

Targeting Criteria and Quality Indicators for Promoting Resident Transitions from Nursing Home to Community

**Report to:
Minnesota Department of Human Services**

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Introduction

Minnesota is attempting to strike a better balance between institutional and community-based long-term resources. Rebalancing long-term care necessitates a comprehensive approach: expanding the capacity of home and community based service providers; offering more options at the initiation of long-term care; and re-directing public funds from institutional to community care.

An important re-balancing strategy is to promote community discharge for persons admitted to the nursing home who wish to return to the community and can be appropriately cared for in that setting. The state might intervene to promote community discharge using two general approaches:

- Direct intervention through a formal transition program targeted to nursing home residents desiring to return to the community and appropriately cared for in that setting. The intervention would involve assessment, care planning, service coordination, placement, and ongoing monitoring of care in the community.
- Indirect intervention that motivate nursing home providers to facilitate community discharge through their own efforts or in cooperation with formal transition programs. These interventions might involve financial incentives for providers (e.g., rate add-ons) tied to their community discharge rates, or public reporting of information (e.g., Nursing Home Report Card) about the success of providers in discharging residents desirous and capable of returning to the community.

In a previous report prepared in July 2007 we examined patterns of community discharge for a cohort of first-time Minnesota nursing home admissions from July 2003 – June 2004. The previous report:

- Described length of stay patterns and factors related to community discharge.
- Identified criteria that could be used to target residents for transition programs or provider-facilitated discharges
 - First-time nursing home admissions without a history of prior nursing home use.
 - Falling within a community transition targeting window beyond the typical post-acute short stay period (e.g., 90 days) yet while ties to the community are still in tact and before the resident has settled into the institution setting (e.g., 180 days);
 - Fitting a short-stay community discharge profile, or health and functional conditions indicating a high probability of being discharged to the community within 90 days, yet remaining in the nursing home beyond that point;
 - Having low care requirements (i.e., low RUG-III case mix groups) indicating the possibility of being cared for more efficiently in a community setting.

- Preferring to return to the community (MDS, Q1a) and having a person who is supportive of community discharge (MDS, Q1b);
- Examined variation in the proportion of residents meeting community discharge targeting criteria as well as risk-adjusted facility community discharge rates.

The current report which builds on prior analysis has the following objectives:

- Assemble and present relevant research literature;
- Conduct further analysis of nursing home length of stay and community discharge from a more recent cohort of first-time nursing home admissions from July 2005 – June 2006;
- Refine community discharge targeting criteria; and
- Further develop nursing home quality indicators.

First, we present the research background. Then we describe the study methods. Next we examine the distribution of targeting criteria and community discharge rates for the nursing home population and by facility. Finally, we present our conclusions and recommendations.

Background

Prior research including our earlier analysis of the Minnesota nursing home cohort has identified key factors associated with community discharge from nursing homes.

Targeting Window

Most transitions from the nursing home occur “naturally” and do not require special intervention. Many nursing home residents are admitted for rehabilitation and/or recuperation or they are in the latter stages of a terminal illness; they either return to the community or die after a short stay in the facility (Jones 2002). A relatively small proportion of admissions become long stays yet they may remain in the nursing home for months or years (Keeler, Kane et al. 1981). The longer one remains in the nursing home, the less the likelihood of a naturally occurring transition. Ideally, the window for an intervention would be that period between the short and long stay when the hope of returning home wanes and the resident begins breaking off community ties and settling into the institution. The window of 90-180 days after admission is in our opinion the optimum period for targeting residents for community transitions.

Probability of Community Discharge

Targeting for community transitions should also consider personal, health and functional conditions that increase the probability of community discharge. Previous studies found that community discharge was most likely for residents who were younger (Murtaugh 1994; Mehr, Williams et al. 1997; Chapin, Wilkinson et al. 1998), male (Engle and Graney 1993; Murtaugh 1994), non-Medicaid pay source (Engle and Graney 1993; Murtaugh 1994; Chapin, Wilkinson et al. 1998), continent (Murtaugh 1994), minimally dependent in ADLs (Engle and Graney 1993; Murtaugh 1994; Mehr, Williams et al. 1997), cognitively intact or only mildly impaired (Engle and Graney 1993; Chapin, Wilkinson et al. 1998), absent behavioral problems (Murtaugh 1994), and admitted with a hip other fracture (Liu, McBride et al. 1994; Cumming, Klineberg et al. 1996).

Low Care Requirements

In addition, community discharge targeting should take into account resident resource requirements. Residents with low need for nursing or other care resources might be good candidates for community care. Mor and colleagues recently estimated the percentage of nursing home residents nationally and by state who were what they termed “low care” (Mor, Zinn et al. 2007). They developed definitions of low care from the Resource Utilization Group (RUG-III) resident classification system (Fries, Schneider et al. 1994; Arling, Kane et al. 2007). Residents meeting their broad definition of low care: (a) fell into one the lowest RUG-III groups, i.e., Impaired Cognition, Behavioral Problems or Physically Reduced Function; and (b) were independent or required only minimal supervision with eating, transferring, bed mobility or hygiene ADLs. Narrowly defined low care residents had to meet the broad definition but were restricted to the RUG Physically Reduced Function groups. In an annual admission cohort with stays of approximately 90 days, 8.4% of residents in Minnesota (5.2% nationally) met the narrow definition of low care and 15.3% met the broad definition (13.5% nationally). Among residents staying 90 days or more during the year, 7.7% in Minnesota (5.1% nationally) met the narrow definition and 12.4 % the broad definition (11.8% nationally). Thus,

Minnesota appears to be close to the national average in the percentage of residents in the low care categories. Many of these residents could conceivably be targeted for community transitions.

Preferences and Support for Community Discharge

Probably the most important consideration in discharge from the nursing home is the resident's preference to return to the community and the availability of someone who supports that preference. Individuals' expectations about nursing home use and availability of formal and informal community support influence their risk of nursing home admission (Freedman 1996; Lindrooth, Hoerger et al. 2000; Gaugler, Kane et al. 2007). Yet, little research has been conducted into how these factors influence transitions back into the community. A move to a nursing home may mean giving up community housing and supportive arrangements. The longer a person stays in a nursing home, the fewer community resources are likely to be intact. Some persons entering nursing homes may have a clear intent for short or long stay, but many may be undecided. Once admitted, the length of the nursing home stay can be difficult to predict. The individual's health may improve or deteriorate; attitudes change, family and community support systems fluctuate. Unfortunately, after the admission assessment, the MDS does not re-ask the questions about discharge preference or support until the annual assessment. Although we could not capture these dynamics of nursing home decisions, we used admission data from the MDS to measure resident preference to return to the community and the availability of social support for that decision.

Methods

Study Sample

An annual admission cohort analysis file was created from MDS data supplied by the Minnesota Department of Health. The admission cohort consisted of all residents with first-time nursing home admissions to Minnesota nursing facilities from July 1 2005 to June 30 2006. The admission cohort was followed to the point of discharge or for a maximum of 365 days in the nursing home. The 365 day limit was chosen because our data set did not allow us to follow the entire cohort beyond 365 days and because, as we will describe below, the probability of community discharge beyond that point was extremely low.

The admission cohort used in the study was restricted to first-time admissions (N=24,648) in order to simplify the analysis and to focus on individuals having their first nursing home experience. Nursing home transfers or persons re-admitted to the nursing home after a hospitalization or stay in the community were excluded. We viewed nursing home stays of transfers and re-admissions as extension of earlier stays. We also identified previous nursing home users by looking back up to 36 months through Minnesota MDS records to see if a person had been recorded as ever using a Minnesota nursing facility. We know from our earlier research in Minnesota that characteristics and probabilities of discharge for persons with prior nursing home experience were much different than for first-time admissions. Including previous users in the admission cohort would have complicated the analysis.

If a resident was discharged and returned to the facility within 21 days, the discharge was treated as temporary and was ignored for purposes of the study. In other cases, residents enter the hospital but never return to the facility. In order to track down these individuals we examined other facility MDS records. If they showed up in other facilities, they were coded as nursing home transfers. We also obtained death records from the Minnesota Department of Health. Any resident discharged from a facility who had a matching death record within 21 days of discharge was assigned a discharge status of death. Most of the cases with follow-up death records had been discharged to the hospital and presumably dies in that setting.

Facilities varied in the number of first-time admissions during the year. The 404 facilities averaged 61 admissions with a median of 37 and range of 1-557. Ten percent (39) of facilities had fewer than 10 admissions, whereas 4% (17) had more than 200 admissions.

Variables

Admission sources taken from the MDS were categorized into: private residence, assisted living, acute care hospital, other, missing, and another nursing home. Discharge destinations also taken from the MDS was categorized into: community discharge (private home/apartment with no home health services, private home/apartment with home health services; or board and care/assisted living), another nursing facility, acute

care hospital, other facility (psychiatric hospital, MR/DD facility, rehabilitation hospital, or other), and deceased.

Basic demographic variables included age, gender, and marital status which were taken from the admission or most recent full MDS. Primary pay source designation for the nursing home per diem (Medicare, Medicaid or private pay and other) was based on a combination of factors -- MDS check box for pay source, the presence of a Medicaid number, and if the assessment was identified as being a Medicare assessment.

Several RUG-III variables were included in the analysis (Fries 1994). Major RUG-III categories of Extensive, Rehabilitation, Special Care, Clinically Complex, Impaired Cognition, Behavioral Problems, or Physical were treated as dichotomous variables. Dependency in activities of daily living (ADL) was measured with the ADL long-form (Morris, Fries et al. 1999). The ADL long index ranges from 0 (independent) to 28 (totally dependent). Cognitive impairment was measured with the Cognitive Performance Scale (CPS) with a range of 0 (intact) to 6 (very severely impaired) (Morris, Fries et al. 1994). Diagnoses and problem conditions, such as hip fracture, dementia, or depression, came from MDS items. The problem behavior variable (scored yes or no) was based on one of more problem behaviors (resists care, verbally abusive, physically abusive, or socially inappropriate) at least weekly.

A resident was coded as low care (low resource use) if he or she fell into one of the RUG-III groups having no specialized nursing services or rehabilitation, being medically stable and having minimal or no dependency in activities of daily living. Low Care Broad was defined by groups IA1, IA2, BA1, BA2, PA1 or PA2. Low Care Medium was defined by groups PB1, PB2, PA1 or PA2. Low Care Narrow was defined by groups PA1 or PA2. Figure 1 shows where these groups fall on the RUG-III hierarchy. In general, lower resource use is associated with groups in the lower right of the RUG-III tree.

Measures of community discharge preference and support were taken from MDS item Q1a – “Resident expresses/indicates preference to return to the community” (yes/no) and Q1b – “Resident has a support person who is positive towards discharge” (yes/no). Only Q1a or Q1b responses from the admission MDS assessment were used in this analysis. These items are not included on the MDS quarterly assessments. They are asked on significant change assessments but the number of these assessments was too small and the timing too unpredictable to use them for updating Q1a or Q1b responses.

The coding of items Q1a and Q1b can be influenced by the viewpoints of facility staff members who conduct the assessment. There is likely some “filtering” of information by staff based on their own assessment of the person’s wishes or potential for discharge, family preferences, degree of cognitive impairment or communication deficits displayed by the resident. This limitation should be kept in mind when interpreting study results.

About 11% of admissions (2,718 out of 24,648) did not have a full admission assessment because they were not in the facility for the full 14 days required for this assessment. Instead, they received the abbreviated Medicare assessment. The Q1a item is recorded on all admission assessments, i.e., full admission assessments or abbreviated Medicare admission assessments; however, the Q1b item is not asked on the abbreviated Medicare admission assessment. Rather than drop the 2,718 cases from the analysis involving Q1b,

we took the conservative approach of re-coding missing responses to “no”. Since much of the analysis concerns residents who were in the facility beyond 14 days, the re-coding of the Q1b variable should not present a serious bias in the results. Also, we have attempted to minimize the missing data problem for the full admission cohort analysis by reporting preference or support for community discharge. Residents staying 14 days or more had considerable overlap in the Q1a and Q1b variables, i.e., residents responding affirmative to preference were very likely to also have support. Nonetheless, the reader should use caution in interpreting the Q1b results for the full admission cohort.

Finally, the study involved measures of facility characteristics that might be related to residents’ preference for community discharge or actual discharge. These characteristics were aggregated individual-level variables representing post-acute care specialization since this characteristic was considered to be a factor in the types of persons being admitted and their discharge destination. Facility-level variables were scored as the percentage of admissions from an acute care hospital, having Medicare as a primary pay source, or falling into the major RUG-III categories of Special Extensive, Rehabilitation, Special Care, or Clinically Complex. Also, we constructed an aggregate variable for the proportion of facility admissions preferring or having support for community discharge.

