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UMBC

report

The Utility of Data from Long-Term Care Assessments for Reducing Repeated Hospital Encounters among Dually Eligible Beneficiaries in Maryland

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Acknowledgements

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Executive Summary

Improving the coordination and safety of patient transitions to, from, and between settings of care is a fundamental domain of population health management. The Medicare program is estimated to spend $17 billion every year on readmissions due to poorly executed transitions of beneficiaries following hospitalizations (Jencks et al., 2009). Hence, care transitions are a focus of efforts by the Centers for Medicare & Medicaid Services (CMS) to improve quality of care and reduce spending (Congressional Budget Office, 2012). CMS has allocated about $500 million for initiatives to help patients safely transition between settings of care (Blumberg et al., 2014). Transitional care is also one of three priority areas identified by the National Academy of Medicine for performance measurement in health care (Ring & Chao, 2006).

Among individuals eligible for both Medicare and Medicaid, an information gap opens during transitions from receiving long-term services and supports (LTSS) to receiving acute care in the hospital setting. Vital information on the patient's cognitive, behavioral, and functional capacities and limitations—which could be useful to better manage the patient's health status in the hospital and help reduce the risk of rehospitalization—is not readily available to acute care providers. A key factor contributing to this information gap is the change in payer coverage for services during such transitions, with Medicaid paying for LTSS and Medicare covering hospital services. The primary sources for these important patient characteristics are standardized assessments administered periodically to individuals receiving LTSS by their providers in institutional (nursing facility) and home- and community-based settings. However, the richly detailed data from these assessments are largely unavailable to hospital care teams at the point of care because the data are dispersed across unintegrated administrative data sets. The transitional care process could be improved by creating a health information exchange (HIE) infrastructure to provide acute care teams with critical cognitive, behavioral, and functional data on dually eligible individuals transitioning from LTSS to hospital care. In the state of Maryland, the Chesapeake Regional Information System for our Patients (CRISP) is uniquely positioned to implement and administer the data portal envisioned; CRISP has extensive experience and has demonstrated expertise in facilitating data linkages between the state's inpatient and ambulatory health care providers.

In this report, Hilltop discusses the findings of its empirical studies to identify the need for developing an HIE solution to bridge the information gap during transitions between LTSS and acute care settings among the population of over 100,000 individuals who are Medicare-Medicaid dually eligible in the state of Maryland. The studies sought to characterize the dually eligible beneficiaries who undergo these transitions, measure the volume of transitions, and identify risk factors derived from the LTSS assessments that are associated with adverse outcomes after their transitions. The inferences from these studies are intended to estimate the volume of encounters to be populated in the envisioned data portal and to highlight specific data

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elements from the LTSS assessments that should be included in the data linkage between acute and LTSS care teams. The following are Hilltop's specific research questions:

1. What is the frequency of transitions between LTSS and acute care settings among dually eligible beneficiaries in Maryland?

2. Among dually eligible individuals in Maryland who transition between acute care and LTSS settings, what are the behavioral, functional, and cognitive characteristics associated with elevated risk of a subsequent hospital event within 30 days of initial discharge?

To answer these questions, Hilltop linked records across the following four administrative/ service management data systems that hold relevant information related to transitions among the population of interest: 1) the Medicare Claim and Claim Line Feed (CCLF); 2) the Maryland Medicaid Management Information System (MMIS2); 3) Maryland's integrated LTSS tracking and case management system (*LTSSMaryland*); and 4) CMS's Minimum Data Set (MDS). We combined claims for hospital services received into episodes of care and identified whether the patients visiting the hospital were transitioning from community-based or institutional LTSS. For patients who were administered standardized assessments in the LTSS setting—the MDS for residents of nursing facilities, or the interRAI Home Care (HC) Assessment Form for community-dwelling individuals receiving home and community-based services (HCBS)—we evaluated the association of their behavioral, functional, and cognitive characteristics with the risk of returning to the hospital after an index acute episode.

Hilltop identified 128,664 hospital episodes (HEs) that began between July 1, 2018, and June 30, 2020. The episodes occurred among 40,859 dually eligible beneficiaries and included inpatient admissions, outpatient emergency department (ED) visits, and observation stays. Prior to admission, the patient had most recently been in a nursing facility in 18,127 (14.1% of) episodes or had most recently been receiving Medicaid-funded HCBS in 27,884 (21.7% of) episodes. The patient returned to the hospital within 30 days of initial discharge after 38,780 (30.1% of) episodes. In their LTSS assessments, patients experiencing these repeat HEs most commonly reported difficulty with functional capacities, such as locomotion, self-dressing, eating, toilet use, personal hygiene, and bathing. In adjusted regression analyses, the odds of experiencing a repeat HE were significantly and positively associated with reporting difficulty with hearing (adjusted odds ratio, AOR: 1.10 [95% confidence interval: $1.02 - 1.19$]), being easily distractible (AOR: 1.09 [$1.00 - 1.18$]), being self-injurious (AOR: 1.33 [$1.09 - 1.63$]), and exhibiting verbal abuse (AOR: 1.15 [$1.02 - 1.30$]). Conversely, displaying inappropriate public behavior (AOR: 0.62 [$0.42 - 0.92$]) and being dependent for eating (AOR: 0.91 [$0.83 - 0.99$]) or bathing (AOR: 0.79 [$0.67 - 0.92$]) were associated with reduced odds for a repeat HE.

These analyses highlighted several behavioral, cognitive, and functional characteristics derived from LTSS assessments and independently associated with the risk of repeat acute encounters among dually eligible beneficiaries in the state of Maryland. They demonstrate the utility of relevant yet unlinked data from institutional and community-based LTSS assessments to supplement the information available to care teams beyond what is available in administrative claims. A data portal to notify acute care teams about their incoming patient's memory issues

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and temperament may facilitate advanced planning to manage these characteristics during the stay. LTSS teams may find this information equally useful for identifying patients with these characteristics who may benefit from targeted interventions to reduce the likelihood of returning to the acute care setting.

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Introduction

Dispersion of health care across the continuum of clinical settings is common for enrollees in the Medicare program. The average beneficiary visits two primary care physicians and five specialists every year (Pham et al., 2007), and one in five Medicare beneficiaries experiences a transfer to or from acute inpatient care annually (Sato et al., 2011). Transitions of Medicare beneficiaries from the hospital back to receiving long-term services and supports (LTSS) in the community or in a nursing facility are complex and require effective care coordination to avoid adverse events. Inadequate transitional care processes may result in avoidable complications, early readmissions, and increased risk of mortality (Burke et al., 2016).

The consequences of inadequate transitional care are particularly concerning for the 12.2 million individuals dually enrolled in Medicare and Medicaid (Medicare Payment Advisory Commission and the Medicaid and CHIP Payment and Access Commission, 2022) for three reasons. First, dually eligible beneficiaries have significantly lower health status than their Medicare-only counterparts, predisposing them to more frequent and complex transitions across health settings. Dually eligible beneficiaries have higher prevalence of being diagnosed with multiple medical conditions, behavioral health conditions, and cognitive and physical disabilities relative to Medicare-only beneficiaries (Cai et al., 2009; Howell et al., 2007; Medicare Payment Advisory Commission and the Medicaid and CHIP Payment and Access Commission, 2022). The current pandemic highlights these differences, as dually eligible beneficiaries are more than twice as likely as Medicare-only enrollees to be hospitalized with COVID-19 (Centers for Medicare & Medicaid Services, 2022). Second, the quality of care for dually eligible beneficiaries in the community and in residential LTSS settings is lower, increasing their risk for adverse outcomes. This is illustrated in findings from recent studies that report dually eligible beneficiaries typically have worse living arrangements than Medicare-only counterparts (Kelly et al., 2010) and, because they are concentrated in low-income neighborhoods, they are more likely to be treated in nursing facilities with lower quality ratings and fewer nursing staff (Rahman et al., 2014). Third, care transitions for dually eligible beneficiaries usually involve shifts in coverage between Medicare and Medicaid, but services are not coordinated across both programs when incentives are misaligned. The result is inefficient duplication of care and poor quality or costly care during transitions (Grabowski, 2007; Walsh & Clark, 2002). It is, therefore, not surprising that dually eligible beneficiaries have a significantly higher likelihood of a 30-day readmission after hospitalization than Medicare-only beneficiaries (Bennett & Probst, 2016).

