The Hilltop Institute

analysis to advance the health of vulnerable populations

Examining the Medicare Resource Use of Dually Eligible Medicaid Recipients

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Executive Summary

As part of its larger effort to examine the coordination of care for Medicaid recipients who are dually eligible for Medicare benefits (or duals, for short), the Maryland Department of Health and Mental Hygiene is exploring the cross-payer effects of providing Medicaid long-term supports and services (LTSS) on Medicare acute care resource use under a grant from the Robert Wood Johnson Foundation (Changes in Health Care Financing and Organization Grant #63756). The study, entitled *Medicaid Long-Term Care Programs: Simulating Rate Setting and Cross-Payer Effects*, is exploring these issues primarily from the perspective of state Medicaid program administrators, for issues related to setting Medicaid payment rates in particular. This document is the third in a series of four reports planned under the grant.

The first report in this series focused on a basic analytical framework for examining Medicare and Medicaid data together. The second report examined Medicaid expenditures within the context of rate setting for managed long-term care. This third report reflects an exploratory analysis of the relationships between Medicare resource use and Medicaid LTSS to address the question: Does providing Medicaid LTSS influence dually eligible Medicaid recipients' use of Medicare resources and, if so, how and to what extent? Much like the first two reports, this report is intended to provide general background information on the interplay of Medicare and Medicaid resources using data from one state—Maryland—as an example for analysts who are beginning to examine similar issues at the state and federal levels.

Report Highlights

This report addresses three broad objectives: (1) to provide an overview of Medicare services and expenditures for dually eligible Medicaid recipients in Maryland; (2) to serve as a primer on analytic methods needed to assess differences related to some given "treatment" effect; and (3) to specifically examine the effects of Medicaid LTSS on Medicare resource use.

The Study Population and Measures of Resource Use

As a companion to the previous reports in this series, the first objective is to provide detail about the Medicare resource use of beneficiaries who are dually eligible for Medicaid. Continuously enrolled duals in Maryland during 2006 were arrayed—as a whole and by selected grouping criteria—with respect to age, sex, and 20 chronic condition indicators. The chronic conditions examined include those identified by the Centers for Medicare and Medicaid Services (CMS) for targeted analysis related to Medicare beneficiaries in the federal Chronic Condition Data Warehouse (CCW).

The study population was arrayed by:

- The study population as a whole
- Status at the end of the study year (12-month enrollees versus those who died)
- Original reason for Medicare entitlement ("ever disabled" versus old age only)
- A frailty marker based on diagnoses that were found by Adjusted Clinical Group (ACG) software developers to be associated with significant functional support needs
- Home and Community-Based Service (HCBS) waiver enrollment, specifically Maryland's Living at Home (LAH) Waiver, Older Adults Waiver (OAW), and combined Community Pathways and New Directions (DD) Waivers for those with a developmental disability.

Total and component Medicare service use and payments during the study year are reported by those characteristics and groupings.

Analytic Methods

A second objective, in keeping with each report in this series so far, is to provide an initial understanding of the technical detail that underlies analyses regarding the integration of Medicare and Medicaid services and costs as a primer for analysts who are new to these issues. While the first two reports emphasized differences in benefits, overall payments, and the general structure of the separate programs, this report emphasizes the analytic methods required to assess quantitative differences in a series of measures across comparable groups. A full sequence of the considerations that underlie inference testing on, in this case, Medicare resource use is covered, including: providing a rationale for, and detail needed to undertake, propensity score matching to establish comparison groups; describing appropriate statistical methods to test the significance of differences between those groups on various resource measures and the technical interpretation of subsequent results; and potential refinements for future analyses that might be considered to improve the preliminary analyses reported here.

The general analytic approach reflected in this report involves identifying various subgroups of Medicaid recipients who are known to use LTSS and then identifying control groups of comparable recipients who do not use those services. Control groups are identified using propensity score matching techniques. Such techniques make it possible to account for an array of covariate factors, such as the demographic characteristics and medical conditions noted above. Cross-payer effects are examined for a broad array of measures related to Medicare service use and costs using statistical tests of differences between those who receive support services (designated as the "treatment" group) and the matched-sample control groups. These analyses were limited to duals who were continuously enrolled for 12 months in 2006. Those who died were excluded to limit the confounding effect of resource use in the last months of life.

For the subgroup analyses:

- A treatment group drawn from the OAW, which provides HCBS supports to participants who are 50 years of age and older, is compared to matched controls drawn from the community who had not otherwise used Medicaid-paid community-based supports.
- A treatment group drawn from the LAH Waiver, which provides HCBS supports to participants who are 18 to 64 years of age, is compared to matched controls drawn from the community who had not otherwise used Medicaid-paid community-based supports. These duals were first eligible for Medicare benefits because of a disability.
- A treatment group drawn from among those who received medical day care (MDC) but no other waiver or long-term institutional care is compared to matched controls drawn from the community who had not otherwise used Medicaid-paid community-based supports.
- A treatment group drawn from the OAW is compared to matched controls drawn from among duals who were in a Medicaid paid long-term nursing facility (LT-NF) stay.

Some results regarding subgroup cohorts drawn from Maryland's LAH Waiver and those who used MDC, in particular, are included in this report even though some aspects of each of these study components indicate possible confounding factors that raise questions about the success of each analysis. An initial LAH Waiver analysis is shown to be hampered because the study cohort is small and the matching process does not seem to account properly for key clinical factors. Notably, the LAH Waiver population includes a high proportion of individuals with quadriplegia or paraplegia. A revised, more tailored analysis that improves on the consideration of diagnostic criteria was performed. Interestingly, both LAH Waiver analyses have the same general result: waiver participants use more Medicare services, which is largely explained by more durable medical equipment (DME) use; however, other Medicare resource use, such as institutional care, is not significantly different.

Results from the MDC analysis suggest that the lack of better direct information about individuals' functional status is not addressed as well in the propensity score matching phase in this study as it is for the other subgroup analyses. This is largely because MDC appears to be a proxy for a higher level of functioning among those who are frail or chronically ill that is not otherwise evident using the propensity score approach to identify a comparable group. Each of these analyses is retained and discussed in this report despite somewhat questionable results regarding the more central focus on cross-payer effects because they are illustrative of practical issues that are common in such complex analyses.

Subgroup Analyses

The third objective of this report is to examine whether, and how, providing Medicaid LTSS affects Medicare resource use through the subgroup analyses described above. Although a summary of each analysis can be found in the main text of this report, two general aspects of the

effects of Medicaid LTSS on Medicare resource are evident from those results as a whole: (1) Medicaid LTSS provided in the community are associated with an increase in the number of Medicare services used with no, or limited, additional Medicare costs overall, and (2) Medicaid institutional supports offset Medicare resource use overall.

Patterns related to Medicaid supports in the community are embodied in the results for the analysis comparing the OAW treatment group to a control group drawn from the community. Providing OAW community support services is associated with more individuals receiving more Medicare services, but *overall* Medicare resource use, particularly on a per-user cost basis, is not significantly higher for those who receive Medicaid supports. On an unadjusted (raw dollar value) basis, the OAW treatment group accrues 7 percent lower Medicare payments than the matched comparison group. When those payments are transformed to meet assumptions regarding the underlying distribution of the data for more sophisticated regression analysis, the OAW treatment group appears to have higher (adjusted) costs. However, those latter results are the result of removing the effect of more high-cost outlier payments from the control group. The more practical significance of these results is that the OAW treatment group generates fewer Medicare payments overall.

There is also evidence in these results of an overall improvement in the quality of care associated with better de facto coordination of services under the OAW—as suggested by fewer hospital readmissions, fewer skilled nursing facility (SNF) stays, and fewer cases of repeated emergency room (ER) visits for the treatment group. At the same time, higher use rates for home health and DME for the treatment group, which may or may not be due to excessive use of those services, suggest both that OAW enrollees are better "plugged-in" to the Medicare service network—than other comparable Medicaid recipients—and that those other comparable recipients have unmet need to some extent.

Thus, the most notable "treatment" effects of providing Medicaid LTSS in the community are: (1) an increase in services that indicates better access to care, particularly home health and DME, and (2) a decrease in services that suggest less coordinated care, particularly repeated inpatient hospital and SNF stays and longer hospice episodes. This is all the more significant because it takes place in the absence of a more formal managed care environment, such as a Medicare Advantage plan.

The second aspect of the overall effects of Medicaid LTSS on Medicare resources is a reaffirmation of results from the second report in this series regarding Medicaid-paid LT-NF care. Recipients of Medicaid LT-NF care accrued significantly lower Medicare payments—close to $440 per member per month (PMPM) (or 36 percent) less—than did comparable OAW recipients in the community.

Along with the primary results, this report identifies a few issues that deserve further, more detailed analysis, such as the relationship between home health and hospice and the implications

of differing patterns in the receipt of physical and outpatient therapies for those with a nursing home level of care need in the community versus those in a nursing facility.

Next Steps

The fourth and final report in this series will include a review of key findings from each of the preceding reports. It will provide a synthesis of results from the second report (on Medicaid resource use) and the subgroup analyses in this report to explore how lessons learned across subgroups might be applied in considering the development of better integrated/coordinated care for duals, particularly by state-level analysts charged with developing and administering such programs. Finally, the fourth report will also include a summary of selected issues identified in the course of this study that would be useful to include in the development of a subsequent research agenda related to the provision of Medicare and Medicaid services as a whole.

Examining the Medicare Resource Use of Dually Eligible Medicaid Recipients

Introduction

As part of its larger effort to examine the coordination of care for Medicaid recipients who are dually eligible for Medicare benefits (or duals, for short), the Maryland Department of Health and Mental Hygiene is exploring the cross-payer effects of providing Medicaid long-term supports and services (LTSS) on Medicare acute care resource use under a grant from the Robert Wood Johnson Foundation (Changes in Health Care Financing and Organization Grant #63756). The study, entitled *Medicaid Long-Term Care Programs: Simulating Rate Setting and Cross-Payer Effects*, is exploring these issues primarily from the perspective of state Medicaid program administrators, for issues related to setting Medicaid payment rates in particular. This document is the third in a series of four reports planned under the grant.

The first report, *A Framework for State-Level Analysis of Duals: Interleaving Medicare and Medicaid Data* (Tucker, Johnson, Rubin, & Fogler, 2008), presents a basic analytical framework for analyzing Medicare and Medicaid data together. It introduces The Hilltop Crossover Framework (Figure 1) as a tool to conceptually summarize data from linked Medicare and Medicaid claims—with specific reference to Medicaid crossover[1] claims—to support analyses of integrated, or coordinated, care. Written largely as a primer for analysts working with state programs, the first report also includes: (1) a basic introduction to Medicare and Medicaid benefits; (2) a detailed outline of the dually eligible population in Maryland, with reference to select demographic and administrative markers; and (3) an overview of resource use that is revealed in Medicare and Medicaid claims data by type of service using the crossover framework.

The second report under the grant, *Examining Rate Setting for Medicaid Managed Long-Term Care* (Tucker & Johnson, 2009), provides further detail about the overall patterns of Medicare and Medicaid resource use for duals with special emphasis on Medicaid expenditures—represented by the right half of the Crossover Framework. The report outlines considerations that typically underlie a rate setting system for the Medicaid portion of costs associated with coordinated care in an integrated Medicare and Medicaid environment. It also examines those costs in the context of a preliminary Medicaid rate system defined in terms of service-based rate categories that might be used to establish Medicaid capitation rates. The report also presents a simulation of expected and actual costs under such a system, and discusses implications for various components of Medicaid and Medicare costs.

[1] The term "crossover" is commonly used to refer to claims in Medicaid claim files that reflect the portion of Medicare payments that state Medicaid programs are responsible for on behalf of Medicaid beneficiaries. Medicare claims are first processed; then, if the patient is identified as Medicaid, a copy of the claim "crosses over" to the appropriate state Medicaid agency. Crossover payments generally include deductibles and copayments for Medicare-covered services.

Figure 1. The Hilltop Crossover Framework

The Hilltop framework is based on a two-by-two format to array Medicare and Medicaid claims data to highlight relationships between government programs and service use. Medicare and Medicaid claims data are represented to the left and right, respectively.

A MEDICARE claims linked to crossover claims	**B** MEDICAID claims crossover
C MEDICARE claims NOT linked to crossover claims	**D** MEDICAID claims NOT crossover

- **Section A** reflects Medicare activity that can be directly linked to Medicaid crossover claims.
- **Section B** reflects Medicaid crossover claims for Medicare deductibles and copayments.
- **Section C** shows Medicare activity that is not reflected in Medicaid claims.
- **Section D** reflects direct Medicaid benefits that are not otherwise associated with Medicare payments. These are services covered only as a Medicaid benefit, such as long-term custodial care or hospital costs incurred once the Medicare benefit is exhausted.

This third report reflects an exploratory analysis that examines, in greater detail, the Medicare resource use (reflected in the left side of the Crossover Framework) of selected subgroups within the larger dually eligible population. Much like the first two reports, this report is intended to provide general background information about the interplay of Medicare and Medicaid resources using information from one state—Maryland—as an example for analysts who are beginning to examine similar issues at the state and federal levels. At the same time, this report seeks to approach the overarching question underlying this study more directly than it was addressed in the previous reports. Stated in terms of a traditional research question: Does providing Medicaid LTSS influence the use of Medicare resources by dually eligible Medicaid recipients and, if so, how and to what extent? The preliminary results of this report will be used to inform subsequent, more narrowly targeted research.

The general analytic approach used in this analysis involves identifying various subgroups of Medicaid recipients who are known to use home and community-based services (HCBS) and then identifying control groups of comparable recipients who do not use those services. Control groups are identified using propensity score matching techniques that account for an array of covariate factors such as demographic characteristics and medical conditions. Cross-payer effects are examined for a broad array of measures related to Medicare service use and costs

using statistical tests of differences between those who receive support services (designated as the "treatment" group) and matched-sample control groups.

As noted above, this report is more broadly intended as an introduction to many of the considerations needed to address the underlying questions examined here in a more definitive way. In addition to preliminary results on cross-payer effects, key analytic issues that are highlighted include the process of identifying matched treatment and control groups, the application of statistical methods to determine the strength of differences in service use and costs across groups, and potential refinements for future analyses that might be considered to improve the preliminary analyses reported here.

The fourth and final report under the grant will provide a synthesis of results from the second report and the subgroup analyses in this report to explore how the lessons learned about resource use across subgroups might be applied to assumptions about rate setting, particularly by state-level analysts charged to develop and administer programs of integrated care for duals.

A Study Population: Characteristics and Measures of Medicare Resource Use

The primary study population for this report includes Medicaid recipients with full benefits under the program who were continuously enrolled in both Medicare and Medicaid during calendar year 2006. Continuous enrollment is defined to include those who were eligible under both programs as of January 1, 2006, until the end of the year, or until the recipient's death if it occurred before the end of the year. This *excludes* Medicare beneficiaries with partial Medicaid benefits, such as Qualified Medicare Beneficiaries (QMBs) who are not otherwise eligible for LTSS under Medicaid, new enrollees during the year, and those who lost eligibility during the year. The study population is also limited to recipients who were not enrolled in a Medicare Advantage (MA) group health plan during the year because claims data needed to assess Medicare resource use is not reported by MA plans for those individuals.

This section describes the overall analysis population with respect to selected characteristics and measures of Medicare resource use. Distinguishing characteristics described here, such as diagnoses and other grouping criteria, will be used in a subsequent section to define treatment and matched control groups as noted above. Measures of Medicare services and costs will then be used as outcome measures to test the significance of differences in resource use between those groups.

Grouping Criteria and Other Distinguishing Characteristics

The primary grouping criteria that are used to support this analysis reflect specific subsets of recipients who receive LTSS under Medicaid. This includes HCBS waiver status, the use of medical day care, and long-term Medicaid-paid nursing facility (NF) care, each category of which requires a nursing home level of care (NHLOC). These criteria are used to establish treatment groups, where treatment reflects Medicaid LTSS, for comparison to matched control

groups. The community-based groups (HCBS waivers and medical day care) will be compared—in terms of their Medicare resource use—to matched groups of recipients in the community who do not receive Medicaid LTSS. The long-term NF care group will be compared to those receiving HCBS waiver supports in the community on the same measures of Medicare services and costs.

Other characteristics—including disability status under Medicare, diagnoses, and selected demographic characteristics—are used in various ways to help identify the control groups, as well as to adjust for additional unknown effects when testing the statistical significance of differences between treatment and control groups. The grouping criteria and other key characteristics have been discussed to some extent in the previous reports in this series and are re-introduced here as a way to describe the study population in more detail with respect to Medicare service use and costs.

A Note on Functional Status

The data used to establish matched control groups in this study are drawn from what is commonly available in claims and other administrative data files. As noted in the previous reports, personal characteristics used to adjust for the need for services would—ideally—include information on individuals' functional status, such as measures of support needed for activities of daily living (ADLs). Because those data are not consistently available for the entire study population, other factors, such as an indicator based on selected diagnoses that suggests an individual is frail (a frailty marker), are used to help establish matched comparison groups for this analysis.

Home and Community-Based Services

As discussed in more detail in Tucker et al. (2008), Medicaid community supports for the dually eligible include: personal care; selected specialized services, such as case management; medical day care; and HCBS waiver services for specific subsets of the population. Personal care services, which can include assistance with ADLs, household services, food shopping, transportation, and other services for recipients in the community, are State Plan benefits[2] that are covered when a qualified physician deems them necessary. A formal NHLOC is not required to receive this benefit. Medical day care (MDC) requires an NHLOC assessment and covers health care services that emphasize primary prevention, early diagnosis and treatment, rehabilitation, and continuity of care outside the recipient's home. While MDC was offered as a State Plan benefit in Maryland during the focal period for this study (2006), it has been provided under an HCBS waiver in Maryland since July 2008. Waiver programs can include an array of

[2] The term "State Plan benefit" refers to a service that is available to all recipients who are otherwise eligible for full Medicaid benefits. Alternatively, waiver services are typically defined in an amendment to the State Plan and may be limited to recipients who meet certain eligibility requirements or availability.

home and community support services—beyond those that are already included in the State Plan—and are defined in the specific agreement with the Centers for Medicare and Medicaid Services (CMS) that establishes a given program.

HCBS waivers are the primary focus for Medicaid LTSS provided in the community for this study because they include an array of services for generally stable (though limited in number) populations and constitute more than 80 percent of the costs of community-based supports and services provided to duals in Maryland. The underlying agreements for these programs allow states to waive certain Medicaid statutory requirements, such as access rules for services and what the state will pay for under its State Plan. To be a waiver participant, an individual must be fully Medicaid-eligible (although financial eligibility may be higher than for regular State Plan services), be medically qualified, be certified for an institutional level of care, and choose to enroll in the waiver as an alternative to institutionalization. It is also required that these waivers cost Medicaid no more to provide services to participants in the community than it would cost the program for institutional care. Each waiver provides a specific set of optional state services that are tailored to support a specific population. There is a formal limit on the number of "slots" available for participants under each waiver in Maryland, and the state manages registry lists for each waiver when the slots are filled. However, Medicaid recipients with full benefits who are in a long-term NF stay and otherwise eligible for transition into the community under a waiver may be able to do so even if the formal limit on slots has been reached. Because each of the waivers outlined here is generally full, most new waiver participation is the result of transition from an NF rather than from the community.

The three largest HCBS waivers in Maryland include:[3]

- The *Older Adults Waiver* (OAW) is a statewide program for Medicaid recipients who are ages 50 or older; meet NHLOC criteria; have a monthly income of no more than 300 percent of Supplemental Security Income (SSI), which is equivalent to 220 percent of the federal poverty level (FPL); and have limited assets. Aside from full Medicaid benefits, examples of additional services OAW participants can receive include home-delivered meals, respite care in assisted living, family/consumer training, personal emergency response systems, extended home health care, assistive devices, environmental assessments and modifications, behavior consultation services, and case management through the state's Area Agencies on Aging. Medicaid enrollment data show that the OAW served a total of 3,615 participants during 2006. Those participants had a mean age of 77 years, and most of them were duals.
- The *Living at Home* (LAH) Waiver is a statewide program for people with physical disabilities who are between the ages of 18 and 64 years and need assistance with ADLs. The program is designed to serve people who are currently in a nursing home with an

[3] See details about Maryland waiver programs at http://www.dhmh.state.md.us/mma/waiverprograms/.

interest in returning to the community, as well as individuals living in the community who may need nursing home services but would like to remain in the community. Examples of LAH Waiver benefits not already mentioned under the OAW include attendant care, such as personal assistance services, and skilled nursing supervision. Medicaid enrollment data show that the LAH Waiver served a total of 462 participants, with a mean age of 44 years, during 2006. Roughly half of LAH Waiver participants were duals.

- The *Community Pathways Waiver* is administered by the Maryland Developmental Disabilities Administration (DDA) and provides services for individuals with developmental disabilities (DD) who meet an intermediate care facility for individuals with mental retardation (ICF/MR) level of care. There is no age limitation for eligibility but, similar to the OAW and LAH Waiver, monthly income may not exceed 300 percent of SSI. Key benefits available under this waiver include resource coordination, residential habilitation, supported employment, day habilitation, respite care, environmental modifications, assistive technology, and adaptive equipment. In 2006, this waiver served close to 10,600 participants—approximately half of whom were duals.

  Maryland has a second DD waiver called *New Directions*. This waiver is much the same as Community Pathways except that it allows participants to direct how some benefits are administered. New Directions was first implemented in July of 2005 and had fewer than 50 participants by the end of 2006. For the purposes of this report, data for these two waivers have been combined and are referred to as the DD Waiver.

The OAW and LAH Waiver populations, in particular, will be used in the subgroup analyses described below. The DD Waiver population is included in this overview but is not included in the more targeted subgroup analyses—in part because data are not available to establish an adequate control for comparison, but also because this group would not typically be included in the kind of integrated managed LTSS program that is the focus of this study (see Tucker et al., 2008).

Disability Status under Medicare

One characteristic that is used to describe key differences within the dually eligible population for this study is disability status as reflected in the original reason for entitlement to Medicare benefits. This characteristic, which was introduced in the context of rate setting for Medicaid managed care in Tucker & Johnson (2009) as "ever disabled" (or EvD), has implications for the type and level of both Medicare and Medicaid resources used. Forty-five percent of dual eligibles included in this study, and nearly all recipients under 65 years of age, were first eligible for Medicare because of a disability.

Diagnoses and Other Demographic Characteristics

Clinical information as represented in diagnoses assigned to individuals during the course of care is reflected in several ways for this analysis.

- Chronic Conditions: A list of specific chronic conditions is entered as explanatory variables in the process of creating matched control groups. This list includes 20 conditions that CMS has identified for more focused attention among Medicare beneficiaries in its Chronic Condition Data Warehouse (CCW).[4] These conditions are defined using criteria established for the CCW and are based on administrative claims data for one to three years, depending on the condition. A count of these conditions is also added as an explanatory variable in the process of testing for statistical significance of differences between treatment and control groups.
- Frailty Condition Marker: A measure of frailty that is also included in the process of establishing matched control groups is derived using the Adjusted Clinical Groups (ACG) case mix system. The ACG system includes an array of tools to facilitate health program management, financing, and related analyses based on administrative data found in health service claims.[5] The frailty marker indicates whether or not an individual had 1 or more of 81 diagnostic codes that ACG system developers have determined are highly associated with marked functional limitations among older individuals. This marker is used in lieu of more comprehensive person-specific functional status information that is not currently available in administrative data for the study population as a whole.
- Expanded Diagnosis Clusters (EDCs): Because comprehensive diagnostic information involves more than 16,000 individual codes, EDCs are defined within the ACG system to aggregate those codes into fewer disease-specific categories. The EDC methodology assigns International Classification of Diseases (ICD) codes (9^{th} and 10^{th} revisions) into 1 of 264 categories that are organized further into 27 Major Expanded Diagnosis Clusters (MEDCs). Individual EDCs are used in some instances to supplement the CCW-defined conditions in the process of establishing control groups and when adjusting for additional explanatory variables in statistical testing of differences across treatment and control groups.

For this analysis, each of the diagnostic indicators mentioned so far are assigned using inpatient, outpatient, and non-institutional provider (physician) claims[6] drawn from both Medicare and Medicaid claims data.

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[4] See http://www.resdac.umn.edu/CCW for more information on the Chronic Condition Data Warehouse.
[5] See http://www.acg.jhsph.edu for more information about the ACG system.
[6] For ease of reference, non-institutional provider claims will be referred to as "physician" claims, although they reflect both physicians and other provider types, such as speech, physical, and occupational therapists.

CMS-Hierarchical Condition Categories

Another diagnosis-based indicator that is used to characterize differences within the study population for the purpose of establishing matched control groups is a measure of relative prospective resource use that is derived using the CMS-Hierarchical Condition Categories (CMS-HCC) system (Pope et al., 2004). The CMS-HCC system is a diagnosis-based case mix application that is used under Medicare Advantage to establish payment rates for that program. Relative resource weights based on this system were introduced in Tucker and Johnson (2009) in the context of estimating a capitation rate to cover what Medicaid pays for Medicare cost sharing. For this study, the system is applied in the same way that it is used for payment, although relative weights rather than dollar values are used as a measure of expected Medicare resource use for each person in the study population. In addition to accounting for selected diagnoses assigned in the year prior to when it is applied for payment, the system reflects age; gender; original reason for Medicare entitlement; and markers for end-stage renal disease (ESRD), institutionalization, and Medicaid status. As was the case for the previous report in this series, the CMS-HCC system and diagnosis data drawn from 2005 Medicare (hospital, outpatient, and physician) claims were used to calculate relative weights for the dual population eligible for this study as a prospective measure of resource "risk" in 2006. Those weights are used in this analysis as an additional (summary) measure of other characteristics described here, both to help account for differences between treatment and control groups and to adjust for unknown factors in testing statistical significance of those differences.

Other Characteristics

Other demographic characteristics that are used to supplement diagnostic data at various stages in this study include age, sex, race, and a count of prior months enrolled for full benefits under Medicaid. Months of eligibility for full benefits under Medicaid is introduced in the process of identifying matched control groups as a way to account, in some way, for length of enrollment under Medicaid more generally. This explanatory variable reflects the number of months enrolled for full Medicaid benefits between January 1, 2001, and January 1, 2006.

The use of each of these indicators will be discussed in more detail in the section on analytical methods. However, it is worth noting again that, although outcome measures of Medicare resource use examined in this study are drawn from 2006 data, diagnostic and other data used to establish matched control groups and to test for significance are primarily drawn from 2005 claims (and prior years for some chronic condition markers). That is, for propensity score matching, data from 2005 are used to identify comparable matches from among the broader population who were eligible at the beginning of the "treatment" period (2006).