Analysis

Most of the analysis was descriptive with results presented through tables and graphs. Difference of means (t-tests) or Chi-square values were used to test for statistical significance. We also estimated more complex statistical models. We were interested in determining the independent effects of resident and facility-level factors that were related to: (a) resident’s preferences for community discharge and (b) the probability of having a short stay community discharge. Therefore, we estimated general linear models for resident characteristics at admission that predict preferences for community discharge (MDS item Q1a: yes=1, no=0). Also we looked at resident characteristics at admission (including preference and support for community discharge) that were predictive of actual community discharge within 90 days. Discharge to the community was scored 1; remaining in the facility, nursing home transfer or other discharge status, or death was scored 0. All independent variables were centered on their grand means. Since residents were clustered within facilities, we estimated a hierarchical general linear model (HGLM) with a logit link function using HLM statistical software (Raudenbush and Bryk 2002; Raudenbush, Bryk et al. 2002). Facility was treated as a random effect. We also tested facility-level variables as fixed effects along with individual-level variables in the models. Appendix 1 describes the general form of the HGLM models.

Finally, we developed a variable indicating whether or not the resident fit a short-stay community discharge profile. The discharge profile was operationalized as the resident’s likelihood of being discharged to the community within 90 days after admission. An individual’s probability of discharge was predicted from personal, health and functional characteristics at admission that were shown in prior research to either facilitate or inhibit short stay community discharge. Persons whose probability of a short stay discharge was above .50 ($p > 50\%$) were defined as fitting the community discharge profile. The probability of community discharge was estimated from a HGLM model similar to the models described above; however, the discharge profile model contained only a subset of

variables: unmarried; living alone prior to admission; older; admitted from an acute care hospital; Alzheimer's or other dementia, depression, other mental health diagnosis; weekly behavioral problems; diagnosis of diabetes, cancer, end stage disease, or hip fracture; more cognitively impaired (cognitive performance scale) or ADL dependent (ADL dependency scale); incontinent; RUG Extensive or Rehabilitation category; and Medicare per diem. All variables were measured at admission. Preference or support for community discharge and low care status were excluded from the models because they represent separate targeting criteria. Medicaid coverage at admission was omitted from the model so as not to discourage discharges of Medicaid residents. Discharge profile probabilities ranged from nearly 0% (no chance of being discharged to the community) to nearly 100% (certainty of returning to the community). Appendix 2 gives the details of the statistical model used to define the community discharge profile variable.

Patterns of Nursing Home Use

Efforts to promote transitions from nursing home to the community should be informed by a basic understanding of current utilization patterns. Most nursing home admissions have short stays and many return to the community even without a formal intervention. In this section of the report we describe and interpret current patterns of care.

Admission Sources, Length of Stay, and Discharge Status

The distinction between short and long stay residents is important in understanding nursing home use. Most admissions fall into the short stay category because they are discharged within a few weeks of admission. Table 1 reports statistics and Figure 2 shows a survival curve with length of stay for the 24,648 residents in the first-time admission cohort. Only 67% (16,441) were still in the facility at 14 days, 19% (4,549) were in the facility at 90 days, 13% (3,238) at 180 days, and 10% (2,481) at one year. However “short stay” is defined (e.g., < 30, < 45, or < 90 days) the graph demonstrates that length of stay is a continuum with no natural break point where the short stay ends and the long stay begins. However, we have chosen 90 days as our “short stay” designation recognizing that a substantial number of community discharges occur before that point.

Table 1 also shows the admission sources and discharge destinations for the admission cohort. Only a small percentage of residents had missing information; they were combined into the “Other” category. The vast majority of admissions (87%) came from acute care hospitals. Smaller percentages of admission were from a private residence (9%), assisted living or board and care homes (2%), or other sources (2%).

A very high percentage (90%) of the first-time admission cohort was discharged over the course of the year. The majority of discharges went to a private residence with home health (32%), private residence without home health (29%), or assisted living (8%). Nine percent of discharges went to another nursing home, 17% died, 4% went to an acute care hospital, and 2% went to another discharge setting.

Figure 3 shows the survival curve by length of stay for discharges to community and through death. Discharges to the community were concentrated early in the nursing home stay; by 45 days less than half of residents remained in the facility and by 60 days less than one-third of residents remained. Discharges through mortality were much more evenly distributed over the year. At approximately 45 days the community discharge and mortality curves cross-over indicating that the likelihood of community discharge is less than discharge through mortality after that point.

Characteristics of Residents at Admission and Length of Stay

Table 2 presents characteristics of first-time nursing home admissions overall and broken out by length of stay of 1-89 days, 90-179 days, or 180 or more days. Admissions were likely to be female, unmarried, and living with someone else prior to admission. The

average age was 77. Most admissions had Medicare as a pay source for the nursing home per diem, and they fell into the higher RUG-III case mix categories of Extensive, Rehabilitation or Special Care. Only 7% of residents had Medicaid as the primary pay source for the per diem at admission. Their most prevalent conditions at admission were Alzheimer's or other forms of dementia, depression, behavioral problems, incontinence, diabetes, cancer and hip fracture. The average CPS score was 1.32 (range = 0-6), the average ADL score was 13.33 (range = 0-28).

Longer stay residents (91-179 days or 180 or more days) were more likely than shorter stay residents (14-89 days) to have been unmarried, admitted from a private residence or assisted living; received Medicaid or private payment for their per diem, diagnosed with dementia, exhibited greater cognitive impairment (average CPS score) and ADL dependency (ADL scale), had behavioral problems or incontinence; and fallen into lower RUG-III categories of Impaired Cognition, Behavioral, or Physical.

Table 3 presents the characteristics of longer stay residents remaining for at least 180 days in the nursing home for characteristics measured at different time points. The MDS admission assessment and the assessments closest to 90th and 180th days of the residents stay were selected for comparison. In most cases the first quarterly MDS assessment was closest to the 90th day and the second quarterly was closest to the 180th day.

Between admission and 90 days the proportion of residents with Medicare as the primary pay source dropped considerably (56% to 19%), while the proportion with Medicaid went from 18% to 39% and private pay or other went from 26% to 42%. Classification in the Special Extensive and Rehabilitation categories declined while proportions of residents in the Impaired Cognition and Physical Categories increased. Residents improved in their ADLs between admission and 90 days (average ADL dependency score went down); however, residents had slight increases in average cognitive impairment (CPS scores), weekly behavioral problems, and incontinence.

The changes in characteristics between 90 and 180 days were less dramatic. The proportion on Medicare at 180 days was only 5%; whereas 50% had Medicaid and 45% private pay or other. The proportion of residents in the Rehabilitation category at 180 days went down from 12% to 3%.

Low Care Residents

A small proportion of all admissions met the low care definitions: broad = 3%, medium = 3%, narrow = 2% (Table 2). However, the rates varied by length of stay categories. Among short stay residents (14-89 days) the percentages of low care residents at admission was only 1-2%, however, among residents with stays of 180 or more days 10% were low care broadly defined, 6% fit the medium definition, and 5% the narrow definition. In addition, the percentage of residents in the low care categories increased significantly over time for the longer stay residents (Table 3). Between admission and 90 days, the percentage of residents meeting low care broad increased from 10% to 23%, low care medium went from 7% to 19% and low care narrow went from 5% to 12%. The proportion of residents in the low care categories continued to rise between 90 and 180 days with 24% fitting the broad definition, 21% the medium definition, and 14% the narrow definition at 180 days.

Preference and Support for Community Discharge

A very high percentage of admissions had a preference or support for returning to the community (Table 2 and Figure 4). Eighty-four percent of admissions had a preference for community discharge and 69% had a support person. Keep in mind that the support item (Q1b) was missing for about 11% of admissions who had stays of less than 14 days. Missing responses were re-coded conservatively into the “no” category. Thus, the proportion of admissions with support is probably understated.

Eighty-six percent had either preference or support, and 67% had both preference and support. Among the longest stay residents, only 56% had a preference for community discharge when they were admitted, and 38% had a support person, 59% had either preference or support, and 34% had both preference and support. As Figure 5 demonstrates, having preference or support for returning to the community at admission was strongly related to length of stay: the proportion of residents with a preference or support for community discharge fell off dramatically as length of stay increased. These variables were also highly predictive of community discharge (Figure 6). Three-fourths of admissions with a preference and support for community discharge returned to the community within 180 days. Among residents with neither preference nor support, only 9% ended up returning to the community, nearly one-half (47%) died, and 32% remained in the nursing home at 180 days.

Predictors of Preference for and Actual Community Discharge

Since preference and support for community discharge had such a strong relationship to actual discharge, we wanted to determine what resident characteristics might be related to residents’ preferences or support for returning to the community. Also, we wanted to determine the relationships between preferences or support for community discharge, other resident characteristics and actual community discharge. Since we anticipated that preferences or community discharge status might be related to the facility characteristics, we included facility-level variables that were aggregates of resident-level variables. The post-acute emphasis of the facility was represented by proportion of admissions from acute care hospital, with Medicare per diem, or falling into one the higher RUG-III categories of Special Extensive of Rehabilitation which were indicative of post-acute service need. We also wanted to see if facilities having a higher proportion of admissions with a preference for or support for returning to the community might be related to likelihood a resident would be discharged.

Table 4 shows results from HGLM models for the outcomes: (a) preference OR support for community discharge at admission (yes=1, no=0) and (b) likelihood of community discharge within 90 days. The sample consisted of all members of the admission cohort and all variables were measured at admission. A “+” indicates a significant positive relationship; “-“ indicates a significant negative relationship; “ns” indicates a non-significant relationship; and “not applicable” indicates that the variable was not entered into the model.

Several variables influenced the likelihood that residents at admission would prefer or have support for community discharge. Preference or support was most likely for persons with admission from an acute care hospital, Medicare as the primary pay source,

living alone prior to admission, RUG Special Extensive or Rehabilitation category, and hip fracture diagnosis. Admissions least likely to prefer or have support for community discharge were unmarried, older, receiving a Medicaid per diem, cognitively impaired and Alzheimer's or other dementia diagnosis, ADL dependent, incontinent, and suffering from cancer or an end stage disease. Residents entering the facility in a low care group were also less likely to prefer or have support for community discharge. In addition, admissions to facilities admitting a higher proportion of persons from acute care hospitals were more likely to prefer or have support for community discharge. Finally, we found a significant interaction effect between resident and facility-level variables. Residents admitted from acute care hospitals were more likely to prefer or have support for community discharge if they were admitted to a facility with a higher proportion of acute care admissions.

As we had anticipated preferring or having support to return to the community was a significant predictor of actual community discharge, even after controlling for other factors. Most of the same factors related to preference or support for community discharge were significantly related to actual discharge. Community discharge within 90 days was most likely for persons with admission from an acute care hospital, RUG Special Extensive or Rehabilitation category, and hip fracture diagnosis. Admissions least likely to be discharged to the community were unmarried, older, living alone prior to admission, Medicaid per diem, cognitively impaired or Alzheimer's or other dementia diagnosis, ADL dependent, incontinent, and mental illness, diabetes, cancer or an end stage disease diagnosis. Residents entering the facility in a low care group were also less likely to be discharged to the community. Two facility-level variables were also significant. A person was more likely to be discharged to the community if he or she entered a facility admitting a higher proportion of persons from acute care hospitals and a facility where a higher proportion of admissions either preferred or had support for community discharge. Again, we found a significant interaction effect between resident and facility-level variables. Residents who preferred or had support for community discharge were more likely to be discharged to the community if they were admitted to a facility with a higher proportion of admissions who preferred or had support for community discharge.

The effects of facility characteristics and their interaction with resident characteristics merit discussion. There may be several reasons why facilities specializing in post-acute care, e.g. higher proportion post-acute admissions, have a higher proportion of residents preferring or having support for community discharge and are more successful at community discharge. First, post-acute facilities may attract persons who want to return to the community and have support to do so. Second, staff in these facilities might be more sensitive to resident and preferences and, as a result, they may be more likely to assess and record a resident's preference or support for community discharge on the MDS. Third, post-acute facilities may place greater emphasis on restorative and rehabilitative care resulting in greater success at community discharges.

Another very important finding is the relationship between a resident's preference or support for community discharge, the proportion of admissions to a facility sharing these

preferences or support, and the increased likelihood the resident will be discharged back to the community. Facilities that have staff members who are more sensitive to resident needs (more careful assessment for preferences and support) or provide better restorative or rehabilitative care may attract residents who prefer to return to the community And who actually do so. Also, these facilities might encourage among their residents and staff a culture of expectations for returning to the community. Being in a context where other residents expect to return to the community is likely to enhance one's own expectations resulting in a successful transition.

Targeting Residents for Community Discharge Interventions

Targeting Criteria

Minnesota has a variety of programs for community based care which probably contribute to the state's high rate of community discharge. Also, some facilities actively promote a resident's return to the community by emphasize rehabilitation and discharge planning. The purpose of the targeting analysis is to identify residents who would be the best candidates for these programs aimed at community discharge. Other residents need not be denied opportunity to return to the community, however targeting is a means of channeling scarce resources toward persons who desire to return and are most likely to make a successful transition. We must also keep in mind the marginal benefit of intervening to transition short-stay residents who otherwise might enter the community on their own.