Several interventions have been developed to improve coordination and continuity of transitional care in practice. Most transitional care models assign the coordination to trained professionals, such as a dedicated advanced practice nurse collaborating with the multidisciplinary care teams. This practice may, however, be prohibitively costly or burdensome, and providers often question its necessity (Barth et al., 2019; Hewner et al., 2021).

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Special needs plans and delivery systems have been developed as systems-oriented solutions to integrate financing and care delivery functions between Medicare and Medicaid services for dually eligible beneficiaries. These arrangements are, however, not available in all states (Thorpe, 2011). There is an untapped need for an automated health information exchange (HIE) to enhance transitional care in a cost-efficient and outcome-effective manner. The consensus is that the "full potential of current technological offerings has not been realized in the science of care coordination" (Hewner et al., 2021).

The research literature on transitional care has identified important risk factors for readmission and other adverse outcomes as patients transfer between locations or levels of care. Apart from acuity, other prominent factors highlighted in a nationally representative study of Medicare beneficiaries include impaired functional status and major disability (Burke et al., 2016). Because these factors are regularly assessed by LTSS providers, transitional care for dually eligible beneficiaries could be enhanced significantly by sharing timely and actionable data between acute care and LTSS teams. There are, however, currently limited formal mechanisms for information sharing between these domains of care. A recent study reported that only 56% of hospitals in the US have any level of HIE with post-acute care providers, and hospitals with these linkages are mostly large health systems or participants in alternative payment models (Cross, 2018).

In the state of Maryland, there is great potential for bridging this information gap by facilitating information sharing through the state's HIE between LTSS and acute care teams. Like existing systems for updating primary care providers on their patients' acute encounters, a supplementary data portal could serve the purpose of automatically communicating relevant information on the patient's behavioral health status, functional limitations, and cognitive capacities from LTSS providers to the admitting hospital during transitions from LTSS to acute care. LTSS providers delivering home and community-based services (HCBS) to eligible Medicaid beneficiaries maintain detailed archives of their care activities, care plans, and periodic assessments of the beneficiary's cognitive, behavioral, and functional characteristics using the interRAI Home Care (HC) Assessment Form in Maryland's integrated LTSS tracking and case management system (*LTSSMaryland*). Dually eligible beneficiaries in skilled nursing facilities also have the statutorily mandated Minimum Data Set (MDS) administered to them at intake and at periodic intervals. Unfortunately, there has been no systematic effort to make the rich data archived in *LTSSMaryland* and in the MDS available to acute care teams, who could use the data for more strategic care planning and potentially reduce adverse outcomes.

For this analysis, Hilltop undertook a series of empirical studies to support the need for an HIE infrastructure to update acute care teams with relevant information on cognitive, behavioral, and functional characteristics of dually eligible beneficiaries transitioning from an LTSS setting to an acute care setting. By linking data systems that house the relevant indicators/markers but are currently unintegrated, Hilltop hypothesizes that this intervention would improve quality of care provided to these patients and reduce the risk of rehospitalization or readmission. The specific aims of these studies are to:

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1. Estimate the magnitude and frequency of transitions between LTSS and acute care settings among dually eligible beneficiaries in Maryland

2. Identify the most relevant cognitive, behavioral, and functional patient indicators abstracted from LTSS assessments recommended for inclusion in the proposed data portal because these markers have the greatest impact on reducing adverse outcomes following discharge

The study population—individuals residing in Maryland who are dually eligible for full benefits under Medicare and Medicaid—totaled around 100,000 and composed 9% of the state's Medicare population (Medicare Payment Advisory Commission and the Medicaid and CHIP Payment and Access Commission, 2022). Hilltop followed their episodes of care in the hospital setting using Medicare claims for institutional services and identified whether they were also recently receiving LTSS in institutional or community-based settings using Medicaid claims. We systematically linked common items in the interRAI HC and MDS assessments to describe the cognitive, behavioral, and functional characteristics of dually eligible beneficiaries experiencing these transitions. Finally, we evaluated whether any of these characteristics sourced from LTSS assessments were independently and significantly associated with the risk of being readmitted to the hospital within 30 days of a previous discharge.

Methods

Data Sources

The data Hilltop analyzed were accessible to this project through a multiparty data use agreement among the Maryland Medicaid Assistance Program Planning Administration, the Health Services Cost Review Commission (HSCRC), CRISP (Maryland's HIE), and the University of Maryland, Baltimore County (UMBC). The primary databases used were the Medicare Claim and Claim Line Feed (CCLF), the Maryland Medicaid Information System (MMIS2), *LTSSMaryland*, and the Centers for Medicare & Medicaid Services (CMS) MDS.

Medicare Claim and Claim Line Feed

Data on demographics, eligibility and enrollment, inpatient admissions, emergency department (ED) visits, and observation stays for dually eligible Marylanders were obtained primarily from the Medicare CCLF extract prepared and transferred monthly to Hilltop by CMS. The feed was created as data input for Hilltop's Predicting Avoidable Hospital Events (Pre-AH) model to determine the attributed Medicare patients of providers participating in the Maryland Primary Care Program (MDPCP) with the greatest probability of experiencing an avoidable hospitalization in the near future based on demographic, clinical, and environmental risk factors (Henderson et al., 2022). Every month, Hilltop receives from CMS a set of eligibility files, Part A claims, Part B claims, and Part D claims covering a rolling 3-year look-back period that dates from the month preceding the transfer. The set includes data on beneficiaries who meet any of the following criteria:

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- Had a health care visit in Maryland during the 3-year look-back period, regardless of residency at time of claim
- Appears as a resident of the state of Maryland during the look-back period, based on HSCRC data

The time period covered by the data authorized under the agreement spanned state fiscal years (FYs) 2019 and 2020 (i.e., from July 2018 to June 2020). For the analyses, Hilltop abstracted beneficiary dates of birth and death (where applicable), sex, race, Medicare coverage dates, monthly indicators of dual enrollment in Medicaid, service dates, principal diagnoses, Medicare Severity Diagnosis-Related Groups (MS-DRGs), and service billing codes from the data sets. We also checked claims for the number of chronic conditions and number of disabilities that a beneficiary was diagnosed with over a look-back period ranging from 2 to 3 years prior to their acute event.

Maryland Medicaid Management Information System (MMIS2)

From MMIS2, Hilltop extracted dually eligible individuals' Medicaid identification numbers, exact dates of Medicaid eligibility, and Medicaid coverage groups and types. We also obtained all Medicaid-paid claims for nursing home visits and for HCBS approved under the state of Maryland's 1915(c) waiver. We used an MMIS2 field MCRENUM (recipient Medicare identification number) for the linkage to the Medicare beneficiary identifier MBI_NUM in the CCLF because no Medicaid identifier was available in the CCLF files. We conducted a validation check to confirm that dually eligible individuals were validly linked between the CCLF and MMIS2 files by comparing the equivalence of date of birth for the same individual between the databases. The test asserted that 98.7% of matched beneficiaries had the same date of birth in both databases.

LTSSMaryland

LTSSMaryland was instituted to facilitate the coordination, delivery, and payment for support and residential services to participants enrolled in Medicaid and state-funded LTSS programs. The system's provider portal allows care personnel to document patient health and environmental assessments, develop person-centered plans of service, log services provided, conduct ongoing case management, and process billing. The standard assessment is the interRAI HC, administered to applicants requesting in-home support services for functional deficiencies and at least annually to enrolled HCBS program participants to monitor health and functional status. This instrument is widely applied in clinical practice and research for the purpose of care planning for individuals receiving HCBS. It is a comprehensive assessment with over 200 questions across several domains spanning cognitive performance, communication, hearing, vision, mood and behavior, social functioning, physical functioning, continence, disease diagnoses, service utilization, medications, health conditions and preventive health measures, nutrition, skin condition, informal support services, and environmental aspects. From *LTSSMaryland*, Hilltop obtained all interRAI HC assessments (version 9.1) administered to Maryland Medicaid beneficiaries between July 2017 and September 2021.

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Minimum Data Set

The MDS version 3.0 is a comprehensive set of screening, clinical, and functional status elements reported on all residents of nursing facilities certified to participate in the Medicare or Medicaid program. The instrument supports patient care by monitoring quality and is applied in estimating a patient's level of resource need to facilitate payments based on intensity of care. Federal law mandates that the MDS is administered in full within 14 days of admission. An abbreviated version is assessed periodically—at least quarterly—but a full assessment must be conducted every year. Hilltop obtained responses to all MDS 3.0 Nursing Home Comprehensive Item Set resident assessments and care screening assessments administered to Medicaid beneficiaries in Maryland nursing facilities between July 2017 and September 2021. Periodic tracking assessments that did not administer the complete MDS instrument were excluded from this analysis.