Long-Term Nursing Facility Users

One of the findings from the second report in this series (Tucker & Johnson, 2009) was that duals in Medicaid-paid long-term nursing facility (LT-NF) stays use markedly less Medicare

resources on average than expected given the relative prospective risk indicated by the Medicare Advantage payment system (CMS-HCCs). At the same time, Medicaid waiver participants were shown to have similar average relative prospective risk as these LT-NF users (based on CMS-HCCs) but use Medicare resources more in keeping with that relative risk. As a follow-up to those results, the same matching process will be used to establish a comparison group for waiver participants from among duals who are associated with LT-NF stays. As was the case in the previous analysis, LT-NF users are defined as having at least 30 days of Medicaid-paid NF care just prior to January 1, 2006. This aspect of the study is intended primarily to explore what might drive lower levels of overall Medicare resource use among LT-NF residents.

Distribution of the Study Population by Selected Characteristics

Age, Sex, and Race

Tables 1 through 4 present the age (as of January 1, 2006), sex, and race distributions of the full population of continuously enrolled duals in this study for selected subpopulations. Each table uses the same format whereby the leftmost data column shows the total population and the rightmost columns reflect selected subgroups of that larger population. The percentage of each cell relative to the respective column total is shown for the total column and each subgroup column. For subgroups presented in Tables 1 through 3, the percentage of each subgroup cell relative to the associated row total is also shown.

Table 1 shows the age, sex, and race distributions for the full study population and by enrollment status at the end of 2006. Row 4 of the table, for example, shows that 22.1 percent of the study population was 65 to 74 years of age. Among those who were enrolled for the full 12 months of the year, 22.7 percent were in this category, while only 15.8 percent of those who died during 2006 were 65 to 74 years old. Note that 4,956 of the continuously enrolled duals (9.2 percent) died during 2006. The distribution of 12-month enrollees by age is much like the population as a whole, yet those who died are disproportionately older. The distributions by sex and race are roughly the same across 12-month enrollees and those who died as they are for the population as a whole, although there is a slightly higher rate of death for those who were white.

Table 1. Duals in Maryland by Age, Sex, Race, and End-of-Year Enrollment Status

		Total		Enrollment Status at End of Year					
				12-Month Enrollees			Deceased		
		#	% col.	#	% col.	% row	#	% col.	% row
	Total Population	53,878	100%	48,922	100%	90.8%	4,956	100%	9.2%
	Age Category								
1	< 35	4,338	8.1%	4,303	8.8%	99.2%	35	0.7%	0.8%
2	35-49	9,098	16.9%	8,888	18.2%	97.7%	210	4.2%	2.3%
3	50-64	7,990	14.8%	7,586	15.5%	94.9%	404	8.2%	5.1%
4	65-74	11,887	22.1%	11,103	22.7%	93.4%	784	15.8%	6.6%
5	75-84	12,657	23.5%	11,137	22.8%	88.0%	1,520	30.7%	12.0%
6	85+	7,908	14.7%	5,905	12.1%	74.7%	2,003	40.4%	25.3%
	Sex								
7	Female	34,510	64.1%	31,118	63.6%	90.2%	3,392	68.4%	9.8%
8	Male	19,368	35.9%	17,804	36.4%	91.9%	1,564	31.6%	8.1%
	Race								
9	Black	19,710	36.6%	18,106	37.0%	91.9%	1,604	32.4%	8.1%
10	White	25,600	47.5%	22,865	46.7%	89.3%	2,735	55.2%	10.7%
11	Other	8,568	15.9%	7,951	16.3%	92.8%	617	12.4%	7.2%

Note: Limited to duals with full benefits under Medicare and Medicaid and continuously enrolled in 2006 (from January 1 to death or the end of the year). Medicare Advantage group health plan enrollment excluded.

Table 2 shows the same distribution by demographic characteristics for the total population, but also separately by original reason for Medicare entitlement (EvD). Almost half (46.5 percent) of the continuously enrolled duals in Maryland in 2006 were EvD. The majority of duals who are flagged as EvD are under 65 years; the majority of those who are not EvD are 65 years and older. The few instances in which those not flagged as EvD are under 65 years of age reflect individuals with Medicare coverage based on a specific condition—primarily ESRD but also amyotrophic lateral sclerosis (ALS). Duals who are EvD are also disproportionately male: 47.1 percent compared to 35.9 percent of all continuously enrolled duals.

Table 2. Duals in Maryland by Age, Sex, Race, and Original Reason for Medicare Entitlement

		Total		Original Reason for Medicare Entitlement					
				Ever Disabled (EvD)			Old Age Only (Non-EvD)		
		#	% col.	#	% col.	% row	#	% col.	% row
	Total Population	53,878	100%	25,064	100%	46.5%	28,814	100%	53.5%
	Age Category								
1	< 35	4,338	8.1%	4,237	16.9%	97.7%	101	0.4%	2.3%
2	35-49	9,098	16.9%	8,889	35.5%	97.7%	209	0.7%	2.3%
3	50-64	7,990	14.8%	7,714	30.8%	96.5%	276	1.0%	3.5%
4	65-74	11,887	22.1%	2,656	10.6%	22.3%	9,231	32.0%	77.7%
5	75-84	12,657	23.5%	1,149	4.6%	9.1%	11,508	39.9%	90.9%
6	85+	7,908	14.7%	419	1.7%	5.3%	7,489	26.0%	94.7%
	Sex								
7	Female	34,510	64.1%	13,268	52.9%	38.4%	21,242	73.7%	61.6%
8	Male	19,368	35.9%	11,796	47.1%	60.9%	7,572	26.3%	39.1%
	Race								
9	Black	19,710	36.6%	10,402	41.5%	52.8%	9,308	32.3%	47.2%
10	White	25,600	47.5%	13,145	52.4%	51.3%	12,455	43.2%	48.7%
11	Other	8,568	15.9%	1,517	6.1%	17.7%	7,051	24.5%	82.3%

Note: Limited to duals with full benefits under Medicare and Medicaid and continuously enrolled in 2006 (from January 1 to death or the end of the year). Medicare Advantage group health plan enrollment excluded.

Table 3 presents comparable information, but separately by whether an individual had at least one of the diagnoses underlying the ACG system-based frailty maker. Almost 29 percent of continuously enrolled duals in Maryland can be considered frail according to this definition. Although found across all age groups, this frailty factor is more commonly associated with those 75 years of age and older than it is with all continuously enrolled duals, and almost half of the duals 85 years of age and older have the marker.

Table 3. Duals in Maryland by Age, Sex, Race, and Frailty Marker

		Total		Frailty Marker					
				Yes			No		
		#	% col.	#	% col.	% row	#	% col.	% row
	Total Population	53,878	100%	15,357	100%	28.5%	38,521	100%	71.5%
	Age Category								
1	< 35	4,338	8.1%	452	2.9%	10.4%	3,886	10.1%	89.6%
2	35-49	9,098	16.9%	1,623	10.6%	17.8%	7,475	19.4%	82.2%
3	50-64	7,990	14.8%	2,131	13.9%	26.7%	5,859	15.2%	73.3%
4	65-74	11,887	22.1%	2,986	19.4%	25.1%	8,901	23.1%	74.9%
5	75-84	12,657	23.5%	4,448	29.0%	35.1%	8,209	21.3%	64.9%
6	85+	7,908	14.7%	3,717	24.2%	47.0%	4,191	10.9%	53.0%
	Sex								
7	Female	34,510	64.1%	10,593	69.0%	30.7%	23,917	62.1%	69.3%
8	Male	19,368	35.9%	4,764	31.0%	24.6%	14,604	37.9%	75.4%
	Race								
9	Black	19,710	36.6%	5,527	36.0%	28.0%	14,183	36.8%	72.0%
10	White	25,600	47.5%	8,125	52.9%	31.7%	17,475	45.4%	68.3%
11	Other	8,568	15.9%	1,705	11.1%	19.9%	6,863	17.8%	80.1%

Note: Limited to duals with full benefits under Medicare and Medicaid and continuously enrolled in 2006 (from January 1 to death or the end of the year). Medicare Advantage group health plan enrollment excluded.

Table 4 shows the basic demographic characteristics for those who were enrolled in one of the three waivers described above at any time during 2006. The LAH Waiver group is, by design, composed of Medicaid recipients who are younger than 65 years. All of these waiver participants are EvD, and patterns across age, sex, and race are much the same as all EvD duals (see Table 2). The OAW group includes beneficiaries who are 50 years of age and older. The distribution by age for this group is close in pattern to those shown as Old Age Only in Table 2, except for being drawn somewhat disproportionately from those 85 years of age and older. This group is slightly more likely to be female and designated as white than is the population as a whole. The DD Waiver population is drawn primarily from those younger than 65 years of age. They are included here for descriptive purposes but, as noted above, they are not included in subsequent subgroup analyses.

Table 4. Dually Eligible Waiver Participants in Maryland by Age, Sex, and Race

			Home and Community-Based Waiver Status					
	Total		Living at Home		Older Adult		Develop. Disabled	
	#	% col.	#	% col.	#	% col.	#	% col.
Total Population	53,878	100%	269	100%	2,739	100%	5,645	100%
Age Category								
< 35	4,338	8.1%	41	15.2%	0	0.0%	1,374	24.3%
35-49	9,098	16.9%	151	56.1%	0	0.0%	2,409	42.7%
50-64	7,990	14.8%	77	28.6%	296	10.8%	1,468	26.0%
65-74	11,887	22.1%	0	0.0%	580	21.2%	291	5.2%
75-84	12,657	23.5%	0	0.0%	1,009	36.8%	90	1.6%
85+	7,908	14.7%	0	0.0%	854	31.2%	13	0.2%
Sex								
Female	34,510	64.1%	147	54.6%	2,095	76.5%	2,417	42.8%
Male	19,368	35.9%	122	45.4%	644	23.5%	3,228	57.2%
Race								
Black	19,710	36.6%	106	39.4%	948	34.6%	1,458	25.8%
White	25,600	47.5%	153	56.9%	1,582	57.8%	3,857	68.3%
Other	8,568	15.9%	10	3.7%	209	7.6%	330	5.8%

Note: Limited to duals with full benefits under Medicare and Medicaid and continuously enrolled in 2006 (from January 1 to death or the end of the year). Medicare Advantage group health plan enrollment excluded.

Chronic Conditions

In general, control groups for this study are drawn from non-waiver populations that meet the basic criteria for the respective waiver program. However, propensity score matching is used to narrow the broader pool of controls based on factors at an individual level. Aside from basic demographic information, variables that reflect a Medicare or Medicaid claim related to chronic conditions highlighted in the CMS CCW comprise the key clinical factors included in the matching process. Tables 5 through 8 show the same subgroups reflected in Tables 1 through 4, but the rows reflect CCW conditions instead of basic demographic factors. Although the control group matching process relies on indicators drawn from 2005 data, CCW indicators underlying Tables 5 through 8 are based on 2006 claims data (the outcome period) for descriptive purposes. Note that individuals with more than one condition are reflected in more than one row.

Table 5 shows the pattern of CCW conditions for continuously enrolled duals in Maryland as evidenced in 2006 claims data—in total and separately for those who were enrolled for 12 months and those who died in 2006. With respect to the population as a whole, 22.7 percent of individuals had no claim for a CCW condition. Diabetes and ischemic heart disease were the most common of the CCW conditions, at 34.2 and 31.7 percent, respectively. Others of the most common conditions included Alzheimer's and/or dementia (25.5 percent), heart failure (23.9 percent), depression (22.8 percent), and rheumatoid/osteoarthritis (19.5 percent). The pattern of percentages across conditions is much the same for 12-month enrollees as for the total population, in large part because more than 90 percent of the full population was enrolled for 12 months. Percentages are higher for nearly all conditions among those who died. In addition to the most common conditions already mentioned, chronic kidney disease (46.3 percent), chronic obstructive pulmonary disease (COPD, 33.8 percent), and stroke (29.7 percent) account for the highest number of duals who died in 2006. Notably, over 61 percent of those who died had a diagnosis of Alzheimer's and/or dementia.

Table 5. Duals in Maryland by Medicare CCW Conditions and End-of-Year Enrollment Status

		Total		Enrollment Status at End of Year					
				12-Month Enrollees			Deceased		
		#	% col.	#	% col.	% row	#	% col.	% row
	Total Population	53,878	100%	48,922	100%	90.8%	4,956	100%	9.2%
1	Acute Myocardial Infarc.	633	1.2%	375	0.8%	59.2%	258	5.2%	40.8%
2	Alzheimer's Disease	5,899	10.9%	4,463	9.1%	75.7%	1,436	29.0%	24.3%
3	Alzheimer's/Dementia	13,752	25.5%	10,702	21.9%	77.8%	3,050	61.5%	22.2%
4	Atrial Fibrillation	4,193	7.8%	3,078	6.3%	73.4%	1,115	22.5%	26.6%
5	Cataract	7,280	13.5%	6,721	13.7%	92.3%	559	11.3%	7.7%
6	Chronic Kidney Disease	10,303	19.1%	8,006	16.4%	77.7%	2,297	46.3%	22.3%
7	COPD	8,269	15.3%	6,593	13.5%	79.7%	1,676	33.8%	20.3%
8	Colorectal Cancer	662	1.2%	490	1.0%	74.0%	172	3.5%	26.0%
9	Depression	12,282	22.8%	10,830	22.1%	88.2%	1,452	29.3%	11.8%
10	Diabetes Mellitus	18,448	34.2%	16,151	33.0%	87.5%	2,297	46.3%	12.5%
11	Endometrial Cancer	89	0.2%	69	0.1%	77.5%	20	0.4%	22.5%
12	Female Breast Cancer	863	1.6%	740	1.5%	85.7%	123	2.5%	14.3%
13	Glaucoma	4,219	7.8%	3,899	8.0%	92.4%	320	6.5%	7.6%
14	Heart Failure	12,880	23.9%	10,157	20.8%	78.9%	2,723	54.9%	21.1%
15	Hip/Pelvic Fracture	422	0.8%	297	0.6%	70.4%	125	2.5%	29.6%
16	Ischemic Heart Disease	17,077	31.7%	14,378	29.4%	84.2%	2,699	54.5%	15.8%
17	Lung Cancer	592	1.1%	331	0.7%	55.9%	261	5.3%	44.1%
18	Osteoporosis	5,899	10.9%	5,228	10.7%	88.6%	671	13.5%	11.4%
19	Prostate Cancer	790	1.5%	651	1.3%	82.4%	139	2.8%	17.6%
20	Rheumatoid/Osteoarthritis	10,480	19.5%	9,318	19.0%	88.9%	1,162	23.4%	11.1%
21	Stroke/TIA	6,145	11.4%	4,673	9.6%	76.0%	1,472	29.7%	24.0%
	No Listed Condition	12,215	22.7%	11,975	24.5%	98.0%	240	4.8%	2.0%

Note: Population limited to duals with full benefits under Medicare and Medicaid and continuously enrolled in 2006 (from January 1 to death or the end of the year). Medicare Advantage group health plan enrollment excluded.
CCW: Chronic Condition Warehouse definitions. Diagnoses drawn from 2006 Medicare and Medicaid claims.

Table 6 is comparable to Table 5 in that the rows reflect chronic conditions. However, the population as a whole is also shown separately by EvD status. In general, the same chronic conditions that are most common among all duals are also most common for those flagged as EvD (shown in the middle columns of Table 6), but the percentage of individuals is lower for nearly all conditions than for the population as a whole. Depression is the one exception to that pattern. Close to 27 percent of duals who were initially entitled to Medicare because of a disability had a diagnosis of depression in 2006, as opposed to 22.8 percent for continuously enrolled duals as a whole. The reverse was generally true for the dually eligible who aged into Medicare (non-EvD). Table 6 shows the high concentration of chronic conditions among duals ages 65 years and older, where 40 percent or more had ischemic heart disease (41.7 percent) and/or diabetes (40 percent) and 36.4 percent had Alzheimer's and/or dementia.

Table 6. Duals in Maryland by Medicare CCW Conditions and Original Reason for Medicare Entitlement

				Original Reason for Medicare Entitlement					
		Total		Ever Disabled (EvD)			Old Age Only (Non-EvD)		
		#	% col.	#	% col.	% row	#	% col.	% row
	Total Population	53,878	100%	25,064	100%	46.5%	28,814	100%	53.5%
1	Acute Myocardial Infarc.	633	1.2%	193	0.8%	30.5%	440	1.5%	69.5%
2	Alzheimer's Disease	5,899	10.9%	992	4.0%	16.8%	4,907	17.0%	83.2%
3	Alzheimer's/Dementia	13,752	25.5%	3,254	13.0%	23.7%	10,498	36.4%	76.3%
4	Atrial Fibrillation	4,193	7.8%	969	3.9%	23.1%	3,224	11.2%	76.9%
5	Cataract	7,280	13.5%	2,214	8.8%	30.4%	5,066	17.6%	69.6%
6	Chronic Kidney Disease	10,303	19.1%	3,507	14.0%	34.0%	6,796	23.6%	66.0%
7	COPD	8,269	15.3%	3,087	12.3%	37.3%	5,182	18.0%	62.7%
8	Colorectal Cancer	662	1.2%	165	0.7%	24.9%	497	1.7%	75.1%
9	Depression	12,282	22.8%	6,762	27.0%	55.1%	5,520	19.2%	44.9%
10	Diabetes Mellitus	18,448	34.2%	6,915	27.6%	37.5%	11,533	40.0%	62.5%
11	Endometrial Cancer	89	0.2%	26	0.1%	29.2%	63	0.2%	70.8%
12	Female Breast Cancer	863	1.6%	266	1.1%	30.8%	597	2.1%	69.2%
13	Glaucoma	4,219	7.8%	1,170	4.7%	27.7%	3,049	10.6%	72.3%
14	Heart Failure	12,880	23.9%	3,789	15.1%	29.4%	9,091	31.6%	70.6%
15	Hip/Pelvic Fracture	422	0.8%	83	0.3%	19.7%	339	1.2%	80.3%
16	Ischemic Heart Disease	17,077	31.7%	5,068	20.2%	29.7%	12,009	41.7%	70.3%
17	Lung Cancer	592	1.1%	196	0.8%	33.1%	396	1.4%	66.9%
18	Osteoporosis	5,899	10.9%	1,469	5.9%	24.9%	4,430	15.4%	75.1%
19	Prostate Cancer	790	1.5%	164	0.7%	20.8%	626	2.2%	79.2%
20	Rheumatoid/Osteoarthritis	10,480	19.5%	3,090	12.3%	29.5%	7,390	25.6%	70.5%
21	Stroke/TIA	6,145	11.4%	1,884	7.5%	30.7%	4,261	14.8%	69.3%
	No Listed Condition	12,215	22.7%	8,860	35.3%	72.5%	3,355	11.6%	27.5%

Note: Population limited to duals with full benefits under Medicare and Medicaid and continuously enrolled in 2006 (from January 1 to death or the end of the year). Medicare Advantage group health plan enrollment excluded.
CCW: Chronic Condition Warehouse definitions. Diagnoses drawn from 2006 Medicare and Medicaid claims.

Table 7 is comparable to Tables 5 and 6 but shows the population separately by whether individuals who have claims for specific CCW conditions are also associated with frailty as denoted in the ACG case-mix system. For the population as a whole, 28.5 percent are flagged as frail (shown in the first row of the table). Not surprisingly, each chronic condition in this table has a higher rate of individuals with a diagnostic indication of frailty than that overall population average of 28.5 percent. Chronic conditions that are most common for the study population are also most commonly associated with frailty, particularly duals with Alzheimer's and/or dementia (49.9 percent), ischemic heart disease (45.2 percent), and diabetes (44.3 percent). More than half—but not all—of those with Alzheimer's and/or dementia (55.8 percent), stroke (54.6 percent), or hip fracture (73 percent) are flagged as frail, which suggests that the frailty marker may be useful in distinguishing level of functional support need in the absence of more targeted information on ADLs.

Table 7. Duals in Maryland by CCW Conditions and Frailty Marker

		Total		Frailty Marker					
				Yes			No		
		#	% col.	#	% col.	% row	#	% col.	% row
	Total Population	53,878	100%	15,357	100%	28.5%	38,521	100%	71.5%
1	Acute Myocardial Infarc.	633	1.2%	304	2.0%	48.0%	329	0.9%	52.0%
2	Alzheimer's Disease	5,899	10.9%	3,364	21.9%	57.0%	2,535	6.6%	43.0%
3	Alzheimer's/Dementia	13,752	25.5%	7,667	49.9%	55.8%	6,085	15.8%	44.2%
4	Atrial Fibrillation	4,193	7.8%	2,071	13.5%	49.4%	2,122	5.5%	50.6%
5	Cataract	7,280	13.5%	2,371	15.4%	32.6%	4,909	12.7%	67.4%
6	Chronic Kidney Disease	10,303	19.1%	4,702	30.6%	45.6%	5,601	14.5%	54.4%
7	COPD	8,269	15.3%	3,755	24.5%	45.4%	4,514	11.7%	54.6%
8	Colorectal Cancer	662	1.2%	290	1.9%	43.8%	372	1.0%	56.2%
9	Depression	12,282	22.8%	5,389	35.1%	43.9%	6,893	17.9%	56.1%
10	Diabetes Mellitus	18,448	34.2%	6,810	44.3%	36.9%	11,638	30.2%	63.1%
11	Endometrial Cancer	89	0.2%	31	0.2%	34.8%	58	0.2%	65.2%
12	Female Breast Cancer	863	1.6%	328	2.1%	38.0%	535	1.4%	62.0%
13	Glaucoma	4,219	7.8%	1,268	8.3%	30.1%	2,951	7.7%	69.9%
14	Heart Failure	12,880	23.9%	5,836	38.0%	45.3%	7,044	18.3%	54.7%
15	Hip/Pelvic Fracture	422	0.8%	308	2.0%	73.0%	114	0.3%	27.0%
16	Ischemic Heart Disease	17,077	31.7%	6,947	45.2%	40.7%	10,130	26.3%	59.3%
17	Lung Cancer	592	1.1%	247	1.6%	41.7%	345	0.9%	58.3%
18	Osteoporosis	5,899	10.9%	2,255	14.7%	38.2%	3,644	9.5%	61.8%
19	Prostate Cancer	790	1.5%	326	2.1%	41.3%	464	1.2%	58.7%
20	Rheumatoid/Osteoarthritis	10,480	19.5%	4,324	28.2%	41.3%	6,156	16.0%	58.7%
21	Stroke/TIA	6,145	11.4%	3,353	21.8%	54.6%	2,792	7.2%	45.4%
	No Listed Condition	12,215	22.7%	1,033	6.7%	8.5%	11,182	29.0%	91.5%

Note: Population limited to duals with full benefits under Medicare and Medicaid and continuously enrolled in 2006 (from January 1 to death or the end of the year). Medicare Advantage group health plan enrollment excluded.
CCW: Chronic Condition Warehouse definitions. Diagnoses drawn from 2006 Medicare and Medicaid claims.

Table 8 shows the distribution of chronic conditions for the three waiver populations. Both the OAW and LAH Waiver populations exhibit patterns that are similar to their respective EvD status. The LAH Waiver population is drawn exclusively from the EvD subgroup and largely reflects the same rate of chronic conditions as the larger EvD population (see Table 6), which is generally lower than the population as a whole. Much like the non-EvD subgroup shown in Table 6, the OAW population has a higher concentration of chronic conditions than the population as a whole—even though the OAW includes enrollees as young as 50 years who are EvD. Note that data are suppressed in cells that include fewer than 11 cases in keeping with standard Medicare data use protocols.

Table 8. Dually Eligible Waiver Participants in Maryland by Medicare CCW Conditions

				Home and Community-Based Waiver Status					
		Total		Living at Home		Older Adult		Develop. Disabled	
		#	% col.	#	% col.	#	% col.	#	% col.
	Total Population	53,878	100%	269	100%	2,739	100%	5,645	100%
1	Acute Myocardial Infarc.	633	1.2%	- ds -	- ds -	67	2.4%	- ds -	- ds -
2	Alzheimer's Disease	5,899	10.9%	- ds -	- ds -	832	30.4%	136	2.4%
3	Alzheimer's/Dementia	13,752	25.5%	24	8.9%	1,562	57.0%	487	8.6%
4	Atrial Fibrillation	4,193	7.8%	12	4.5%	427	15.6%	59	1.0%
5	Cataract	7,280	13.5%	- ds -	- ds -	443	16.2%	733	13.0%
6	Chronic Kidney Disease	10,303	19.1%	43	16.0%	923	33.7%	288	5.1%
7	COPD	8,269	15.3%	32	11.9%	663	24.2%	155	2.7%
8	Colorectal Cancer	662	1.2%	0	0.0%	50	1.8%	10	0.2%
9	Depression	12,282	22.8%	80	29.7%	855	31.2%	970	17.2%
10	Diabetes Mellitus	18,448	34.2%	84	31.2%	1,343	49.0%	758	13.4%
11	Endometrial Cancer	89	0.2%	0	0.0%	11	0.4%	- ds -	- ds -
12	Female Breast Cancer	863	1.6%	- ds -	- ds -	72	2.6%	30	0.5%
13	Glaucoma	4,219	7.8%	- ds -	- ds -	258	9.4%	232	4.1%
14	Heart Failure	12,880	23.9%	49	18.2%	1,242	45.3%	315	5.6%
15	Hip/Pelvic Fracture	422	0.8%	0	0.0%	53	1.9%	10	0.2%
16	Ischemic Heart Disease	17,077	31.7%	54	20.1%	1,494	54.5%	315	5.6%
17	Lung Cancer	592	1.1%	0	0.0%	32	1.2%	- ds -	- ds -
18	Osteoporosis	5,899	10.9%	22	8.2%	431	15.7%	344	6.1%
19	Prostate Cancer	790	1.5%	- ds -	- ds -	49	1.8%	27	0.5%
20	Rheumatoid/Osteoarthritis	10,480	19.5%	29	10.8%	812	29.6%	276	4.9%
21	Stroke/TIA	6,145	11.4%	31	11.5%	702	25.6%	86	1.5%
	No Listed Condition	12,215	22.7%	89	33.1%	117	4.3%	2,800	49.6%

Note: Population limited to duals with full benefits under Medicare and Medicaid and continuously enrolled in 2006 (from January 1 to death or the end of the year). Medicare Advantage group health plan enrollment excluded.
CCW: Chronic Condition Warehouse definitions. Diagnoses drawn from 2006 Medicare and Medicaid claims.
"ds" indicates data have been suppressed because of small cell size.