Five targeting criteria were developed and tested. Targeted residents would:

- First-time nursing home admission
- Fall into targeting windows:
 - Early stage interventions at 90-179 days
 - Money Follows the Person Interventions after 180 days
- Prefer to return to the community OR have a support person for community care;
- Have a low care requirements for nursing home services as indicated by low resource use RUG-III case mix groups:
 - Low Care Broad -- PA1, PA2, PB1, PB2, IA1, IA2, BA1, BA2
 - Low Care Medium -- PA1, PA2, PB1, PB2
 - Low Care Narrow -- PA1, PA2
- Fit a community discharge profile – above average probability (> 50%) of a short stay (< 90 days) with community discharge. The discharge profile is based on the resident's characteristics at admission: unmarried; living alone prior to admission; older; admitted from an acute care hospital; Alzheimer's or other dementia, depression, other mental health diagnosis; weekly behavioral problems; diagnosis of diabetes, cancer, end stage disease, or hip fracture; more cognitively impaired (cognitive performance scale) or ADL dependent (ADL dependency scale); incontinent; RUG Extensive or Rehabilitation category; and Medicare per diem.

Residents Meeting Targeting Criteria

The percentage of residents meeting targeting criteria varied by criteria and resident length of stay. Table 5 presents the percentage of residents meeting different criteria for all admissions and among residents still in the facility at 90, 180, 270 and 365 days. Figures 7-10 display percentages graphically. Targeting criteria for all admissions was based on their status at admission. The preference, support, and discharge profile criteria for residents at 90, 180, 270 and 365 days were also based on these resident's status at admission. The low care criteria, on the other hand, were based on the MDS assessment closest to the length of stay reference point. For example, the 1st quarterly assessment

was used to determine low care for residents still in the facility at 90 days, the 2nd quarterly assessment was used for low care at 180 days, and so on.

A relatively high proportion of all admissions met preference (84%), support (69%), or preference or support (86%) criteria. Also, 70% fit the discharge profile and 68% met the criteria for a combination of preference or support and fitting the discharge profile. The percentages meeting these criteria were lower for residents still in the facility at 90 days, 180, 270, or 365 days (Table 5 and Figure 7).

The proportion of residents meeting the low care criteria were quite low for all admissions at admission (broad=3%, medium=3%, or narrow=2%). The percentages were substantially higher at 90 days (broad=20%, medium=16%, or narrow=11%). They reached a peak at 180 days (broad=24%, medium=21%, or narrow=14%) and remained steady through 365 days.

When criteria are combined the highest percentage of residents meet the preference or support and fit profile criteria: 68% at admission, 32% at 90 days, 25% at 180 days, and 24% at 270 days, and 23% at 365 days. Smaller percentages met the combination of preference/support and low care broad: 2% at admission, 11% at 90 days, 14% at 180 days, and 13% at 270 days, and 12% at 365 days. Even smaller percentages fit the profile and were low care broad: 1% at admission, 9% at 90 days, 12% at 180 days, and 12% at 270 days, and 11% at 365 days. As would be expected, the smallest percentages met all three criteria (preference/support and fit profile, and low care broad): 1% at admission, 6% at 90 days, 8% at 180 days, and 7% at 270 days, and 7% at 365 days.

Independence of Targeting Criteria

We have argued that all three criteria – preference or support for community discharge, fitting a short-stay community discharge profile, and having low care needs—need to be considered in targeting. Yet, the question arises: how much do the criteria overlap and to what degree are they independent of each other? Figures 9 and 10 show Venn diagrams of the three criteria for residents in the nursing home at 90 and 180 days. Although targeting criteria overlap somewhat, they have unique components which would appear to represent different targeting dimensions. Of particular interest is the relatively large proportion of low care residents or residents meeting the community discharge profile who had not expressed a preference nor had support for community discharge when they were admitted. This finding suggests that they remained in the nursing home despite their potential for community discharge because they wanted to be there or because they lacked a social support system to help them make a transition to the community. In addition, many low care residents may have had conditions such as incontinence (not a factor in the RUG classification) or cognitive impairment that made them poor candidates for community discharge, particularly if they lacked social supports.

Sensitivity and Specificity of Targeting Criteria

One way of evaluating the effectiveness of screening or targeting criteria is to determine their sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV). Each of these dimensions is a different way of looking at the

correspondence between targeting criteria and the outcome we want to predict. Criteria with high sensitivity and PPV would be good at targeting people who experience the outcome; whereas, criteria with high specificity and NPV would be good at not targeting people who do not experience the outcome. Since we do not have a measure of which residents would truly be the best candidates for community discharge, we have used the persons who were actually discharged to the community as our outcome. Thus, community discharge serves as a proxy for the best candidates for discharge targeting. Based on a resident's targeting criteria at admission we attempted to predict whether or not that resident would be discharged to the community. Appendix 3 shows the scores on dimensions of sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) for the targeting criteria and other variables associated with community discharge. Scores on each dimension vary from 0% to 100% with 100% being the best score. In general, targeting criteria should strike a balance with medium to high sensitivity, specificity, PPV, and NPV. Three of the criteria are medium to high on these dimensions:

- (a) preference or support for community discharge
- (b) fit the community discharge profile
- (c) preference/support AND fit discharge profile

The criterion of preference or support for community discharge was able to correctly identify 98% of residents who were discharged to the community (sensitivity) but it correctly identified only 34% of residents who did not have a community discharge (specificity). Seventy-one percent of residents having preference or support were discharged to the community (PPV) and while 91% of residents who did not prefer or have support either remained in the nursing home, died, or had another discharge status (NPV). The community discharge profile criterion had 87% sensitivity, 58% specificity, 78% PPV and 74% NPV. Preference or support combined with fitting the community discharge profile had 86% sensitivity, 64% specificity, 80% PPV and 74% NPV. Meeting a low care definition (broadly defined) either alone or in combination with other criteria had very low sensitivity; only 1-2% of residents with community discharges met this criterion. Having a Medicare per diem had high sensitivity (81%) but low specificity (31%). Similarly, being admitted from an acute care hospital had 92% sensitivity but only 23% specificity. Membership in high RUG-III categories had relatively high specificity but low sensitivity. Thus, from the standpoint of picking people most likely to be discharged to the community, the preference and support variables along with a resident's community discharge profile struck the best balance of both sensitivity and specificity. The community discharge profile has the Medicare per diem and RUG Rehabilitation as components along with other characteristics predictive of discharge. It performs with better predictive accuracy than any of these variables alone.

Selection of Targeting Criteria

Selection of targeting criteria should take into consideration the resident's potential for community discharge. We have shown that preference and/or support for community discharge and other characteristics (discharge profile) are highly predictive of community discharge. One must ask -- why is the resident still in the nursing home at 90 or 180 days

if he or she expressed a preference to return to the community, had support for community discharge, or fit a community discharge profile?

Second, from a policy perspective we need to consider the nursing home resource requirements of residents, as indicated by a low care RUG-III group. Even if low care residents had not expressed a preference nor had other characteristics associated with community discharge, they may well be served more efficiently in the community assisted living or with home-based care.

Finally, any targeting effort should result in a manageable number of targeted residents in line with the resources available for care planning and placement.

We developed three targeting models based on combinations of targeting criteria. In all three models targeted residents would be:

- First-time nursing home admissions
- Targeting window 90-180 days after admission for an early intervention.

The three models are:

Model 1: Preference & Support for Community Discharge AND Fit Community Discharge Profile

Model 2: Low Care (Broadly Defined)

Model 3: Model 1 [Preference & Support for Community Discharge AND Fit Community Discharge Profile] OR Model 2 [Low Care]

Table 6. Residents Meeting Targeting Models at 90 and 180 Days after Admissions

	Residents at 90 Days	Residents at 180 Days
Model 1	1471 (32%)	822 (25%)
Model 2	888 (20%)	787 (24%)
Model 3	2075 (45%)	1362 (42%)
All Residents	4549 (100%)	3238 (100%)

Facility Distributions of Residents Meeting Targeting Criteria

The next step in the analysis was to determine the proportion of each facility’s residents in the nursing home who met targeting criteria at admission, 90, 180 days, 270, and 365 days. Table 7 presents the average percentage and number of residents per facility who meet different targeting criteria including Model 1, Model 2, and Model 3. The number of residents meeting the criteria would appear to be manageable considering that dates marking the 90th and 180th day for each resident’s stay would be spread across the year.

The average facility had 53% of residents meeting Model 1 (preference/support and discharge profile) criteria at admission, but only 30% met the criteria at 90 days and 25% at 180 days. Few residents met the Model 2 criterion at admission (facility average of 7%), yet an average of 21% met this criterion at 90 days and 26% at 180 days. Finally, the facility average for residents meeting Model 3 criteria (Model 1 OR Model 2) was 58% at admission, 44% at 90 days and 43% at 180 days.

The number of residents meeting most targeting criteria was quite large at admission; however the number declined considerably by 90 days, primarily because a small percentage of admissions were left in the facility at 90 days, and many of those fitting the targeting criteria were the one's who had left. A facility average of 3.7 residents met Model 1 criteria at 90 days and 2.1 residents at 180 days. An average of 2.2 residents per facility met Model 2 criterion at 90 days and 2.0 residents met the criterion at 180 days. The number meeting Model 3 criteria was 5.3 at 90 days and 3.5 at 180 days.

Figures 11-16 show facility distributions for the percentage and number of residents still in the facility at 90 or 180 days who meet Model 1-3 targeting criteria. Facilities widely in residents meeting these criteria. This variation suggests the possibility of using targeting criteria as quality indicators to discriminate between facilities which are successful and unsuccessful in facilitating community discharge.

Community Transition Quality Indicators

We are recommending community transition quality indicators (QIs) that tap indicators of transition between admission and 90 days in the facility. The recommended QIs are:

1. Percentage of First-Time Admissions Expressing a Preference or Having Support for Community Discharge (EB Adjusted Rate);
2. Percentage of First-Time Admissions who are Discharged to a Community Setting (Private Residence or Assisted Living) within 90 Days of Admission (AB Adjusted Rate);
3. Percentage of First Time Admissions Still in the Nursing Home at 90 Days who meet Model 3 Targeting Criteria: Preference & Support for Community Discharge AND Fit Community Discharge Profile] OR [Low Care]

The preference or support and community discharge QIs have been statistically adjusted for differences between facilities in characteristics at admissions that might influence the probability of residents having a preference/support or community discharge or actually being discharged. Statistical adjusters for each QI were the resident-level variables in Table 4 that were statistically significantly related to the QI. Facility-level variables (% of admissions from hospitals and % of admissions having preference or support) were not entered into the adjustment equations. We need a better understanding of facility-level effects before adjusting for these variables.

We should note that preference for community discharge or having a support person was used as an adjuster in the community discharge QI. These items on the MDS are filled out by facility staff and may in part reflect their views in addition to those of residents or their families. Although risk adjustment with these variables might invite gaming through under-recording of preferences to return to the community or having support, the separate QI related to preference or support should discourage gaming.

The adjusted QIs were developed from a hierarchical general linear model similar to that used in estimating probabilities of community discharge in the previous section of the report. An additional feature of the adjustment process was the use of empirical Bayes (EB) estimation techniques which help to differences between facilities in the number of residents they admit. Facilities admitting fewer residents could have less reliable discharge rates, and the EB estimate tends to correct for that problem. This approach to risk adjustment has been applied to nursing home quality indicators (Arling, Lewis et al. 2007) and the Minnesota quality of life - resident satisfaction measures. Facilities with fewer than 10 annual admissions were not included in the model or results. They had too few admissions for reliable estimation even after EB adjustment. A total of 372 facilities had enough admissions for the QI calculations.

The facility statistics for the QIs are presented in Table 9 and Figures 17-19. Most facilities had a high percentage of admissions expressing a preference or having support for community discharge (mean = 91%, median = 92%, 10th percentile = 85%, 90th percentile = 96%). The distribution on this QI was skewed to the left (Figure 17).

Community discharge rates averaged .53 with a median of .52. They were normally distributed (Figure 18) ranging from .41 at the 10th percentile to .65 at the 90th percentile. Finally, the percentage of residents meeting the Model 3 targeting criteria at 90 days after admission averaged 45% with facilities at the 10th percentile with 27% and facilities at the 90th percentile with 71%. The facility QI distribution was approximately normal (Figure 19).

Conclusions and Recommendations

The Minnesota nursing home population is dynamic. Most nursing home admissions are discharged shortly after admission and many people return to the community. Preference to return to the community and availability of a support person were strong predictors of actually returning. As would be expected, longer stay residents were less likely than shorter stay residents to have preferred returning to the community. Factors positively related to community discharge were: admitted from an acute care hospital, Medicare per diem, hip fracture, and RUG-III Rehabilitation group. Factors negatively related to community discharge were: older, unmarried, living alone prior to admission, Medicaid per diem, Alzheimer's or dementia diagnosis, cognitive impairment score, depression, greater ADL dependency, and falling into a broadly defined Low Care group.