Defining Hospital Episodes and Repeat Hospital Episodes of Dually Eligible Beneficiaries

For this analysis, Hilltop defined a "hospital episode" (HE) as continuous care received in an acute care facility that is separated from other HEs by two or more calendar days. The admission date of the episode was determined as the first date of service of the earliest hospital claim, and the discharge date of the episode was determined as the last date of service of the latest claim. An HE includes any acute-to-acute direct transfers between institutions that occurred between the admission and discharge dates. Hence, the episode may span several successive days and may continue across different hospitals.

To define HEs, Hilltop's team first collated Medicare Part A claims for acute care encounters with service begin dates during FY 2019 (July 1, 2018, to June 30, 2019) or FY 2020 (July 1, 2019, to June 30, 2020). To ensure that there were at least 6 months of claim runout following the end of each fiscal year, we pulled qualifying claims for July to December 2018 from the CCLF data files provided as of June 2019 and drew claims for service dates from January 2019 to June 2020 from the CCLF data files provided in May 2021. These time selections were also made to provide adequate pre-episode and post-episode durations for confirming continuous dual Medicare and Medicaid eligibility—up to 1 year before each admission, and at least 30 days after the episode to track readmissions. Inpatient admissions were identified using claim type codes 60 (inpatient claim) and 61 (inpatient full-encounter claim). Claims for ED visits were identified using revenue center codes 0450-0459 and 0981. Hilltop also included observation stays defined as claims with revenue codes 0762. For all beneficiaries with qualifying HEs, we linked their Medicare IDs to the respective eligibility and enrollment files to obtain demographic information, dates of birth and death, and monthly indicators for dual enrollment in the Medicaid program.

A series of contiguous acute care claims by the same beneficiary was combined into one HE by absorbing overlapping claims and by combining adjacent non-overlapping claims. Any overlapping HE claims occurring entirely within the duration of another HE claim by the same beneficiary were absorbed into the claim with the longer duration and deleted. Hilltop combined

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separate non-overlapping claims into an acute HE if the discharge date of one was within one calendar day of the admission date of the subsequent claim. Hilltop defined the admission date of the earliest—and the discharge date of the latest—combined claims, respectively, as the HE's admission and discharge dates. The patient's disposition from the latest claim was assigned as the discharge status for the HE. Hilltop retained only HEs that began while the Medicare beneficiary was concurrently enrolled in Medicaid.

Hilltop then categorized HEs based on a hierarchy that prioritized whether an inpatient claim, an ED claim, or an observation stay was among the component claims of the episode. **Inpatient** HEs had to include at least one inpatient claim, although the patient may have been evaluated in the ED or undergone an observation stay during the course of the episode. **Outpatient ED** HEs included an ED claim without any inpatient admission, while **outpatient observation** HEs included an observation stay with neither an inpatient admission nor an ED visit.

Hilltop defined a "repeat hospital episode" as an HE that followed the discharge date of a prior/index HE by the same individual within 30 calendar days (30-day repeat HEs). For inpatient repeat HEs preceded by an inpatient HE, the team defined the former as a same-cause repeat HE if the MS-DRG for both episodes was the same.

Defining Pre-Episode LTSS Settings

For each dually eligible patient who had a qualifying HE, Hilltop verified whether the beneficiary was transitioning to acute care from recently being in an institutional LTSS setting, a community-based LTSS setting, or a non-LTSS community setting. We identified an individual's pre-episode LTSS setting based on claims paid by Medicaid up to 1 year before the HE admission date. Medicaid LTSS claims include claims for nursing facility services (identified by provider type 57) or for any of the following three programs approved for eligible Medicaid beneficiaries under Maryland's HCBS 1915(c) waivers: [1]

1. Community Personal Assistance Services (CPAS)

2. Community First Choice (CFC)

3. Home and Community-Based Options (CO) Waiver

Based on the presence or absence of a claim(s) for the above HCBS, Hilltop classified beneficiaries with HEs into one of the following categories for pre-episode LTSS setting: nursing facility (NF), HCBS, or community. See Table 1 for a definition of each category.

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[1] All three programs provide community services and supports such as personal assistance services, supports planning, and nurse monitoring to older adults who reside in the community and need support with bathing, grooming, dressing, mobility, or other activities of daily living. Participants must meet Medicaid eligibility and financial requirements and also meet the program's medical level of care required to qualify for nursing facility services. CFC services also include personal emergency response systems, assistive technology, accessibility adaptations, transition services, and home-delivered meals. CO Waiver services encompass all CFC services and also offer family training, case management, dietician and nutritionist services, and behavioral consultation.

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Table 1. Definitions of Pre-Episode Long-Term Care Settings

Name of Pre-Episode Setting/Category	Definition
NF	Beneficiary's most recent Medicaid LTSS claim within 365 days before HE admission date was for an NF service
HCBS	Beneficiary's most recent Medicaid LTSS claim within 365 days before HE admission date was for an HCBS service
Community	Beneficiary did not have a Medicaid claim for NF or HCBS services during the 365-day pre-episode window

If a patient's most recent NF claim and most recent HCBS claim prior to the HE had the same service date, then the patient was assigned to the NF pre-episode LTSS setting by default. Because this definition was based on a point-in-time status—that is, the setting of the LTSS claim most proximal to the HE—we included a sensitivity analysis to evaluate the durability of the assigned pre-episode setting. Hilltop assessed how many months the patient had at least one claim in the assigned NF or HCBS setting category during the 6 months before HE admission.

Assessing the Behavioral, Functional, and Cognitive Characteristics of Dually Eligible Patients in Hospital Episodes

Hilltop obtained data from the interRAI HC and MDS assessments on the behavioral traits, functional characteristics, and cognitive capacities of dually eligible individuals undergoing transitions from LTSS to acute settings. Because individuals could transition from LTSS in either the community or an NF, it was necessary to create a standardized set of descriptive characteristics that could be extracted from either the interRAI HC assessment or the MDS assessment, depending on the individual's pre-episode LTSS setting. For this purpose, we matched survey items between both instruments that had equivalent or reasonably similar wording. This effort was helped, in large part, by the underlying similarity in item domains between both assessments.

There were two major challenges in this exercise. Because the response scales for some matched items differed in their original instruments, Hilltop created binary categories for the combined item that essentially reduced the dimensions of response to a simple indicator of presence/absence of the characteristic. Where the original items had different recall periods in the question prompts, Hilltop created the combined item to indicate if the behavior or trait was ever reported.

When the exercise was concluded, Hilltop's team successfully linked 21 items between both assessments and classified them into the following three domains:

- Cognition (see Table 2)

- Mood and behavior (see Table 3)

- Functional status (see Table 4)

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Responses to the linked items were evaluated on a binary scale that indicated presence or absence of the trait/behavior, ability or inability to conduct the activity independently, presence or absence of a cognitive impairment, and difficulty or no reported difficulty in performing a task. We reported the prevalence of the linked behavioral, functional, and cognitive characteristics of patients abstracted from the LTSS assessment most recently administered prior to an HE of interest.

Table 2. Items on Cognition Linked between interRAI HC and MDS Assessments

interRAI HC Item	MDS Item
MEMORY/RECALL ABILITY Short-term memory OK – seems/appears to recall after 5 minutes *(Item C.2.a)*	**SHORT-TERM MEMORY OK** Seems or appears to recall after 5 minutes *(Item C0700)*
MAKING SELF UNDERSTOOD (Expression) Expressing information content—both verbal and non-verbal *(Item D.1)*	**MAKES SELF UNDERSTOOD** Ability to express ideas and wants, consider both verbal and non-verbal expression *(Item B0700)*
ABILITY TO UNDERSTAND OTHERS (Comprehension) Understanding verbal information content (however able; with hearing appliance normally used) *(Item D.2)*	**ABILITY TO UNDERSTAND OTHERS** Understanding verbal content, however able (with hearing aid or device if used) *(Item B0800)*
HEARING Ability to hear (with hearing appliance normally used) *(Item D.3)*	**HEARING** Ability to hear (with hearing aid or hearing appliances if normally used) *(Item B0200)*
VISION Ability to see in adequate light (with glasses or with other visual appliance normally used) *(Item D.4)*	**VISION** Ability to see in adequate light (with glasses or other visual appliances) *(Item B1000)*
COGNITIVE SKILLS FOR DAILY DECISION MAKING Making decisions regarding tasks of daily life—e.g., when to get up or have meals, which clothes to wear or activities to do *(Item C.1)*	**COGNITIVE SKILLS FOR DAILY DECISION MAKING** Made decisions regarding tasks of daily life *(Item C1000)*
EASILY DISTRACTED—e.g., episodes of difficulty paying attention; gets sidetracked *(Item C.3.a)*	**INATTENTION** - Did the resident have difficulty focusing attention, for example being easily distractible, or having difficulty keeping track of what was being said? *(Item C1310.B)*
EPISODES OF DISORGANIZED SPEECH—e.g., speech is nonsensical, irrelevant, or rambling from subject to subject; loses train of thought *(Item C.3.b)*	**DISORGANIZED THINKING** - Was the resident's thinking disorganized or incoherent (rambling or irrelevant conversation, unclear or illogical flow of ideas, or unpredictable switching from subject to subject)? *(Item C1310.C)*

