wedge} \rightarrow A \rightarrow O$, or $H \rightarrow E^{\wedge} \rightarrow H \rightarrow A \rightarrow O$ which indicate one or more emergent care visits, either immediately prior to or not immediately prior to a hospitalization, followed by an ‘other’ discharge; otherwise (s) has followed the paths $H \rightarrow E^{\wedge} \rightarrow A \rightarrow H$, or $H \rightarrow E^{\wedge} \rightarrow H \rightarrow A \rightarrow H$, which indicate one or more emergent care visits followed by a hospitalization and then resumption of home care, and will have another assessment period.

A non-hospitalized patient who is not discharged to the community has two possible outcomes, namely the triplets (0,0,0) and (1,0,0). If the patient has the triplet (0,0,0) as the final assessment, then s/he has followed the path $H \rightarrow O$ which indicates an ‘other’ discharge without any emergent care or acute care hospitalization; otherwise s/he has followed the path $H \rightarrow S \rightarrow H$, which indicates a facility stay followed by resumption of home care, and will have another assessment period. Note that this is the only situation in which we have actual evidence from a triplet that the patient had a facility stay, but that other facility stays are possible within other observed triplets. If the patient has the triplet (1,0,0) as the final assessment, then s/he has followed the path $H \rightarrow E^{\wedge} \rightarrow H \rightarrow O$ which indicates one or more emergent care visits before an ‘other’ discharge; otherwise s/he has followed the path $H \rightarrow E^{\wedge} \rightarrow H$, which indicates one or more emergent care visits with resumption of home care, followed by another assessment period.

The only unambiguous triplet to observe with respect to the stochastic process model of home care is (0,0,1), which corresponds to the path $H \rightarrow C$. Here we know that, in the assessment period, the patient had no emergent care visits or hospitalization before being discharged to the community. Slightly ambiguous is the triplet (1,0,1), which corresponds to the path $H \rightarrow E^{\wedge} \rightarrow H \rightarrow C$. Here we know that, in the assessment period, the patient had an emergent care visit but no hospitalization on the way to discharge to the community, but we do not know how many emergent care visits were had.

In summary, the OASIS Tally Report data permit examination of only select transition paths in the basic stochastic process model for home care. And only in one instance do they permit examination of transition to a facility stay.

Application

We used data from the Bringing Healthcare Home Study (Golbeck et al, in press; Hansen et al, in press). We studied low-income patients served between 2004 and 2009 by seven rural, not-for-profit home care agencies of different types in designated health professional shortage areas or medically underserved areas in Montana, Pennsylvania and Missouri. Basic inclusion criteria were that: (1) patients qualified for skilled nursing services; (2) they had Medicare or Medicaid as the primary payer for the home health care services; and (3) they or their caregiver had the cognitive ability to manage the patient's disease state in the home.

Data for these patients were extracted from the OASIS B1 database using the Outcomes Tally Report software. After extracting 2,964 cases and omitting those with unknown values for **E**, **A**, or **C** ($n=65$), this left a total of 2,899 cases for analysis. There were between 1 and 8 records (assessment periods) for each patient.

Table 2 shows, in the column labeled 'none', the data for patients who had only one assessment period ($n=2,547$), broken down by triplet. It shows that 88% of the total patients had only one assessment period, and that most (over 70%) of the total patients were discharged to the community after the first assessment period without ever having an emergent care visit or an acute care hospitalization (triplet (0,0,1), or path $H \rightarrow C$).

Table 2 also shows, in the columns labeled by triplets, the data for patients who had two or more assessment periods ($n=352$). It shows that 4% of the total patients had one or more emergent care visits followed by a hospitalization in the first assessment period and were discharged to the community in the second assessment period without having another emergent care visit or acute care hospitalization. This corresponds to triplet (1,1,0) in the first assessment period and triplet (0,0,1) in the second assessment period, or paths $H \rightarrow E \rightarrow A \rightarrow H \rightarrow C$ or $H \rightarrow E \rightarrow H \rightarrow A \rightarrow H \rightarrow C$. Less than 4% of the total patients followed each of the other paths in the first two assessment periods.

Discussion

Here we have outlined a six-state stochastic process model for home care and delineated how a home care patient may transition among these states. We have examined outcome variables available to home care agencies on OASIS Tally Reports, and illuminated the stochastic process model information that is available from these reports. We have used data from a previous outcomes study to illustrate the information available in the first two assessment periods.

This exercise was revealing. First of all, there are outcome variables corresponding to only three of the states in the stochastic model for home care, namely any emergent care (**E**), acute care hospitalization (**A**), and discharge to the community (**C**). Transitions to a facility stay (**S**) or an 'other' discharge (**O**) may sometimes be inferred, but these require an inspection of whether the patient record corresponds to the final assessment or not. Second, there is no information in these data about the number of times a home care patient has an emergent care visit within an assessment period. We simply know whether the patient had one or more visits in the period. Third, the event time information is incomplete. For example, there is no variable for time of an emergent care visit.

The OASIS Tally Report data therefore has some limitations for use in research on utilization outcomes. The structure of the Tally Report data permit ready analysis of whether or not the patient was hospitalized or not, and whether the patient was discharged to the community or not, in the first assessment period. Analyses to answer other questions will require thoughtful consideration of the structure of the data in relationship to the underlying stochastic model.