A more comprehensive snapshot of clinical conditions for continuously enrolled duals in 2006 that reflects the distribution of EDCs and MEDCs for the population as a whole, and by EvD status, is available from the authors upon request.

Measures of Medicare Resource Use

The basic approach for the analyses of Medicare resource use in this study is to examine outcome measures for selected subgroups of continuously enrolled duals—from among the larger study population—to explore the relationship between providing Medicaid LTSS and Medicare resource use. Do Medicaid recipients who receive HCBS waiver services, for example, use more or fewer Medicare services (and have higher or lower associated costs) than comparable recipients who do not receive the waiver services? For this analysis, the outcome measures include a broad array of measures primarily reflecting overall costs and counts of service use within key components of Medicare benefit coverage.

As an overview of these measures and a further description of the larger study population, Table 9 shows an initial set of measures of Medicare resource use for the study population as a whole and by enrollment status at the end of 2006. The table rows show the primary outcome measures that will be tested for significant differences across waiver/community support (treatment) and matched control groups in subsequent subgroup analyses. The Total column in Table 9 shows that the 53,878 continuously enrolled duals in Maryland in 2006 had 617,778 member months of enrollment during the year.[7] This population generated $740 million of direct Medicare payments,[8] or $1,198 per member per month (PMPM, calculated by dividing total payments by enrollee member months), during that period. The remaining rows indicate payments, the number of users, and some counts of service use within major cost categories. The percentages that total component payments and the number of users of those services represent of total payments and enrollees, respectively, are also shown for each major service category. Hospital costs, for example, account for 50.7 percent of all Medicare payments included for this population, and 30.1 percent of the full population had a hospital stay. Part B services, which include physician, outpatient, and durable medical equipment (DME), account for another 36.9 percent of overall payments and were used by 94.6 percent of the population.

[7] This population, which excludes those with any group health plan enrollment in 2006, is the same as the population included in the first report in this series (Tucker et al., 2008). There are minor differences in totals due largely to updated coverage and enrollment data.

[8] Only direct Medicare payments are included in this analysis. Full costs would also include Medicare premium payments and cost sharing, such as deductibles and copayments, which Medicaid covers on behalf of recipients. See Tucker et al. (2008).

Table 9. Medicare Resource Measures (2006) by Enrollment Status at Year End

Resource Use Measure	Total	% of Total Costs or Enrollees	Enrollment Status at Year End: 12-Month Enrollees	% of Total	Deceased	% of Total
Enrollees	53,878	100%	48,922	100%	4,956	100%
Enrollee Member Months	617,778		587,064		30,714	
Total Direct Medicare						
Total Payments	$740,231,628	100%	$577,470,361	100%	$162,761,267	100%
Total Users	51,033	94.7%	46,188	94.4%	4,845	97.8%
Hospital						
Hospital Payments	$375,525,945	50.7%	$269,678,779	46.7%	$105,847,165	65.0%
Users	16,228	30.1%	13,090	26.8%	3,138	63.3%
Hospital Stays	35,043		27,818		7,225	
Medicare-Paid Hospital Days	214,421		157,757		56,664	
Skilled Nursing Facility (SNF)						
SNF Payments	$65,630,340	8.9%	$50,568,966	8.8%	$15,061,374	9.3%
Users	5,781	10.7%	4,179	8.5%	1,602	32.3%
SNF Stay	9,828		6,914		2,914	
Medicare-Paid SNF Days	238,929		183,530		55,399	
Home Health						
Home Health Payments	$12,240,671	1.7%	$10,637,545	1.8%	$1,603,126	1.0%
Users	3,475	6.4%	2,956	6.0%	519	10.5%
Home Health Episodes	4,245		3,621		624	
Home Health Visits	72,305		63,003		9,302	
Hospice						
Hospice Payments	$13,859,764	1.9%	$6,664,120	1.2%	$7,195,644	4.4%
Users	1,559	2.9%	319	0.7%	1,240	25.0%
Hospice Episodes	1,616		336		1,280	
Medicare-Paid Hospice Days	97,041		48,950		48,091	
Part B						
Part B Payments	$272,974,907	36.9%	$239,920,950	41.5%	$33,053,957	20.3%
Users	50,973	94.6%	46,181	94.4%	4,792	96.7%
Physician Payments	$141,538,092	19.1%	$121,392,827	21.0%	$20,145,266	12.4%
Users	50,509	93.7%	45,762	93.5%	4,747	95.8%
Outpatient Payments	$110,827,825	15.0%	$99,719,812	17.3%	$11,108,013	6.8%
Users	36,748	68.2%	33,121	67.7%	3,627	73.2%
DME Payments	$20,608,990	2.8%	$18,808,312	3.3%	$1,800,678	1.1%
Users	16,998	31.5%	15,325	31.3%	1,673	33.8%

Note: Limited to duals with full benefits under Medicare and Medicaid and continuously enrolled in 2006 (from January 1 to death or the end of the year). Medicare Advantage group health plan enrollment excluded.

The rightmost columns of Table 9 show separate results for these measures for those who were enrolled for the full 12 months of 2006 and for those who died during the year. The 4,956 enrollees who died had an average length of enrollment of just over 6 months. The $162.8 million in total payments for those who died represents 22 percent of all payments. On a PMPM basis, those who died were five times as costly as 12-month enrollees ($5,299 versus $984, respectively). Overall, the distribution of payments across major cost categories was much the same for 12-month enrollees as the population as a whole, with only slightly lower institutional and slightly higher Part B payments as a percentage of the total within that group. Those who died had a markedly different pattern of costs that was heavily weighted toward institutional services. These results are consistent with the generally known pattern of high end-of-life expenditures (Emanuel & Emanuel, 1994; Hogan, Lunney, Gabel, & Lynn, 2001).

Table 10 shows data comparable to those in Table 9, but these data are separated by original reason for Medicare entitlement. Overall patterns of payments for 12-month enrollees are much the same for both groups, although the EvD used a slightly higher rate of hospital services and the non-EvD used slightly higher rates of skilled nursing facility (SNF) and home health services. Patterns of payments and service use for those who died among both the EvD and non-EvD groups were also much the same in relation to each other and as compared to those who died among the population as a whole (shown in Table 9).

Again, these data reaffirm known patterns of expenditures in the last months of life—a relatively limited number of cases account for a disproportionately high percentage of costs. Total Medicare payments PMPM also vary sharply across 12-month enrollee and deceased groups by CCW condition (data not otherwise shown). Given the relatively small number of cases of waiver participants in particular, patterns associated with service use and costs at the end of life would confound the subgroup analyses explored below. Thus, those who died during 2006 are excluded from the subsequent subgroup analyses in order to focus more directly on the central question of cross-payer effects in this study rather than on issues related to end-of-life care.

Table 10. Medicare Resource Measures (2006) by Original Reason for Medicare Entitlement and Enrollment Status at Year End

	Ever Disabled (EvD)				Old Age Only (Non-EvD)			
Resource Use Measure	**12-Month Enrollees**	**% of Total**	**Deceased**	**% of Total**	**12-Month Enrollees**	**% of Total**	**Deceased**	**% of Total**
Enrollees	23,936	100%	1,128	100%	24,986	100%	3,828	100%
Member Months	287,232		7,035		299,832		23,679	
Total Direct Medicare								
Total Payments (000s)	$269,991	100%	$53,649	100%	$307,479	100%	$109,113	100%
Total Users	22,306	93.2%	1,106	98.0%	23,882	95.6%	3,739	97.7%
Hospital								
Hospital Payments (000s)	$134,471	49.8%	$37,111	69.2%	$135,207	44.0%	$68,736	63.0%
Users	6,094	25.5%	817	72.4%	6,996	28.0%	2,321	60.6%
Hospital Stays	14,043		2,211		13,775		5,014	
Hospital Days	83,201		19,359		74,556		37,305	
SNF								
SNF Payments (000s)	$17,139	6.3%	$3,924	7.3%	$33,430	10.9%	$11,138	10.2%
Users	1,368	5.7%	382	33.9%	2,811	11.3%	1,220	31.9%
SNF Stay	2,346		786		4,568		2,128	
SNF Days	62,003		14,206		121,527		41,193	
Home Health (HH)								
HH Payments (000s)	$4,474	1.7%	$420	0.8%	$6,163	2.0%	$1,183	1.1%
Users	1,178	4.9%	143	12.7%	1,778	7.1%	376	9.8%
HH Episodes	1,469		175		2,152		449	
HH Visits	27,752		2,640		35,251		6,662	
Hospice								
Hospice Payments (000s)	$1,104	0.4%	$1,317	2.5%	$5,561	1.8%	$5,878	5.4%
Users	65	0.3%	233	20.7%	254	1.0%	1,007	26.3%
Hospice Episodes	68		241		268		1,039	
Hospice Days	8,029		8,104		40,921		39,987	
Part B								
Part B Payments (000s)	$112,803	41.8%	$10,876	20.3%	$127,118	41.3%	$22,178	20.3%
Users	22,303	93.2%	1,095	97.1%	23,878	95.6%	3,697	96.6%
Phys. Payments (000s)	$53,995	20.0%	$6,497	12.1%	$67,398	21.9%	$13,648	12.5%
Users	22,032	92.0%	1,085	96.2%	23,730	95.0%	3,662	95.7%
Outpat. Payments (000s)	$48,964	18.1%	$3,862	7.2%	$50,756	16.5%	$7,246	6.6%
Users	16,265	68.0%	869	77.0%	16,856	67.5%	2,758	72.0%
DME Payments (000s)	$9,844	3.6%	$517	1.0%	$8,964	2.9%	$1,284	1.2%
Users	7,039	29.4%	453	40.2%	8,286	33.2%	1,220	31.9%

Note: Limited to duals with full benefits under Medicare and Medicaid and continuously enrolled in 2006 (from January 1 to death or the end of the year). Medicare Advantage group health plan enrollment excluded.

Analytic Methods

As stated earlier, the goal of this report is to explore whether, and to what extent, providing Medicaid LTSS to Maryland's dually eligible population influences their Medicare resource use. To accomplish this goal, treatment groups (those who receive LTSS) and comparable controls (those who do not receive those services) are drawn from the larger population of the dually eligible, and measures of Medicare resource use are analyzed for differences that may be attributed in some way to the Medicaid supports. This section describes the procedures used in this study to assure comparability across treatment and control groups and the statistical methods used to test differences in outcome measures for those groups.

It is important to note at the outset that randomized control trials (RCTs) are considered the gold standard for making inferences regarding the causal effects of a particular treatment (or intervention) on some outcome of interest (Onur, 2006). In RCTs, subjects are randomly assigned to either the treatment group or the control group before the treatment is provided; this randomization ensures that there are no systematic differences between the groups and allows the researcher to infer that the treatment is the cause of any differences in the outcome under study (Ho, Imai, King, & Stuart, 2007; Stuart & Rubin, 2007).

However, randomization to a treatment group often is neither feasible nor ethical, and researchers frequently must rely on data from observational studies to examine treatment effects. This is usually the case with the implementation of new Medicaid programs, in particular. When HCBS waiver programs are put in place, for example, enrollment criteria are typically defined such that all otherwise eligible recipients have a similar chance to enroll. Enrollment will generally be established on a first-come, first-served basis rather than through overt assignment. Once such a program reaches capacity, other intervening factors—such as the number of "slots" available, or available funds, rather than need—may affect enrollment. In order to assess the impacts of such programs in the absence of true randomization, treatment effects must be estimated using quasi-experimental study designs that produce pseudo-randomized control trials based on historical data (retrospectively).

One limitation inherent in retrospective observational studies is that the treatment group typically differs in important ways from those who did not receive the treatment. Researchers must then account for such differences in order to obtain unbiased estimates of the treatment's effects. Although this can be accomplished through statistical adjustment methods such as sophisticated regression analysis, the resultant estimated treatment effects may depend heavily on the statistical models and assumptions used in the analysis (Ho et al., 2007). To lessen this dependence on model specification, and therefore to achieve more robust estimates of the treatment effects, researchers use *matching techniques* to create treatment and control groups that are as similar to each other as possible—prior to the analysis step (Stuart & Rubin, 2007). In other words, the matching process itself helps to ensure that differences observed across the comparison groups can be more confidently attributed to causal effects of the treatment. Additional statistical adjustment may be applied subsequent to the matching process to further refine the estimates of the treatment effects.

Propensity Score Matching

Traditionally, matching techniques used to support observational studies have involved identifying controls using characteristics on a few measures (or covariates) that are related in some indirect way to treatment assignment. Those characteristics may be either close to or exactly the same as those of the treated subject. For example, a researcher might look for controls who are the same sex (referred to as *exact matching*) and within three years of the age of a given treatment subject. The drawback to this level of matching is that it may be difficult to find controls that exactly (or closely) match individuals in the treatment group on all relevant covariates—even if the pool of potential controls is large. This difficulty is exacerbated if there are more than a few covariates that are deemed important for matching.

More recently, matching based on a "score" derived using a formula that accounts for (potentially) many covariate measures—a propensity score—has become accepted and prevalent practice in health services research, economics, epidemiology, and the social sciences (D'Agostino, 1998; Dehejia & Wahba, 1999). The propensity score, introduced by Rosenbaum and Rubin in 1983, is defined as the true probability of treatment, conditional on some set of covariates (Rosenbaum & Rubin, 1983). The process of estimating a propensity score for a given analysis involves pooling data on a fixed set of covariates for both those who receive the "treatment" and the population of potential controls who are otherwise eligible but have not received the treatment. Typically, a logistic regression is then used to calculate the probability (the propensity) of any given individual to be in the treatment group given the larger population eligible for the treatment and the set of covariates defined for that analysis. The *true* probability of treatment is never actually known in observational studies (Ho et al., 2007); however, assuming that it is the best available reflection of that probability, the propensity score for each individual in the treatment group is used to find the closest match (on that score) among the potential population of controls. Because this approach explicitly separates the design stage from the analysis stage—that is, matches are chosen without reference to the outcome variables and subsequent difference testing is less dependent on the statistical model—selection bias in the final analysis is minimized (Stuart & Rubin, 2007).

The Matching Process

Once propensity scores are assigned, additional procedures are commonly applied to establish individual treatment/control matches based on those scores. Some of the most common of these procedures include nearest neighbor, caliper, and Mahalanobis metric matching (D'Agostino, 1998; Onur, 2006). Each of these methods can be used with replacement, where a particular control can be matched to more than one individual in the treatment group, or without replacement, where a particular control is matched to only one individual in the treatment group. Each method also can be used to match one control to one treated subject (1:1 matching) or to match more than one control to each treated subject (k:1 matching).

In nearest neighbor matching, subjects from the treatment cohort are selected at random and then the control that has the closest propensity score to that treated subject is chosen. This procedure

is repeated until controls are selected for all the treated subjects. In caliper matching, a subset of potential controls with scores that fall within some predetermined distance from a given treatment subject's propensity score (e.g., propensity score ± .001) is randomly selected as the control for that treated subject. In Mahalanobis metric matching, a measure of the "distance" between treated subjects and controls is calculated. This distance is typically a function of several covariates of predictive importance related to either the treatment or the outcome of interest (D'Agostino, 1998). Treated subjects are selected at random, and the Mahalanobis distance measurement between the first treated subject and the potential controls is computed. [9] The potential control with the smallest Mahalanobis distance is selected as the control for the treated individual and the process is then repeated for the next treated subject, and so on. Refinements of the basic Mahalanobis distance technique include incorporating the propensity score as one of the covariates in the computation of the Mahalanobis distance metric and using that metric in conjunction with a caliper that is a function of the propensity score.[10]

The full propensity score matching process can be described in a series of steps:

1) Select relevant covariates and calculate the propensity score itself. Covariates should include distinguishing characteristics that are associated with treatment assignment but that are not affected by that treatment assignment (Stuart & Rubin, 2007). When estimating the propensity score, using logistic regression for example, it is the predictive power of the overall equation that is important, rather than specific parameter estimates, so including interaction terms and/or higher-order terms that might otherwise "over-fit" the model is acceptable.
2) Select the distance measure to be used to assess potentially appropriate matches, such as exact, nearest neighbor, Mahalanobis distance, or some combination of approaches.
3) Select matches from among the potential treatment and control cohorts.
4) Evaluate the quality of the matches by examining the resultant "balance" between the treatment and control groups for each of the covariates. When balanced, the multivariate distributions of the covariates used in the matching process for the treatment and control groups are very similar. Methods to assess balance include: comparing the means of individual covariates for the treatment and control groups using t-tests, chi-square tests, etc.; calculating the standardized difference between those means; and examining the distributions of the covariates through quantile-quantile (QQ) graphs (Stuart & Rubin, 2007). If the covariates are not balanced, the propensity score should be re-estimated—

[9] The Mahalanobis distance, d(i,j), between a treatment subject, *i*, and a potential control, *j*, is equal to $(u-v)^T C^{-1}(u-v)$, where *u* and *v* are the values of the covariates used in the distance measurement (the matching variables) for subjects *i* and *j*, and *C* is the covariance matrix of the matching variables from all of the potential controls (D'Agostino, 1998).

[10] Rosenbaum and Rubin (1985) suggest using a caliper size that is ¼ of a standard deviation of the logit of the propensity score.

perhaps including additional covariates, interaction terms, and/or higher order terms—and new controls selected, in an iterative process, until balance is achieved.

There are, however, potential limitations in propensity score matching. First, there may be hidden differences between the treatment group and the control group because important variables are unmeasured or otherwise excluded from the matching methodology. The absence of direct information on the functional status for the underlying population is one such factor in this study. Also, there may be missing data for measured covariates of interest. Finally, the size of the pool of potential controls may be too small to find enough appropriate matches.

Statistical Testing

Statistical testing is applied in two distinct phases of the analyses in this study. Testing is first applied to assess the strength of the balance achieved in establishing matched treatment and control groups. Once an acceptable level of balance is achieved, various statistical tests are applied to assess the treatment effects across those groups.

Assessing the Balance of Matched Treatment and Control Groups

One point of ambiguity in the literature involves how to check for balance in propensity score matched samples. Many published studies use significance tests, such as t-tests and chi-square tests, to compare the treatment and control groups. However, authors of recent theoretical papers (Austin, 2008; Ho, et al., 2007) assert that significance testing is not appropriate for assessing balance, especially given that the results are a function of sample size. These authors suggest using standardized differences[11] or QQ plots to assess balance. For this study, both significance tests and standardized differences are used.

Statistical Significance of Differences in Outcome Measures

Once matched treatment and control groups are established, various statistical methods are applied to assess the significance of any differences that are evident in specific outcomes of interest. As in any comparable analysis, the choice of methods will depend on the nature and distribution of the specific outcome measure. One consideration that is specific to analyses that

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[11] The standardized difference, d, is defined as $d = \frac{(\bar{x}_{treatment} - \bar{x}_{control})}{\sqrt{\frac{s^2_{treatment} + s^2_{control}}{2}}}$ and

$d = \frac{(\hat{p}_{treatment} - \hat{p}_{control})}{\sqrt{\frac{\hat{p}_{treatment}(1-\hat{p}_{treatment}) + \hat{p}_{control}(1-\hat{p}_{control})}{2}}}$ for continuous and dichotomous variables, respectively (Austin, 2009).

involve propensity score matching is whether or not to account for the matched nature of the treatment and control groups when estimating the treatment effects. Experts in propensity score matching techniques disagree on this issue. For example, Austin (2008) states that analyses for treatment effects must account for the fact that individual pairs are matched—using techniques such as the paired t-test, the Wilcoxon signed rank test, McNemar's test, or generalized estimating equation (GEE) methods, for example. Conversely, Stuart (2008) argues that such "pairwise" analysis is unnecessary, and that a two-sample t-test or Wilcoxon rank sum test may be used. A two-sample approach involves comparing the treatment group as a whole versus the control group as a whole, which may in fact be more appropriate, particularly because the matching process is less ideal on a one-to-one basis than it would be in a true random trial.

For this study, analyses using both paired and non-paired statistical methods are used to test statistical significance of differences when the analysis is not otherwise adjusted for additional factors. Pairwise analyses test the difference between specific matched treatment and control cases, and those results are essentially summarized at the group level. However, given the general complexity of clinical factors in this study, the correlation between the matched pairs is assumed to be more limited between specific treatment/controls pairs overall than the broader comparability at the group level. "Groupwise" analyses test the difference between the group-level sum total of the outcome measure for the treatment versus the control groups. Only non-paired (groupwise) approaches are used for analyses that involve adjustment for explanatory factors that are not fully accounted for in the propensity score matching process.

Another analytic consideration for this study was whether—and if so, how—to adjust for differences in covariates beyond what was achieved in the matching process. Many applied researchers perform only simple tests of differences in means after matching (unadjusted analyses). However, Ho and colleagues (2007) recommend using the same parametric analyses as would have been used if matching had not been done—that is, modeling with statistical adjustment of important covariates using regression analysis, for example. Such adjustment serves to "clean up" residual imbalance between the treatment and control groups and also may reduce underlying variance associated with the treatment effect (Stuart & Rubin, 2007). For this study, both unadjusted and adjusted analyses were performed. A subset of covariates that were used in the matching process, as well as additional covariates as appropriate, were used in the adjusted analyses.

Yet another preliminary consideration involved the type of analyses to be used for specific outcome measures. The various types of Medicare resource use measures—overall and per-user payments, individual-level use of services, and counts of stays, days, and visits—require different statistical modeling approaches. For example, linear regression methods are appropriate for analyses of payment data, yet the underlying distribution of health service payments is typically skewed because a relatively few cases tend to account for a disproportionate amount of the costs. In such cases, Box-Cox transformations of the dependent variable were used as appropriate to try to better meet the assumption of normality necessary for linear regression. Alternatively, for measures of service use, logistic (rather than linear) regression methods are

appropriate because the outcome values are dichotomous in nature—that is, an individual either did or did not use a particular service.

The values for measures of stays, days, and visits reflect a discrete number of non-negative integers and, as such, are candidates for count-data regression methods such as Poisson or negative binomial models. Moreover, because these measures tend to include many zero values (most people do not have a hospital stay, for example), zero-inflated Poisson and zero-inflated negative binomial models may also be appropriate. Zero-inflated models are, essentially, two-part models where the first step involves a logistic regression calculation that determines the probability of a non-zero outcome (or, more properly, the probability of "excess zeros") and the second step tests differences based on those who actually used services. For this study, the count data were modeled using Poisson, negative binomial, zero-inflated Poisson (ZIP), and zero-inflated negative binomial (ZINB) techniques.[12] When zero-inflated (two-part) modeling is used, p-values and parameter estimates for both the first part (the logistic regression) and the second part (Poisson or negative-binomial, whichever is appropriate) of the model are reported.

It should be noted that p-values are emphasized in the text of this report because they indicate significance of a given (treatment) effect. Parameter estimates, which indicate both the magnitude and the direction of an effect, are also important to consider. The significance of differences is more important than the specific size (magnitude) of a given parameter for this study. The direction of significant differences still needs to be assessed, however, and the direction of those differences can be affected either by including additional covariates in a regression model or by transforming the underlying data or both. For findings based on models using untransformed data that include no additional covariates, the direction of the estimates can be discerned from the raw data. That is, if total payments are higher for the treatment group, the direction of the parameter estimate for treatment on that measure will be positive for an otherwise unadjusted model. Parameter estimates based on models that reflect transformed data, such as payment values transformed to a log scale in this study, may indicate a different direction than what is seen in the raw data. For example, untransformed data may show that total payments are higher for the treatment group, but if the data entered into the statistical model are transformed such that the treatment group has lower payments on the new scale, the resultant parameter estimate associated with treatment can be negative for that measure (showing that treatment is associated with lower payments). Likewise, the addition of other covariates in an adjusted (regression) model may also change the direction of the treatment effect. If such a pronounced change occurs in the absence of a transformation of the underlying data after propensity score matching, it is evidence of what is termed a confounding effect, which may indicate that balance was not adequately achieved in the matching process.

[12] Liu and Cela (2008) include a practical discussion of each of these tests, as well as related tests used to determine which is most appropriate for a given analysis. Both the Schwarz Bayesian Criterion and the Vuong test (Vuong, 1989) were used to identify the most appropriate models for stays, days, and visit outcomes.

Subgroup Analyses

Separate subgroup analyses are presented in this section of the report. For each analysis, propensity scores are assigned to each individual in combined treatment and potential control populations that consist of continuously enrolled duals with 12 months of enrollment and no MA group health plan enrollment in 2006. Control subjects are matched to treatment subjects using the resultant score, where the control with the smallest Mahalanobis distance is assigned to a treatment subject from among the subset of controls within a defined range (caliper) of the treatment subject's propensity score. The Mahalanobis distance is used, in this study, to refine the priority order of the controls for selection from among a more limited subset of (callipered) controls. Treatment/control pairs are drawn without replacement so that any given control subject is matched to only one treatment subject. In some instances, there are no control subjects with scores close enough to meet these requirements; thus, the final set of treatment and control pairs used for analysis may include fewer treatment cases than the full set of potential 12-month enrollees in a given treatment cohort.

It is important to reiterate that outcomes of interest in this study—measures of Medicare resource use—were not used in any way to establish control groups. Nevertheless, it is reasonable to assume that a more targeted (matched) set of controls would have rates of service use that are closer to that of the treatment population than does the full potential control population. The matching process is intended to draw the best, or most reasonably comparable, set of controls from the potential control population given the kind of administrative clinical and demographic data available for the study. Moreover, tests of statistical differences in the outcome measures of interest across the treatment and control groups can then be used to assess whether cross-payer effects can be attributed to "the treatment": Medicaid LTSS.

For this study, test results on the effect of Medicaid supports, such as waiver status, are reported based on up to four statistical models for each outcome. Those are:

- An unadjusted pairwise model, which assesses the difference between specific matched treatment and control cases, and summarizes any differences at the group level,
- An unadjusted (non-paired) groupwise model, which assesses the difference between the group-level sum of the outcome measure for the treatment versus the control groups as a whole,
- A regression-based groupwise model (Model A) that includes further adjustment for some of the distinguishing characteristics (covariates) that are used in the propensity score matching process, and
- A regression-based groupwise model (Model B) that includes the same covariates as Model A, as well as additional clinical factors that were generally not used in the propensity score matching process.

Note that—although they are very similar—results for both Model A and Model B are reported to highlight the fact that a second adjustment for some factors already included in the propensity

score matching process (Model A) may be useful to help ensure that the comparison of treatment and control groups is fair. This may be obscured if results for only the more comprehensive model (Model B) were reported. Because both of these models include covariate factors in addition to waiver/LTSS status, p-values and parameter estimates are generated for each covariate in the models. However, only the p-values for waiver/LTSS status are reported in the result tables in the text below, as they best reflect the more central question posed in this study. The parameter estimates for waiver/LTSS status for each test are included in an Appendix.