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Table 3. Items on Mood and Behavior Linked between interRAI HC and MDS Assessments

interRAI HC Item	MDS Item
SELF-INJURIOUS–e.g., biting, scratching, putting inappropriate object into body cavity, head banging or slapping *(Item E.3.g)*	Thoughts that you would be better off dead, or of **hurting yourself** in some way States that life isn't worth living, wishes for death, or attempts to **harm self** *(Items D0200.I.1 & D0500.I.1)*
PHYSICAL ABUSE—e.g., others were hit, shoved, scratched, sexually abused *(Item E.3.c)*	**Physical behavioral symptoms** directed toward others (e.g., hitting, kicking, pushing, scratching, grabbing, abusing others sexually) *(Item E0200.A)*
VERBAL ABUSE—e.g., others were threatened, screamed at, cursed at *(Item E.3.b)*	**Verbal behavioral symptoms** directed toward others (e.g., threatening others, screaming at others, cursing at others) *(Item E0200.B)*
WANDERING—Moved with no rational purpose, seemingly oblivious to needs or safety *(Item E.3.a)*	Has the resident **wandered**? *(Item E0900)*
Inappropriate **public sexual behavior or public disrobing** *(Item E.3.e)*	Other behavioral symptoms not directed toward others (e.g., physical symptoms such as hitting or scratching self, pacing, rummaging, **public sexual acts, disrobing in public**, throwing or smearing food or bodily wastes, or verbal/vocal symptoms like screaming, disruptive sounds) *(Item E0200.C)*

Table 4. Items on Functional Status Linked between interRAI and MDS Assessments

interRAI HC Item	MDS Item
BED MOBILITY - how resident moves to and from lying position, turns from side to side, and positions body while in bed or alternate sleep furniture *(Item G.2.i)*	**BED MOBILITY** - how resident moves to and from lying position, turns side to side, and positions body while in bed or alternate sleep furniture *(Item G0110.A)*
LOCOMOTION—How moves between locations on same floor (walking or wheeling). If in wheelchair, self-sufficiency once in chair *(Item G.2.f)*	**LOCOMOTION OFF UNIT** - how resident moves to and returns from off-unit locations (e.g., areas set aside for dining, activities or treatments). If facility has only one floor, how resident moves to and from distant areas on the floor. If in wheelchair, self-sufficiency once in chair *(Item G0110.F)*
DRESSING UPPER BODY—How dresses and undresses (street clothes, underwear) above the waist, including prostheses, orthotics, fasteners, pullovers, etc. *(Item G.2.c)* **DRESSING LOWER BODY**—How dresses and undresses (street clothes, underwear) from the waist down including prostheses, orthotics, belts, pants, skirts, shoes, fasteners, etc. *(Item G.2.d)*	**DRESSING** - how resident puts on, fastens and takes off all items of clothing, including donning/removing a prosthesis or TED™ hose. Dressing includes putting on and changing pajamas and housedresses *(Item G0110.G)*

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interRAI HC Item	MDS Item
EATING—How eats and drinks (regardless of skill). Includes intake of nourishment by other means (e.g., tube feeding, total parenteral nutrition) *(Item G.2.j)*	**EATING** - how resident eats and drinks, regardless of skill. Do not include eating/drinking during medication pass. Includes intake of nourishment by other means (e.g., tube feeding, total parenteral nutrition, IV fluids administered for nutrition or hydration) *(Item G0110.H)*
TOILET USE—How uses the toilet room (or commode, bedpan, urinal), cleanses self after toilet use or incontinent episode(s), changes pad, manages ostomy or catheter, adjusts clothes — exclude transfer on and off toilet *(Item G.2.h)*	**TOILET USE** - how resident uses the toilet room, commode, bedpan, or urinal; transfers on/off toilet; cleanses self after elimination; changes pad; manages ostomy or catheter; and adjusts clothes. Do not include emptying of bedpan, urinal, bedside commode, catheter bag or ostomy bag. *(Item G0110.I)*
PERSONAL HYGIENE How manages personal hygiene, including combing hair, brushing teeth, shaving, applying make-up, washing and drying face and hands (exclude baths and showers) *(Item G.2.b)*	**PERSONAL HYGIENE** How resident maintains personal hygiene, including combing hair, brushing teeth, shaving, applying makeup, washing/drying face and hands (excludes baths and showers) *(Item G0110.J)*
BATHING How takes a full-body bath/shower. Includes how transfers in and out of tub or shower, and how each part of body is bathed: arms, upper and lower legs, chest, abdomen, perineal area (excludes washing of back and hair) *(Item G.2.a)*	**BATHING** How resident takes full-body bath/shower, sponge bath, and transfers in/out of tub/shower (excludes washing of back and hair) *(Item G0120.A)*
TRANSFER TOILET How moves on and off toilet or commode *(Item G.2.g)*	**TOILET TRANSFER** The ability to safely get on and off a toilet or commode *(Item GG0170.F)*

Statistical Analysis

For the multivariable analyses, Hilltop fit logistic regression models to the binary outcome of an index HE resulting in a repeat HE within 30 days of initial discharge. The primary independent variables were the patients' responses to the behavioral, cognitive, and functional items linked between the interRAI HC and MDS assessments. We restricted discharge dates for included index HEs to range from July 1, 2018, to May 31, 2020, to ensure that the begin date of any repeat HE occurred before the end of FY 2020. The models adjusted for the following: age at admission, race, sex, reported marital status, calendar quarter of admission, an indicator for whether any part of the HE occurred in the ED, an indicator for any HE in the 6 months prior to the index HE, count of diagnosed chronic conditions, and count of diagnosed disabilities.

Hilltop fit two nested logistic regression models. The first logistic regression model, termed the base model, assessed the binary outcome as a function of the demographic, episode-related, and diagnostic covariates collectively. Observations in this model were limited to index HEs where the patient's pre-episode LTSS setting was NF or HCBS, the patient had an interRAI or

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MDS assessment administered within a year prior to admission, the patient did not die during the index HE, and they were not discharged to hospice care.

The second model, termed the expanded model, assessed the outcome as a function of covariates from the base model and all primary independent variables collectively. In addition to meeting the inclusion criteria for the base model, observations in the expanded model had to have nonskipped responses to all of the behavioral, cognitive, and functional items in their most recent interRAI HC or MDS assessment.[2] Before fitting the expanded model, Hilltop calculated the pairwise correlations among components of the three classes of primary independent variables (cognitive, behavioral, functional) to confirm that including the variables in the same model would not introduce excessive multicollinearity.