We found two very interesting facility-level relationships. Persons admitted to post-acute facilities (higher % of acute facility admissions from hospitals) were more likely to prefer or have support for community discharge and to actually be discharged to the community. Also, admissions entering facilities with a higher percentage of residents who preferred or had support for community discharge were more likely to be discharged to the community. The reasons for these relationships are unclear although persons who want to return to the community may seek out post-acute facilities, these facilities may be better at assessing for resident's preference or support, or these facilities may simply do a better job of restorative and rehabilitative care. Similarly, facilities with a concentration of residents with preference or support for returning to the community may provide a context of high expectations that facilitate community discharge.

Targeting Criteria

In developing and applying targeting criteria, we focused on characteristics associated with community discharge – residents preference to return to the community and having support for community discharge, as well as other factors predictive of returning to the community such as being admitted on Medicare from an acute care hospital with low ADL dependency and absence of cognitive impairment, and being continent. One has to ask -- why did they remain in the facility after 90 or 180 days when such a large percentage of similar residents returned to the community? These residents should be prime candidates for successful transition back to the community. Second, we focused on residents having low care requirements as indicated by the RUG-III groups. Finally, we wanted to identify a manageable number of residents for intervention.

Targeting criteria examined:

- First-time nursing home admission
- Fall into targeting windows:
 - Early stage interventions at 90-179 days
 - Money Follows the Person Interventions after 180 days
- Prefer to return to the community and/or have a support person for community care;

- Have a low care requirements for nursing home services as indicated by low resource use RUG-III case mix groups:
 - Low Care Broad -- PA1, PA2, PB1, PB2, IA1, IA2, BA1, BA2
 - Low Care Medium -- PA1, PA2, PB1, PB2
 - Low Care Narrow -- PA1, PA2
- Fit a community discharge profile – above average probability of a short stay discharge based on the resident’s characteristics at admission.

Proposed targeting models:

Model 1: Preference & Support for Community Discharge AND Fit Community Discharge Profile

Model 2: Low Care (Broadly Defined)

Model 3: Model 1 [Preference & Support for Community Discharge AND Fit Community Discharge Profile] OR Model 2 [Low Care]

The average facility had 53% of residents meeting Model 1 (preference/support and discharge profile) criteria at admission, but only 30% met the criteria at 90 days and 25% at 180 days. Few residents met the Model 2 criterion at admission (facility average of 7%), yet an average of 21% met this criterion at 90 days and 26% at 180 days. Finally, the facility average for residents meeting Model 3 criteria (Model 1 OR Model 2) was 58% at admission, 44% at 90 days and 43% at 180 days.

The number of residents meeting the criteria would appear to be manageable considering that the dates marking the 90th and 180th day for each resident would be spread across the year. The average number of residents per facility meeting Model 1 criteria was 3.7 at 90 days and 2.1 residents at 180 days. The average number who met Model 2 criteria was 2.2 at 90 days and 2.0 at 180 days. Finally, average number meeting Model 3 criteria was 5.3 at 90 days and 3.5 at 180 days.

Community Transition QIs

We are recommending community transition quality indicators (QIs) that tap indicators of transition between admission and 90 days in the facility. The recommended QIs are:

1. Percentage of First-Time Admissions Expressing a Preference or Having Support for Community Discharge (EB Adjusted Rate);
2. Percentage of First-Time Admissions who are Discharged to a Community Setting (Private Residence or Assisted Living) within 90 Days of Admission (AB Adjusted Rate);
3. Percentage of First Time Admissions Still in the Nursing Home at 90 Days who meet Model 3 Targeting Criteria: Preference & Support for Community Discharge AND Fit Community Discharge Profile] OR [Low Care]

The preference or support and community discharge QIs have been statistically adjusted for differences in resident-level characteristics (see resident-level variables in Table 4). Most facilities had a high percentage of admissions expressing a preference or having support for community discharge (mean = 91%, median = 92%). Community discharge

rates averaged .53 with a median of .52. The percentage of residents meeting the Model 3 targeting criteria at 90 days after admission averaged 45%. All three QIs had substantial inter-facility variation suggesting reasonable capacity for discrimination.

Recommendations

- The state should engage in discussion with stakeholders about targeting criteria and community transition quality indicators. Further refinement and analysis may be required to respond to stakeholder concerns.
- The application of the community transition QIs requires further decisions about scoring methods, how much weight might be attached to each QI, and whether or not the QIs should be folded into the scoring with other nursing home QIs or scored separately.
- The state should consider requiring a more rigorous methodology for facilities to use in assessing resident preferences and support for community discharge (Q1a and Q1b on the MDS).
- The early stage transition intervention (90-180 days) could involve a “watch list” where the state sends a list of targeted residents along with their targeting criteria to each facility and transition team. The facility might be required to explain why the resident remains in the facility, what plans there are for community discharge if any, etc.
- The targeting criteria may have broader application in identifying residents who could be diverted from nursing home use at the nursing home pre-admission screening stage.
- While the MDS gives a reasonably good picture of nursing home use, additional information would have to be obtained from other sources, e.g., community care program records or follow-up surveys of discharges, in order to get a clearer picture of how persons are faring the community.
- Community discharges should be evaluated to determine if they are “successful” in maintaining the individual in the community, meeting personal preferences, improving quality of life, managing acute or chronic health conditions, and resulting in a reasonable cost to the public, individual or family.
- Targeting criteria and transition QIs should be refined as experience accumulates from their application.

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Table 1. Admission Cohort by Admission Source, Discharge Destination, and Length of Stay

<u>Admitted From</u>		
Private residence	2,163	8.78%
Assisted living or board and care	612	2.48%
Acute care hospital	21,362	86.67%
Psychiatric, rehabilitation or DD hospital	312	1.27%
Other	199	0.81%
Total admission cohort	24,648	100.00%
<u>Discharges to</u>		
Private home without home health services	6,432	29.0%
Private home with home health services	7,023	31.7%
Assisted living or board and care	1,700	7.7%
Another NH	1,951	8.8%
Acute care hospital	985	4.4%
Psychiatric hospital, MR/DD facility	51	0.2%
Rehabilitation hospital	58	0.3%
Deceased	3,720	16.8%
Other	247	1.1%
Total Discharges	22,167	100.0%
<u>Length of Stay</u>		
< 14 Days	8207	33.3%
14-89 Days	11889	48.2%
90-179 Days	1314	5.3%
180-269 Days	447	1.8%
270-365 Days	310	1.3%
> 365 Days	2481	10.1%
Total	24,648	100.0%
<u>Residents in Nursing Home at</u>		
14 Days	16,441	66.7%
90 Days	4,549	18.5%
180 Days	3,238	13.1%
270 Days	2,791	11.3%
365 Days	2,481	10.1%
Total Cohort	24,648	

Table 2. Characteristics of Nursing Home Residents at Admission by Stays of 14-89, 90-179 and 180+ Days

	All Admissions (n=20,095)		LOS 1-89 (N=20,095)		LOS 90-179 (N=2,628)		LOS 180 or More (N=3,233)	
	%/Mean	Std Dev	%/Mean	Std Dev	%/Mean	Std Dev	%/Mean	Std Dev
Female	61%		61%		57%		64%	
Not Married	61%		59%		65%		70%	
Age	77.3	12.70	76.6	12.5	76.8	14.6	81.5	12.6
Live Alone								
Prior to Admission	40%		44%		44%		42%	
Admitted from Home or Assisted Living	11%		7%		17%		35%	
Admit from Hospital	87%		91%		78%		61%	
Alz or Dementia								
Diagnosis	16%		13%		23%		43%	
History of MH or DD	6%		7%		8%		8%	
Schizo, Bi-Polar, Anxiety	12%		14%		15%		14%	
Depression	24%		23%		27%		28%	
Diabetes	26%		26%		28%		24%	
Cancer	14%		17%		16%		9%	
Hip Fracture	7%		7%		7%		5%	
End Stage Disease	3%		4%		2%		1%	
Prefer Community Discharge (Q1a)	85%		90%		74%		56%	
Support for Community Discharge (Q1b)	79%		75%		67%		38%	
Prefer OR Support for Community Discharge	87%		91%		78%		59%	

	All Admissions (n=20,095)		LOS 1-89 (N=20,095)		LOS 90-179 (N=2,628)		LOS 180 or More (N=3,233)	
	%/Mean	Std Dev	%/Mean	Std Dev	%/Mean	Std Dev	%/Mean	Std Dev
Prefer AND Support for Community Discharge	77%		73%		62%		34%	
Medicare	77%		80%		72%		56%	
Medicaid	7%		6%		12%		18%	
Other	16%		14%		16%		26%	
Cog Performance Scale (CPS) Score	1.32	1.53	1.12	1.45	1.83	1.62	2.36	1.50
Moderate to Very Severe Cog Imp	24%		19%		38%		53%	
ADL from RUG (Range=4-18)	11.02	4.51	10.90	4.42	12.50	4.56	11.17	4.89
ADL Long- Form Scale (Range=0-28)	13.33	6.97	13.07	6.84	15.61	7.01	14.00	7.56
Incont Bowel or Bladder (Freq or Greater))	21%		18%		33%		36%	
Behavior Problem at Least Weekly	14%		11%		21%		26%	
RUG Extensive	46%		48%		44%		34%	
RUG Rehab	35%		36%		33%		29%	
RUG Special	6%		6%		4%		4%	
RUG ClinComp	4%		4%		5%		6%	
RUG Imp Cognition	3%		1%		4%		11%	
RUG Behavioral	0%		0%		0%		1%	
RUG Physical	6%		5%		9%		15%	
MN Low Care Broad	3%		1%		5%		10%	

	All Admissions (n=20,095)		LOS 1-89 (N=20,095)		LOS 90-179 (N=2,628)		LOS 180 or More (N=3,233)	
	Std		Std		Std		Std	
	%/Mean	Dev	%/Mean	Dev	%/Mean	Dev	%/Mean	Dev
MN Low Care Medium	3%		2%		4%		6%	
MN Low Care Narrow	2%		1%		3%		5%	

Table 3. Characteristics of Residents with Stays of at Least 180 days

	Characteristics of Residents Still in the Nursing Home at 180 Days (n=3,235)		
	At Admission	At 90 Days	At 180 Days
	%/Mean	%/Mean	%/Mean
Medicare	56%	19%	5%
Medicaid	18%	39%	50%
Other	26%	42%	45%
Cog Performance Scale (CPS) Score (Standard Deviation)	2.36 (1.49)	2.39 (1.47)	2.45 (1.51)
Moderate to Very Severe Cog Imp ADL from RUG (Range=4-18) (Standard Deviation)	53% 11.17 (4.89)	54% 9.94 (4.91)	55% 10.11 (5.03)
ADL Long-Form Scale (Range=0-28) (Standard Deviation)	14.00 (7.56)	12.16 (7.97)	12.39 (8.28)
Incontinence of Bowel or Bladder (Freq or Greater)	36%	38%	40%
Behavior Problem at Least Weekly	26%	29%	31%
RUG Extensive	34%	4%	4%
RUG Rehab	29%	12%	3%
RUG Special	4%	6%	6%
RUG Clinically Complex	6%	18%	20%
RUG Imp Cognition	11%	19%	18%
RUG Behavioral	1%	1%	1%
RUG Physical	15%	41%	47%
MN Low Care Broad	10%	23%	24%
MN Low Care Medium	7%	19%	21%
MN Low Care Narrow	5%	12%	14%

Note: Characteristics measured at MDS assessment closest to the length of stay (e.g., admission, 90 or 180 days).