In some instances, statistical analysis is based only on individuals who used a given service—that is, "users." Although users are drawn from the final matched treatment and control groups for each analysis, and so are still in some sense matched at the group level, the two groups may no longer be as balanced as the full matched treatment/control group, which might lead to bias. Thus, test results based on users alone are discussed separately within each subgroup analysis below, and only regression-based results that adjust for a full array of covariates used in the propensity score matching process (Model A) and the more comprehensive Model B are reported.

Finally, the treatment effects in this study—Medicaid LTSS—are assessed to be statistically significant if the associated p-value is less than 0.05. In some instances, marginal significance is discussed if the p-value is less than 0.10.

Older Adults Waiver

As outlined earlier in the introduction of grouping criteria, the OAW is an HCBS waiver program for Medicaid recipients in Maryland who are 50 years of age or older. For this subgroup analysis, an initial OAW treatment group was drawn from among continuously enrolled duals who had any enrollment in the waiver during 2006. That larger group was limited further to only those who were enrolled in the waiver for the entire year. The population of potential controls from which to draw matched controls was limited to 12-month enrollees who met the same age criteria but did not otherwise receive LTSS from Medicaid (personal care, medical day care, waiver, or institutional services) during 2006.

These potential controls are otherwise "well" duals as far as Medicaid service use suggests. Although it is important to keep in mind that direct information on functional status is lacking in this study, it should also be noted that all individuals in each of the treatment groups defined for this study have, by definition, been identified as requiring an NHLOC. No such information is available on the potential controls. However, earlier research on ADL limitations among community-dwelling duals in Maryland indicates that many beneficiaries among the otherwise well dual population have substantial functional support needs (Center for Health Program Development and Management,[13] 2006).[14] Thus, the population of potential controls is expected

[13] The Center for Health Program Development and Management, or CHPDM, is the former name of The Hilltop Institute.

to include individuals with a comparable level of need to that of individuals in the treatment groups. The propensity score matching process is intended to identify the best matching case, with an assumption of similar general need, for each treatment case from among possible controls using available administrative data.

Table 11 shows Medicare resource measures for various initial OAW study cohorts. The leftmost data column reflects continuously enrolled duals who were enrolled in the OAW at any time during 2006. The middle data column reflects 12-months enrollees among that first group, but excluding those enrolled in the waiver for less than 12 months and those who died. The rightmost column reflects the population of potential controls—that is, well duals enrolled for the full 12 months of 2006 with no Medicare group health coverage, ages 50 years and older. For the OAW subgroup analysis, the OAW 12-Month Enrollees (in the middle data column of Table 11) and the Potential Controls (in the rightmost column) will be used to establish matched treatment and control groups, respectively.

The leftmost group in Table 11—those with any enrollment in the OAW—had a higher use rate for institutional (hospital and SNF), home health, and hospice services than the same (OAW) group limited to 12-month enrollees; however, they had comparable use rates for Part B services. This largely indicates the influence on these measures of those in that leftmost group who died. The potential control group has noticeably lower use rates for all the service categories. Total PMPM costs (not otherwise shown) also reflect the intensity of service use across these study cohorts. Where the leftmost group generated $1,907 PMPM in payments, the middle group of OAW enrollees that excludes those who died generated $1,252 PMPM, and the population of potential controls generated $754 in payments overall.

[14] A 2006 survey of community-dwelling Medicaid recipients in Maryland indicated that the population receiving community supports could increase by as much as one-third, or some 2,100 individuals, if all the individuals who reported a need for support for three or more ADLs—but did not otherwise receive Medicaid support services—received that support through the program. An NHLOC can require fewer than three ADLs (CHPDM, 2006).

Table 11. Medicare Resource Measures (2006) for Potential Treatment and Control Populations, Older Adults Waiver (OAW)

Resource Use Measure	OAW Study Cohorts					
	OAW Continuously Enrolled	% of Total	OAW 12-Month Enrollees	% of Total	Potential Controls (12-month)	% of Total
Enrollees	2,739	100%	1,759	100%	19,095	100%
Enrollee Member Months	30,548		21,108		229,140	
Total Direct Medicare						
Total Payments	$58,266,423	100%	$26,424,626	100%	$172,851,042	100%
Total Users	2,728	99.6%	1,754	99.7%	17,778	93.1%
Hospital						
Hospital Payments	$29,495,050	50.6%	$11,790,541	44.6%	$80,638,323	46.7%
Users	1,356	49.5%	711	40.4%	4,469	23.4%
Hospital Stays	2,927		1,407		8,670	
Medicare-Paid Hospital Days	17,243		6,984		41,253	
Skilled Nursing Facility (SNF)						
SNF Payments	$5,351,997	9.2%	$1,439,503	5.4%	$7,444,947	4.3%
Users	495	18.1%	155	8.8%	730	3.8%
SNF Stay	754		205		1,020	
Medicare-Paid SNF Days	17,460		3,987		22,516	
Home Health						
Home Health Payments	$3,150,656	5.4%	$1,863,710	7.1%	$3,725,883	2.2%
Users	724	26.4%	406	23.1%	1,235	6.5%
Home Health Episodes	908		510		1,459	
Home Health Visits	17,154		9,934		22,292	
Hospice						
Hospice Payments	$2,243,314	3.9%	$923,719	3.5%	$2,042,286	1.2%
Users	207	7.6%	37	2.1%	62	0.3%
Hospice Episodes	224		41		67	
Medicare-Paid Hospice Days	15,993		6,882		14,877	
Part B						
Part B Payments	$18,025,407	30.9%	$10,407,154	39.4%	$78,999,602	45.7%
Users	2,721	99.3%	1,752	99.6%	17,776	93.1%
Physician Payments	$9,745,360	16.7%	$5,437,181	20.6%	$43,663,332	25.3%
Users	2,710	98.9%	1,746	99.3%	17,630	92.3%
Outpatient Payments	$5,846,483	10.0%	$3,300,581	12.5%	$29,961,628	17.3%
Users	1,930	70.5%	1,202	68.3%	11,476	60.1%
DME Payments	$2,433,564	4.2%	$1,669,392	6.3%	$5,374,642	3.1%
Users	1,917	70.0%	1,221	69.4%	6,096	31.9%

Note: Limited to duals, 50 years of age and older, with full benefits under Medicare and Medicaid and continuously enrolled in 2006 (from January 1 to death or the end of the year). Medicare Advantage health plan enrollment excluded.

The potential treatment and control populations that were combined to generate propensity scores for this analysis included 1,759 and 19,095 individuals, respectively (see the top row of Table 11). Covariates included in the propensity score calculation included age, sex, race, frailty status, CMS-HCC relative value, EvD status, 20 CCW condition indicators,[15] an ESRD indicator, and months of full Medicaid coverage (since January 2001). Once a propensity score was assigned to each individual, a subset of covariates (in addition to the propensity score itself) was used in the calculation of a Mahalonobis distance measure; these included the CMS-HCC value, age, sex, and a count of the chronic conditions (values range from 0 to 20). These covariates were chosen as a reasonably discrete set of key factors associated with Medicare service use to consider in making a final match. Note, again, that all the diagnostic indicators—frailty status, CMS-HCC value, and the chronic condition flags—were derived from 2005 claims data so that the choice of controls was based on information prior to the outcome period.

Balance across OAW Study Cohorts

Table 12 shows measures of balance in the covariates of interest across OAW treatment and control groups, both before and after propensity score matching. Covariates are considered *imbalanced* when the absolute value of the standardized difference is greater than 10 (Austin, 2009) or if p-values from the significance tests are relatively low. As shown in the leftmost data columns, before matching, the OAW treatment and control groups were imbalanced on age, CMS-HCC, number of conditions, months of Medicaid, sex, race, frailty, and 12 of the CCW chronic conditions. However, after matching, all of the covariates were balanced based on the standardized difference measure. With respect to age, for example, while the full treatment group had an average age of 78.1 years, the potential control group had an average age of 71 years. After the matching process, the final treatment and control groups had an average age of 76.8 and 76.6, respectively.

The p-value for months of Medicaid eligibility suggested a significant difference between the treatment and control groups, but the actual difference of .9 months was quite small. This possible imbalance was not considered important enough to worry about in a practical sense in light of the non-significance indicated by the standardized difference on that measure.

[15] The Alzheimer's condition flag shown in Tables 5 through 8 is subsumed under the Alzheimer's/dementia condition flag and is therefore not used separately in this process.

Table 12. Balancing Diagnostics for Treatment and Control Groups: OAW

	Before Propensity Score Matching				After Propensity Score Matching			
	Treatment (n=1,759)	Controls (n=19,095)	Balance Diagnostics		Treatment (n=1,440)	Controls (n=1,440)	Balance Diagnostics	
Distinguishing Characteristics	**Mean / N[1]**	**Mean / N[1]**	**P-value[2]**	**Std. Dif.**	**Mean / N[1]**	**Mean / N[1]**	**P-value[2]**	**Std. Dif.**
Age	78.1	71.0	<.0001	69.1	76.8	76.6	0.6023	1.4
Std. Dev. (Age)	10.5	10.0			10.4	10.4		
HCC	2.3	1.3	<.0001	80.3	2.2	2.2	0.7674	-3.9
Std. Dev. (HCC)	1.3	1.0			1.3	1.4		
Number of Conditions	3.6	2.0	<.0001	84.0	3.3	3.4	0.2695	-4.3
Std. Dev. (Conditions)	2.2	1.8			2.1	2.1		
Months	42.2	52.2	<.0001	-57.1	44.5	45.4	<.0001	-4.5
Std. Dev. (Months)	19.3	15.4			18.4	20.5		
Sex			<.0001				0.3065	
Male	417	5,554		-12.2	359	383		-3.8
Female	1,342	13,541		12.2	1,081	1,057		3.8
Race			<.0001				0.4847	
Black	594	7,201		-8.2	500	486		2.0
White	1,026	6,589		49.2	806	834		-3.9
Other/unknown	139	5,305		-53.8	134	120		3.4
Ever Disabled			0.1220				0.4123	
No	1,282	13,584		3.9	1,030	1,010		3.1
Yes	477	5,511		-3.9	410	430		-3.1
Diagnostic Criteria (Y/N)								
Frailty Marker	573	2,329	<.0001	50.4	438	435	0.9032	0.5
ESRD Status	50	365	0.0075	6.1	48	48	1.0000	0.0
Acute Myocard. Infarc.	23	120	0.0010	6.9	15	16	0.8567	-0.7
Alzheimer's/Dementia	836	1,092	<.0001	107.4	557	520	0.1542	5.3
Atrial Fibrillation	197	842	<.0001	25.5	152	156	0.8094	-0.9
Cataracts	308	3,227	0.5139	1.6	258	272	0.5008	-2.5
Chronic Kidney Disease	397	2,137	<.0001	30.7	307	322	0.4987	-2.5
COPD	359	2,304	<.0001	22.8	278	286	0.7072	-1.4
Colorectal Cancer	24	188	0.1286	3.5	20	23	0.6448	-1.7
Depression	503	2,179	<.0001	44.0	369	361	0.7318	1.3
Diabetes	793	6,336	<.0001	24.6	633	654	0.4312	-2.9
Endometrial Cancer	- ds -	33	0.1180	3.3	- ds -	- ds -	not valid	2.6
Female Breast Cancer	42	354	0.1165	3.7	35	42	0.4187	-3.0
Glaucoma	171	2,046	0.1959	-3.3	138	134	0.7988	0.9
Heart Failure	660	3,216	<.0001	47.8	489	521	0.2115	-4.7
Hip/Pelvic Fracture	19	48	<.0001	10.2	13	10	0.5300	2.3
Ischemic Heart Disease	874	5,829	<.0001	39.9	668	714	0.0862	-6.4
Lung Cancer	15	128	0.3750	2.1	11	10	0.8266	0.8
Osteoporosis	277	2,217	<.0001	12.1	210	228	0.3503	-3.5
Prostate Cancer	28	284	0.7297	0.8	21	25	0.5522	-2.2
Rheum./osteo arthritis	490	3,913	<.0001	17.3	382	375	0.7670	1.1
Stroke/TIA	366	911	<.0001	49.5	241	260	0.3503	-3.5

[1] Means are shown for continuous variables; N's are shown for categorical variables

[2] P-values are from rank sum tests (for continuous variables) and chi-square tests (for categorical variables)

Note: "ds" indicates data have been suppressed because of small cell size.

Note also that, although the number of potential control subjects was more than 10 times that of the treatment group, the final OAW subgroup sample included 1,440 individuals, representing a loss of 319 subjects from the (potential) treatment group. The treatment recipients who were not matched were significantly different (statistically) from those who were matched: they were older, female, and more likely to be frail; they had higher CMS-HCC values, more chronic conditions, and fewer months of prior Medicaid coverage; and they were less likely to be originally entitled to Medicare because of a disability (data not otherwise shown).

Additional Clinical Markers for Model B

As noted in the introduction to this section, analyses based on what is referred to as Model B reflect additional diagnostic information that is generally not otherwise included in the propensity score matching process. Markers for selected EDCs were identified for Model B based on a combination of exploratory analysis (to identify which conditions diagnosed in 2005 appeared at the greatest differing rates across the treatment and control groups) and the advice of clinical staff on their relevance to the study population. For the OAW analysis, EDCs for dementia and delirium,[16] other paralytic syndromes, schizophrenia and affective psychosis, and incontinence were included as additional morbidity indicators in the Model B analysis.

OAW Subgroup Analysis Results

Results for total Medicare resources are introduced below, and followed by separate sections on component services and payments.

Total Medicare Resources

Table 13 shows the total Medicare payments for those in the OAW treatment and control groups. Note that the total beneficiary member-months are the same for each group because this analysis is limited to those with 12 months of enrollment in 2006. Total Medicare payments were $1.42 million less for the treatment group than for the control group ($21,067,556 versus $22,492,149, respectively). This difference represents $83 PMPM (or close to 7 percent) higher costs for the control group. However, slightly more beneficiaries in the treatment group used Medicare services than did those in the control group (1,435 versus 1,390, respectively).

The unadjusted results, which modeled the effects of the waiver alone, were not statistically significant for total payments using the pairwise test (p-value of 0.4694), which (again) takes specific matches into account. The differences in payments were statistically significant

[16] Although dementia is included in the CCW list of conditions and in the propensity score process, this EDC is included in Model B to capture specific reference to delirium and to more specifically adjust for dementia in Model B because only a count of the CCW conditions is included in Model A.

(indicated in red in the summary tables) using the groupwise test (0.0045), indicating that—as a whole—the treatment group generated significantly less Medicare payments overall. Accounting for the matched nature of the treatment/control groups is a more stringent analytic constraint; thus, it is not necessarily surprising that the pairwise analysis did not find a statistically significant difference in cost while the groupwise analysis did.

Table 13. Resource Use and Testing Results for Treatment versus Control Groups: OAW Total Medicare

Resource Use Measure	With OAW (treatment)	Without OAW (control)	Pairwise[1] Unadjusted p-value	Groupwise[2] Unadjusted p-value	Groupwise[2] Model A[3] p-value	Groupwise[2] Model B[4] p-value
Beneficiaries	1,440	1,440				
Member Months	17,280	17,280				
Total Medicare						
Total Medicare Payments	$21,067,556	$22,492,149	0.4694	**0.0045**	**0.0013**	**0.0020**
PMPM	$1,219	$1,302				
Users	1,435	1,390	**<.0001**	**<.0001**	**<.0001**	**<.0001**

[1] Pairwise analysis tests the difference between matched treatment/control cases, summarized at the group level.

[2] Groupwise analysis tests the difference between the grouped sum of treatment and control groups.

[3] Model A is a groupwise test that also adjusts for sex, age, HCC value, months in Medicaid, ESRD, frailty, and count of CCW chronic conditions.

[4] Model B is the same as Model A but also adjusts for additional clinical conditions (EDCs): dementia & delirium, other paralytic syndromes, incontinence, and schizophrenia & affective psychosis.

Accounting for other residual differences (other than what was achieved in the propensity score matching process) using the regression-based adjusted models also suggested statistical significances between the treatment and control groups, both using only factors already include in propensity score matching (0.0013 for Model A) and using additional factors (0.0020 for Model B). However, the parameter estimates for treatment for those models are positive (see Table A1 in the Appendix), suggesting that treatment was associated with higher payments. Additional testing showed that this was a result of the transformation of the payment data required for regression-based modeling. That is, the transformation process changed the direction of average costs between the treatment and control groups in this subgroup analysis—as compared to the raw data results. It is also worth noting that the transformation used in this case effectively truncates high cost values in order to limit the influence of high-cost outlier cases. The underlying data reveal that more of such cases are included in the control group: the individual with the highest payments among the controls accrued twice the payments of the highest cost individual among the treatment group, and there were 51 versus 35 individuals among the control and treatment groups, respectively, with payments of at least $80,000. After the transformation, average total payments were higher for the treatment group because more dollars from the controls were effectively "truncated" in that process. Thus, the practical (real

dollar) difference indicated by these results may still suggest higher cost for the control group. In any case, analysis of the component costs will help identify the source of significant differences that are evident across the two (treatment and control) groups.

With respect to the dichotomous measure of users, both unadjusted (pairwise and groupwise) models suggested statistically significant differences in overall Medicare service use across the treatment and control groups. Thus, the higher use rate for the OAW treatment group suggests that these individuals are statistically more likely to use Medicare services than the control group. Note that, except for a limited number of measures that will be identified in the forthcoming text, the direction of significant differences between the treatment and control groups can be discerned from the raw data included in each table.

Inpatient Resource Use

Medicare resource use for inpatient services—specifically, hospital and SNF services—for those in the OAW treatment and control groups are shown in Table14. For Medicare-paid hospital services, the nominal pattern was similar to total Medicare resource use in that more individuals in the treatment group had a hospitalization (552 versus 511, respectively), but overall Medicare payments for these services were higher for the control group ($9,464,409 versus $10,122,075, respectively). As with total Medicare payments described above, the transformation used for the adjusted models also changed the direction of those differences for Medicare-paid hospital services such that the treatment group had higher average hospital payments after the transformation. Unlike total Medicare service use, however, these differences were not statistically significant at the .05 level, even after adjusting for various demographic and morbidity factors.

The OAW control group did have slightly more hospital stays overall than did the treatment group (1,166 versus 1,107, respectively). This difference was statistically significant after adjusting for the various demographic and morbidity covariates in Model A and Model B. Note that the two p-values in the table for this outcome measure indicate that a two-part zero-inflated model was used. The top p-value reflects the probability of any stay. More properly, the statistical test used in this case assesses whether there are "excess zeros"—that is, more non-users—in either group. A negative parameter estimate for the logistic result (logit) on treatment, for example, indicates that the treatment group has fewer non-users (more users)—which is the case for both Model A and Model B. This is consistent with the higher number of users shown in the Users line for hospital inpatient, although these results indicate significant difference for this part of the two-part results (0.0240 for Model A and 0.0020 for Model B). The difference between this measure and that for use/non-use as a whole (Users) is related to the subtle differences of testing for excess non-use in the logit part of the two-part test as opposed to testing the frequency of use among users as a whole.

Table 14. Resource Use and Testing Results for Treatment versus Control Groups: OAW Medicare Inpatient

Resource Use Measure	With OAW (treatment)	Without OAW (control)	Pairwise[1] Unadjusted p-value	Groupwise[2] Unadjusted p-value	Groupwise[2] Model A[3] p-value	Groupwise[2] Model B[4] p-value
Hospital Inpatient						
Total Hospital Payments	$9,464,409	$10,122,075	0.9529	0.2941	0.0803	0.1128
PMPM	$548	$586				
Users	552	511	0.1118	0.1133	0.0616	0.0894
Hospital Stays	1,107	1,166	0.7130	0.4546	**0.0240** **0.0320**	**0.0020** **0.0080**
Stays Per User	2.0	2.3				
Medicare-Paid Days	5,527	5,663	0.4380	0.0860 0.1450	0.0690 0.8560	0.1040 0.8050
Days Per User	10.0	11.1				
Days Per Stay	5.0	4.9				
Skilled Nursing Facility (SNF)						
Total SNF Payments	$1,032,723	$1,548,313	**0.0081**	0.0592	0.0696	**0.0473**
PMPM	$60	$90				
Users	112	139	0.0801	0.0742	0.0861	0.0591
SNF Stays	146	205	**0.0182**	**0.0163**	0.8130 0.2990	0.1510 **0.0040**
Stays Per User	1.3	1.5				
Medicare-Paid SNF Days	2,892	4,987	**0.0026**	0.0790 **0.0010**	0.0900 **0.0020**	0.0620 **0.0020**
Days Per User	25.8	35.9				
Days Per Stay	19.8	24.3				

[1] Pairwise analysis tests the difference between matched treatment/control cases, summarized at the group level.

[2] Groupwise analysis tests the difference between the grouped sum of treatment and control groups.

[3] Model A is a groupwise test that also adjusts for sex, age, HCC value, months in Medicaid, ESRD, frailty, and count of CCW chronic conditions.

[4] Model B is the same as Model A but also adjusts for additional clinical conditions (EDCs): dementia & delirium, other paralytic syndromes, incontinence, and schizophrenia & affective psychosis.

The bottom p-value of the two-part results reflects whether there is a difference in the number of stays for those who had any stay. Both adjusted models suggest a statistically significant difference in the number of stays between the treatment and control groups, controlling for any hospitalization. The parameter for treatment is negative (see Table A1 in the Appendix) indicating that the control group had more stays per user. Stays per hospital user reported in

Table 14 show this result in a different way in that the control group had 0.3 (or 15 percent) more stays per user than the treatment group. When readmissions were defined in terms of days between discharge and subsequent admission, more detailed analysis of the data shows that 21 percent of the control group who had an admission had a readmission within 7 days as compared to 15 percent of those in the treatment group. Forty-two percent of the control group who had an admission had another admission within 90 days of discharge as compared to 35 percent of those in the treatment group (data not otherwise shown).

The control group had more hospital days overall than the treatment group (5,663 versus 5,527, respectively). However, although the control group had marginally more days overall, there was no statistical difference in the number of days compared to the treatment group, after controlling for the likelihood of generating any stay/day.

In contrast to hospital inpatient services, there is evidence of higher costs and use of SNF services among the OAW control group. The control group generated $515,590 more in SNF payments than the treatment group (a difference of $30 PMPM). There were more users, more stays, and more days among this group. The p-value for the unadjusted groupwise model was marginally significant for both total SNF payments and users (0.0592 and 0.0742, respectively). After full adjustment, the difference in SNF payments was statistically significant (0.0473 for Model B, in the direction of higher costs for the controls), although the test on users remained only marginally significant (0.0591). The fully adjusted model also indicated that, although having any stay/day was not statistically different across the groups, those in the OAW control group who had any stay/day had significantly more SNF stays (p-value of 0.0040) and days (p-value of 0.0020) than the treatment group.

Home Health and Hospice Resource Use

Medicare resource use for home health and hospice services for those in the OAW treatment and control groups is shown in Table 15. Unlike with inpatient services, the OAW treatment group had higher Medicare home health payments than the control group (a difference of $621,618, or $35 PMPM). Likewise, the treatment group had more users of those services than did the control group (309 [21.5 percent] versus 211 [14.7 percent], respectively). Both the unadjusted and adjusted models suggested statistically greater use by the treatment group for each of these measures. Similarly, recipients in the treatment group had more home health episodes and visits than those in the control group. The logit results on both home health episodes and visits suggest that there is a statistical difference in whether those services occur: they reaffirm that the treatment group received them more often. However, the second part p-values for those measures suggest that there was no statistically significant difference in the frequency of episodes or visits (among those who actually received them) between the treatment group and control group.

Table 15. Resource Use and Testing Results for Treatment versus Control Groups: OAW Medicare Home Health and Hospice

Resource Use Measure	With OAW (treatment)	Without OAW (control)	Pairwise[1] Unadjusted p-value	Groupwise[2] Unadjusted p-value	Groupwise[2] Model A[3] p-value	Groupwise[2] Model B[4] p-value
Home Health (HH)						
Total HH Payments	$1,373,733	$752,115	**<.0001**	**<.0001**	**<.0001**	**<.0001**
PMPM	$79	$44				
Users	309	211	**<.0001**	**<.0001**	**<.0001**	**<.0001**
HH Episodes	380	268	**<.0001**	**0.0030** 0.3790	**<.0001** 0.9930	**<.0001** 0.9690
Episodes Per User	1.2	1.3				
HH Visits	6,938	4,467	**0.0001**	**<.0001** 0.5050	**<.0001** 0.1090	**<.0001** 0.1470
Visits Per User	22.5	21.2				
Visits Per Episode	18.3	16.7				
Hospice						
Total Hospice Payments	$550,648	$1,613,476	**0.0003**	**0.0252**	**0.0210**	**0.0177**
PMPM	$32	$93				
Users	22	39	**0.0396**	**0.0268**	**0.0217**	**0.0084**
Hospice Episodes	25	41	**0.0479**	0.0512	0.0790 **0.0010**	**0.0194**
Episodes Per User	1.1	1.1				
Medicare-Paid Days	4,065	11,861	**0.0006**	0.1216	**0.0220** **<.0001**	**0.0080** **<.0001**
Days Per User	184.8	304.1				
Days Per Episode	162.6	289.3				

[1] Pairwise analysis tests the difference between matched treatment/control cases, summarized at the group level.

[2] Groupwise analysis tests the difference between the grouped sum of treatment and control groups.

[3] Model A is a groupwise test that also adjusts for sex, age, HCC value, months in Medicaid, ESRD, frailty, and count of CCW chronic conditions.

[4] Model B is the same as Model A but also adjusts for additional clinical conditions (EDCs): dementia & delirium, other paralytic syndromes, incontinence, and schizophrenia & affective psychosis.

Medicare hospice services are the least utilized Medicare benefit for the OAW treatment and control groups. Only 22 individuals in the OAW treatment group used the Medicare hospice benefit in 2006, while 39 individuals in the control group did. Although the numbers are small, the higher number of users in the control group was statistically different from the number of users in the treatment group, and those differences resulted in significantly higher costs for the control group (a difference of $1,062,828, or $61 PMPM). Further, the fully adjusted (Model B)

results suggest that those in the control group had significantly more hospice episodes and a significantly higher number of hospice days than did the treatment group. Notably, at 289.3 days, the average length of a hospice episode was 1.8 times longer for the control group than for the treatment group.