From all the models, coefficients and 95% confidence intervals (CIs) are reported as adjusted odds ratios (AORs). Hilltop's team assessed statistical significance of regression coefficients at the 5% level using double-sided Wald tests and reported the resulting P values. To assess the predictive utility of the models, Hilltop reported the area under the receiver operator characteristic curve (AUC-ROC).
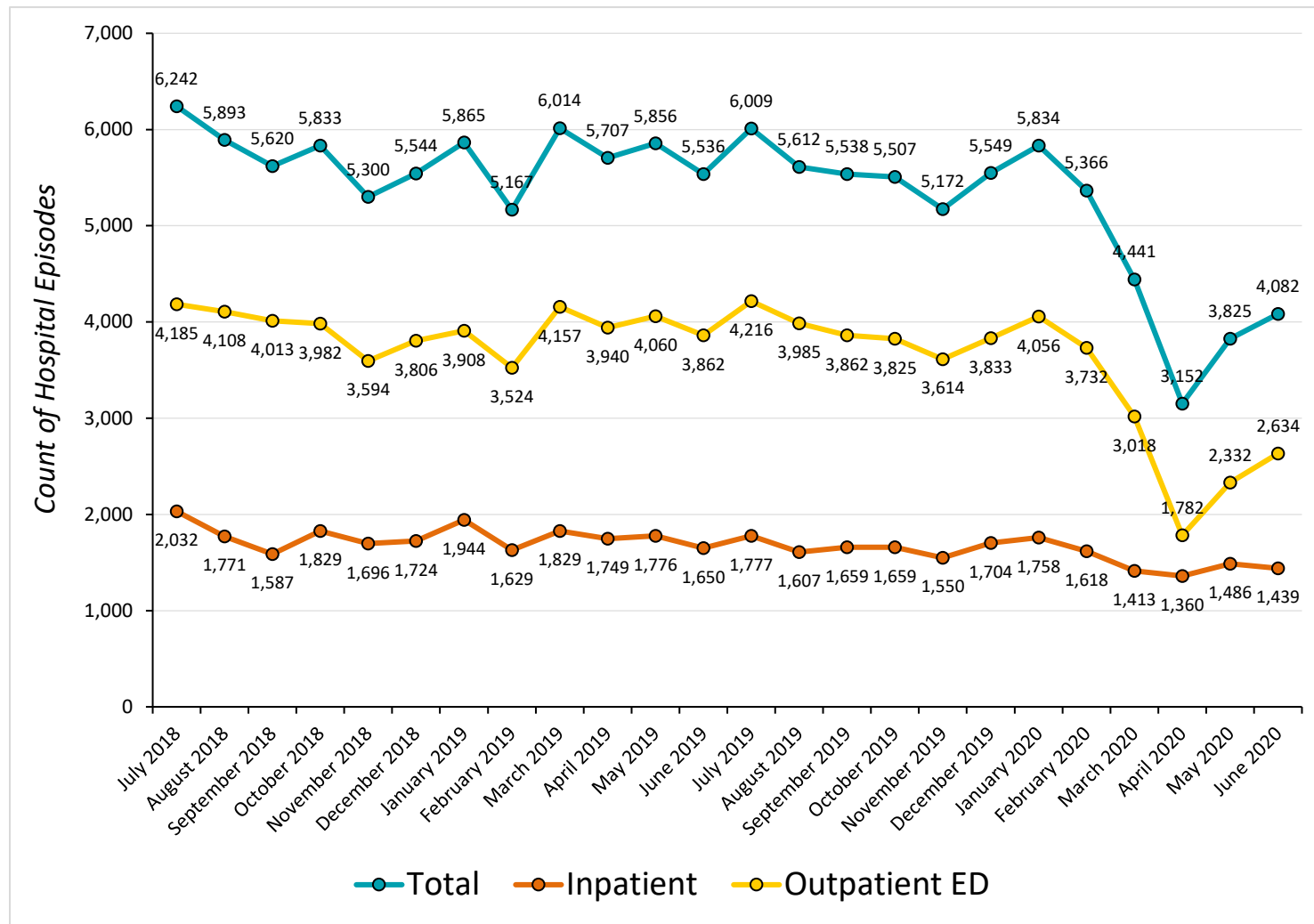
Results

Characteristics of Hospital Events

Hilltop identified 128,664 HEs with admission dates within the specified date range (July 1, 2018, to June 30, 2020). The episodes occurred among 40,859 dually eligible beneficiaries and comprised 40,246 (31.3%) inpatient admissions, 88,028 (68.4%) outpatient ED HEs, and 390 (0.3%) outpatient observation HEs. Figure 1 on the following page displays the monthly counts of inpatient HEs, outpatient observation HEs, and total HEs over the study period. The average length of stay for inpatient HEs was 8.8 days, with a median of 6 days. The dip in the monthly trend of total HEs beginning in April 2020 marks the impact of the onset of the COVID-19 pandemic in restricting acute health care utilization for noninfectious conditions.

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[2] Although only completed assessments were included in the analysis, some of the items that the study team linked between the interRAI HC and MDS did not require responses where the instrument's branching logic allowed the question to be skipped for various reasons, such as answers to previous questions or if the respondent met certain criteria.

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Figure 1. Monthly Trend of Included Hospital Episodes among Dually Eligible Beneficiaries in Maryland

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The dually eligible beneficiaries who experienced the included HEs were mostly female (62%), non-White (59%), and in the Medicaid S02 coverage group for Supplemental Security Income recipients (61%) (see Table 5). About half (56%) of all HEs occurred among beneficiaries older than 60 years at admission. The most prevalent principal diagnoses were sepsis, chest pain, urinary tract infection (UTI), and chronic obstructive pulmonary disorder (COPD). Most (75%) patients were discharged to their homes at the conclusion of the episode.

Table 5. Characteristics of Patients in Hospital Episodes

Patient Characteristics		n	%
N = 40,859 patients			
Sex	Female	25,302	61.9%
	Male	15,557	38.1%
Race/ethnicity	White	16,684	40.8%
	Black	18,042	44.2%
	Asian	2,709	6.6%
	Hispanic	1,418	3.5%
	Other	2,006	4.9%
Medicaid coverage group at first episode	S02 (SSI)	24,847	60.8%
	L98 (ABD LTC)	6,101	14.9%
	H01 (HCBS waiver)	2,976	7.3%
	F05 (parents/primary caretakers <123% FPL)	2,689	6.6%
	S98 (ABD medically needy)	1,833	4.5%
	Other	2,413	5.9%
N = 128,664 episodes			
Age at admission (years)	<50	35,073	27.3%
	50-54	9,787	7.6%
	55-69	12,353	9.6%
	60-64	11,250	8.7%
	65-69	15,825	12.3%
	70-74	12,983	10.1%
	75-79	10,292	8.0%

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Patient Characteristics		n	%
N = 40,859 patients			
	80+	21,101	16.4%
Top 5 DRGs (inpatient HEs only)	871 (sepsis)	3,847	9.6%
	885 (psychoses)	1,626	4.0%
	291 (heart failure)	1,312	3.3%
	189 (respiratory failure)	878	2.2%
	872 (septicemia)	854	2.1%
Top 5 principal ICD-10-CM diagnosis	A419 (sepsis)	4,038	3.1%
	N390 (UTI)	3,040	2.4%
	R079 (chest pain)	2,812	2.2%
	R0789 (chest pain)	2,726	2.1%
	J441 (COPD)	2,103	1.6%
Patient Disposition	Discharged home	95,804	74.5%
	SNF transfer	14,489	11.3%
	Home care	6,831	5.3%
	Left against advice	3,385	2.6%
	Death	2,248	1.8%
	Other	5,907	4.6%

ABD: aged, blind, or disabled, FPL: federal poverty level, QMB: qualified Medicare beneficiary, SLMB: specified low-income Medicare beneficiary, SNF: skilled nursing facility, SSI: Supplemental Security Income

Incidence of Repeat Hospital Episodes

Hilltop identified 38,780 repeat HEs that occurred within 30 days of a previous HE by the same patient (see Table 6). This puts the 30-day repeat HE rate at 30.1% of HEs. Restricting index episodes to the 40,246 inpatient HEs, there were 5,979 (14.9%) 30-day inpatient repeat HEs.

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Table 6. Number and Percentage of Repeat Hospital Episodes

Hospital Episode		Total Repeat HEs (*N* = 38,780)
Type of index episode	Inpatient stay	11,074 (28.6%)
	ED visit	27,583 (71.1%)
	Observation stay	123 (0.3%)
Setting of repeat HE	Inpatient stay	11,837 (30.5%)
	ED visit	26,830 (69.2%)
	Observation stay	113 (0.3%)
Same-cause repeat HE (inpatient repeat HEs of index inpatient HEs only)*		909 (9.0%)
Repeat HE occurred with same provider as HE**		25,425 (65.6%)
Discharge status of index episode	Discharged to home	30,132 (77.7%)
	Discharged to SNF	3,870 (10.0%)
	Discharged to home care	2,205 (5.7%)
	Left against advice	1,379 (3.6%)
	Other	2,573 (6.6%)
Discharge status of repeat HE	Discharged to home	28,900 (74.5%)
	Discharged to SNF	4,199 (10.8%)
	Discharged to home care	2,083 (5.4%)
	Left against advice	1,310 (3.4%)
	Death	617 (1.6%)
	Other	1,194 (3.1%)

*The denominator includes 10,127 index inpatient stays with non-missing Medicare Severity Diagnosis. Related Groups (MS-DRG) and followed by a subsequent inpatient stay within 30 days of initial discharge. The numerator includes repeat inpatient stays with the same MS-DRG as the index inpatient stay.