Table 4. Characteristics at Admission Related to Preference or Support for Returning to the Community and Actual Community Discharge (N= 24,648)

	<u>Preference OR</u> <u>Support for</u> <u>Community</u> <u>Discharge</u> (yes=1, no=0)	<u>Discharged to</u> <u>Community</u> <u>within 90 Days</u> (1=yes, 0=no)
Facility Characteristic		
Post-Acute Facility (Facility % of Admissions from Acute Care Hospital)	+	+
Facility % of Admissions with Preference or Support for Returning to the Community	not applicable	+
Resident Characteristics and Interactions		
Resident Prefer Community Discharge (Q1a) or Support for Community Discharge (Q1b)	not applicable	+
<u>Interaction:</u> Facility % of Admissions with Preference or Support X Resident Prefers or Has Support	not applicable	+
Resident Admitted from Acute Care Hospital	+	+
<u>Interaction:</u> Post-Acute Facility X Resident Admitted from Acute Care Hospital	+	ns
Resident Characteristics		
Not Married	-	-
Age	-	-
Live Alone Prior to Admission	+	-
Medicare	+	ns
Medicaid	-	-
Mental Health Diagnosis	ns	-
Alzheimer's or Dementia Diagnosis	-	-
Diabetes	ns	-
Cancer	-	-
Hip Fracture	+	+
End Stage Disease	-	-
Cog Performance Scale (CPS) Score	-	-
ADL Long-Form Scale (Range=0-28)	-	-
Incontinent Bowel or Bladder (Freq or Greater)	-	-
RUG Extensive	+	+
RUG Rehabilitation	+	+
Low Care (Broad)	-	-

+ = significant positive relationship, - = significant negative relationship, ns = not significant, not applicable: not entered into the statistical model
Notes: Results Hierarchical General Linear Models (HGLM) with Logit Link Function.
Preference for OR Support for Community Discharge coded 1=Yes, 0= No; Community Discharge = 1; remain in facility, mortality, or other discharge = 0

Table 5. Residents Meeting Various Targeting Criteria by Length of Stay

Targeting Criteria	Admit (N=24,648)	Residents Remaining in the Facility by LOS								
		90 Days (N=4,549)	180 Days (N=3,238)	270 Days (N=2,791)	365 Days (2,483)					
<u>Targeting Models</u>										
<u>Model 1:</u> Preference or Support AND Fit Profile	68%	16660	32%	1471	25%	822	24%	669	23%	577
<u>Model 2:</u> Low Care Broadly Defined (IA1-2,BA1-2,PA1-2)	3%	703	20%	888	24%	787	24%	678	23%	580
<u>Model 3:</u> [Preference or Support AND Fit Profile] OR Low Care Broadly Defined	70%	17138	46%	2075	42%	1362	41%	1143	40%	993
<u>Other Targeting Criteria</u>										
Prefer (Q1a) OR Support (Q1b)	86%	21220	64%	2914	58%	1890	56%	1576	56%	1384
Prefer Returning to Community (Q1a)	84%	20775	60%	2745	55%	1777	53%	1477	52%	1299
Fit Discharge Profile (p >.50 of Community Discharge)	70%	17345	40%	1809	34%	1106	33%	928	33%	812
Support for Returning to Community (Q1b)	69%	17013	47%	2117	38%	1245	37%	1020	36%	886
Pref or Supp & Fit Profile	68%	16660	32%	1471	25%	822	24%	669	23%	577
Prefer (Q1a) AND Support (Q1b)	67%	16568	43%	1948	35%	1132	33%	921	32%	801
Low Care Medium (PA1-2, PB1-2)	3%	711	16%	726	21%	676	22%	601	22%	553
Pref or Supp & Low Care Broad	2%	436	11%	505	14%	447	13%	374	12%	309
Low Care Narrow (PA1-2)	2%	379	11%	490	14%	443	14%	392	13%	326
Fit Profile & Low Care Broad	1%	286	9%	428	12%	374	12%	325	11%	273
Pref or Supp AND Fit Profile AND Low Care Broad	1%	225	6%	284	8%	247	7%	204	7%	164

Table 7. Average Percentage of Residents per Facility Meeting Targeting Criteria for Residents Still in the Nursing Home

<u>Average Percentage of Residents per Facility by Residents Still in Nursing Home</u>										
	<u>Admission N=404</u>		<u>90 days N=395</u>		<u>180 Days N=391</u>		<u>270 days N=384</u>		<u>365 days N=383</u>	
	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev
<u>Targeting Models</u>										
<u>Model 1: Preference or Support AND Fit Profile</u>	53%	21%	30%	21%	25%	21%	23%	21%	22%	21%
<u>Model 2: Low Care Broadly Defined (IA1-2,BA1-2,PA1-2)</u>	7%	14%	21%	19%	26%	23%	25%	22%	24%	24%
<u>Model 3: Model 1 OR Model 2</u>	58%	19%	44%	22%	43%	23%	41%	23%	40%	25%
<u>Other Targeting Criteria</u>										
Low Care Medium (PA1-2, PB1-2)	5%	7%	16%	15%	21%	19%	22%	19%	22%	21%
Low Care Narrow (PA1-2)	4%	9%	12%	15%	15%	19%	15%	18%	14%	19%
Fit Discharge Profile (p >.50 of Community Discharge)	57%	21%	38%	22%	33%	22%	32%	23%	32%	24%
Prefer Returning to Community (Q1a)	76%	16%	58%	23%	54%	25%	53%	27%	52%	28%
Support for Returning to Community (Q1b)	63%	20%	44%	23%	38%	25%	37%	25%	36%	27%
Prefer (Q1a) OR Support (Q1b)	78%	16%	62%	23%	58%	25%	57%	26%	56%	28%
Prefer (Q1a) AND Support (Q1b)	60%	20%	40%	23%	34%	24%	32%	25%	32%	26%
Pref or Supp & Low Care Broad Fit Profile & Low Care Broad	4%	9%	11%	13%	15%	18%	14%	18%	13%	18%
Pref or Supp AND Fit Profile AND Low Care Broad	2%	7%	9%	12%	12%	16%	12%	15%	11%	16%
	2%	6%	6%	9%	8%	12%	8%	13%	7%	12%

Table 8. Average Number of Residents per Facility Meeting Targeting Criteria for Residents Still in the Nursing Home

	<u>Average Percentage of Residents per Facility by Residents Still in Nursing Home</u>									
	<u>Admission N=404</u>		<u>90 days N=395</u>		<u>180 Days N=391</u>		<u>270 days N=384</u>		<u>365 days N=383</u>	
	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev
All Residents	61.0	72.3	11.5	7.3	8.3	5.3	7.3	4.6	6.5	4.2
<u>Targeting Models</u>										
<u>Model 1: Preference or Support AND Fit Profile</u>	41.2	64.0	3.7	4.3	2.1	2.4	1.7	2.0	1.5	1.7
<u>Model 2: Low Care Broadly Defined (IA1-2,BA1-2,PA1-2)</u>	1.7	2.0	2.2	2.2	2.0	1.9	1.8	1.7	1.5	1.5
<u>Model 3: Model 1 OR Model 2</u>	42.4	64.0	5.3	4.7	3.5	3.0	3.0	2.5	2.6	2.2
<u>Other Targeting Criteria</u>										
Low Care Medium (PA1-2, PB1-2)	1.8	1.9	1.8	1.8	1.7	1.7	1.6	1.5	1.4	1.5
Low Care Narrow (PA1-2)	0.9	1.3	1.2	1.5	1.1	1.3	1.0	1.2	0.9	1.1
Fit Discharge Profile (p >.50 of Community Discharge)	42.9	65.2	4.6	4.7	2.8	2.9	2.4	2.4	2.1	2.2
Prefer Returning to Community (Q1a)	51.4	68.6	6.9	5.5	4.5	3.5	3.8	3.0	3.4	2.7
Support for Returning to Community (Q1b)	42.1	53.0	5.4	4.9	3.2	2.9	2.7	2.4	2.3	2.2
Prefer (Q1a) OR Support (Q1b)	52.5	69.3	7.4	5.7	4.8	3.7	4.1	3.0	3.6	2.8
Prefer (Q1a) AND Support (Q1b)	41.0	52.3	4.9	4.7	2.9	2.8	2.4	2.3	2.1	2.1
Pref or Supp & Low Care Broad Fit Profile & Low Care Broad	1.1	1.4	1.3	1.4	1.1	1.3	1.0	1.1	0.8	1.0
Pref or Supp AND Fit Profile AND Low Care Broad	0.7	1.1	1.1	1.4	1.0	1.2	0.8	1.1	0.7	0.9
	0.6	0.9	0.7	1.1	0.6	0.9	0.5	0.8	0.4	0.7

Table 9. Facility Average Rates for Community Transition QIs (Facilities with 10 or More Admissions)

		% of Admissions with Preference or Support	EB Adjusted Community Discharge Rate	Number of Admissions	% Meeting Model 3 Criteria at 90 Days	Number of Residents Still in Facility at 90 Days
# of Facilities		372	372	372	372	372
Mean		91%	0.530	66	45%	12
Median		92%	0.528	40	45%	11
Percentiles	10	85%	0.414	17	20%	5
	20	88%	0.453	22	27%	6
	30	90%	0.478	27	33%	8
	40	91%	0.506	33	39%	9
	50	92%	0.528	40	45%	11
	60	93%	0.550	49	50%	12
	70	94%	0.572	64	55%	14
	80	95%	0.605	93	60%	17
	90	96%	0.645	138	71%	20