Part B Resource Use

Medicare Part B resource use for those in the OAW treatment and control groups is shown in Table 16—in total and separately for physician, outpatient, and DME services. Total Part B costs are slightly higher, but significantly different (statistically), for the OAW treatment group as compared to the control group (a difference of $189,872, or $11 PMPM). Also, the treatment group had significantly more users of Part B services than did the control group (1,433 versus 1,390, respectively). Although there are statistically significant differences at each component level, the pattern of more users and higher costs for the OAW treatment group is not consistent across component services. The pattern of higher payments among the treatment group is consistent and statistically significant for physician services, although this difference is only $52,965 ($3 PMPM). DME service use and costs are also higher for the treatment group, and statistically different from that for the control group, but—at nearly twice the payments on a PMPM basis for almost 60 percent more users—it is more markedly so. In contrast, outpatient service use and payments are higher (and statistically different) for the control group.

A more detailed examination of DME services at the procedure code level showed that the 2,880 individuals in the combined treatment and control groups used 476 different specific DME items—from lubricants for catheter insertions to wheelchairs. Although this is an admittedly crude measure, the treatment group used a "richer" array of DME: they received 413 of those items while the control group received just 285. Much of the differences in cost seemed to be associated with more high-end hospital bed rentals and mattresses for the treatment group. On one hand, this may be an indication that, despite elaborate consideration of diagnoses and other factors in the propensity score matching process, the OAW treatment group has a greater need for DME supports. On the other hand, it is not clear to what extent this may also be a result of more ready access associated with coordination of services under the OAW—that is, being "plugged-in" to the provider network—and/or unmet need within the control group.

Table 16. Resource Use and Testing Results for Treatment versus Control Groups: OAW Medicare Part B

Resource Use Measure	With OAW (treatment)	Without OAW (control)	Pairwise[1] Unadjusted p-value	Groupwise[2] Unadjusted p-value	Groupwise[2] Model A[3] p-value	Groupwise[2] Model B[4] p-value
Part B						
Total Part B Payments	$8,646,041	$8,456,169	**0.0361**	**0.0002**	**<.0001**	**<.0001**
PMPM	$500	$489				
Users	1,433	1,390	**<.0001**	**<.0001**	**<.0001**	**<.0001**
Physician Payments	$4,535,655	$4,482,690	0.0592	**0.0025**	**<.0001**	**<.0001**
PMPM	$262	$259				
Users	1,429	1,381	**<.0001**	**<.0001**	**<.0001**	**<.0001**
Outpatient Payments	$2,809,130	$3,314,847	**0.0035**	**0.0025**	**0.0105**	**0.0123**
PMPM	$163	$192				
Users	975	1,027	**0.0385**	**0.0353**	**0.0377**	**0.0376**
DME Payments	$1,301,255	$658,632	**<.0001**	**<.0001**	**<.0001**	**<.0001**
PMPM	$75	$38				
Users	985	620	**<.0001**	**<.0001**	**<.0001**	**<.0001**

[1] Pairwise analysis tests the difference between matched treatment/control cases, summarized at the group level.

[2] Groupwise analysis tests the difference between the grouped sum of treatment and control groups.

[3] Model A is a groupwise test that also adjusts for sex, age, HCC value, months in Medicaid, ESRD, frailty, and count of CCW chronic conditions.

[4] Model B is the same as Model A but also adjusts for additional clinical conditions (EDCs): dementia & delirium, other paralytic syndromes, incontinence, and schizophrenia & affective psychosis.

Some effort was made to account for differences in outpatient services by looking at emergency room (ER) visits and costs, under the assumption that the control group might make more use of ER as a result of less coordinated access to care. It is important to understand that outpatient claims reflect ER costs if the patient is not formally admitted to the hospital as a result of the ER visit. If there is a related admission, the ER costs are subsumed in the hospital payments.

Based on outpatient data alone, and much like inpatient hospital services, more individuals among the treatment group used the ER (505 versus 469 in the control group) while the controls had more ER visits per person (1.8 versus 2.4 for the treatment and control groups, respectively—data not otherwise shown). With respect to ER visits that resulted in a hospital admission, the treatment group had more individuals (498 versus 426 for the controls) and more hospital stays (932 versus 861 for the controls) that began with ER visits, once again representing fewer related hospital stays per person for the treatment group. At the same time, the higher number of hospital stays for the treatment group may help explain their lower ER outpatient costs—because more ER costs were subsumed in hospital rather than outpatient

claims. To the extent that subsequent admission to the hospital indicates the intensity of need for the ER visit, the control group seems to have used the ER more often for a lower level of need. Taken together, this suggests that waiver participants got care more readily than the control group but that better coordination of services seems to have moderated subsequent returns to the ER.

Payments per User

The analysis reflected in Table 17 is slightly different than the analysis presented in Tables 13 through 16 in that it is limited to users alone and more directly explores whether there are differences in payments across the treatment and control groups given some service use. Individuals in the treatment and control groups can no longer be considered matched pairs and there is less of a presumption that the two groups are balanced on the covariates used in the earlier propensity score matching process. Although the comparison between treatment and control groups is still limited to the populations identified in the propensity score matching process—and, thus, are in some sense more comparable at the group level than otherwise random treatment and control groups might be—these measures are presented separately to highlight the point that the stronger propensity score assumptions do not necessarily apply. At the same time, these results are related to the second step results of the two-part zero-inflated models. Unadjusted treatment effects are also not shown for these measures because of the lack of formal matching. Moreover, the adjusted models (Model A and Model B) are slightly different than the adjusted models in Tables 13 through 16 in that they include almost all of the covariates used in the propensity score matching process (except that the count of CCW conditions is included rather than the 20 separate condition indicators).

Results on payments per user are slightly different than the overall results. As with the results for overall Medicare payments in Table 13, there were somewhat conflicting results after statistical adjustment for total Medical payments per user. In this case, the control group generated close to $1,500 (or 10 percent) more costs per user, but the parameter estimate (see Appendix Table A1) for the adjusted models suggested more costs for the treatment group—although the difference was not statistically significant. Hospital inpatient payments per user were also higher for the control group, but not statistically different from the treatment group. SNF payments per user were higher for the control group, but, unlike for overall SNF payments, the difference was not statistically significant.

The patterns for per-user payments for both home health and hospice are the same as for overall payments: higher payments among users in the treatment group for home health services and higher payments for hospice services among users in the control group, with differences on both measures being statistically significant.

Table 17. Resource Use and Testing Results for Treatment versus Control Groups: OAW Users Only for Total and Component Costs

Resource Use Measures	With OAW (treatment)		Without OAW (control)		Model A[1]	Model B[2]
	Per User	N	Per User	N	p-value	p-value
Total Medicare Payments	$14,681	1,435	$16,181	1,390	0.1272	0.1580
Hospital Payments	$17,146	552	$19,808	511	0.2850	0.2628
SNF Payments	$9,221	112	$11,139	139	0.0845	0.1013
Home Health Payments	$4,446	309	$3,565	211	**0.0120**	**0.0233**
Hospice Payments	$25,029	22	$41,371	39	**0.0005**	**0.0002**
Part B Payments	$6,034	1,433	$6,084	1,390	**0.0002**	**0.0001**
Physician Payments	$3,174	1,429	$3,246	1,381	**0.0154**	**0.0074**
Outpatient Payments	$2,881	975	$3,228	1,027	0.0810	0.1006
DME Payments	$1,321	985	$1,062	620	**<.0001**	**<.0001**

[1] Adjusted for age, sex, race, frailty status, CMS-HCC relative value, ever-disabled status, count of 20 CCW conditions, ESRD status, and months in Medicaid (since January 1, 2001).

[2] Adjusted for the same covariates included in Model A, as well as EDC-based indicators for dementia and delirium, other paralytic syndromes, incontinence, and schizophrenia and affective psychosis

Results on per-user Part B payments provide a somewhat more mixed picture than do the results that include non-users in Table 16. The control group had slightly higher average overall per-user Part B payments, with higher physician and outpatient components. However, the differences were only statistically significant for the overall and component physician payments and, as was the case with the results that included non-users, those differences were statistically higher for the treatment group. In these cases, the transformation used in the regression analysis did not change the direction of the difference in the underlying data from that evident in the raw (untransformed) results: average transformed payments were higher for the treatment group even though raw per-user costs were higher for the control group. DME payments remained significantly higher, both nominally and statistically, for the treatment group on a per-user basis. The higher DME payments, in particular, seem to have led to the overall higher payments in Part B services for the treatment group.

OAW Summary Discussion

Clearly, more work is needed to definitively explain differences that are evident between the treatment and control groups in this analysis. As noted throughout this report, better information on each individual's functional status might provide more defensible comparison groups, for example. Also, more targeted analysis to "drill down" below the measures presented here might help explain in a practical way what may truly account for differences. Nevertheless, a basic pattern does emerge from these results: providing OAW community support services tends to be associated with more individuals receiving more Medicare services, but *overall* Medicare

resource use, particularly on a per-user payment basis, is not significantly higher for those who receive Medicaid supports.

There may also be an overall improvement in the quality of care associated with better coordination of services under the OAW—as suggested by fewer hospital readmissions, fewer SNF stays, and fewer cases of repeated ER visits for the treatment group. More individuals were admitted to the hospital among those who received OAW services, but the overall cost of those stays tended to be lower with fewer SNF days associated with those stays. More individuals received home health services, and the associated costs were higher for the OAW treatment group, but those effects appear to be offset by the lower SNF use, as well as lower hospice costs, and shorter hospice episodes for the treatment group to some degree.

Both higher home health and DME use and costs for the OAW treatment group may indicate greater functional support needs for that group. To the extent that the treatment group does have greater needs, the lack of relatively higher inpatient and outpatient costs for the treatment group helps buttress the suggestion that better coordinated access to home health and DME, in particular, can moderate other Medicare costs. At the same time, given the extensive efforts to adjust for factors related to need in this study, the higher use rates for home health and DME for the treatment group also suggest both that OAW enrollees are "plugged-in" to the Medicare service network better than other comparable Medicaid recipients and that those comparable recipients may have unmet need related to those services to some extent.

Thus, the most notable "treatment" effects of providing Medicaid OAW LTSS are: (1) an increase in services that indicate better access to care, particularly home health and DME and (2) a decrease in services that suggest less coordinated care, particularly repeated inpatient hospital and SNF stays and longer hospice episodes. This is all the more significant because it takes place in the absence of a more formal managed care environment, such as a Medicare Advantage plan.

Living at Home Waiver

The initial intention of the overall subgroup analysis was to develop a kind of template for analysis of Medicare resource use, particularly within the context of key clinical categories that affect Medicare beneficiaries as a whole. To that end, the basic covariate structure used in the OAW analysis above—including the full set of CCW chronic conditions—was initially applied in the LAH analysis. As this second analysis progressed it became increasingly clear that a simple overlay of the decision rules used for the OAW analysis was not ideally suited to the LAH treatment group. The LAH Waiver population is relatively small and, more importantly, the initial analysis suggested that key clinical factors that might otherwise be introduced in the more fully adjusted Model B in this study should be integrated earlier in the process. Thus, a second—revised—analysis was conducted with a more narrowly defined set of matching criteria than was initially planned. Aspects of the initial and the revised analyses are reported in this section both as a way to share the separate results and as an exercise to illustrate the process of analysis.

Initial LAH Subgroup Analysis

The LAH Waiver is an HCBS waiver program for Medicaid recipients in Maryland who are 18 to 64 years of age. Continuously enrolled duals under this waiver are drawn almost exclusively from those who were first entitled to Medicare benefits because of a disability. As was the case for the OAW analysis, a potential LAH treatment group was limited to only those who were enrolled in the waiver for the entire year. The population of potential controls from which to draw matched cases was limited to 12-month enrollees who met the same age criteria and were first eligible for Medicare because of a disability, but did not otherwise receive long-term supports from Medicaid (personal care, medical day care, waiver, or institutional services) during 2006.

Table 18 shows Medicare resource measures for various initial LAH Waiver study cohorts. The leftmost data column reflects continuously enrolled duals who were enrolled in the LAH Waiver at any time during 2006. The middle data column reflects 12-month enrollees among that first group: excluding those enrolled in the waiver for less than 12 months and those who died. The rightmost column reflects the population of potential controls—that is, EvD well duals enrolled for the full 12 months of 2006 with no Medicare group health coverage, between 18 and 64 years of age.

The leftmost group in Table 18 has a higher use rate for institutional (hospital and SNF) and home health care than the same group limited to 12-month enrollees. The potential control group has noticeably lower use rates for all the service categories. Overall Medicare payments for LAH Waiver participants are slightly higher across study cohorts on a PMPM basis than those for the comparable OAW group: $2,227 for the full LAH Waiver group, $1,538 for 12-month enrollees, and $860 for the potential controls group. The potential treatment and control populations that were combined to generate propensity scores for this analysis included 202 and 11,322 individuals, respectively (see the top row of Table 18).

Because the LAH Waiver group as a whole was found to have a similar—although less intense—pattern of chronic conditions as the OAW group (see the discussion of Table 8), the initial set of covariates included in the propensity score calculation for this analysis was largely the same as that for the OAW analysis. Covariates included in the propensity score calculation included age, sex, race, frailty status, CMS-HCC relative value, 20 CCW condition indicators, an ESRD indicator, and months of full Medicaid coverage (since January 2001). EvD status was not included because all treatment and control subjects for this analysis were EvD. After matching, all 202 treatment subjects were paired with a control. Sex, age, CMS-HCC value, a count of the chronic conditions, and the propensity score itself were used in the calculation of the Mahalonobis distance measure applied to establish matched treatment and control pairs.

Table 18. Medicare Resource Measures (2006) for Potential Treatment and Control Populations, LAH Waiver

Resource Use Measure	LAH Study Cohorts					
	LAH Continuously Enrolled	% of Total	LAH 12-Month Enrollees	% of Total	Potential Controls (12-month)	% of Total
Enrollees	269	100%	202	100%	11,322	100%
Enrollee Member Months	3,137		2,424		135,864	
Total Direct Medicare						
Total Payments	$6,985,715	100%	$3,728,809	100%	$116,850,099	100%
Total Users	266	98.9%	200	99.0%	10,356	91.5%
Hospital						
Hospital Payments	$3,336,736	47.8%	$1,411,492	37.9%	$58,005,259	49.6%
Users	104	38.7%	57	28.2%	2,894	25.6%
Hospital Stays	263		138		6,726	
Medicare-Paid Hospital Days	1,982		863		36,780	
Skilled Nursing Facility (SNF)						
SNF Payments	$260,996	3.7%	$31,618	0.8%	$2,033,560	1.7%
Users	22	8.2%	- ds -	- ds -	213	1.9%
SNF Stay	36		- ds -		307	
Medicare-Paid SNF Days	1,098		127		6,338	
Home Health						
Home Health Payments	$746,117	10.7%	$589,872	15.8%	$1,196,487	1.0%
Users	100	37.2%	68	33.7%	397	3.5%
Home Health Episodes	145		101		480	
Home Health Visits	5,180		4,365		7,684	
Hospice						
Hospice Payments	$103,421	1.5%	$44,003	1.2%	$234,258	0.2%
Users	- ds -	- ds -	- ds -	- ds -	- ds -	- ds -
Hospice Episodes	- ds -		- ds -		- ds -	
Medicare-Paid Hospice Days	767		334		1,640	
Part B						
Part B Payments	$2,538,445	36.3%	$1,651,823	44.3%	$55,380,534	47.4%
Users	264	98.1%	199	98.5%	10,355	91.5%
Physician Payments	$850,904	12.2%	$530,317	14.2%	$25,134,182	21.5%
Users	257	95.5%	192	95.0%	10,201	90.1%
Outpatient Payments	$877,582	12.6%	$498,082	13.4%	$26,592,904	22.8%
Users	207	77.0%	150	74.3%	7,767	68.6%
DME Payments	$809,959	11.6%	$623,425	16.7%	$3,653,449	3.1%
Users	230	85.5%	175	86.6%	2,901	25.6%

Note: Limited to duals, 18 to 64 years of age, with full benefits under Medicare and Medicaid and continuously enrolled in 2006 (from January 1 to death or the end of the year). Medicare Advantage health plan enrollment excluded. "ds" indicates data have been suppressed because of small cell size.

Balance across LAH Study Cohorts

Table 19 shows the balance in the covariates of interest before and after initial propensity score matching. Before matching, the LAH treatment and control groups were imbalanced on CMS-HCC, number of conditions, months of Medicaid, race, frailty, ESRD status, and on nine of the 20 CCW conditions—that is, the absolute value of the standardized difference is greater than 10 in each case. After matching, no cases were discarded and most of the demographic covariates were balanced except for the other/unknown race category, which involved very few cases. Nine of the 10 CCW conditions that occurred often enough within the treatment group to generate dependable p-value statistics suggested balance based on standardized differences. Five of the remaining conditions did not occur in the treatment group or in the matched control group. There were too few treatment cases for the remaining five conditions to calculate p-values, but the standardized differences suggested balance in all but two conditions (cataracts and glaucoma). Thus the resultant set of matched controls was markedly closer to the treatment group in nearly every respect.

At the same time, these results on balancing statistics make evident the point that it is difficult to account for many covariates—even using a propensity score process—when the number of treatment cases is small. More importantly, perhaps, they suggest that the set of clinical covariates was too broad, or otherwise poorly defined, for this population.

Additional Clinical Markers for Model B

As was the case with the OAW, analysis based on what is referred to as Model B is intended to reflect additional diagnostic information that is not otherwise included in the propensity score matching process. Markers for selected EDCs are chosen for Model B based on a combination of exploratory analysis—to identify which chronic conditions diagnosed in 2005 appeared at the greatest differing rates across the treatment and control groups—and the advice of clinical staff on their relevance to the study population.

For the LAH analysis, the preliminary EDC analysis indicated that, while the treatment and control groups were more balanced with respect to the rate of CCW conditions in each group, differences in occurrence of other conditions was greater after the matching process. In some cases, those greater differences were associated with conditions that suggest distinct clinical needs that might affect the results. The occurrence of substance abuse, for example, was disproportionately higher among the matched controls—that is, as a result of the matching process.

Table 19. Balancing Diagnostics for Treatment and Control Groups: LAH Waiver

	Before Propensity Score Matching				After Propensity Score Matching			
	Treatment (n=202)	Controls (n=11,322)	Balance Diagnostics		Treatment (n=202)	Controls (n=202)	Balance Diagnostics	
Distinguishing Characteristics	Mean / N[1]	Mean / N[1]	P-value[2]	Std. Dif.	Mean / N[1]	Mean / N[1]	P-value[2]	Std. Dif.
Age	44.8	44.7	0.7698	0.4	44.8	45.0	0.7799	-3.2
Std. Dev. (Age)	9.1	11.0			9.1	9.0		
HCC	2.2	1.2	<.0001	67.5	2.2	2.2	0.9223	-2.5
Std. Dev. (HCC)	1.8	1.1			1.8	1.9		
Number of Conditions	1.4	1.2	0.1932	12.4	1.4	1.4	0.9641	-1.5
Std. Dev. (Conditions)	1.6	1.5			1.6	1.7		
Months	50.7	53.2	<.0001	-20.6	50.7	50.2	0.0030	3.3
Std. Dev. (Months)	10.3	13.6			10.3	15.9		
Sex			0.3075				1.0000	
Male	89	5,398		-7.3	89	89		0.0
Female	113	5,924		7.3	113	113		0.0
Race			0.0005				0.4689	
Black	68	5,160		-24.5	68	73		-5.2
White	126	5,496		28.1	126	125		1.0
Other/unknown	- ds -	666		-8.9	- ds -	- ds -		11.7
Diagnostic Criteria (Y/N)								
Frailty Marker	47	1,423	<.0001	28.2	47	47	1.0000	0.0
ESRD Status	- ds -	359	0.1734	-11.2	- ds -	- ds -	not valid	0.0
Acute Myocard. Infarc.	0	34	not valid	-7.8	0	0	not valid	0.0
Alzheimer's/Dementia	16	217	<.0001	28.0	16	17	0.8559	-1.8
Atrial Fibrillation	- ds -	122	not valid	3.6	- ds -	- ds -	not valid	0.0
Cataracts	- ds -	504	0.3103	-7.8	- ds -	10	0.3075	-10.2
Chronic Kidney Disease	24	949	0.0762	11.6	24	21	0.6352	4.7
COPD	11	981	0.1059	-12.6	11	10	0.8227	2.2
Colorectal Cancer	0	33	not valid	-7.6	0	0	not valid	0.0
Depression	47	3,241	0.0946	-12.2	47	48	0.9066	-1.2
Diabetes	52	2,435	0.1469	10.0	52	50	0.8188	2.3
Endometrial Cancer	0	- ds -	not valid	-3.3	0	0	not valid	0.0
Female Breast Cancer	0	76	not valid	-11.6	0	0	not valid	0.0
Glaucoma	- ds -	396	0.6856	-3.0	- ds -	12	0.1479	-14.4
Heart Failure	24	969	0.0953	11.0	24	29	0.4612	-7.3
Hip/Pelvic Fracture	- ds -	- ds -	not valid	12.3	- ds -	- ds -	not valid	0.0
Ischemic Heart Disease	32	1,633	0.5698	4.0	32	36	0.5948	-5.3
Lung Cancer	0	29	not valid	-7.2	0	0	not valid	0.0
Osteoporosis	23	347	<.0001	32.6	23	13	0.0808	17.4
Prostate Cancer	- ds -	22	not valid	5.1	- ds -	- ds -	not valid	0.0
Rheum./osteo arthritis	18	1,078	0.7694	-2.1	18	14	0.4612	7.3
Stroke/TIA	12	285	0.0023	17.1	12	16	0.4333	-7.8

[1] Means are shown for continuous variables; N's are shown for categorical variables

[2] P-values are from rank sum tests (for continuous variables) and chi-square tests (for categorical variables)

Note: "ds" indicates data have been suppressed because of small cell size.

Examining patterns of EDCs also revealed that a high proportion of treatment subjects had a diagnosis of quadriplegia or paraplegia. There were 78 individuals (or 38.6 percent) with an EDC for quadriplegia/paraplegia among the treatment group, as compared to 11 cases among the matched controls. The treatment group accounted for 40.8 percent of all (191) individuals identified with quadriplegia/paraplegia in the combined potential treatment and control populations using 2005 data. At the same time, a separate exploratory analysis of DME claims, engendered because of a marked difference in DME payments across the treatment and matched control groups, showed that the treatment group used many more hospital bed rentals than the control group. Because diagnoses drawn from DME claims were not included in the primary assignment of EDCs used for this study, a second effort was made to identify individuals with a diagnosis of quadriplegia/paraplegia using DME claims, as well as a second year (2004) of all claims data, to help ensure that individuals with quadriplegia or paraplegia were properly identified. As a result of including DME claims to assign the EDC, an additional 45 individuals in the combined potential treatment and controls population were found to have a diagnosis of quadriplegia/paraplegia using 2005 data. Another 31 individuals with such a diagnosis were found in the same (combined potential treatment and controls) population using 2004 data as well.

EDCs included in the Model B applied for the initial LAH subgroup analysis included: quadriplegia & paraplegia, substance abuse, schizophrenia & affective psychosis, and multiple sclerosis. The EDC for quadriplegia & paraplegia was based on diagnoses from all sources described in the preceding paragraph.

Initial LAH Results

Results for the initial analysis of treatment effects related to the LAH Waiver are shown in Tables 20-24. Again, although they represent a legitimate approach to examine the effects of the LAH Waiver, these results are presented largely for illustrative purposes, and as a prelude to the more tailored, revised, analysis presented below.

Total Medicare Resource Use

Table 20 shows the results of significance tests on total Medicare payments and service use. Both (pairwise and groupwise) unadjusted tests, and the adjusted Model A, suggest a statistically significant difference in Medicare payments across the LAH treatment and control groups. The treatment group used more resources overall, although the rate of use (Users) was not statistically different across the groups. Adjusting for key additional factors in Model B, however, moderated the results for total Medicare payments. In other words, there was no significant difference in overall Medicare resource use that could be attributed to the LAH Waiver in this analysis once a few specific conditions that were not included in the initial propensity score matching process were accounted for.

Table 20. Resource Use for Treatment versus Control Groups: LAH Waiver
Total Medicare

Resource Use Measure	With LAH Waiver (treatment)	Without LAH Waiver (control)	Pairwise[1] Unadjusted p-value	Groupwise[2] Unadjusted p-value	Groupwise[2] Model A[3] p-value	Groupwise[2] Model B[4] p-value
Beneficiaries	202	202				
Member Months	2,424	2,424				
Total Medicare						
Total Medicare Payments	$3,728,809	$3,470,305	**0.0399**	**0.0382**	**0.0188**	0.5713
PMPM	$1,538	$1,432				
Users	200	196	0.2891	0.1441	0.1454	0.1351

[1] Pairwise analysis tests the difference between matched treatment/control cases, summarized at the group level.

[2] Groupwise analysis tests the difference between the grouped sum of treatment and control groups.

[3] Model A is a groupwise test that adjusts for HCC value, ESRD, frailty, and count of CCW chronic conditions.

[4] Model B is the same as Model A but also adjusts for additional clinical conditions (EDCs): multiple sclerosis, quadriplegia & paraplegia, substance abuse, schizophrenia & affective psychosis.

Inpatient Resource Use

Initial results related to inpatient resource use are presented in Table 21. Unadjusted groupwise and adjusted Model A results suggest that there is a statistically significant difference in both total hospital payments and use between the groups. The direction of the difference is different from overall results, however, in that the control group used more resources than the treatment group. At the same time, much like the overall results in Table 20, the more fully adjusted Model B tended to help explain those differences as a function of additional clinical factors. The probability of having any hospital stay did remain statistically significant (0.0480), and more likely for the control group, using Model B.

This population generally accrued too few SNF stays and days to report all of the related detail, thus much of the information regarding SNF in the lower section of Table 21 has been suppressed. As a practical matter, the direction of higher SNF use among the control group is self evident, yet there are too few cases available for this analysis to establish statistical significance.