**Providers were identified using the facility's national provider identifier (NPI) number on the claim.

Pre-Episode LTSS Settings

Out of 128,664 HEs, there were 21,144 HEs (16.4%) in which the beneficiary recorded a nursing facility claim within 1 year prior to the HE admission date and 30,221 HEs (23.5%) in which an HCBS claim was recorded over the same period. The median intervals from the HE admission date to the prior nursing facility claim and to the prior HCBS claim were 5 days and 1 day, respectively. Based on which type of claim was closer to the HE admission date, Hilltop assigned a pre-episode setting of nursing home facility to 18,127 (14.1%) HEs and a pre-episode setting of HCBS to 27,884 (21.7%) HEs.

The assigned post-episode settings demonstrated acceptable durability. Hilltop found that, in 77.1% of HEs in the nursing facility pre-episode setting, the patient had a nursing home claim in at least four of the six months preceding the HE. The HCBS pre-episode setting also had 86.8% of HEs in which the patient had an HCBS claim in at least four of six months preceding the HE.

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Behavioral, Functional, and Cognitive Characteristics of Dually Eligible Patients in Hospital Episodes

The patient received a qualifying MDS or interRAI HC assessment within 1 year prior to admission in 42,375 (32.9%) of 128,664 HEs. There were 23,084 HEs in which the MDS was the most recent assessment, and 19,291 HEs in which the interRAI HC was the most recent assessment. The median duration between the assessment date and HE admission date was 34 days for MDS assessments and 154 days for interRAI HC assessments. Table 7 shows the reasons for administering the included assessments.

**Table 7. Reasons for MDS and interRAI HC Assessments
Administered Prior to HE Admission**

interRAI HC Assessments (*N* = 19,291 hospital episodes)		MDS Assessments (*N* = 23,084 hospital episodes)	
Reason for Assessment	*N (%)*	*Reason for Assessment*	*N (%)*
First/original assessment	3,445 (17.9%)	Admission assessment	809 (3.5%)
Routine reassessment	15,217 (78.9%)	Annual assessment	1,655 (7.2%)
Return reassessment	166 (0.9%)	Quarterly review	7,578 (32.8%)
Significant change in status	395 (2.1%)	Significant change in status	617 (2.7%)
Other	68 (0.4%)	Other	12,425 (53.8%)

Among 38,780 index HEs that had a repeat HE within 30 days of discharge, Hilltop noted 11,029 index HEs in which the pre-episode setting was NF or HCBS, and the patient had a recently administered interRAI HC or MDS assessment. Table 8 lists the distribution of responses from these patients to the linked items from the assessments. In more than half of the index HEs that resulted in repeat episodes, patients reported difficulty with locomotion (74%), self-dressing (83%), eating (52%), toilet use (76%), personal hygiene (85%), and bathing (93%).

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Table 8. Behavioral, Functional, and Cognitive Characteristics of Patients in Repeat HEs

Domain of Linked Item from interRAI HC & MDS Assessments	Linked Item from interRAI HC & MDS Assessments	Index Episodes that Resulted in Repeat Hospital Episodes (*N* = 11,029)
BEHAVIORAL	Self-injurious	288 (2.6%)
	Physical abuse exhibited	328 (3.0%)
	Verbal abuse exhibited	1,033 (9.4%)
	Wandering	558 (5.1%)
	Inappropriate public behavior	242 (2.2%)
FUNCTIONAL	Bed mobility dependence	4,886 (44.3%)
	Locomotion dependence	8,167 (74.1%)
	Dressing dependence	9,114 (82.6%)
	Eating dependence	5,747 (52.1%)
	Toilet use dependence	8,403 (76.2%)
	Personal hygiene dependence	9,325 (84.5%)
	Bathing dependence	10,197 (92.5%)
	Toilet transfer dependence	3,380 (30.6%)
COGNITIVE	Short-term memory issue(s)	4,197 (38.1%)
	Cognitive impairment in daily decisions	5,083 (46.1%)
	Impairment in comprehension	4,232 (38.4%)
	Hearing difficulty	2,655 (24.1%)
	Vision impairment	4,191 (38.0%)
	Easily distractible	3,197 (29.0%)
	Disorganized thinking	1,965 (17.8%)

Associations of Behavioral, Functional, and Cognitive Characteristics with Risk of Repeat Hospital Episodes

There were 34,354 index HEs by 12,387 unique patients that met the criteria for inclusion in the base regression model. Specifically, the pre-episode LTSS setting of the HEs was NF or HCBS, the patient had an interRAI or MDS assessment administered over the same period, the patient did not die during the index HE, and they were not discharged to hospice care (Figure 2). The HEs comprised 18,734 episodes with admission dates in FY 2019 (55%) and 15,620 episodes that began during FY 2020 (45%). Specifically, there were 14,693 inpatient admissions, 19,576 ED visits, and 85 observation stays.

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Figure 2. Flow Diagram Showing Stages of Inclusion and Exclusion Criteria for Regression Analyses
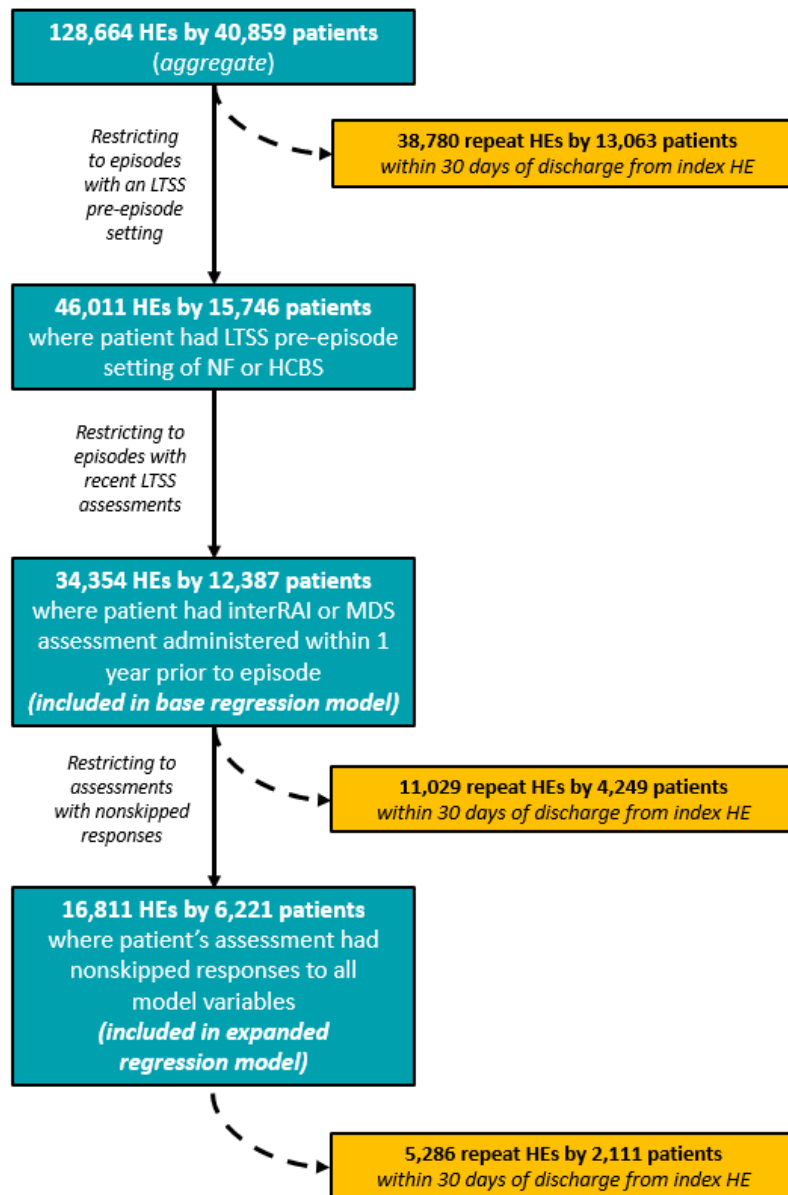

Table 9 describes the patient demographics, pre-episode LTSS settings, and episode-related characteristics of the HEs included in the regressions. Most patients were older than 70 years, female, and not married. The majority of patients were recently receiving HCBS prior to their admission. There were fewer episodes between April and June, likely due to reduced utilization brought on by the COVID-19 pandemic during the last quarter of FY 2020. About one third (32%) of these index HEs were followed by a repeat HE within 30 days of initial discharge.