Figure 1: Transitions among Home Care States

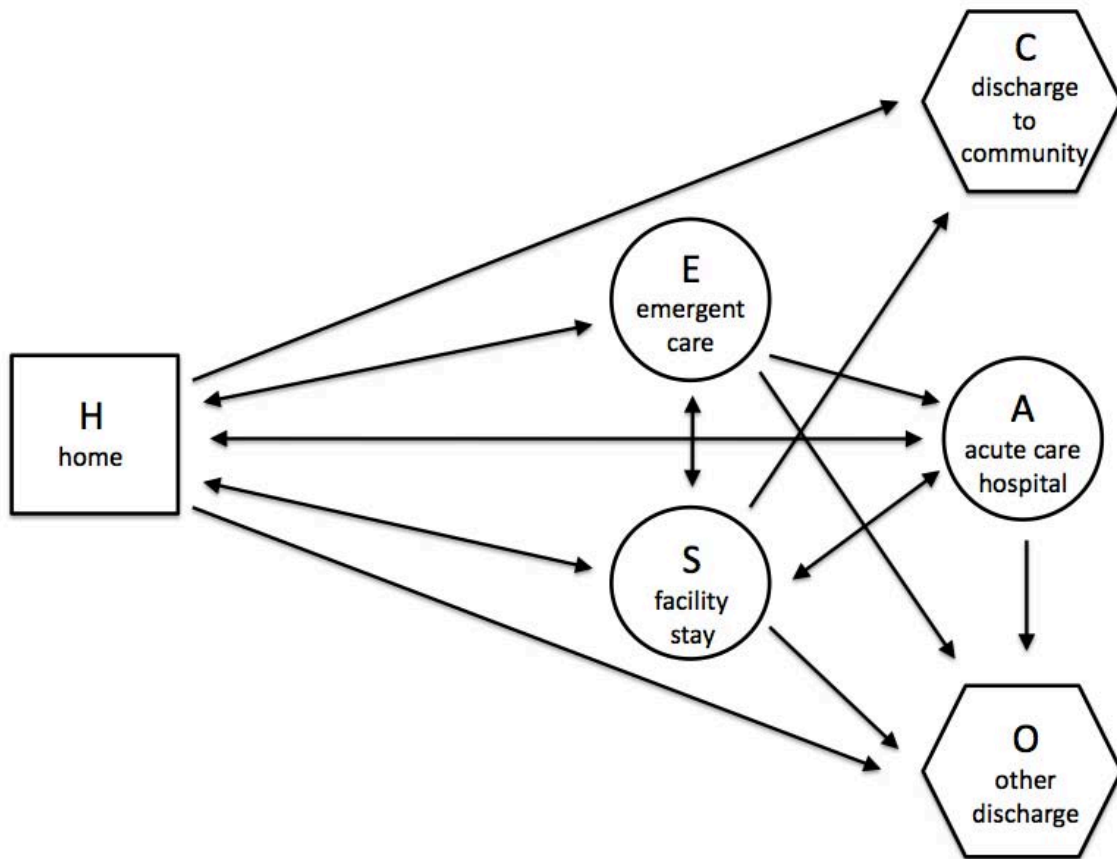


Table 1: Outcome Triplets ($E = \text{Any Emergent Care}$, $A = \text{Acute Care Hospitalization}$, $C = \text{Discharge to the Community}$) and Stochastic Model Paths

(E,A,C)	Path ⁺
(0,1,1)	$H \rightarrow A \rightarrow C$. This path is not possible
(1,1,1)	$H \rightarrow E^{\wedge} \rightarrow A \rightarrow C$. This path is not possible
(0,1,0)	<ul style="list-style-type: none"> ▪ If last record for the patient, then $H \rightarrow A \rightarrow O$ ▪ If not last record for the patient, then $H \rightarrow A \rightarrow H$
(1,1,0)	<ul style="list-style-type: none"> ▪ If last record for the patient, then $H \rightarrow E^{\wedge} \rightarrow A \rightarrow O$, or $H \rightarrow E^{\wedge} \rightarrow H \rightarrow A \rightarrow O$ ▪ If not last record for the patient, then $H \rightarrow E^{\wedge} \rightarrow A \rightarrow H$, or $H \rightarrow E^{\wedge} \rightarrow H \rightarrow A \rightarrow H$
(0,0,0)	<ul style="list-style-type: none"> ▪ If last record for the patient, then $H \rightarrow O$ ▪ If not last record for the patient, then $H \rightarrow S \rightarrow H$
(1,0,0)	<ul style="list-style-type: none"> ▪ If last record for the patient, then $H \rightarrow E^{\wedge} \rightarrow H \rightarrow O$ ▪ If not last record for the patient, then $H \rightarrow E^{\wedge} \rightarrow H$
(0,0,1)	$H \rightarrow C$
(1,0,1)	$H \rightarrow E^{\wedge} \rightarrow H \rightarrow C$

⁺In all cases, the number of transitions to S is unknown

[^]Indicates that there is at least one transition to E, but the actual number of transitions is unknown

Table 2: Percent of 2,899 Home Care Patients Transitioning from First Assessment Period (rows) to Second Assessment Period (columns)

	none	(0,1,0)	(1,1,0)	(0,0,0)	(1,0,0)	(0,0,1)	(1,0,1)	Total
(0,1,0)	2.28	1.00	0.83	0.31	0.10	2.14	0.24	6.90
(1,1,0)	6.93	0.48	1.72	0.34	0.00	4.10	0.62	14.21
(0,0,0)	4.48	0.00	0.07	0.03	0.00	0.10	0.00	4.69
(1,0,0)	0.52	0.00	0.00	0.00	0.00	0.03	0.00	0.55
(0,0,1)	70.54	-	-	-	-	-	-	70.54
(1,0,1)	3.07	-	-	-	-	-	-	3.07
Total	87.82	1.48	2.62	0.69	0.10	6.38	0.86	100.00

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