Table 21. Resource Use for Treatment versus Control Groups: LAH Waiver Medicare Inpatient

Resource Use Measure	With LAH Waiver (treatment)	Without LAH Waiver (control)	Pairwise[1] Unadjusted p-value	Groupwise[2] Unadjusted p-value	Groupwise[2] Model A[3] p-value	Groupwise[2] Model B[4] p-value
Hospital Inpatient						
Total Hospital Payments	$1,411,492	$1,829,403	0.0953	**0.0192**	**0.0061**	0.0596
PMPM	$582	$755				
Users	57	81	**0.0106**	**0.0116**	**0.0085**	0.0729
Hospital Stays	138	234	**0.0443**	**0.0122**	0.0520 0.4340	**0.0480** 0.6800
Stays Per User	2.4	2.9				
Medicare-Paid Days	863	1,193	0.1336	**0.0100** 0.7950	**0.0040** 0.6330	0.0560 0.3930
Days Per User	15.1	14.7				
Days Per Stay	6.3	5.1				
Skilled Nursing Facility (SNF)						
Total SNF Payments	$31,618	$113,295	0.0946	0.2935	0.3173	0.2661
PMPM	$13	$47				
Users	- ds -	- ds -	0.4240	0.3051	0.3141	0.2511
SNF Stays	- ds -	- ds -	0.1935	0.1206	0.0648	0.1516
Stays Per User	- ds -	- ds -				
Medicare-Paid SNF Days	127	393	0.1205	0.3029	0.1294	0.3986
Days Per User	- ds -	- ds -				
Days Per Stay	- ds -	- ds -				

[1] Pairwise analysis tests the difference between matched treatment/control cases, summarized at the group level.

[2] Groupwise analysis tests the difference between the grouped sum of treatment and control groups.

[3] Model A is a groupwise test that adjusts for HCC value, ESRD, frailty, and count of CCW chronic conditions.

[4] Model B is the same as Model A but also adjusts for additional clinical conditions (EDCs): multiple sclerosis, quadriplegia & paraplegia, substance abuse, schizophrenia & affective psychosis.

Note: "ds" indicates data have been suppressed because of small cell size.

Home Health and Hospice Resource Use

Table 22 shows results based on home health and hospice resource use. Each of the models reflected in the table suggested statistical significance in higher rates of home health services for the treatment group. Despite being based on a relatively small sample, this appears to reflect one

of the more consistent emerging themes in the subgroup analysis as a whole: waiver participants tend to use more Medicare home health services.

There were not enough cases in this subgroup analysis to test differences in hospice use.

Table 22. Resource Use for Treatment versus Control Groups: LAH Waiver Medicare Home Health and Hospice

Resource Use Measure	With LAH Waiver (treatment)	Without LAH Waiver (control)	Pairwise[1] Unadjusted p-value	Groupwise[2] Unadjusted p-value	Groupwise[2] Model A[3] p-value	Groupwise[2] Model B[4] p-value
Home Health (HH)						
Total HH Payments	$589,872	$64,847	<.0001	<.0001	<.0001	0.0022
PMPM	$243	$27				
Users	68	16	<.0001	<.0001	<.0001	0.0020
HH Episodes	101	17	<.0001	<.0001	<.0001	<.0001
Episodes Per User	1.5	1.1				
HH Visits	4,365	373	<.0001	<.0001 0.0020	<.0001	<.0001
Visits Per User	64.2	23.3				
Visits Per Episode	43.2	21.9				
Hospice						
Total Hospice Payments	$44,003	$0	not valid	not valid	not valid	not valid
PMPM	$18	$0				
Users	- ds -	0	not valid	not valid	not valid	not valid
Hospice Episodes	- ds -	0	not valid	not valid	not valid	not valid
Episodes Per User	- ds -	0.0				
Medicare-Paid Days	334	0	not valid	not valid	not valid	not valid
Days Per User	- ds -	0.0				
Days Per Episode	- ds -	0.0				

[1] Pairwise analysis tests the difference between matched treatment/control cases, summarized at the group level.

[2] Groupwise analysis tests the difference between the grouped sum of treatment and control groups.

[3] Model A is a groupwise test that adjusts for HCC value, ESRD, frailty, and count of CCW chronic conditions.

[4] Model B is the same as Model A but also adjusts for additional clinical conditions (EDCs): multiple sclerosis, quadriplegia & paraplegia, substance abuse, schizophrenia & affective psychosis.

Note: "ds" indicates data have been suppressed because of small cell size.

Part B Resource Use

Table 23 presents initial LAH treatment effect results on Medicare Part B services as a whole and by components underlying the total. As was the case with hospital costs, each of the statistical models that was limited to the preliminary covariates (either through the propensity score process or in regression adjustment using Model A) suggests statistically significant differences in overall Part B payments across the treatment and control groups, with the treatment group accruing more costs. Results after adjusting for additional clinical factors in Model B did not suggest statistically significant differences between the groups. Neither physician nor outpatient payments, both of which were higher for the control group, were associated with statistically significant differences between the groups. Each of the adjusted models did suggest statistically significant differences in DME payments and use. Moreover, those services and costs were markedly greater for the treatment group. Unlike Part B payments as a whole, the statistical significance of the treatment effect on DME payments was not changed by additional factors included in Model B.

Table 23. Resource Use for Treatment versus Control Groups: LAH Waiver Medicare Part B

Resource Use Measure	With LAH Waiver (treatment)	Without LAH Waiver (control)	Pairwise[1]	Groupwise[2]		
			Unadjusted	Unadjusted	Model A[3]	Model B[4]
			p-value	p-value	p-value	p-value
Part B						
Total Part B Payments	$1,651,823	$1,462,761	**0.0083**	**0.0100**	**0.0043**	0.3553
PMPM	$681	$603				
Users	199	196	0.5078	0.3073	0.2793	0.2603
Physician Payments	$530,317	$745,275	0.1507	0.2254	0.1377	0.0671
PMPM	$219	$307				
Users	192	196	0.4240	0.3051	0.2859	0.4754
Outpatient Payments	$498,082	$560,093	0.0777	0.0589	0.0757	0.0602
PMPM	$205	$231				
Users	150	163	0.1175	0.1211	0.1083	0.2688
DME Payments	$623,425	$157,393	**<.0001**	**<.0001**	**<.0001**	**<.0001**
PMPM	$257	$65				
Users	175	68	**<.0001**	**<.0001**	**<.0001**	**<.0001**

[1] Pairwise analysis tests the difference between matched treatment/control cases, summarized at the group level.

[2] Groupwise analysis tests the difference between the grouped sum of treatment and control groups.

[3] Model A is a groupwise test that adjusts for HCC value, ESRD, frailty, and count of CCW chronic conditions.

[4] Model B is the same as Model A but also adjusts for additional clinical conditions (EDCs): multiple sclerosis, quadriplegia & paraplegia, substance abuse, schizophrenia & affective psychosis.

Payments per User

The initial results based on users of services across the LAH treatment and control groups suggest a largely similar pattern as those for the more complete results in Tables 20-23, at least with respect to total Medicare and Part B payments. User-only results in Table 24 suggest statistically significant differences in total Medicare payments based on the adjusted Model A that are then explained away by the additional factors included in Model B. The same is true for Part B service use per user. Unlike the results that included non-users, the significance of differences in home health services was also explained away by Model B. DME services per user remain statistically different across the groups, even using Model B. The direction of these results is the same as is indicated by the raw payment results for each measure.

Table 24. Medicare Payments for Treatment versus Control Groups: LAH Waiver Users Only for Total and Component Costs

Resource Use Measures	With LAH Waiver (treatment)		Without LAH Waiver (control)		Model A[1]	Model B[2]
	Per User	N	Per User	N	p-value	p-value
Total Medicare Payments	$18,644	200	$17,706	196	**0.0272**	0.7565
Hospital Payments	$24,763	57	$22,585	81	0.7148	0.2950
SNF Payments	- ds -	- ds -	- ds -	- ds -	0.6178	0.2253
Home Health Payments	$8,675	68	$4,053	16	**0.0271**	0.3343
Hospice Payments	- ds -	- ds -	- ds -	0	- ds -	- ds -
Part B Payments	$8,301	199	$7,463	196	**0.0046**	0.4703
Physician Payments	$2,762	192	$3,802	196	0.3035	0.1415
Outpatient Payments	$3,321	150	$3,436	163	0.3983	0.2039
DME Payments	$3,562	175	$2,315	68	**<.0001**	**0.0070**

[1] Adjusted for age, sex, race, frailty status, CMS-HCC relative value, count of 20 CCW conditions, ESRD, and months in Medicaid (since January 1, 2001).

[2] Adjusted for the same covariates included in Model A, as well as EDC-based indicators for multiple sclerosis, schizophrenia and affective psychosis, quadriplegia & paraplegia, and substance abuse.

Note: "ds" indicates data have been suppressed because of small cell size.

Revised LAH Subgroup Analysis Results

A second (revised) LAH subgroup analysis was conducted using a more narrowly focused set of covariates in order to better fit that target population. The initial (potential) treatment and control populations were the same as that for the initial analysis (see Table 18). However, a revised set of covariates for the underlying propensity score process was defined to include age, sex, race, frailty, CMS-HCC relative value, months of full Medicaid coverage, an ESRD indicator, just three of the CCW condition indicators (Alzheimer's/dementia, osteoporosis, and stroke/TIA), five additional EDC indicators based on 2005 data (multiple sclerosis, schizophrenia and affective psychosis, substance use, developmental disorders, and thyroid disease), and a quadriplegia/paraplegia indicator based on supplemented diagnosis data from DME and other 2004 claims. Sex, age, CMS-HCC value, and the propensity score itself were used in the calculation of the Mahalonobis distance measure applied to establish matched treatment and control pairs.

Balance across Revised LAH Study Cohorts

Table 25 shows the balance in the covariates of interest before and after propensity score matching. Before matching, the LAH treatment and control groups were imbalanced on CMS-HCC, months of Medicaid, race, frailty, ESRD status, and on eight of the nine chronic conditions. After matching, all of the covariates were balanced. Note, in particular, that both the treatment and control groups have the same number of individuals with diagnoses of quadriplegia/paraplegia. The matching process resulted in the loss of 18 beneficiaries from the LAH Waiver group. All of these non-matched treatment subjects had quadriplegia or paraplegia. More of the non-matches had osteoporosis, multiple sclerosis, and thyroid disease; they were also significantly more likely to have higher HCC values (data not otherwise shown).

Table 25. Balancing Diagnostics for Treatment and Control Groups: LAH Waiver (Revised)

	Before Propensity Score Matching				After Propensity Score Matching			
	Treatment (n=202)	Controls (n=11,322)	Balance Diagnostics		Treatment (n=184)	Controls (n=184)	Balance Diagnostics	
Distinguishing Characteristics	**Mean / N[1]**	**Mean / N[1]**	**P-value[2]**	**Std. Dif.**	**Mean / N[1]**	**Mean / N[1]**	**P-value[2]**	**Std. Dif.**
Age	44.8	44.7	0.7698	0.4	44.6	44.9	0.8004	-3.3
Std. Dev. (Age)	9.1	11.0			9.4	10.0		
HCC	2.2	1.2	<.0001	67.5	2.1	2.0	0.6640	5.7
Std. Dev. (HCC)	1.8	1.1			1.7	1.6		
Months	50.7	53.2	<.0001	-20.6	51.1	52.2	<.0001	-8.6
Std. Dev. (Months)	10.3	13.6			10.2	14.5		
Sex			0.3075				0.6760	
Male	89	5,398		-7.3	84	88		-4.4
Female	113	5,924		7.3	100	96		4.4
Race			0.0005				0.9524	
Black	68	5,160		-24.5	59	57		2.3
White	126	5,496		28.1	117	118		-1.1
Other/unknown	- ds -	666		-8.9	- ds -	- ds -		-2.6
Diagnostic Criteria (Y/N)								
Frailty Marker	51	1,525	<.0001	30.1	48	44	0.6301	5.0
ESRD Status	- ds -	359	0.1734	-11.2	- ds -	- ds -	not valid	not valid
Alzheimer's/Dementia	16	217	<.0001	28.0	13	11	0.6728	4.4
Developmental Disorder	- ds -	618	0.3518	-7.1	- ds -	- ds -	0.8039	-2.6
Multiple Sclerosis	39	70	<.0001	65.7	27	29	0.7716	-3.0
Osteoporosis	23	347	<.0001	32.6	17	18	0.8590	-1.9
Quadri/Paraplegia	104	163	<.0001	137.8	86	86	1.0000	0.0
Schizophrenia & Affective Psychosis	12	2,850	<.0001	-55.0	12	- ds -	0.5002	7.0
Stroke/TIA	12	285	0.0023	17.1	11	12	0.8295	-2.2
Substance Use	- ds -	1,543	<.0001	-34.6	- ds -	- ds -	0.5572	6.1
Thyroid Disease	36	1,357	0.0117	16.4	29	27	0.7716	3.0

[1] Means are shown for continuous variables; N's are shown for categorical variables

[2] P-values are from rank sum tests (for continuous variables) and chi-square tests (for categorical variables)

Note: "ds" indicates data have been suppressed because of small cell size.

Overall Medicare Resource Use

For this revised analysis, statistical tests were limited to unadjusted pairwise and groupwise models and one adjusted model (Model A). As was the case in other subgroup analyses, Model A includes a limited number of covariates that were used in the propensity score process to account for additional residual effects of those factors. However, because the full propensity score matching process included all the clinical factors that were included in the initial LAH analysis Model B except for a count of the CCW chronic conditions, results for Model A in this revised analysis can be roughly compared to those for the previous Model B.

Table 26 shows testing results on total Medicare resource use for the revised LAH subgroup analysis. Total Medicare payments were significantly higher (statistically) for the treatment group. Where Model B in the initial LAH analysis showed no significant difference on total payments between the treatment and control groups, this revised analysis, which accounts more fully for additional factors included in the initial analysis, indicates that the treatment group has significantly higher Medicare payments. There continues to be no significant difference in the rate of use (Users) between the groups.

Table 26. Resource Use for Treatment versus Control Groups: LAH Waiver (Revised)
Total Medicare

Resource Use Measure	With LAH Waiver (treatment)	Without LAH Waiver (control)	Pairwise[1] Unadjusted p-value	Groupwise[2] Unadjusted p-value	Groupwise[2] Model A[3] p-value
Beneficiaries	184	184			
Member Months	2,208	2,208			
Total Medicare					
Total Medicare Payments	$3,222,413	$2,579,068	**0.0037**	**0.0066**	**0.0074**
PMPM	$1,459	$1,168			
Users	182	177	0.0625	0.0827	0.1257

[1] Tests the difference between matched treatment/control cases, summarized at the group level.

[2] Tests the difference between the grouped sum of treatment and control groups.

[3] Adjusts for sex, age, HCC value, ESRD, substance abuse, and schizophrenia & affective psychosis.

Inpatient Resource Use

Table 27 shows results based on inpatient use and costs. Unlike the initial LAH analysis, there were no significant differences on these measures between the revised treatment and control groups. There were also, again, too few cases to present detail related to SNF use for these groups.

Table 27. Resource Use for Treatment versus Control Groups: LAH Waiver (Revised) Medicare Inpatient

Resource Use Measure	With LAH Waiver (treatment)	Without LAH Waiver (control)	Pairwise[1] Unadjusted p-value	Groupwise[2] Unadjusted p-value	Groupwise[2] Model A[3] p-value
Hospital Inpatient					
Total Hospital Payments	$1,204,335	$1,253,069	0.4911	0.2075	0.0695
PMPM	$545	$568			
Users	49	59	0.2888	0.2520	0.1223
Hospital Stays	119	139	0.7307	0.5072	0.4400 0.4650
Stays Per User	2.4	2.4			
Medicare-Paid Days	750	860	0.3931	0.1200 0.6260	0.0530 0.4700
Days Per User	15.3	14.6			
Days Per Stay	6.3	6.2			
Skilled Nursing Facility (SNF)					
Total SNF Payments	$31,618	$51,019	not valid	not valid	not valid
PMPM	$14	$23			
Users	- ds -	- ds -	not valid	not valid	not valid
SNF Stays	- ds -	12	not valid	not valid	not valid
Stays Per User	- ds -	- ds -			
Medicare-Paid SNF Days	127	184	not valid	not valid	not valid
Days Per User	- ds -	- ds -			
Days Per Stay	- ds -	- ds -			

[1] Tests the difference between matched treatment/control cases, summarized at the group level.

[2] Tests the difference between the grouped sum of treatment and control groups.

[3] Adjusts for sex, age, HCC value, ESRD, substance abuse, and schizophrenia & affective psychosis.

Note: "ds" indicates data have been suppressed because of small cell size.

Home Health and Hospice Resource Use

Results on home health and hospice for the revised LAH analysis are shown in Table 28. Note that the nominal use rates and numbers of home health episodes are much closer across the revised LAH treatment and control groups (shown in the leftmost data columns of Table 28) as compared to the initial LAH analysis groups (see Table 22). This is one indicator of a better match, and stronger subsequent comparability, across the treatment and control groups as a consequence of the revised matching process.

The revised LAH results are slightly more mixed than the initial LAH results, but the treatment group is still associated with higher Medicare home health payments. P-values in Table 28 indicate that those payments were significantly different between the groups—they were higher for the treatment group—both before and after final adjustment using Model A. The number of episodes was noticeably higher for the treatment group, but neither the probability of any episode (with logit results of 0.1220 and 0.5360, for the unadjusted groupwise and Model A tests, respectively) nor the number of episodes for those who had any episode (with Poisson results of 0.5870 and 0.1700 for treatment and control groups, respectively) proved to be statistically significant. The logit results on home health visits did suggest a statistically significant greater probability that an LAH enrollee would have any home health visit. Differences in the number of visits, given any visit, were not significant between the groups in the groupwise tests.

Hospice use was too limited to report dependable results.

Part B Resource Use

Results based on Medicare Part B services are shown in Table 29. Much like the initial LAH results, total Part B payments were significantly different between the study groups. The primary source of those overall Part B differences continued to be a significantly higher rate of DME payments and use for the treatment group. Thus, even after special accounting for quadriplegia/paraplegia in the propensity score matching process, and accounting for other residual effects in Model A, DME payments and use were higher among the treatment group.

Because of the continuing importance of DME as a distinguishing difference between the LAH treatment and control groups, and because individuals with quadriplegia use different signature DME (hospital beds) than do those with paraplegia (motorized chairs), a more detailed analysis was conducted to explore DME use patterns associated with those specific conditions. Both beds and chairs are high-cost DME items, but beds are generally more expensive than chairs. More individuals with quadriplegia in the treatment group might help explain the higher DME costs for that group. Although more individuals with quadriplegia were found in the treatment group, the number of specific DME items and average DME payments were higher for both conditions (quadriplegia and paraplegia) for those in the treatment group (data not otherwise shown). Moreover, the treatment group continued to have significantly higher costs even when those conditions were controlled for separately in regression analyses.

Table 28. Resource Use for Treatment versus Control Groups: LAH Waiver (Revised) Medicare Home Health and Hospice

Resource Use Measure	With LAH Waiver (treatment)	Without LAH Waiver (control)	Pairwise[1] Unadjusted p-value	Groupwise[2] Unadjusted p-value	Groupwise[2] Model A[3] p-value
Home Health (HH)					
Total HH Payments	$493,344	$207,269	**0.0011**	**0.0021**	**0.0032**
PMPM	$223	$94			
Users	55	31	**0.0018**	**0.0030**	**0.0031**
HH Episodes	81	43	**0.0010**	0.1220 0.5870	0.5360 0.1700
Episodes Per User	1.5	1.4			
HH Visits	3,786	1,318	**0.0018**	**0.0040** 0.0530	**0.0040** 0.0670
Visits Per User	68.8	42.5			
Visits Per Episode	46.7	30.7			
Hospice					
Total Hospice Payments	$44,003	$0	not valid	not valid	not valid
PMPM	$20	$0			
Users	- ds -	- ds -	not valid	not valid	not valid
Hospice Episodes	- ds -	- ds -	not valid	not valid	not valid
Episodes Per User	- ds -	- ds -			
Medicare-Paid Days	334	0	not valid	not valid	not valid
Days Per User	- ds -	- ds -			
Days Per Episode	- ds -	- ds -			

[1] Tests the difference between matched treatment/control cases, summarized at the group level.

[2] Tests the difference between the grouped sum of treatment and control groups.

[3] Adjusts for sex, age, HCC value, ESRD, substance abuse, and schizophrenia & affective psychosis.

Note: "ds" indicates data have been suppressed because of small cell size.

Table 29. Resource Use for Treatment versus Control Groups: LAH Waiver (Revised) Medicare Part B

Resource Use Measure	With LAH Waiver (treatment)	Without LAH Waiver (control)	Pairwise[1] Unadjusted p-value	Groupwise[2] Unadjusted p-value	Groupwise[2] Model A[3] p-value
Part B					
Total Part B Payments	$1,449,112	$1,067,711	**0.0021**	**0.0015**	**0.0008**
PMPM	$656	$484			
Users	181	177	0.2188	0.1936	0.2441
Physician Payments	$475,572	$535,251	0.6215	0.5793	0.9552
PMPM	$215	$242			
Users	174	172	0.7905	0.6599	0.7954
Outpatient Payments	$427,986	$341,816	0.8913	0.9586	0.9527
PMPM	$194	$155			
Users	136	139	0.8072	0.7189	0.5474
DME Payments	$545,554	$190,644	**<.0001**	**<.0001**	**<.0001**
PMPM	$247	$86			
Users	157	98	**<.0001**	**<.0001**	**<.0001**

[1] Tests the difference between matched treatment/control cases, summarized at the group level.

[2] Tests the difference between the grouped sum of treatment and control groups.

[3] Adjusts for sex, age, HCC value, ESRD, substance abuse, and schizophrenia & affective psychosis.

Payments per User

Results on payments per user shown in Table 30 reaffirm the same patterns noted earlier for overall Medicare payments: the (revised) LAH treatment group had significantly higher overall Medicare payments. The treatment group generated higher payments per user for each component cost except SNF and physician services. Nevertheless, only DME payments suggested a statistically significant difference between the treatment and control groups. DME appears to be the primary source of significant differences in total Part B payments.

Table 30. Medicare Payments for Treatment versus Control Groups: LAH Waiver (Revised) Users Only for Total and Component Costs

Resource Use Measures	With LAH Waiver (treatment)		Without LAH Waiver (control)		Model A[1]
	Per User	N	Per User	N	p-value
Total Medicare Payments	$17,706	182	$14,571	177	**0.0259**
Hospital Payments	$24,578	49	$21,238	59	0.4642
SNF Payments	5,270	- ds -	7,288	- ds -	not valid
Home Health Payments	$8,970	55	$6,686	31	0.2230
Hospice Payments	44,003	- ds -	$0	0	not valid
Part B Payments	$8,006	181	$6,032	177	**0.0015**
Physician Payments	$2,733	174	$3,112	172	0.8374
Outpatient Payments	$3,147	136	$2,459	139	0.4138
DME Payments	$3,475	157	$1,945	98	**<.0001**

[1] Adjusted for sex, race, age, HCC value, months in Medicaid, ESRD, frailty status, alzheimer's/dementia, osteoporosis, TIA/stroke, quadriplegia/paraplegia, substance abuse, developmental disorders, schizophrenia & affective psychosis, thyroid disease, and multiple sclerosis.
Note: "ds" indicates data have been suppressed because of small cell size.

LAH Summary Discussion

The LAH subgroup analysis was hampered from the outset by the small number of cases in the treatment group. Nevertheless, initial results suggested that the LAH treatment group used significantly more Medicare resources than the control group, and component-level analysis suggested that home health and DME payments were the key sources of those differences. At the same time, it became clear that, while the initial propensity score matching process helped to control for the occurrence of certain (CCW) chronic conditions within the treatment and control groups, the matching process actually resulted in a disproportionate occurrence of other conditions that might reasonably have skewed the results. Statistical adjustment using a Model B as part of the initial LAH analysis tended to moderate the earlier significance of results and suggested, further, that a revised analytic approach was needed for the LAH treatment group.

The revised LAH analysis accounted more directly for several clinical conditions that were not included in the first analysis. Although there were fewer instances of significant differences across the groups in the revised analysis, particularly with respect to inpatient hospital payments, the more pronounced results remained essentially the same as those using the initial approach. The LAH Waiver group used significantly more Medicare resources, particularly home health and DME. The revised analysis results on home health and DME are also similar in pattern to those from the OAW analysis discussed above, but there was less of a trade-off in fewer users of other services in the LAH as compared to the OAW analysis. Finally, the small number of cases involved in the LAH analysis and the markedly different clinical needs of the two waiver groups preclude inferring too much from these results beyond the pattern of greater home health and DME associated with waiver participation.

Medical Day Care

Medical day care (MDC) is the only community-level support other than waiver services that requires an NHLOC in Maryland. During the period of this study, MDC was a State Plan benefit, but it is now a waiver service in Maryland. It represents a lower level of Medicaid community supports than do the OAW and LAH Waiver programs. MDC is used here to explore cross Medicare and Medicaid effects given more limited supports. For this analysis, a treatment group was formed from the larger study population consisting of those who were enrolled for 12 months in 2006 and received MDC, but no other waiver or long-term institutional support services under Medicaid during the year. Individuals in this group may have received short-term Medicaid-paid institutional care, but—consistent with the Medicaid rate categories discussed in the previous report in this series (Tucker & Johnson, 2009)—no more than 29 days of the more intensive services at any one time. The MDC analysis was also limited to those who were at least 50 years of age so that the same population of potential controls as that for the OAW could be used. Finally, those in the MDC treatment group had to use those services at the beginning of the year and had to have received them in at least 10 months of the year. This requirement ensures that the treatment group is limited to duals with more than a passing need for MDC services but also allows for short periods when they are not required, or otherwise not available.

Table 31 shows the basic set of Medicare resource measures for the MDC treatment and potential control groups. Despite the fact that the MDC group required an NHLOC, results on these resource measures are markedly lower than those for the waiver groups and much the same as the Potential Controls group (shown in the rightmost column of Table 31). Average total Medicare payments for the MDC group, for example, were $761 as opposed to $754 for the Potential Controls. It is useful to remember that, because MDC services are, by definition, provided outside the home, individuals who receive them are at least well enough to travel on a routine basis and, thus, are likely to be healthier on average than other groups of LTSS recipients that include homebound recipients, such as the OAW treatment group. Nevertheless, propensity score matching was used to establish a more narrowly defined control group for this analysis.