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Table 9. Demographics, Episode-Related Characteristics, and Pre-Episode Settings of Hospital Episodes Included in Regressions

Attributes		*N* = 34,354 HEs
Mean age at admission in years (median)		70.3 (72)
Female sex, n (%)		21,721 (63.2%)
Patient's race/ethnicity, n (%)	White	15,065 (43.9%)
	Black	15,006 (43.7%)
	Hispanic	808 (2.4%)
	Other	3,475 (10.1%)
Married or have partner, n (%)		5,445 (15.9%)
Calendar quarter of admission, n (%)	January – March	9,151 (26.6%)
	April – June	6,568 (19.1%)
	July – September	9,422 (27.4%)
	October – December	9,213 (26.8%)
Prior HE within previous 6 months, n (%)		20,703 (60.3%)
Repeat acute episode occurred within	7 days after discharge	4,068 (11.8%)
	30 days after discharge	11,029 (32.1%)
Pre-episode LTSS setting, n (%)	*NF*	14,467 (42.1%)
	HCBS	19,887 (57.9%)
Source of most recent assessment	*MDS*	17,502 (51.0%)
	interRAI HC	16,852 (49.1%)

Table 10 shows the associations from the base logistic regression model of demographic and clinical characteristics, episode-related characteristics, and pre-episode LTSS setting with risk of an index HE resulting in a repeat HE within 30 days of initial discharge. Within the cohort of individuals receiving LTSS, being seen in the ED during the index episode, having a prior hospital episode, having disabilities, and recent use of HCBS services significantly increased the risk of a repeat HE. Older age, female sex, and being of Asian or Native American race, however, were protective factors. The AUC-ROC for the base model was 0.658.

Table 10. Adjusted Associations of Base Model Covariates with Odds of Repeat Hospital Episodes

Covariate		Adjusted Odds Ratio	*P*	Lower 95% CI	Upper 95% CI
Age at admission		0.99**	<0.001	0.99	0.99
Patient's race [reference = White]	*Black*	0.99	0.791	0.94	1.04
	Asian	0.72**	<0.001	0.65	0.81
	Hispanic	0.93	0.363	0.79	1.09
	Native American	0.39*	0.038	0.16	0.95
	Unknown	0.75**	0.002	0.63	0.90
	Other	1.04	0.738	0.83	1.29

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Covariate		Adjusted Odds Ratio	P	Lower 95% CI	Upper 95% CI
Female sex		0.91**	<0.001	0.86	0.95
Married		0.94	0.085	0.88	1.01
Calendar quarter of admission [reference = Jan - Mar]	*Apr - Jun*	1.05	0.205	0.98	1.12
	Jul - Sep	1.22**	<0.001	1.15	1.30
	Oct - Dec	1.06	0.086	0.99	1.13
Includes ED component		1.28**	0.001	1.11	1.47
Admission in prior 6 months		2.58**	<0.001	2.45	2.72
Count of chronic conditions		1.00	0.231	0.99	1.00
Count of disabilities		1.02*	0.046	1.00	1.04
Pre-episode LTSS setting is HCBS [reference = nursing facility]		1.10**	<0.001	1.05	1.16
Constant term		0.48**	<0.001	0.40	0.59

*p<0.05. **p<0.01.

Within each of the three classes of primary independent variables, the component items showed low to moderate correlation. So, the expanded model included all of the covariates from the base model, as well as all of the behavioral, cognitive, and functional indicators linked from the MDS and interRAI HC assessments. There were 16,811 index HEs by 6,221 unique patients that met the criteria for inclusion in the expanded regression model. This model demonstrates the added predictive value from—and significant characteristics from—the addition of LTSS assessment data. The model results shown in Table 11 report that these four cognitive and behavioral characteristics were significantly associated with increased odds of a repeat HE: (1) hearing difficulty (AOR = 1.10 [95% CI: 1.02 - 1.19], *P* = 0.02), (2) being easily distractible (AOR = 1.09 [1.00 - 1.18], *P* = 0.04), (3) being self-injurious (AOR = 1.33 [1.09 - 1.63], *P* = 0.005), and (4) exhibiting verbal abuse (AOR = 1.15 [1.02 - 1.30], *P* = 0.02). Two functional characteristics— dependence for eating (AOR = 0.91 [0.83 - 0.99], *P* = 0.04) or bathing (AOR = 0.79 [0.67 - 0.92], *P* = 0.002)—and displaying inappropriate behavior in public (AOR = 0.62 [0.42 - 0.92], *P* = 0.02) were negatively associated with the outcome. At 0.661, the AUC-ROC for the expanded model was slightly higher than for the base model.

Table 11. Adjusted Associations of Behavioral, Functional, and Cognitive Characteristics with Odds of Repeat Hospital Episodes

Covariate		Adjusted Odds Ratio [95% CI]	P
BEHAVIORAL	Self-injurious	1.33** [1.09 - 1.63]	0.005
	Physical abuse exhibited	1.02 [0.81 - 1.29]	0.885
	Verbal abuse exhibited	1.15* [1.02 - 1.30]	0.022
	Wandering	1.05 [0.91 - 1.21]	0.500
	Inappropriate public behavior	0.62* [0.42 - 0.92]	0.018
FUNCTIONAL	Bed mobility dependence	1.02 [0.92 - 1.13]	0.688
	Locomotion dependence	0.95 [0.87 - 1.03]	0.237

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Covariate		Adjusted Odds Ratio [95% CI]	P
	Dressing dependence	1.02 [0.92 - 1.14]	0.679
	Eating dependence	**0.91* [0.83 - 0.99]**	**0.036**
	Toilet use dependence	0.95 [0.85 - 1.06]	0.374
	Personal hygiene dependence	0.99 [0.90 - 1.09]	0.887
	Bathing dependence	**0.79** [0.67 - 0.92]**	**0.002**
	Toilet transfer dependence	1.04 [0.93 - 1.16]	0.491
COGNITIVE	Short-term memory issue(s)	1.06 [0.98 - 1.15]	0.170
	Cognitive impairment in daily decisions	0.94 [0.85 - 1.04]	0.222
	Impairment in comprehension	1.00 [0.91 - 1.09]	0.966
	Hearing difficulty	**1.10* [1.02 - 1.19]**	**0.016**
	Vision impairment	1.01 [0.93 - 1.08]	0.878
	Easily distractible	**1.09* [1.00 - 1.18]**	**0.044**
	Disorganized thinking	1.02 [0.93 - 1.11]	0.726

*p<0.05. **p<0.01. Covariates in bold font were significantly associated with the outcome at the 5% level. Coefficients are adjusted for patient's age at admission, race, sex, reported marital status, calendar quarter of admission, an indicator for whether any part of the HE occurred in the ED, an indicator for any HE in the 6 months prior to the index HE, count of diagnosed chronic conditions, and count of diagnosed disabilities.

Conclusion

The findings of this analysis affirm that data from LTSS assessments in the institutional and community-based settings contribute important information to evaluating the risk of adverse outcomes for dually eligible patients who transition between hospitals and LTSS settings. Hilltop identified four cognitive and behavioral characteristics sourced from the interRAI HC assessment and the federal MDS data set that raised the likelihood of repeated hospital encounters among this population. In the state of Maryland, the databases of these LTSS assessments— *LTSSMaryland* and the federal MDS repository—are not officially linked and are largely unavailable to acute care providers. However, this information gap is fully remediable and could even be automated. The results of Hilltop's studies indicate that formalizing and strengthening the data linkage between LTSS and hospital providers by facilitating access to key information from patients' cognitive and functional assessments can significantly improve the quality of transitional care.

As with all studies, it is important to consider the limitations to the inferences from these studies. The occurrence of the COVID-19 pandemic toward the end of the study period placed restrictions on acute utilization, which may have reduced the frequency of HEs during the final quarter of FY 2020 and may have artificially reduced the number of repeat HEs (if patients could not or chose not to return to the hospital for fear of viral infection). Hilltop did not have access to data to control for quality of hospital care or for the quality of care provided to discharged patients in NFs or in the community. Because the number of independent primary variables was already high relative to the count of model observations, we were constrained to reduce the patients' responses to binary indicators that obscured the granularity in the actual degree of impairment reported in the assessments. However, even with those limitations, we are confident

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that these findings are a true representation of the utilization of the study cohort, and that these patterns will be found in other states and across time.