Figure 1 Low Care Definitions

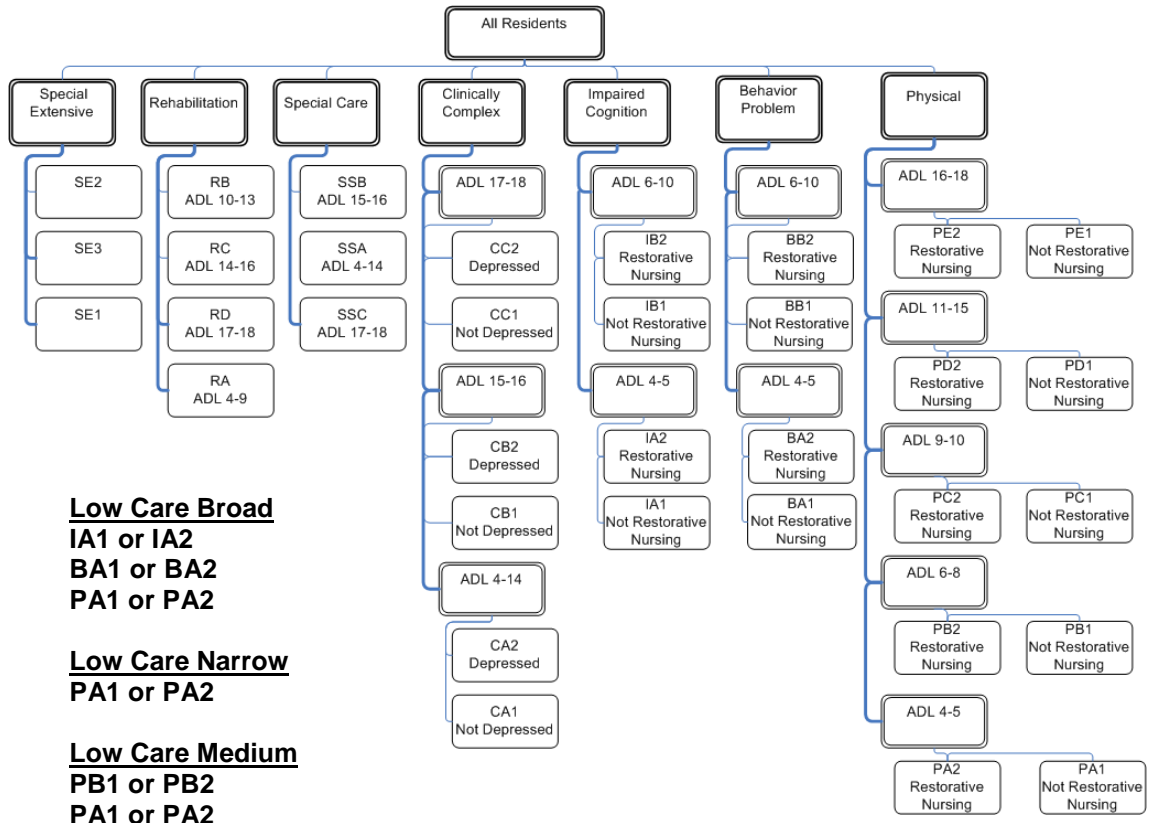


Figure 2

**Admission Cohort by Length of Stay
(All Admissions)**

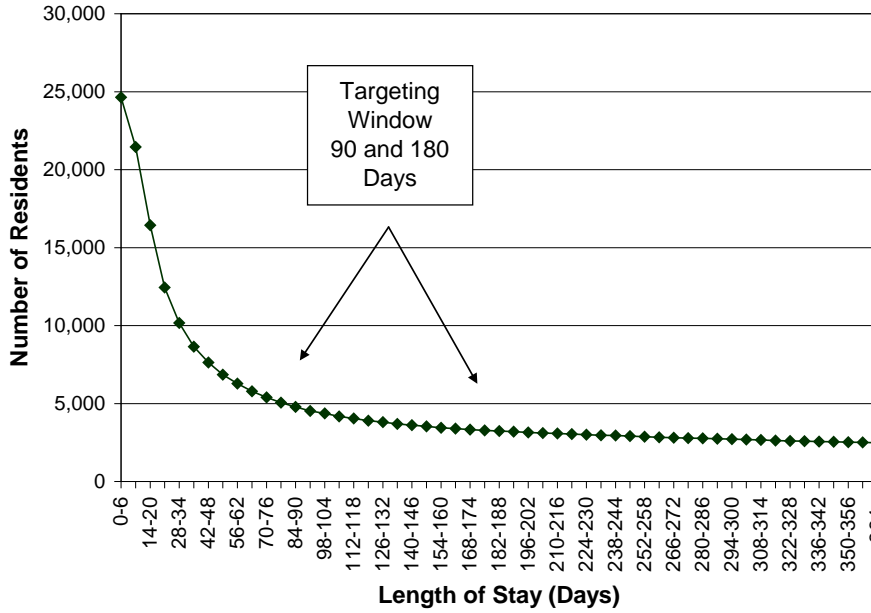


Figure 3

**Admission Cohort by Length of Stay and Discharge Status
(All Admissions)**

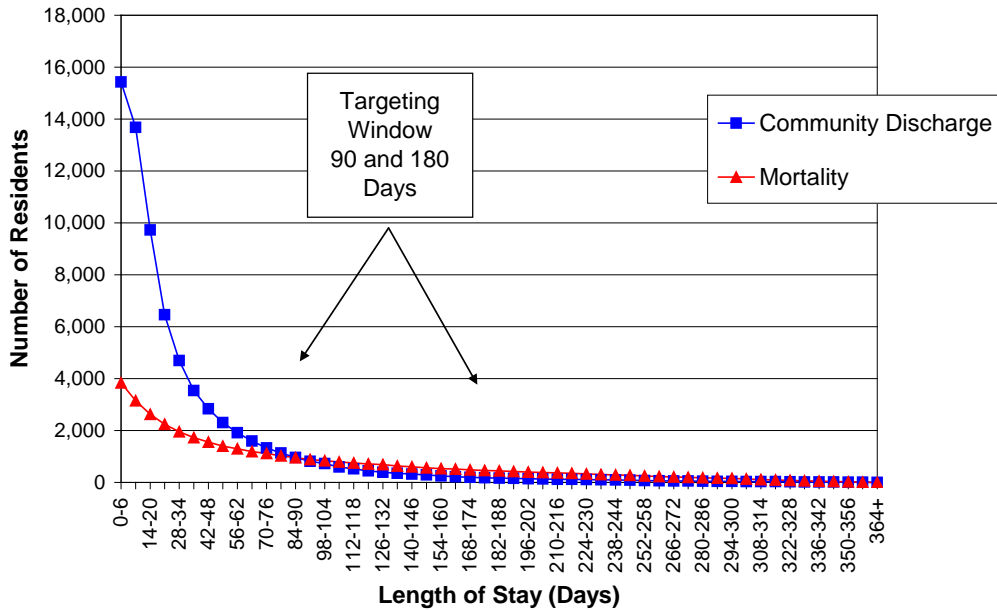


Figure 4

**Preference and Support for Returning to the Community
(At Admission)**

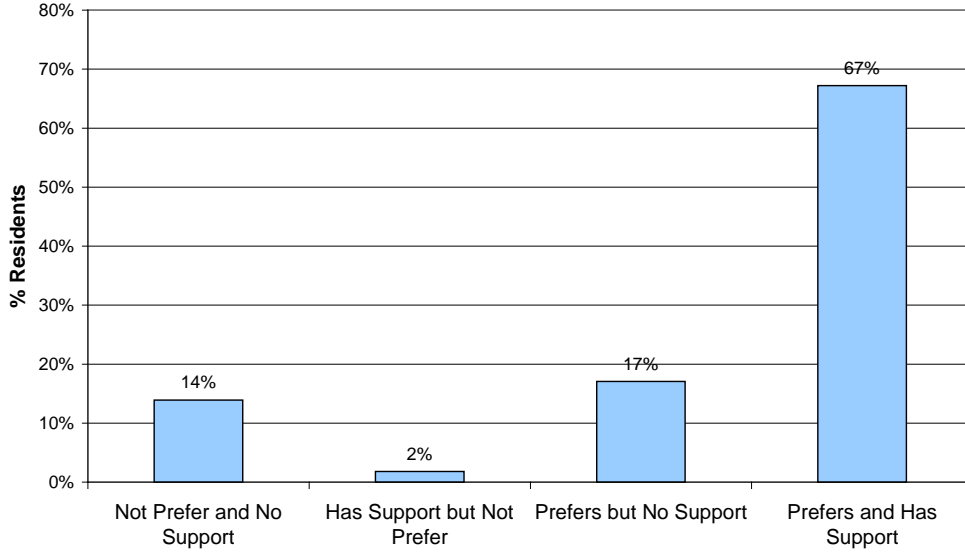


Figure 5

**Preference or Support for Community Discharge
by LOS (Admission Cohort)**

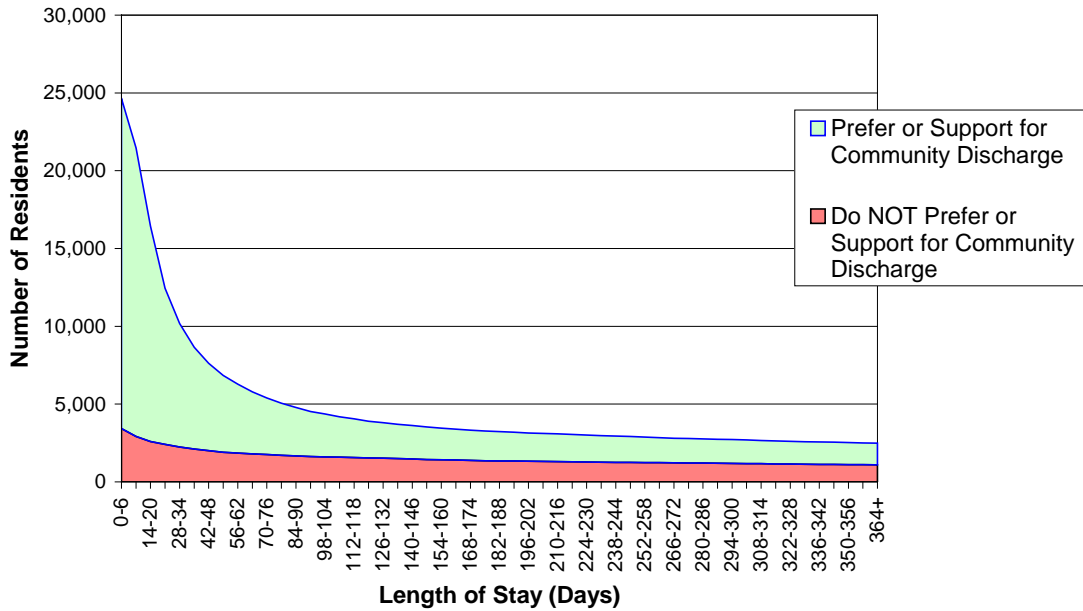


Figure 6

**Discharge Status by Preference and Support for Returning to the Community
(Discharged within 180 Days or in Nursing Home at 180 days)**

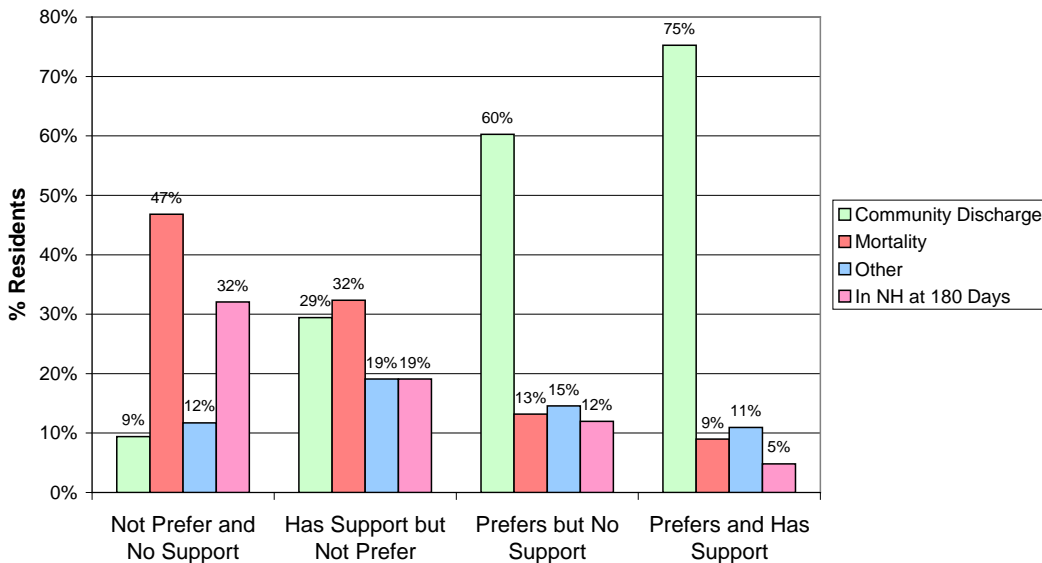


Figure 7

Percentage of Residents Meeting Targeting Criteria

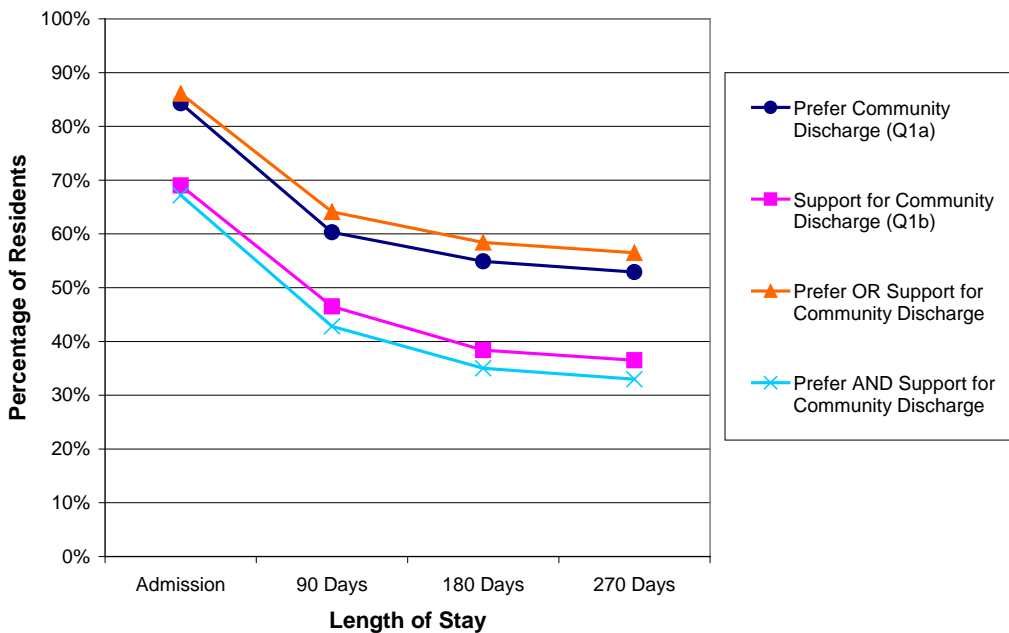


Figure 8

Percentage of Residents Meeting Targeting Criteria

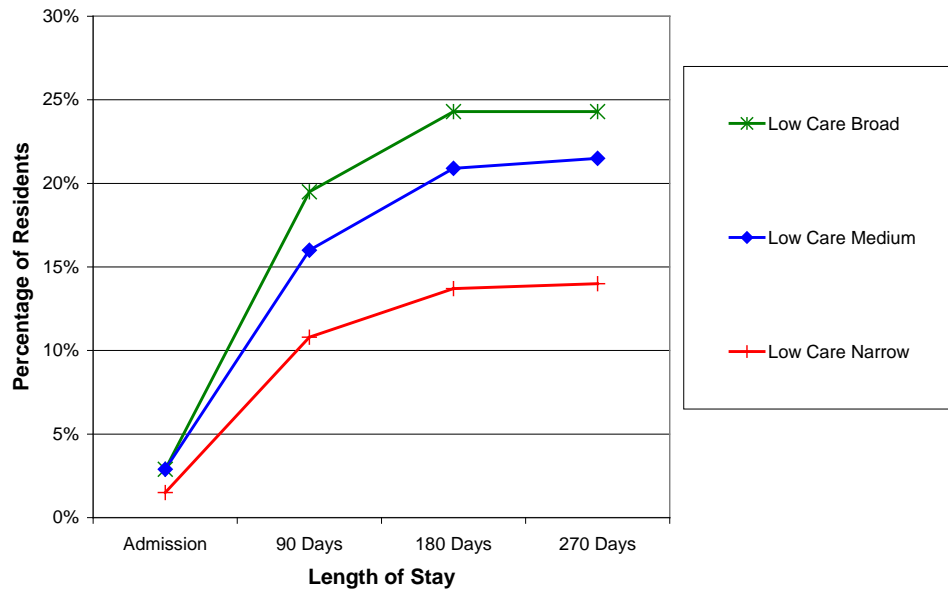


Figure 9
Intersection of Targeting Criteria for Residents at 90 Days (N = 4549)

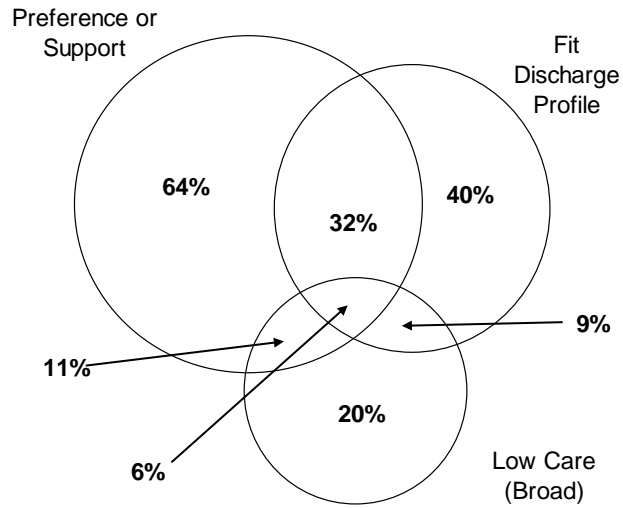


Figure 10
Intersection of Targeting Criteria for Residents at 180 Days (N = 3238)