Table 31. Medicare Resource Measures (2006) for Potential Treatment and Controls, MDC

Resource Use Measure	MDC Study Cohorts			
	MDC	% of Total	Potential Controls (12-month)	% of Total
Enrollees	1,294	100%	19,095	100%
Enrollee Member Months	15,528		229,140	
Total Direct Medicare				
Total Payments	$11,824,445	100%	$172,851,042	100%
Total Users	1,289	99.6%	17,778	93.1%
Hospital				
Hospital Payments	$4,676,396	39.5%	$80,638,323	46.7%
Users	345	26.7%	4,469	23.4%
Hospital Stays	567		8,670	
Medicare-Paid Hospital Days	2,595		41,253	
Skilled Nursing Facility (SNF)				
SNF Payments	$511,771	4.3%	$7,444,947	4.3%
Users	57	4.4%	730	3.8%
SNF Stay	77		1,020	
Medicare-Paid SNF Days	1,591		22,516	
Home Health				
Home Health Payments	$140,686	1.2%	$3,725,883	2.2%
Users	63	4.9%	1,235	6.5%
Home Health Episodes	71		1,459	
Home Health Visits	653		22,292	
Hospice				
Hospice Payments		0.0%	$2,042,286	1.2%
Users		0.0%	62	0.3%
Hospice Episodes			67	
Medicare-Paid Hospice Days			14,877	
Part B				
Part B Payments	$6,495,593	54.9%	$78,999,602	45.7%
Users	1,289	99.6%	17,776	93.1%
Physician Payments	$4,379,698	37.0%	$43,663,332	25.3%
Users	1,282	99.1%	17,630	92.3%
Outpatient Payments	$1,740,244	14.7%	$29,961,628	17.3%
Users	867	67.0%	11,476	60.1%
DME Payments	$375,650	3.2%	$5,374,642	3.1%
Users	647	50.0%	6,096	31.9%

Note: Limited to duals, 50 years of age and older, with full benefits under Medicare and Medicaid and continuously enrolled in 2006 (from January 1 to death or the end of the year). Medicare Advantage health plan enrollment excluded.

The potential treatment and control populations that were combined to generate propensity scores for the MDC analysis included 1,294 and 19,095 individuals, respectively (see the top row of Table 31). Covariates included in the propensity score calculation were the same as those used in the OAW analysis described above, including age, sex, race, frailty status, CMS-HCC relative value, EvD status, 20 CCW condition indicators, an ESRD indicator, and months of full Medicaid coverage. Once propensity scores were assigned to each individual, a callipered Mahalonobis distance measure, also described above for the OAW analysis, was used to establish a final matched set of 1,288 treatment/control pairs for this analysis.

Balance across MDC Study Cohorts

Table 32 shows measures of balance in the covariates of interest across MDC treatment and control groups, both before and after propensity score matching. As shown in the data columns to the left, before matching, the MDC treatment and control groups were imbalanced on some measure (p-value or the standardized difference) on each of the demographic covariates and at least 13 of the diagnostic criteria. After matching, all of the covariates were balanced based on both p-values and standardized difference measures. With respect to average prospective risk in 2006 as reflected in HCC relative values, for example, while the full treatment group had an average value of 1.7, the potential control group had an average value of 1.3—that is, the control group as a whole was expected to use substantially fewer Medicare resources on average in 2006. After the matching process, both the final treatment and control groups had an average HCC relative risk of 1.7. As another reminder of the relative health status of the MDC treatment group as compared to other groups that receive LTSS, note that the final OAW treatment group had an average HCC value of 2.2 (shown in Table 12), which is close to 30 percent higher than the 1.7 for the MDC group.

Additional Clinical Markers for Model B

As was the case for the OAW analysis, markers for selected EDCs were identified for Model B based on a combination of exploratory analysis and the advice of clinical staff on their relevance to the study population. For the MDC analysis, EDCs for dermotophytoses, other paralytic syndromes, schizophrenia and affective psychosis, and thyroid disease were included as additional morbidity indicators in the Model B analysis.

Table 32. Balancing Diagnostics for Treatment and Control Groups: MDC

	Before Propensity Score Matching				After Propensity Score Matching			
	Treatment (n=1,294)	Controls (n=19,096)	Balance Diagnostics		Treatment (n=1,288)	Controls (n=1,288)	Balance Diagnostics	
Distinguishing Characteristics	Mean / N[1]	Mean / N[1]	P-value[2]	Std. Dif.	Mean / N[1]	Mean / N[1]	P-value[2]	Std. Dif.
Age	75.0	71.0	<.0001	39.5	75.0	75.0	0.9615	-0.4
Std. Dev. (Age)	10.0	10.0			10.0	9.9		
HCC	1.7	1.3	<.0001	36.1	1.7	1.7	0.2550	3.7
Std. Dev. (HCC)	1.0	1.0			1.0	0.9		
Number of Conditions	3.0	2.0	<.0001	57.8	3.0	3.0	0.8401	1.7
Std. Dev. (Conditions)	1.9	1.8			1.9	1.8		
Months	56.9	52.2	<.0001	36.4	56.9	57.0	0.6393	-1.4
Std. Dev. (Months)	10.0	15.4			10.0	9.4		
Sex			0.0405				1.0000	
Male	411	5,554		5.8	408	408		0.0
Female	883	13,542		-5.8	880	880		0.0
Race			<.0001				0.2300	
Black	317	7,201		-28.8	317	346		-5.2
White	745	6,589		47.6	739	737		0.3
Other/unknown	232	5,306		-23.6	232	205		5.6
Ever Disabled			0.0015				0.6180	
No	974	13,585		9.3	968	957		2.0
Yes	320	5,511		-9.3	320	331		-2.0
Diagnostic Criteria (Y/N)								
Frailty Marker	349	2,329	<.0001	37.9	347	326	0.3463	3.7
ESRD Status	- ds -	365	0.0004	-12.5	- ds -	- ds -	1.0000	0.0
Acute Myocard. Infarc.	- ds -	120	0.6988	-1.1	- ds -	- ds -	0.7810	1.1
Alzheimer's/Dementia	359	1,092	<.0001	61.8	355	353	0.9297	0.3
Atrial Fibrillation	101	842	<.0001	14.2	100	99	0.9412	0.3
Cataracts	290	3,228	<.0001	13.9	288	299	0.6054	-2.0
Chronic Kidney Disease	193	2,137	<.0001	11.1	192	177	0.3989	3.3
COPD	194	2,304	0.0019	8.6	192	190	0.9117	0.4
Colorectal Cancer	22	188	0.0136	6.2	22	21	0.8778	0.6
Depression	345	2,179	<.0001	39.6	342	316	0.2401	4.6
Diabetes	563	6,336	<.0001	21.4	559	589	0.2344	-4.7
Endometrial Cancer	- ds -	33	not valid	2.8	- ds -	- ds -	0.5263	-2.5
Female Breast Cancer	20	354	0.4240	-2.4	20	12	0.1547	5.6
Glaucoma	179	2,046	0.0005	9.5	178	201	0.2008	-5.0
Heart Failure	285	3,216	<.0001	13.1	283	269	0.5014	2.6
Hip/Pelvic Fracture	- ds -	48	not valid	3.6	- ds -	- ds -	not valid	7.5
Ischemic Heart Disease	585	5,829	<.0001	30.6	580	578	0.9369	0.3
Lung Cancer	- ds -	128	0.0241	-8.1	- ds -	- ds -	not valid	-1.8
Osteoporosis	214	2,218	<.0001	14.2	213	207	0.7490	1.3
Prostate Cancer	32	284	0.0055	7.1	31	37	0.4609	-2.9
Rheum./osteo arthritis	400	3,913	<.0001	24.0	399	376	0.3231	3.9
Stroke/TIA	103	911	<.0001	13.1	102	96	0.6572	1.7

[1] Means are shown for continuous variables; N's are shown for categorical variables. [2]P-values are from rank sum tests (for continuous variables) and chi-square tests (for categorical variables). "ds" indicates data suppressed for cell size.
Note: "ds" indicates data have been suppressed because of small cell size.

MDC Subgroup Analysis Results

Total and component Medicare services and payments are discussed separately below.

Total Medicare Resource Use

Table 33 shows total Medicare payments for separate treatment and control groups of 1,288 individuals included in the MDC analysis, along with the p-values for pairwise and groupwise statistical tests of differences associated with the treatment effect of MDC. Both unadjusted and adjusted models indicated a statistically significant difference in overall Medicare payments. Similar to the OAW results, more individuals in the treatment group received any service, but overall payments were higher—by $159 PMPM, or nearly 21 percent—for the control group. Also similar to the OAW results, however, the effect of the transformation used to improve the distribution of the underlying data was to remove more outlier payments from the control group, which changed the direction of the differences attributable to the treatment effect (parameter estimates are included in Appendix Table A4). Both Model A and Model B indicate statistical significance in the remaining differences between the MDC treatment and control groups, but the treatment group has higher costs (on the transformed scale).

Results on Users in Table 33 indicate that the treatment group is significantly more likely to use any Medicare service based on each of the unadjusted and adjusted statistical tests.

Table 33. Resource Use for Treatment versus Control Groups: MDC

Total Medicare

Resource Use Measure	With MDC (treatment)	Without MDC (control)	Pairwise[1] Unadjusted p-value	Groupwise[2] Unadjusted p-value	Groupwise[2] Model A[3] p-value	Groupwise[2] Model B[4] p-value
Beneficiaries	1,288	1,288				
Member Months	15,456	15,456				
Total Medicare						
Total Medicare Payments	$11,780,328	$14,232,842	**0.0049**	**<.0001**	**0.0050**	**0.0186**
PMPM	$762	$921				
Users	1,283	1,254	**<.0001**	**<.0001**	**<.0001**	**0.0001**

[1] Pairwise analysis tests the difference between matched treatment/control cases, summarized at the group level.

[2] Groupwise analysis tests the difference between the grouped sum of treatment and control groups.

[3] Model A adjusts for HCC value, ever-disabled status, ESRD, frailty, and count of CCW chronic conditions.

[4] Model B is the same as Model A but also adjusts for additional clinical conditions (EDCs): dermotophytoses, schizophrenia & affective psychosis, thyroid disease, and other paralytic syndromes.

Inpatient Resource Use

Results on inpatient resource use are shown in Table 34 and—again similar to the OAW results—there was no statistically significant difference in total hospital payments or use, overall, across the MDC treatment and control groups, despite markedly higher actual costs for the control group. Although they were not significant, the parameter estimates for both those measures (see Appendix Table A4) were in the direction of higher use for the control group.

Two-part results on the number of hospital stays suggest significant differences for both parts based on Model A (0.0260 for the logit result looking at the probability of any use and <.0001 for the remaining [Poisson] result looking at the number of stays given any stay). However, based on the parameter estimate of the Model A logit result, the direction of significantly higher probability of use (or, more properly, the lower probability of excess zeros) is toward the treatment group—despite the nominally fewer users (343 versus 350 for the controls) and the much fewer hospital stays (565 versus 721 for the controls) for the treatment group. Because this model does not involve a transformation of the data, other covariates in the model must account for that change of direction from the raw data. The fact that the covariates in Model A changed the direction of the results in this case suggests more broadly that the propensity score process did not adequately include some factor, such as a better measure of functional status (perhaps), that was needed to establish better matches between the treatment and potential control populations.

The lower part result of the two-part Model A, which tests the number of stays given any stay, still suggests that the control group is more likely to have a readmission during the study year. Interestingly, as odd as the logit result seems, Model A results on hospital stays, together, are consistent with the overall pattern for hospital stays seen in the OAW analysis: the treatment group is more likely to have a stay but the control group is more likely to have a readmission given any stay. Although the parameter estimates are in the same direction as Model A, Model B results on hospital stays do not show a significant difference in the probability of any use across the groups (0.1360), suggesting that the additional covariates included in that model also seemed to explain some meaningful difference(s); however the result for the number of stays given any stay remained significant (<.0001) using Model B.

The measures for stays per user (1.6 and 2.1 for the treatment and control groups, respectively) indicate that, on average, the control group had more than 30 percent more hospital stays per user than the treatment group. Thus, while roughly the same number of individuals in each group had some hospital stay, the control group had more repeated stays. More detailed analysis of the data shows that 19 percent of those in the control group who had an admission had a readmission within 7 days, as compared to 11 percent in the treatment group.

Table 34. Resource Use for Treatment versus Control Groups: MDC Medicare Inpatient

Resource Use Measure	With MDC (treatment)	Without MDC (control)	Pairwise[1] Unadjusted p-value	Groupwise[2] Unadjusted p-value	Groupwise[2] Model A[3] p-value	Groupwise[2] Model B[4] p-value
Hospital Inpatient						
Total Hospital Payments	$4,664,571	$6,647,583	0.1737	0.4686	0.5372	0.3982
PMPM	$302	$430				
Users	343	350	0.7866	0.7558	0.5994	0.4316
Hospital Stays	565	721	0.0588	**0.0049**	**0.0260** **<.0001**	0.1360 **<.0001**
Stays Per User	1.6	2.1				
Medicare-Paid Days	2,585	3,334	0.6190	0.6690 **0.0060**	0.7760 **0.0020**	0.8190 **0.0330**
Days Per User	7.5	9.5				
Days Per Stay	4.6	4.6				
Skilled Nursing Facility (SNF)						
Total SNF Payments	$506,407	$857,150	**0.0285**	**0.0270**	**0.0193**	**0.0144**
PMPM	$33	$55				
Users	56	81	**0.0314**	**0.0277**	**0.0215**	**0.0125**
SNF Stays	76	117	**0.0343**	**0.0275**	**0.0153**	**0.0127**
Stays Per User	1.4	1.4				
Medicare-Paid SNF Days	1,576	2,660	**0.0420**	**0.0300** 0.2580	**0.0220** 0.3300	**0.0130** 0.2640
Days Per User	28.1	32.8				
Days Per Stay	20.7	22.7				

[1] Pairwise analysis tests the difference between matched treatment/control cases, summarized at the group level.

[2] Groupwise analysis tests the difference between the grouped sum of treatment and control groups.

[3] Model A adjusts for HCC value, ever-disabled status, ESRD, frailty, and count of CCW chronic conditions.

[4] Model B is the same as Model A but also adjusts for additional clinical conditions (EDCs): dermotophytoses, schizophrenia & affective psychosis, thyroid disease, and other paralytic syndromes.

The results on the number of hospital days echo the results on stays. While the probability of having at least one hospital day was not significantly different across the MDC treatment and control groups (see the logit result of 0.8190 for Model B, for example), the overall number of days given any day/stay was significantly different using each of the groupwise tests (the lower result [Poisson] result for Model B was 0.0330, for example). The scale of this difference in days

is evident in the measure of days per user, which was 7.5 and 9.5 for the treatment and control groups, respectively.

Results for SNF (shown in the lower half of Table 34) suggest a strong and consistent statistically significant difference in both payments and use between the MDC treatment and control groups. The treatment group included fewer SNF users and fewer stays overall, although both the treatment and control groups had roughly the same number of stays per user on average (1.4). The two-part model results for SNF days indicate that there was a statistically significant difference in the probability of having any SNF day/stay across the groups (see the logit results of 0.0130 for Model B, for example) but that the difference in number of days given any day was not statistically different. Note that the results on stays were based on one-part tests when comparable results on other measures where many individuals have no related service require a two-part test to account for "excess" zeros. In this instance, the Vuong test used to determine the most appropriate testing approach (see footnote 11 in the section on Statistical Testing, above) suggested the one-part approach. This may be related in some way to the fact that there were so few cases. The results on days, which tend to echo results on stays (as was the case in the hospital results), may be a better reflection of the implication of the SNF results: the probability of any use is greater for the control group, but there is no significant difference between the MDC treatment and control groups on days per stay for those who had any SNF stay/day.

Home Health and Hospice Resource Use

Both home health and hospice suggest a somewhat different picture, with broader implications for the MDC analysis, across treatment and control groups than did the OAW analysis. Results on home health shown in Table 35 show statistically significant differences for both payments and service use based on nearly all of the tests. There are also marked actual differences across the groups, with the treatment group using relatively few services. The logit results on the probability of any home health episode for both Model A and Model B (0.9510 and 0.9680, respectively) did not indicate significant differences across the groups, which appears to be anomalous given the strong results of each of the other tests on home health—particularly the results on Users. It is likely, however, that this is a consequence of the different ways in which the logistic regression is calculated for the one-part test on users versus the two-part tests on episodes, in combination with the small numbers of cases available for the two-part tests. The salient difference between these results and the earlier OAW analysis, however, is that, where the OAW was associated with higher rates of home health use than the comparable controls, the MDC treatment group is associated with markedly less home health use.

Table 35. Resource Use for Treatment versus Control Groups: MDC Medicare Home Health and Hospice

Resource Use Measure	With MDC (treatment)	Without MDC (control)	Pairwise[1] Unadjusted p-value	Groupwise[2] Unadjusted p-value	Groupwise[2] Model A[3] p-value	Groupwise[2] Model B[4] p-value
Home Health (HH)						
Total HH Payments	$140,686	$478,476	**<.0001**	**<.0001**	**<.0001**	**<.0001**
PMPM	$9	$31				
Users	63	132	**<.0001**	**<.0001**	**<.0001**	**<.0001**
HH Episodes	71	154	**<.0001**	**<.0001**	0.9510 **<.0001**	0.9680 **0.0010**
Episodes Per User	1.1	1.2				
HH Visits	653	2,652	**<.0001**	**<.0001** **<.0001**	**<.0001** **<.0001**	**<.0001** **<.0001**
Visits Per User	10.4	20.1				
Visits Per Episode	9.2	17.2				
Hospice						
Total Hospice Payments	$0	$469,480	**0.0005**	**0.0005**	**0.0003**	**0.0001**
PMPM	$0	$30				
Users	0	12	n/a [5]	**<.0001**	0.9431	0.9382
Hospice Episodes	0	13	**0.0005**	0.9691	0.9863	0.9861
Episodes Per User	0.0	1.1				
Medicare-Paid Days	0	3,456	**0.0005**	0.9703	0.9675	0.9621
Days Per User	0.0	288.0				
Days Per Episode	0.0	265.8				

[1] Pairwise analysis tests the difference between matched treatment/control cases, summarized at the group level.

[2] Groupwise analysis tests the difference between the grouped sum of treatment and control groups.

[3] Model A adjusts for HCC value, ever-disabled status, ESRD, frailty, and count of CCW chronic conditions.

[4] Model B is the same as Model A but also adjusts for additional clinical conditions (EDCs): dermotophytoses, schizophrenia & affective psychosis, thyroid disease, and other paralytic syndromes.

[5] The McNemar test can not be run for this measure because there were no users in the treatment group.

The most notable aspect of the hospice results shown in Table 35 is that the MDC treatment group used no hospice services. The limited hospice experience for the control group was technically enough to calculate tests for differences between the groups, and the tests on total payments suggest significant differences between the groups. However, the pattern of both no hospice and limited home health for the MDC treatment group shown in this table may indicate

more about service patterns for the MDC group that have not been adequately addressed in this analysis than they do about meaningful statistical differences between the treatment and control groups. That is, because Medicare eligibility requirements for both home health and hospice suggest a type of home-bound care that recipients of long-term MDC may not need, MDC service use as it is defined for this treatment group may be a proxy for a level of functional status that is not otherwise addressed in the propensity score and statistical modeling applied here. And, again, the small number of users of these services in both the treatment and control groups raises questions about the strength of the statistical differences that are revealed in these tests.

Part B Resource Use

Although overall Medicare payments shown in Table 33 are higher for the control group, Part B payments shown in Table 36 were significantly higher for the MDC treatment group. The MDC treatment group accrued $45 PMPM more, overall, in Part B payments than the control group. This result is somewhat muddled when looking at the components of Part B resource use in that outpatient hospital and DME payments are higher for the control group. Roughly the same number of individuals used outpatient services in the two study groups, but the evident difference in payments was not significant. More individuals received DME services in the treatment group, but the overall costs were significantly higher (statistically) for the control group on an unadjusted model basis. The direction of that result was changed using Model A and Model B as a consequence of transformation used in those models.

Table 36. Resource Use for Treatment versus Control Groups: MDC
Medicare Part B

Resource Use Measure	With MDC (treatment)	Without MDC (control)	Pairwise[1] Unadjusted p-value	Groupwise[2] Unadjusted p-value	Groupwise[2] Model A[3] p-value	Groupwise[2] Model B[4] p-value
Part B						
Total Part B Payments	$6,468,664	$5,780,153	<.0001	<.0001	<.0001	<.0001
PMPM	$419	$374				
Users	1,283	1,254	<.0001	<.0001	<.0001	<.0001
Physician Payments	$4,359,915	$3,359,996	<.0001	<.0001	<.0001	<.0001
PMPM	$282	$217				
Users	1,276	1,247	<.0001	<.0001	0.0001	0.0004
Outpatient Payments	$1,734,012	$1,991,461	0.1771	0.3566	0.4907	0.2132
PMPM	$112	$129				
Users	862	861	1.0000	0.9666	0.9186	0.5619
DME Payments	$374,737	$428,695	0.0012	<.0001	<.0001	<.0001
PMPM	$24	$28				
Users	643	505	<.0001	<.0001	<.0001	<.0001

[1] Pairwise analysis tests the difference between matched treatment/control cases, summarized at the group level.

[2] Groupwise analysis tests the difference between the grouped sum of treatment and control groups.

[3] Model A adjusts for HCC value, ever-disabled status, ESRD, frailty, and count of CCW chronic conditions.

[4] Model B is the same as Model A but also adjusts for additional clinical conditions (EDCs): dermotophytoses, schizophrenia & affective psychosis, thyroid disease, and other paralytic syndromes.

Payments per User

Results that reflect payments based on users alone shown in Table 37 are somewhat inconsistent with the results based on the full study population in Tables 33 through 36. Overall Medicare payments per user appear to be higher for the control group, but given the transformation used in the models that adjusted for additional factors, significant differences were found in the opposite direction—the treatment group accrued more (explainable) costs. Although hospital payments per user were 40 percent higher for the control group, they were not significantly different (statistically) between the treatment and control groups once a full set of covariates was applied using Model B (0.1910). Home health payments per user were significantly higher for the control group. Overall Part B payment results and those for physician and outpatient services per user in Table 37 were similar to those for the full study population (see Table 36), but DME payments per user were not significantly different between the groups despite 46 percent higher average payments for the control group. A closer examination of the underlying data suggests that more (high) outlier cases in the control group accounts for much of the average difference between the groups.

Table 37. Medicare Payments for Treatment versus Control Groups: MDC Users Only for Total and Component Costs

Resource Use Measures	With MCD (treatment)		Without MCD (control)		Model A[1]	Model B[2]
	Per User	N	Per User	N	p-value	p-value
Total Medicare Payments	$9,182	1,283	$11,350	1,254	**0.0001**	**0.0015**
Hospital Payments	$13,599	343	$18,993	350	**0.0347**	0.1910
SNF Payments	$9,043	56	$10,582	81	0.6033	0.8671
Home Health Payments	$2,233	63	$3,625	132	**0.0008**	**0.0025**
Hospice Payments	0	0	$39,123	12	n/a	n/a
Part B Payments	$5,042	1,283	$4,609	1,254	**<.0001**	**<.0001**
Physician Payments	$3,417	1,276	$2,694	1,247	**<.0001**	**<.0001**
Outpatient Payments	$2,012	862	$2,313	861	0.1227	0.0770
DME Payments	$583	643	$849	505	0.6699	0.6440

[1] Adjusted for age, sex, race, frailty status, CMS-HCC relative value, ever-disabled status, count of 20 CCW conditions, ESRD, and months enrolled in Medicaid (since January 1, 2001).

[2] Model B is the same as Model A but also adjusts for additional clinical conditions (EDCs): dermotophytoses, schizophrenia & affective psychosis, thyroid disease, and other paralytic syndromes.

MDC Summary Discussion

Based on absolute counts and unadjusted payments, the MDC treatment group used less Medicare resources than the comparable control group across all service components except Part B physician services. Much like the OAW analysis, while overall payments were found to be significantly higher for the control group on an unadjusted basis, regression-based modeling indicated that the treatment group had significantly higher payments once the effect of high outlier cases was moderated in the transformation that was used to improve assumptions about the distribution of the underlying cost data. Once again, it may be reasonable to question whether such outlier costs should be ignored in a practical sense in understanding the direction of any differences. Furthermore, the pattern of component resource use for the control group in this (MDC) analysis—specifically, the use of Medicare home health and hospice services—suggests that, unlike in the OAW analysis, there may still be important remaining differences between the treatment and control groups that were not addressed by the propensity score matching process.

In this analysis, the pattern of higher home health, hospice, and, possibly, DME resource use for the control group, seems to suggest that the control group has greater functional support need than the treatment group. Although this assumption is based on the outcomes that provide a focus in this study, it is also consistent with the suggestion that extensive MDC use may be an indirect indication of a higher level of functioning. Thus, the propensity score matching process used in this study does not appear to adequately address unknown functional status differences between those who do or do not receive MDC services. Consequently, although the control group is found

to use significantly more Medicare resources, this cannot be ascribed to an MDC treatment effect alone. At the same time, this suggests that MDC service use might be used as one indicator of functional support needs in analysis of other treatment effects.[17]

Long-Term Nursing Facility Care

Although most of the focus in this report is on the relationship between Medicaid LTSS provided in the community and Medicare service use for comparable groups living in the community, this subgroup analysis involves a comparison of HCBS and institutional care because both programs (or modes) of service require an NHLOC—and waiver services are generally considered an alternative to NF care. For this analysis, a cohort of duals who received Medicaid-paid LT-NF care is identified as a second potential control population for comparison to the OAW treatment group. The selection criteria for the LT-NF cohort are the same as those defined in Tucker and Johnson (2009) for a Medicaid rate group consisting of recipients who receive substantial NF care: duals who had at least 30 days of Medicaid-paid NF care just prior to January 1, 2006. To be consistent with OAW participation rules, the LT-NF cohort in this subgroup analysis was limited to recipients who were at least 50 years of age. As in the other subgroup analyses, the treatment and control groups were limited to 12-month enrollees, which excluded those who died. Those in the LT-NF cohort also had to meet the 30-day NF criteria for at least 10 months during the study year (2006). This last criterion ensured that LT-NF recipients were in the NF for most of the year but also allowed for short-term hospital stays.

Table 38 shows Medicare resource measures for three cohorts underlying this analysis. The leftmost data column shows the 12-month enrollee sample for the OAW treatment group. This is the same group shown in the middle columns of Table 11 for the initial OAW subgroup analysis. The middle column of Table 38 reflects all continuously enrolled duals who met the NF criteria on January 1, 2006. This is the same group included in the CMS-HCC analysis of Medicare resources in the previous report in this series. The rightmost column shows results for the 12-month enrollees among the broader NF group who make up the potential LT-NF control cohort for comparison to the OAW treatment group.

[17] Note that MDC status would not contribute to the prior OAW subgroup analysis as it was designed in this study, even though individuals within the OAW treatment group may or may not have received MDC service, because the potential control group excluded individuals who received other LTSS, including MDC.