Apart from the immediate impact on reducing the risk of repeat hospitalizations, it is important to consider efficiency returns of integrating key LTSS assessment information into the robust HIE infrastructure that already exists in the state of Maryland. In the context of inpatient care, having access to information on the patient's physical, mental, and functional health status at the point of admission will save critical resources that would otherwise have been spent on unnecessary diagnostics or testing. The acute care team would also be better prepared for the patient's admission, ensuring that all appropriate personnel needed to manage indicated conditions and limitations are readily available. There are several interventions that have been developed and tested to address the risk factors we have identified as significantly associated with risk of repeat hospital encounters. For example, aggressive behavior in the hospital setting could be mitigated by adapting the environment to lower stimuli that trigger challenging or dangerous behaviors. Such triggers might include unmet physical, social, and emotional needs that the patient is not able to articulate clearly, resulting in agitative behavior (Lourida et al., 2020; Wharton et al., 2019). While pharmacologic interventions have been deemed effective, recent evidence suggests that a multidisciplinary assessment and care plan involving behavior specialists, and introducing activity interventions such as tailored music, art, and social therapy could also help to reduce agitative behavior among older adults hospitalized with dementia (Lourida et al., 2019; Watt et al., 2019).

There are also other potential benefits. Automating the timely transfer of relevant patient indicators between acute and LTSS settings would likely reduce the amount of time care coordinators spend communicating about patients and assessing care goals with acute care providers (Popejoy et al., 2015). Better coordination of care across settings is also associated with greater trust and confidence in providers and higher patient satisfaction, metrics that are increasingly important in patient-centered health care (Fan et al., 2005; Mainous et al., 2001; Nyweide, 2014).

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References

Barth, S., Silow-Carroll, S., Reagan, E., Russell, M., & Simmons, T. (2019). *Care coordination in integrated care programs serving dually eligible beneficiaries–Health plan standards, challenges and evolving approaches*. Report to the Medicaid and CHIP Payment and Access Commission. Lansing, MI: Health Management Associates.

Bennett, K. J., & Probst, J. C. (2016). Thirty-day readmission rates among dual-eligible beneficiaries. *The Journal of Rural Health*, *32*(2), 188–195.

Blumberg, L. J., Waidmann, T. A., Blavin, F., & Roth, J. (2014). Trends in health care financial burdens, 2001 to 2009. *The Milbank Quarterly*, *92*(1), 88–113.

Burke, R. E., Whitfield, E. A., Hittle, D., Min, S., Levy, C., Prochazka, A. V., Coleman, E. A., Schwartz, R., & Ginde, A. A. (2016). Hospital readmission from post-acute care facilities: Risk factors, timing, and outcomes. *Journal of the American Medical Directors Association*, *17*(3), 249–255.

Cai, Q., Salmon, J. W., & Rodgers, M. E. (2009). Factors associated with long-stay nursing home admissions among the US elderly population: Comparison of logistic regression and the Cox proportional hazards model with policy implications for social work. *Social Work in Health Care*, *48*(2), 154–168.

Centers for Medicare & Medicaid Services. (2022). *Preliminary Medicare COVID-19 data snapshot*. https://www.cms.gov/files/document/medicare-covid-19-data-snapshot-fact-sheet.pdf

Congressional Budget Office. (2012). *Lessons from Medicare's demonstration projects on disease management, care coordination, and value-based payment*. https://www.cbo.gov/sites/default/files/cbofiles/attachments/WP2012-01_Nelson_Medicare_DMCC_Demonstrations.pdf

Cross, D. (2018). *Electronic information sharing to improve post-acute care transitions* [PhD Thesis]. https://deepblue.lib.umich.edu/bitstream/handle/2027.42/146031/dacross_1.pdf?sequence=1

Fan, V. S., Burman, M., McDonell, M. B., & Fihn, S. D. (2005). Continuity of care and other determinants of patient satisfaction with primary care. *Journal of General Internal Medicine*, *20*(3), 226–233.

Grabowski, D. C. (2007). Medicare and Medicaid: Conflicting incentives for long-term care. *The Milbank Quarterly*, *85*(4), 579–610.

Henderson, M., Han, F., Perman, C., Haft, H., & Stockwell, I. (2022). Predicting avoidable hospital events in Maryland. *Health Services Research*, *57*(1), 192–199.

The Hilltop Institute

Hewner, S., Chen, C., Anderson, L., Pasek, L., Anderson, A., & Popejoy, L. (2021). Transitional care models for high-need, high-cost adults in the United States: A scoping review and gap analysis. *Professional Case Management*, *26*(2), 82–98.

Howell, S., Silberberg, M., Quinn, W. V., & Lucas, J. A. (2007). Determinants of remaining in the community after discharge: Results from New Jersey's Nursing Home Transition Program. *The Gerontologist*, *47*(4), 535–547.

Jencks, S. F., Williams, M. V., & Coleman, E. A. (2009). Rehospitalizations among patients in the Medicare fee-for-service program. *New England Journal of Medicine*, *360*(14), 1418–1428.

Kelly, A., Conell-Price, J., Covinsky, K., Cenzer, I. S., Chang, A., Boscardin, W. J., & Smith, A. K. (2010). Length of stay for older adults residing in nursing homes at the end of life. *Journal of the American Geriatrics Society*, *58*(9), 1701–1706.

Lourida, I., Gwernan-Jones, R., Abbott, R., Rogers, M., Green, C., Ball, S., … & Thompson Coon, J. (2020). Activity interventions to improve the experience of care in hospital for people living with dementia: a systematic review. *BMC Geriatrics, 20*(1), 1-14.

Mainous, A. G., Baker, R., Love, M. M., Gray, D. P., & Gill, J. M. (2001). Continuity of care and trust in one's physician: Evidence from primary care in the United States and the United Kingdom. *Fam Med*, *33*(1), 22–27.

Medicare Payment Advisory Commission and the Medicaid and CHIP Payment and Access Commission. (2022). *Data book: Beneficiaries dually eligible for Medicare and Medicaid— February 2022*. https://www.macpac.gov/wp-content/uploads/2022/02/Beneficiaries-Dually-Eligible-for-Medicare-and-Medicaid-February-2022.pdf

Nyweide, D. J. (2014). Concordance between continuity of care reported by patients and measured from administrative data. *Medical Care Research and Review*, *71*(2), 138–155.

Pham, H. H., Schrag, D., O'Malley, A. S., Wu, B., & Bach, P. B. (2007). Care patterns in Medicare and their implications for pay for performance. *New England Journal of Medicine*, *356*(11), 1130–1139. https://doi.org/10.1056/NEJMsa063979

Popejoy, L. L., Jaddoo, J., Sherman, J., Howk, C., Nguyen, R., & Parker, J. C. (2015). Monitoring resource utilization in a health care coordination program. *Professional Case Management*, *20*(6), 310–320.

Rahman, M., Grabowski, D. C., Gozalo, P. L., Thomas, K. S., & Mor, V. (2014). Are dual eligibles admitted to poorer quality skilled nursing facilities? *Health Services Research*, *49*(3), 798–817.

Ring, J. C., & Chao, S. M. (2006). *Performance measurement: Accelerating improvement*. https://www.ncvhs.hhs.gov/wp-content/uploads/2014/05/060222p1.pdf

The Hilltop Institute

Sato, M., Shaffer, T., Arbaje, A. I., & Zuckerman, I. H. (2011). Residential and health care transition patterns among older Medicare beneficiaries over time. *The Gerontologist*, *51*(2), 170–178.

Thorpe, K. E. (2011). *Estimated federal savings associated with care coordination models for Medicare-Medicaid dual eligibles*. https://www.kff.org/wp-content/uploads/sites/2/2011/09/dual-eligible-study-september-2011.pdf

Walsh, E. G., & Clark, W. D. (2002). Managed care and dually eligible beneficiaries: Challenges in coordination. *Health Care Financing Review*, *24*(1), 63.

Watt, J. A., Goodarzi, Z., Veroniki, A. A., Nincic, V., Khan, P. A., Ghassemi, M., ... & Straus, S. E. (2019). Comparative efficacy of interventions for aggressive and agitated behaviors in dementia: a systematic review and network meta-analysis. *Annals of Internal Medicine*, 171(9), 633-642.

Wharton, T., Paulson, D., Burcher, K., & Lesch, H. (2019). Delirium and antipsychotic medications at hospital intake: screening to decrease likelihood of aggression in inpatient settings among unknown patients with dementia. *American Journal of Alzheimer's Disease & Other Dementias*, *34*(2), 118-123.

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