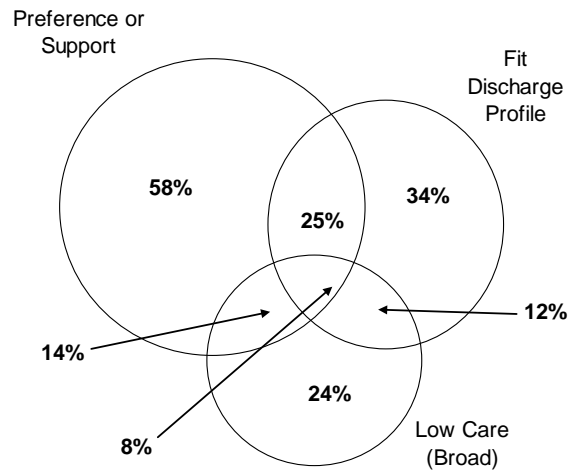


Figure 11

**MN Facilities by Percentage of Residents Meeting
Model 1 Criteria (Preference-Support AND Fit Profile) at 90 or 180 Days**

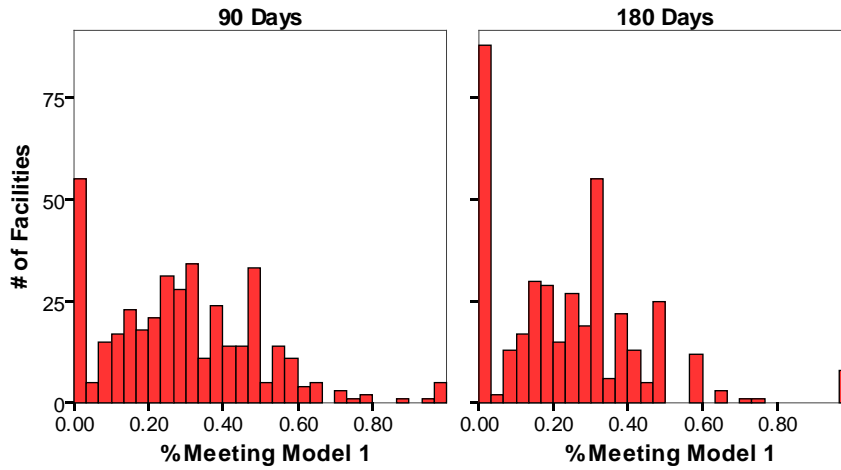


Figure 12

**MN Facilities by Number of Residents Meeting
Model 1 Criteria (Preference-Support AND Fit Profile) at 90 or 180 Days**

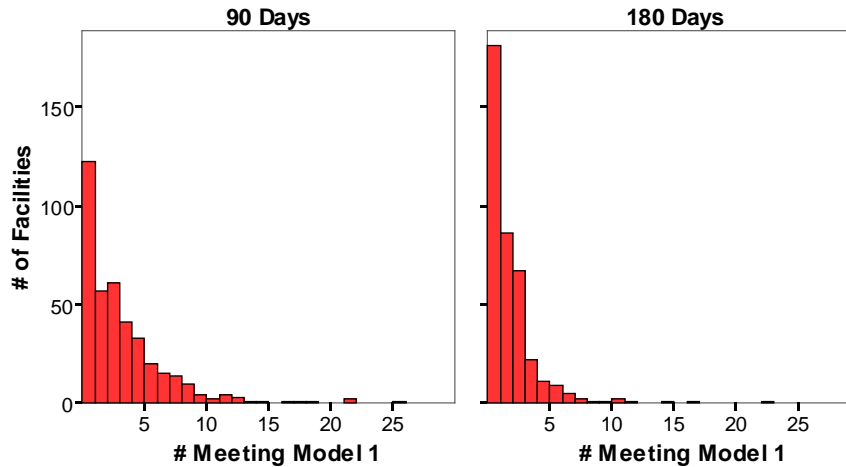


Figure 13

MN Facilities by Percentage of Residents Meeting Model 2 Criteria (Low Care) at 90 or 180 Days

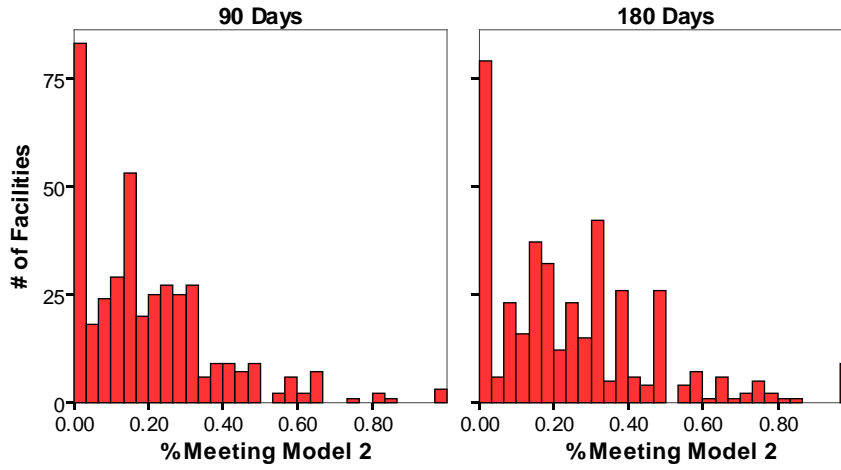


Figure 14

MN Facilities by Number of Residents Meeting Model 2 Criteria (Low Care) at 90 or 180 Days

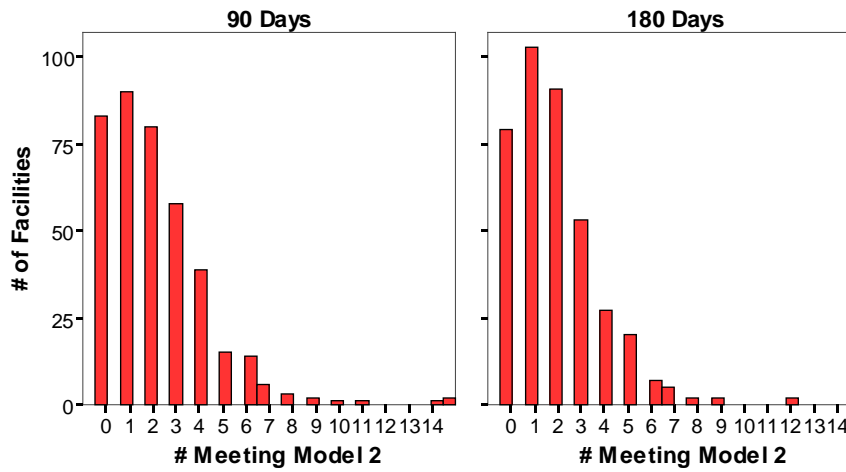


Figure 15

MN Facilities by Percentage of Residents Meeting Model 3 Criteria (Model 1 or 2) at 90 or 180 Days

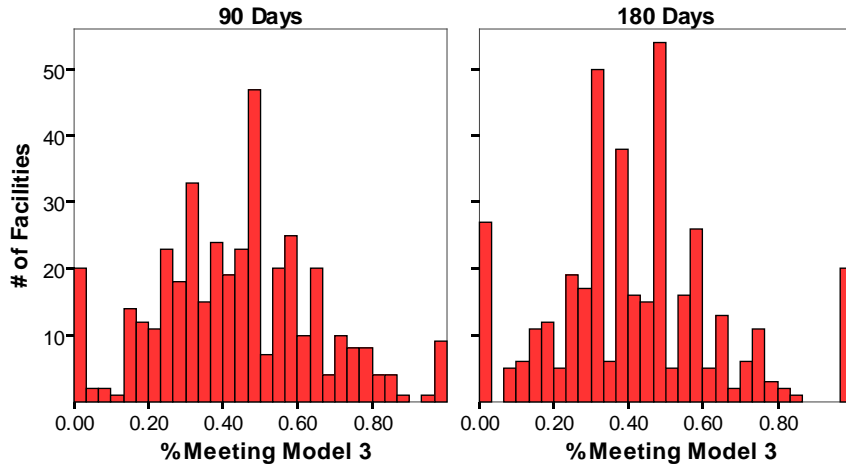


Figure 16

MN Facilities by Number of Residents Meeting Model 3 Criteria (Model 1 or 2) at 90 or 180 Days

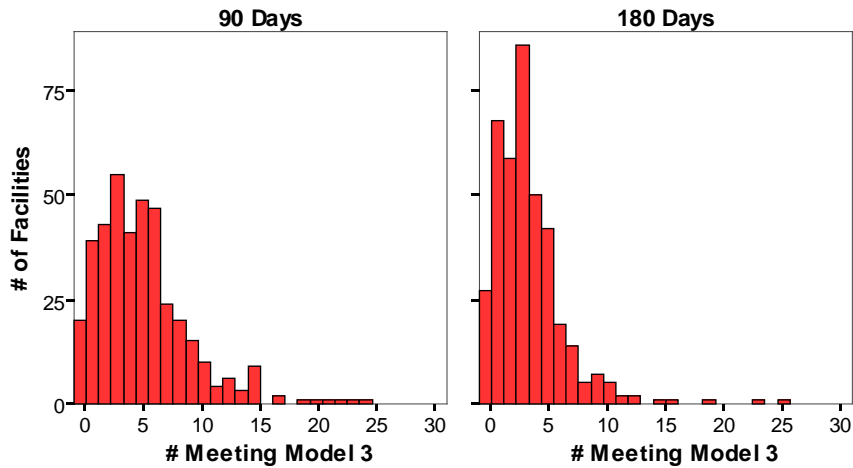


Figure 17

**MN Facilities by % of Residents with Preference or Support for Community Discharge
(EB Adjusted Rate for Facilities with 10 or More Admissions)**

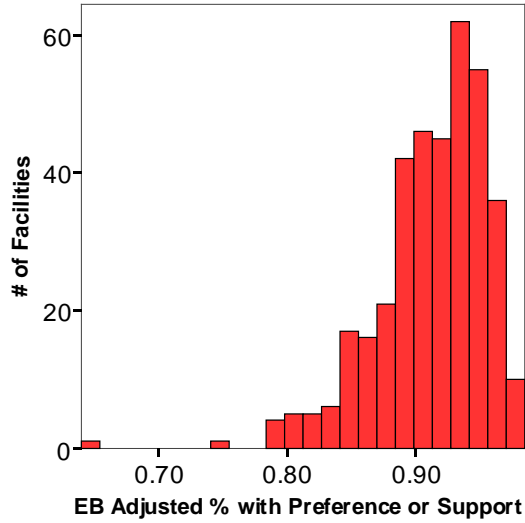


Figure 18

**MN Facilities by Community Discharge Rate
(EB Adjusted Rate for Facilities with 10 or More Admissions)**

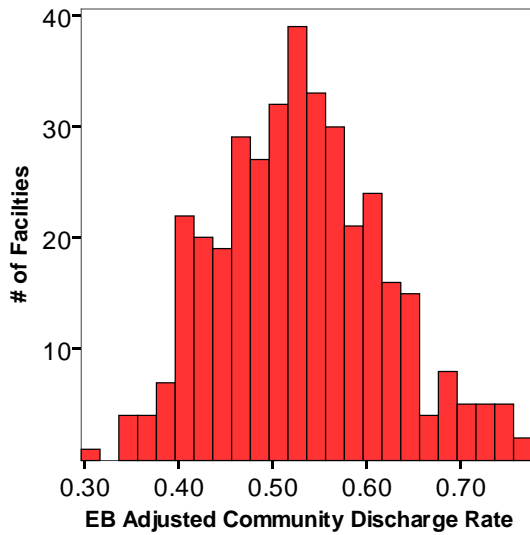
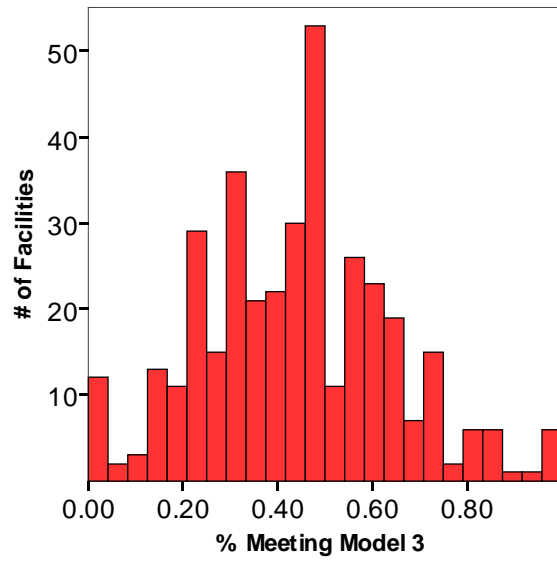


Figure 19

**MN Facilities by % of Residents Meeting
Model 3 Targeting Criteria at 90 Days
(EB Adjusted Rate for Facilities with 10 or More Admissions)**



APPENDIX 1

Hierarchical General Linear Model (HGLM)

Sample = Minnesota annual NH admissions (July 2004 to June 2005) who were followed until discharge from the facility or up to 365 days residing in the facility.

Residents = 24,648

Facilities = 404

Dependent Variable (Y)

1 = Community discharge in 1-90 days

0 = Death, other discharge status or remain in nursing home at 90 days

Or

1 = Preference or support for community discharge

0 = neither preference nor support for community discharge

All independent variables were centered on their grand means.

General HGLM Model

Let Y_{ij} be the binary Community Discharge response for the i th resident in the j th facility, where $i = 1, 2, \dots, n_j$ and $j = 1, 2, \dots, J$. Assuming that Y_{ij} follows a Bernoulli distribution, $Y_{ij} | p_{ij} \sim B(1, p_{ij})$, we write the hierarchical model as

Level-1 Model

[1]

$$\log\left(\frac{p_{ij}}{1-p_{ij}}\right) = \beta_{0j} + \boldsymbol{\beta}_{1j}\mathbf{X}_{ij} + r_{ij},$$

Level-2 Models

$$\beta_{0j} = \gamma_{00} + u_{0j},$$

$$\boldsymbol{\beta}_{1j} = \boldsymbol{\gamma}_{10} + \mathbf{u}_{1j},$$

where β_{0j} and $\boldsymbol{\beta}_{1j}$ are the random intercept and slope associated with facility j . In addition, we assume that $(u_{0j}, \mathbf{u}_{1j}^T)^T \sim \text{MVN}(\mathbf{0}, \mathbf{T})$, where

$$\mathbf{T} = \text{Var} \begin{bmatrix} u_{0j} \\ \mathbf{u}_{1j} \end{bmatrix} = \begin{bmatrix} \tau_{00} & \boldsymbol{\tau}_{01} \\ \boldsymbol{\tau}_{10} & \boldsymbol{\tau}_{11} \end{bmatrix}.$$

In this model, the predicted Community Discharge for resident i in facility j involves the intercept β_{0j} (the logit Community Discharge rate for residents in facility j) plus the effect of the resident level variable, $\boldsymbol{\beta}_{1j}\mathbf{X}_{ij}$. The β_{0j} is a function of γ_{00} , the estimated logit of the Community Discharge proportion in the population (all nursing home residents), plus the error term u_{0j} associated with nursing facility j . The u_{0j} distribution

is assumed to be approximately normal with a mean of 0 and a variance of τ_{00} . In addition, this model assumes that that $\beta_{1j} = \gamma_{10} + \mathbf{u}_{1j}$, or expected effects of the resident level variables remain constant across level 2 units (facilities).

The expanded HGLM model has a Level 2 (facility-level) variable W_j and a term for the interaction between the Level 2 W_j and Level 1 (resident-level) variable X_{ij} .

$$\beta_{0j} = \gamma_{00} + \gamma_{01} W_j + \mu_{0j}$$

$$\beta_{1j} = \gamma_{10} + \gamma_{02} X_{ij} + \mu_{1j}$$

Table 1. HGLM Results for Resident’s Preference or Support for Returning to the Community Based on Resident Characteristics at Nursing Home Admission (N = 24,648)

	Coefficient	Odds Ratio	Confidence Interval
Intercept	2.36	10.61	9.65,11.65
Facility Characteristic			
Post-Acute Facility (Facility % of Admissions from Acute Care Hospital)	2.11	8.29	4.97,13.83
Resident Characteristics and Interactions			
Resident Admitted from Acute Care Hospital	0.94	2.55	2.27,2.86
<u>Interaction:</u> Post-Acute Facility X Resident Admitted from Acute Care Hospital	2.10	8.13	4.46,14.82
Resident Characteristics			
Not Married	-0.45	0.64	0.57,0.71
Age	-0.02	0.98	0.98,0.98
Live Alone Prior to Admission	0.17	1.18	1.06,1.33
Medicare	0.45	1.57	1.38,1.78
Medicaid	-0.20	0.81	0.70,0.95
Alzheimer’s or Dementia Diagnosis	-0.37	0.69	0.62,0.77
Cancer	-0.62	0.54	0.48,0.60
Hip Fracture	0.93	2.54	1.97,3.28
End Stage Disease	-2.39	0.09	0.08,0.11
Cog Performance Scale (CPS) Score	-0.46	0.63	0.62,0.65
ADL Long-Form Scale (Range=0-28)	-0.05	0.95	0.95,0.96
Incontinent Bowel or Bladder (Freq or Greater)	-0.36	0.70	0.63,0.77
RUG Extensive	0.58	1.78	1.57,2.03
RUG Rehabilitation	0.87	2.39	2.08,2.75
Low Care (Broad)	-0.56	0.57	0.46,0.71

Note: All independent variables were statistically significant ($p < .001$). Results Hierarchical General Linear Models (HGLM) with Logit Link Function. Prefer or support for community discharge = 1; do not prefer nor have support for community discharge = 0. All independent variables were centered on their grand means.

Table 2. HGLM Results for Community Discharge within 90 Days Based on Resident Characteristics at Nursing Home Admission (N=24.648)

	Coefficient	Odds Ratio	Confidence Interval
Intercept	0.06	1.06	0.99,1.13
Facility Characteristic			
Post-Acute Facility (Facility % of Admissions from Acute Care Hospital)	0.90	2.47	1.72,3.55
Facility % of Admissions with Preference or Support for Returning to the Community	1.05	2.85	1.72,4.72
Resident Characteristics and Interactions			
Resident Prefer Community Discharge (Q1a) or Support for Community Discharge (Q1b)	2.15	8.59	7.53,9.79
<u>Interaction</u> : Facility % of Admissions with Preference or Support X Resident Prefers or Has Support	1.44	4.21	1.75,10.11
Resident Admitted from Acute Care Hospital	0.44	1.56	1.38,1.76
Resident Characteristics			
Not Married	-0.24	0.78	0.73,0.84
Age	0.00	1.00	0.99,1.00
Medicare	0.02	1.02	0.92,1.13
Medicaid	0.47	0.63	0.53,0.73
Mental Health Diagnosis	-0.14	0.87	0.78,0.96
Alzheimer's or Dementia Diagnosis	-0.19	0.83	0.74,0.92
Diabetes	-0.24	0.79	0.73,0.85
Cancer	-0.59	0.56	0.51,0.61
Hip Fracture	0.26	1.30	1.15,1.48
End Stage Disease	-1.36	0.26	0.19,0.35
Cog Performance Scale (CPS) Score	-0.33	0.72	0.70,0.74
ADL Long-Form Scale (Range=0-28)	-0.08	0.93	0.92,0.93
Incontinent Bowel or Bladder (Freq or Greater)	-0.45	0.64	0.58,0.70
RUG Extensive	0.32	1.37	1.22,1.54
RUG Rehabilitation	0.53	1.70	1.51,1.91
Low Care (Broad)	-0.73	0.48	0.39,0.60

Notes: Results Hierarchical General Linear Models (HGLM) with Logit Link Function. Community Discharge = 1; remain in facility, mortality, or other discharge = 0. All independent variables were centered on their grand means.

APPENDIX 2

Community Discharge Profile

Table 1. HGLM Results for Short Stay Community Discharge within 90 days Based on Resident Characteristics at Nursing Home Admission (N= 24,648).

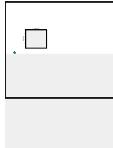
	Coefficient	Odds Ratio	Confidence Interval
Intercept	0.43	1.54	1.45,1.64
Not Married	-0.38	0.68	0.63,0.73
Age	-0.02	0.98	0.98,0.99
Live Alone Prior to Admission	0.11	1.11	1.03,1.20
Medicare	0.31	1.36	1.25,1.48
Medicaid			
Mental Health Diagnosis	-0.14	0.87	0.79,0.96
Alzheimer's or Dementia Diagnosis	-0.31	0.73	0.67,0.80
Diabetes	-0.20	0.82	0.76,0.88
Cancer	-0.68	0.51	0.46,0.56
Hip Fracture	0.41	1.50	1.31,1.71
End Stage Disease	-1.98	0.14	0.11,0.18
Cog Performance Scale (CPS) Score	-0.35	0.71	0.69,0.73
ADL Long-Form Scale (Range=0-28)	-0.06	0.94	0.93,0.94
Incontinent Bowel or Bladder (Freq or Greater)	-0.45	0.64	0.58,0.70
RUG Extensive	0.54	1.71	1.54,1.89
RUG Rehabilitation	0.86	2.36	2.13,2.62
Female	0.30	1.34	1.25,1.45
Depression	-0.10	0.90	0.84,0.97
Behavioral Problems (Weekly or More)	-0.36	0.70	0.63,0.77

Note: All independent variables were statistically significant ($p < .001$). Results Hierarchical General Linear Models (HGLM) with Logit Link Function. Community Discharge = 1; remain in facility, mortality, or other discharge = 0. All independent variables were centered on their grand means.

Table 2. ROC Results for Predicted Probability of Community Discharge in 90 Days

Community Discharge 90	Valid N (listwise)
Positive(a)	14604
Negative	10044

Larger values of the test result variable(s) indicate stronger evidence for a positive actual state.
a The positive actual state is yes.



Area Under the Curve

Test Result Variable(s): Prob of Community Discharge

Area	Std. Error(a)	Asymptotic Sig.(b)	Asymptotic 95% Confidence Interval	
			Upper Bound	Lower Bound
.822	.003	.000	.817	.827

The test result variable(s): Probability of Comm Disch < 90 Days has at least one tie between the positive actual state group and the negative actual state group. Statistics may be biased.

a Under the nonparametric assumption

b Null hypothesis: true area = 0.5

APPENDIX 3

Sensitivity and Specificity Analysis for Resident Characteristics at Admission Predicting Discharge to the Community in < 90 Days

Characteristics at Admission		<u>Disch Community < 90 Days</u>									
		no		yes		TOTAL		Sensitivity	Specificity	PPV	NPV
		Number	%	Number	%	Number	%				
Admit from Hospital	no	2099	64%	1187	36%	3286	100%	0.92	0.23	0.67	0.64
	yes	7121	33%	14241	67%	21362	100%				
Medicare Per Diem Source	no	2826	49%	2942	51%	5768	100%	0.81	0.31	0.66	0.49
	yes	6394	34%	12486	66%	18880	100%				
RUG Extensive	no	4902	37%	8403	63%	13305	100%	0.46	0.53	0.62	0.37
	yes	4318	38%	7025	62%	11343	100%				
RUG Rehabilitation	no	6960	43%	9144	57%	16104	100%	0.41	0.75	0.74	0.43
	yes	2260	26%	6284	74%	8544	100%				
RUG Special Care	no	8654	37%	14539	63%	23193	100%	0.06	0.94	0.61	0.37
	yes	566	39%	889	61%	1455	100%				
RUG Clinically Complex	no	8583	36%	14988	64%	23571	100%	0.03	0.93	0.41	0.36
	yes	637	59%	440	41%	1077	100%				
Prefer (Q1a) OR Support (Q1b) at Admit Assess	no	3106	91%	322	9%	3428	100%	0.98	0.34	0.71	0.91
	yes	6114	29%	15106	71%	21220	100%				
Low Care Broad (IA1-2,BA1-2,PA1-2)	no	8784	37%	15161	63%	23945	100%	0.02	0.95	0.38	0.37
	yes	436	62%	267	38%	703	100%				
Fit Discharge Profile - Admit to 90 Days	no	5372	74%	1931	26%	7303	100%	0.87	0.58	0.78	0.74
	yes	3848	22%	13497	78%	17345	100%				
Pref or Supp & Low Care Broad	no	9026	37%	15186	63%	24212	100%	0.02	0.98	0.56	0.37
	yes	194	44%	242	56%	436	100%				

Pref or Supp & Fit Profile	no	5895	74%	2093	26%	7988	100%	0.86	0.64	0.80	0.74
	yes	3325	20%	13335	80%	16660	100%				
Fit Profile & Low Care Broad	no	9102	37%	15260	63%	24362	100%	0.01	0.99	0.59	0.37
	yes	118	41%	168	59%	286	100%				
Pref or Sup Fit Profile & Low Care Broad	no	9152	37%	15271	63%	24423	100%	0.01	0.99	0.70	0.37
	yes	68	30%	157	70%	225	100%				

Notes:

True Positive = Discharge in < 90 Days= Yes AND Characteristic = Yes

False Positive = Discharge in < 90 Days= No AND Characteristic = Yes

True Negative = Discharge in < 90 Days= No AND Characteristic = No

False Negative = Discharge in < 90 Days= Yes AND Characteristic = No

Sensitivity = True Positives / (True Positives + False Negatives)

Specificity = True Negatives / (True Negatives + False Positives)

Positive Predictive Value (PPV) = True Positives / (True Positives + False Positives)

Negative Predictive Value (NPV) = True Negatives / (True Negatives + False Negatives)