Table 38. Medicare Resource Measures (2006) for Potential OAW Treatment and LT-NF Control Populations

Resource Use Measure	OAW and Long-Term NF Cohorts					
	OAW 12-Month Enrollees	% of Total	LT NF Continuously Enrolled	% of Total	Potential Controls (12-month)	% of Total
Enrollees	1,759	100%	9,344	100%	6,336	100%
Enrollee Member Months	21,108		99,133		76,032	
Total Direct Medicare						
Total Payments	$26,424,626	100%	$137,592,916	100%	$56,099,197	100%
Total Users	1,754	99.7%	9,304	99.6%	6,324	99.8%
Hospital						
Hospital Payments	$11,790,541	44.6%	$64,959,516	47.2%	$20,933,070	37.3%
Users	711	40.4%	3,385	36.2%	1,541	24.3%
Hospital Stays	1,407		6,484		2,529	
Medicare-Paid Hospital Days	6,984		40,605		13,448	
Skilled Nursing Facility (SNF)						
SNF Payments	$1,439,503	5.4%	$21,183,889	15.4%	$5,975,411	10.7%
Users	155	8.8%	1,998	21.4%	819	12.9%
SNF Stay	205		3,331		1,078	
Medicare-Paid SNF Days	3,987		82,653		20,954	
Home Health						
Home Health Payments	$1,863,710	7.1%	$279,320	0.2%	$14,158	0.0%
Users	406	23.1%	60	0.6%	4	0.1%
Home Health Episodes	510		76		4	
Home Health Visits	9,934		1,501		70	
Hospice						
Hospice Payments	$923,719	3.5%	$4,531,262	3.3%	$354,083	0.6%
Users	37	2.1%	618	6.6%	53	0.8%
Hospice Episodes	41		625		53	
Medicare-Paid Hospice Days	6,882		31,988		2,547	
Part B						
Part B Payments	$10,407,154	39.4%	$46,638,929	33.9%	$28,822,474	51.4%
Users	1,752	99.6%	9,300	99.5%	6,324	99.8%
Physician Payments	$5,437,181	20.6%	$24,995,929	18.2%	$14,326,943	25.5%
Users	1,746	99.3%	9,269	99.2%	6,305	99.5%
Outpatient Payments	$3,300,581	12.5%	$17,825,003	13.0%	$11,795,829	21.0%
Users	1,202	68.3%	8,220	88.0%	5,704	90.0%
DME Payments	$1,669,392	6.3%	$3,817,996	2.8%	$2,699,702	4.8%
Users	1,221	69.4%	2,060	22.0%	1,329	21.0%

Note: Limited to duals, 50 years of age and older, with full benefits under Medicare and Medicaid and continuously enrolled in 2006 (from January 1 to death or the end of the year). Medicare Advantage health plan enrollment excluded.

As a reminder, the full NF group shown in the middle column of Table 38 includes those who died during 2006 and are, thus, more properly comparable to the similarly defined group among the OAW in the leftmost column of Table 11. Although the full NF cohort in the middle of Table 38 had slightly higher overall Medicare costs PMPM than the 12-month OAW group ($1,388 versus $1,252, respectively), the more reasonably comparable full OAW cohort that includes those who died shown in Table 11 was much higher on average, at $1,907, than the full NF cohort. The potential LT-NF controls cohort, which is the most comparable to the 12-month OAW group, included 6,336 individuals and generated $738 PMPM in total Medicare payments in 2006.

Results in Tucker and Johnson (2009) suggested that comparable HCBS waiver and LT-NF groups will tend to have similar prospective CMS-HCC relative risk values, but that the NF group will have lower actual Medicare costs. The raw average CMS-HCC values for the groups reflected in Table 38 are 2.29, 2.32, and 2.18 from left to right, respectively.[18] Using average Medicare payments of $1,252 PMPM and a CMS-HCC relative value of 2.29 for the 12-month OAW treatment group as an overall measure of expected costs, the CMS-HCC-based expected costs for the 12-month NF group (with a relative value of 2.18) would be closer to $1,192 PMPM, which is substantially (61.5 percent) higher than the $738 actual payments PMPM for that NF group. This tends to reaffirms the basic findings from the previous report. This subgroup analysis is intended to test differences on measures of Medicare resource use across these groups in more detail. As discussed in the previous report, these differences matter in the context of Medicare Advantage, in particular, because payments to MA plans would be made on the basis of CMS-HCC relative risk—which is much the same across the groups in this analysis—when average actual Medicare program costs are markedly different across these groups.

Balance across OAW and LT-NF Study Cohorts

Table 39 shows measures of balance in the covariates of interest across OAW treatment and LT-NF control groups, both before and after propensity score matching. As shown in the leftmost data columns, before matching, the treatment and control groups were imbalanced on some measure on age, months of Medicaid, race, ever-disabled status, frailty, and 11 of the CCW chronic conditions. Interestingly, the groups were already balanced on CMS-HCC, number of CCW conditions, and sex even before matching, which is another indication of the natural comparability of waiver and NF populations. After matching, all of the covariates were balanced based on the standardized difference measure. Only EvD status and osteoporosis were not balanced based on p-values after the matching.

[18] The CMS-HCC relative value for the continuously enrolled OAW group that included those who died during the year shown in Table 11 was 2.46.

Table 39. Balancing Diagnostics for OAW Treatment and LT-NF Control Groups

	Before Propensity Score Matching				After Propensity Score Matching			
	Treatment (n=1,759)	Controls (n=6,336)	Balance Diagnostics		Treatment (n=1,731)	Controls (n=1,731)	Balance Diagnostics	
Distinguishing Characteristics	Mean / N[1]	Mean / N[1]	P-value[2]	Std. Dif.	Mean / N[1]	Mean / N[1]	P-value[2]	Std. Dif.
Age	78.1	80.9	<.0001	-26.5	78.3	77.7	0.2265	5.6
Std. Dev. (Age)	10.5	10.5			10.4	10.8		
HCC	2.3	2.2	0.0502	8.7	2.3	2.3	0.0864	-1.6
Std. Dev. (HCC)	1.3	1.2			1.3	1.3		
Number of Conditions	3.6	3.6	0.7563	0.8	3.6	3.6	0.4343	2.6
Std. Dev. (Conditions)	2.2	2.2			2.2	2.2		
Months	42.2	35.0	<.0001	35.2	42.0	42.7	0.0556	-3.4
Std. Dev. (Months)	19.3	21.3			19.4	19.9		
Sex			0.0735				1.0000	
Male	417	1,635		-4.9	413	413		0.0
Female	1,342	4,701		4.9	1,318	1,318		0.0
Race			0.0070				0.9797	
Black	594	1,960		6.1	588	589		-0.1
White	1,026	3,743		-1.5	1,005	1,001		0.5
Other/unknown	139	633		-7.3	138	141		-0.6
Ever Disabled			<.0001				0.0293	
No	1,282	4,950		-12.2	1,263	1,205		7.4
Yes	477	1,386		12.2	468	526		-7.4
Diagnostic Criteria (Y/N)								
Frailty Marker	573	3,499	<.0001	-46.9	572	540	0.2441	4.0
ESRD Status	50	109	0.0027	7.5	46	37	0.3173	3.4
Acute Myocard. Infarc.	23	58	0.1437	3.7	22	22	1.0000	0.0
Alzheimer's/Dementia	836	4,493	<.0001	-49.0	836	866	0.3078	-3.5
Atrial Fibrillation	197	756	0.3992	-2.3	194	188	0.7448	1.1
Cataracts	308	868	<.0001	10.5	295	272	0.2908	3.6
COPD	359	1,161	0.0475	5.3	348	361	0.5840	-1.9
Chronic Kidney Disease	397	1,227	0.0030	7.9	385	379	0.8058	0.8
Colorectal Cancer	24	81	0.7779	0.8	23	16	0.2596	3.8
Depression	503	2,023	0.0076	-7.3	494	493	0.9700	0.1
Diabetes	793	2,572	0.0007	9.1	776	774	0.9455	0.2
Endometrial Cancer	- ds -	- ds -	not valid	5.3	- ds -	- ds -	not valid	0.0
Female Breast Cancer	42	115	0.1233	4.0	42	34	0.3535	3.2
Glaucoma	171	405	<.0001	12.3	164	140	0.1495	4.9
Heart Failure	660	2,218	0.0512	5.2	644	629	0.5970	1.8
Hip/Pelvic Fracture	19	87	0.3390	-2.7	19	19	1.0000	0.0
Ischemic Heart Disease	874	2,488	<.0001	21.1	850	834	0.5864	1.8
Lung Cancer	15	27	0.0276	5.4	12	- ds -	0.2500	3.9
Osteoporosis	277	874	0.0380	5.5	264	213	0.0119	8.6
Prostate Cancer	28	101	0.9947	0.0	27	31	0.5963	-1.8
Rheum./osteo arthritis	490	1,743	0.7731	0.8	484	465	0.4691	2.5
Stroke/TIA	366	1,591	0.0002	-10.2	364	403	0.1105	-5.4

[1] Means are shown for continuous variables; N's are shown for categorical variables.

[2] P-values are from rank sum tests (for continuous variables) and chi-square tests (for categorical variables).

Note: "ds" indicates data have been suppressed because of small cell size.

When the full OAW treatment group of 1,759 individuals was matched to community-dwelling duals in the previous OAW subgroup analysis, the propensity score matching process led to the loss of 319 cases of primarily older, more frail female waiver recipients from the treatment group. Only 28 cases were dropped as a result of the OAW/LT-NF matching process because of the higher incidence of frailty in the LT-NF population.

Additional Clinical Markers for Model B

As with the preceding analyses, markers for selected EDCs included as covariates in Model B were identified using a combination of exploratory analysis and the advice of clinical staff on their relevance to the study population. More conditions—particularly ones that tend to complicate, or suggest complications associated with, NF care—were included than for the previous OAW analysis. The additional EDC markers included: quadriplegia/paraplegia, schizophrenia & affective psychosis, disorders of lipoid metabolism, dementia/delirium, chronic skin ulcer, seizure disorder, iron deficiency, and hypertension w/major complications.

OAW/LT-NF Subgroup Analysis Results

Total and component Medicare services and costs are discussed separately below.

Total Medicare Resource Use

Table 40 presents results on total Medicare resource use. Given the cost expectations related to LT-NF care, it is not surprising that the LT-NF group used fewer Medicare resources overall than the OAW treatment group, and that the difference was statistically significant. LT-NF residents accrued close to $440 PMPM (or 36 percent) less in Medicare payments than comparable OAW recipients in the community. There was no significant difference between the treatment and control groups in whether recipients used any service (Users).

Table 40. Resource Use for OAW Treatment versus LT-NF Control Groups: Total Medicare

Resource Use Measure	With OAW (treatment)	With LT-NF (control)	Pairwise[1] Unadjusted p-value	Groupwise[2] Unadjusted p-value	Groupwise[2] Model A[3] p-value	Groupwise[2] Model B[4] p-value
Beneficiaries	1,731	1,731				
Member Months	20,772	20,772				
Total Medicare						
Total Medicare Payments	$25,490,880	$16,320,755	**<.0001**	**<.0001**	**<.0001**	**<.0001**
PMPM	$1,227	$786				
Users	1,726	1,729	0.4531	0.2486	0.2432	0.2892

[1] Pairwise analysis tests the difference between matched treatment/control cases, summarized at the group level.

[2] Groupwise analysis tests the difference between the grouped sum of treatment and control groups.

[3] Adjusts for age, HCC value, ESRD, frailty, ever-disabled status, osteoporosis, and TIA/stroke.

[4] Model B is the same as Model A but also adjusts for additional clinical conditions (EDCs): quadri/paraplegia, schizophrenia & affective psychosis, disorders of lipoid metabolism, dementia/delirium, chronic skin ulcer, seizure disorder, iron deficiencies, hypertension w/major complications.

Inpatient Resource Use

As shown in Table 41, there was a statistically significant difference in hospital payments and use between the OAW treatment and LT-NF control groups. The treatment group had higher payments using each testing approach. The treatment group also had a statistically higher probability of having any hospital stay or day (see Model B logit p-value results of 0.0050 and <.0001, for stays and days, respectively) and more stays and days, given any stay/day, particularly based on the fully adjusted Model B (see p-values for negative binomial results of <.0001 and 0.0130, for stays and days, respectively). The LT-NF control group had longer hospital stays, on average, with 5.4 days per stay versus 5.0 for the OAW treatment group, but that difference was not tested for statistical significance.

There was a statistically significant difference in SNF payments and use across the study groups: the LT-NF group accrued more SNF payments and used those services more often than the OAW group. The only significant difference between the groups related to the number of stays was that the LT-NF group had a greater probability of having any stay based on the logit result from Model B (0.0470). There was a significant difference in the probability of having any SNF day, however—based on each of the groupwise logit results (all p-values of <.0001). There were no statistically significant differences in the number of SNF stays or days, given any stay/day.

Table 41. Resource Use for OAW Treatment versus LT-NF Control Groups: Medicare Inpatient

Resource Use Measure	With OAW (treatment)	With LT-NF (control)	Pairwise[1] Unadjusted p-value	Groupwise[2] Unadjusted p-value	Groupwise[2] Model A[3] p-value	Groupwise[2] Model B[4] p-value
Hospital Inpatient						
Total Hospital Payments	$11,311,121	$6,490,191	**<.0001**	**<.0001**	**<.0001**	**<.0001**
PMPM	$545	$312				
Users	698	428	**<.0001**	**<.0001**	**<.0001**	**<.0001**
Hospital Stays	1,357	741	**<.0001**	0.9970 **0.0030**	**0.0010** **<.0001**	**0.0050** **<.0001**
Stays Per User	1.9	1.7				
Medicare-Paid Days	6,723	4,020	**<.0001**	**<.0001** 0.6540	**<.0001** 0.1690	**<.0001** **0.0130**
Days Per User	9.6	9.4				
Days Per Stay	5.0	5.4				
Skilled Nursing Facility (SNF)						
Total SNF Payments	$1,413,530	$1,580,614	0.1885	**0.0009**	**0.0003**	**0.0004**
PMPM	$68	$76				
Users	153	217	**0.0005**	**0.0004**	**0.0003**	**0.0006**
SNF Stays	200	288	**0.0024**	0.0650 0.7480	0.1430 0.4320	**0.0470** 0.2550
Stays Per User	1.3	1.3				
Medicare-Paid SNF Days	3,896	5,462	**0.0040**	**<.0001** 0.8760	**<.0001** 0.8420	**<.0001** 0.8480
Days Per User	25.5	25.2				
Days Per Stay	19.5	19.0				

[1] Pairwise analysis tests the difference between matched treatment/control cases, summarized at the group level.

[2] Groupwise analysis tests the difference between the grouped sum of treatment and control groups.

[3] Adjusts for age, HCC value, ESRD, frailty, ever-disabled status, osteoporosis, and TIA/stroke.

[4] Model B is the same as Model A but also adjusts for additional clinical conditions (EDCs): quadri/paraplegia, schizophrenia & affective psychosis, disorders of lipoid metabolism, dementia/delirium, chronic skin ulcer, seizure disorder, iron deficiencies, hypertension w/major complications.

The difference between the groupwise unadjusted and Model A logit results for stays versus days is interesting in that those results are not significant for stays, but are significant for days—when those tests are a reflection of any activity (yes/no, or 1/0) in either case. Since any stay should be the same as any day (no stays are associated with 0 days and vice versa), the significance of the results might be expected to be the same for both stays and days. The groupwise unadjusted and

Model A logit results are different with respect to significance across the measures of stays and days in this case because the two-part test involves a weighting of information on use/non-use (technically, related to excess zeros) and the underlying distribution. In effect, the weighting is different for the results on stays versus days because of the different scales of the counts of stays and days. Another factor in this instance is that a zero-inflated Poisson (ZIP) approach was used for stays and a zero-inflated negative binomial (ZINB) approach was used for days. Model B results for stays, which indicate significance in the p-value for the logit (0.0470), were based on a ZINB approach. The choice of approach in each case was based on the Schwarz Bayesian Criterion (SBC) noted in the Analytic Methods section above, which proved not to be the same across the measures of SNF stays and days for the groupwise unadjusted and Model A tests in this case.

Home Health and Hospice Resource Use

Test results based on home health and hospice are shown in Table 42. Because it is primarily defined by institutional service need, it is not surprising that the LT-NF group uses significantly fewer of these community-based services. As a reminder, the marked differences in actual home health and hospice between the study groups in the MDC analysis described above suggested a possible problem in accounting for functional status in that analysis because there was no formal indicator of the level of functional support need for the MDC control group. However, these OAW/LT-NF results are less likely to indicate such a problem because each individual in both the OAW and LT-NH groups was required to meet at least the minimum criteria for an NHLOC in order to receive those services under Medicaid. It might also be noted that home health and hospice payments for the OAW group in this subgroup analysis are much higher than was the case for the OAW treatment group in the previous OAW versus community control analysis (see Table 15); this is because many of the most frail individuals in the potential OAW treatment group were dropped in the matching process for the earlier analysis. The high level of these services in this analysis is one indication of the appropriateness of the underlying matching process, as home health and hospice are intended, in large part, as an alternative to institutional care.

Table 42. Resource Use for OAW Treatment versus LT-NF Control Groups: Medicare Home Health and Hospice

Resource Use Measure	With OAW (treatment)	With LT-NF (control)	Pairwise[1] Unadjusted p-value	Groupwise[2] Unadjusted p-value	Groupwise[2] Model A[3] p-value	Groupwise[2] Model B[4] p-value
Home Health (HH)						
Total HH Payments	$1,845,583	$2,697	<.0001	<.0001	<.0001	<.0001
PMPM	$89	$0				
Users	400	- ds -	<.0001	<.0001	<.0001	<.0001
HH Episodes	502	- ds -	<.0001	<.0001	<.0001	<.0001
Episodes Per User	1.3	- ds -				
HH Visits	9,847	- ds -	<.0001	<.0001 0.2960	<.0001 0.5470	<.0001 0.4150
Visits Per User	24.6	- ds -				
Visits Per Episode	19.6	- ds -				
Hospice						
Total Hospice Payments	$923,719	$32,817	<.0001	<.0001	<.0001	<.0001
PMPM	$44	$2				
Users	37	- ds -	<.0001	<.0001	0.0001	<.0001
Hospice Episodes	41	- ds -	<.0001	<.0001	<.0001	<.0001
Episodes Per User	1.1	- ds -				
Medicare-Paid Days	6,882	- ds -	<.0001	<.0001 <.0001	<.0001 <.0001	<.0001
Days Per User	186.0	- ds -				
Days Per Episode	167.9	- ds -				

[1] Pairwise analysis tests the difference between matched treatment/control cases, summarized at the group level.

[2] Groupwise analysis tests the difference between the grouped sum of treatment and control groups.

[3] Adjusts for age, HCC value, ESRD, frailty, ever-disabled status, osteoporosis, and TIA/stroke.

[4] Model B is the same as Model A but also adjusts for additional clinical conditions (EDCs): quadri/paraplegia, schizophrenia & affective psychosis, disorders of lipoid metabolism, dementia/delirium, chronic skin ulcer, seizure disorder, iron deficiencies, hypertension w/major complications.

Part B Resource Use

Table 43 shows that the OAW treatment group accrued more overall Part B payments, and that the difference on that measure was statistically significant. Those higher overall payments were related to higher physician and DME component costs. The LT-NF control group had higher outpatient payments. Only the outpatient and DME component use rates (Users) were significantly different between the study groups. All the significant differences were higher in the direction suggested by the raw payment values and user counts in the table.

A more detailed examination of the underlying claims data shows that almost 75 percent of DME payments for the LT-NF group was related to enteral (tube) feeding. The DME payments for the OAW group are driven by oxygen concentrators, power hospital beds and chairs, related items such as mattresses and footrests, and blood glucose strips—most of which are subsumed in NF payments for the LT-NF group.

Table 43. Resource Use for OAW Treatment versus LT-NF Control Groups: Medicare Part B

Resource Use Measure	With OAW (treatment)	With LT-NF (control)	Pairwise[1]	Groupwise[2]		
			Unadjusted	Unadjusted	Model A[3]	Model B[4]
			p-value	p-value	p-value	p-value
Part B						
Total Part B Payments	$9,996,928	$8,214,437	<.0001	<.0001	<.0001	0.0001
PMPM	$481	$395				
Users	1,724	1,729	0.1797	0.0859	0.1023	0.1103
Physician Payments	$5,274,295	$3,969,423	<.0001	<.0001	<.0001	<.0001
PMPM	$254	$191				
Users	1,718	1,725	0.1671	0.1032	0.1098	0.1582
Outpatient Payments	$3,098,114	$3,384,874	<.0001	<.0001	<.0001	<.0001
PMPM	$149	$163				
Users	1,179	1,555	<.0001	<.0001	<.0001	<.0001
DME Payments	$1,624,518	$860,140	<.0001	<.0001	<.0001	<.0001
PMPM	$78	$41				
Users	1,197	411	<.0001	<.0001	<.0001	<.0001

[1] Pairwise analysis tests the difference between matched treatment/control cases, summarized at the group level.

[2] Groupwise analysis tests the difference between the grouped sum of treatment and control groups.

[3] Adjusts for age, HCC value, ESRD, frailty, ever-disabled status, osteoporosis, and TIA/stroke.

[4] Model B is the same as Model A but also adjusts for additional clinical conditions (EDCs): quadri/paraplegia, schizophrenia & affective psychosis, disorders of lipoid metabolism, dementia/delirium, chronic skin ulcer, seizure disorder, iron deficiencies, hypertension w/major complications.

Outpatient services and payments were notable as one of the two possible areas (along with overall SNF costs) where the LT-NF group generated higher overall payments than the OAW group. Patterns of ER use were explored to help account for those higher payments. However, the OAW group was found to generate twice the amount of payments for ER than the LT-NF group. More detailed analysis of the underlying claims showed that the primary source of the higher outpatient payments for the LT-NF group was physical and occupational therapy. During a Medicare SNF stay, those therapies are subsumed in the Medicare per-diem. Thus, the higher therapy payments for the LT-NF group are not related to their SNF stays.

The LT-NF group used a minimum of $625,000 more physical and occupational therapies not otherwise related to a SNF stay in outpatient settings than the OAW treatment group. In order to examine whether this effect was related to the service setting, differences on the five most commonly occurring therapies in the outpatient data[19] were explored using physician (provider) claims. Where between 200 and 530 LT-NF individuals had outpatient claims for these therapies, depending on the therapy, only four individuals had any physician claim for those services. In contrast, claims reflecting four of the five therapies were commonly found in physician claims for the OAW group, and in two cases that was more often than in outpatient claims for that group. The OAW group had roughly $160,000 more payments associated with the four common therapies than the LT-NF group based on physician claims. Thus, the higher outpatient payments for the LT-NF group are not just a function of services that the OAW group does not receive—they appear to be offset to some degree by other physician/provider claims. However, the LT-NF group clearly receives more outpatient services across the board, most likely because of provider relationships between the NF and outpatient facilities—which may or may not be a unit within the given NF—that occur to address those outpatient needs in the facility.

Payments per User

Results based on users alone suggest a slightly different pattern of significant differences than do the results in Tables 40 through 43. Total Medicare and component inpatient hospital payments per user continue to be significantly higher (nominally and statistically) for the OAW treatment group when non-users are excluded from the analysis. However, SNF payments, which were significantly higher for the LT-NF group when non-users were included (see Table 41), are significantly higher (again, nominally and statistically) for the OAW treatment group on a per-user basis. While the differences in home health and hospice payments were statistically significant overall, they were not significantly different when assessed on a per-user basis—particularly using Model B—largely because there were so few LT-NF users. The differences in overall payments for Medicare Part B and component physician payments continued to be

[19] The five therapies (procedure codes) include: Oral function therapy (92526); Therapeutic exercises(97110); Neuromuscular reeducation (97112); Gait training therapy (97116); Therapeutic activities (97530).

statistically significant and higher for the OAW group. Outpatient payments were higher on a dollar per-user basis for the OAW group, and the difference was statistically significant, but the parameter associated with that statistical test (see Appendix Table A5) indicated that the LT-NF group had higher costs (because of the effects of the transformation used). Raw DME per-user payment values in Table 44 were higher for the LT-NF group. The direction of the difference indicated by the model estimates still suggested that the OAW group had higher DME costs, but that difference was not statistically significant.

Table 44. Medicare Payments for OAW Treatment versus LT-NF Control Groups: Users Only for Total and Component Costs

Resource Use Measures	With OAW (treatment)		With LT-NF (control)		Model A[1]	Model B[2]
	Per User	N	Per User	N	p-value	p-value
Total Medicare Payments	$14,769	1,726	$9,439	1,729	**<.0001**	**<.0001**
Hospital Payments	$16,205	698	$15,164	428	**0.0264**	**0.0208**
SNF Payments	$9,239	153	$7,284	217	**0.0028**	**0.0068**
Home Health Payments	$4,614	400	$2,697	- ds -	0.8505	0.9883
Hospice Payments	$24,965	37	$4,688	- ds -	**0.0113**	0.0675
Part B Payments	$5,799	1,724	$4,751	1,729	**<.0001**	**<.0001**
Physician Payments	$3,070	1,718	$2,301	1,725	**<.0001**	**<.0001**
Outpatient Payments	$2,628	1,179	$2,177	1,555	**0.0492**	**0.0123**
DME Payments	$1,357	1,197	$2,093	411	0.1523	0.0822

[1] Adjusted for age, sex, race, frailty status, CMS-HCC relative value, ever-disabled status, count of 20 CCW conditions, ESRD, osteoperosis, and TIA/Stroke.

[2] Model B is the same as Model A but also adjusts for additional clinical conditions (EDCs): quadri/paraplegia, schizophrenia & affective psychosis, disorders of lipoid metabolism, dementia/delirium, chronic skin ulcer, seizure disorder, iron deficiencies, hypertension w/major complications, and other paralytic syndromes.

Note: "ds" indicates data have been suppressed because of small cell size.

OAW Treatment versus LT-NF Controls Summary Discussion

Results from this analysis show that LT-NF Medicaid recipients who are dually eligible for Medicare use significantly fewer Medicare resources than do comparable duals who receive Medicaid HCBS supports in the community. The community-based (OAW) group had higher costs in each Medicare cost category except SNF and outpatient services. Although the LT-NF group was more likely to use SNF care, the OAW group had more SNF payments per user, which were driven by more days per stay. Higher outpatient payments for the LT-NF group were driven by payments for physical and occupational therapies, in particular, although this appears to be more generally related to the site of service. Providers of these outpatient services often are affiliated with the NF providers and thus the higher use among the LT-NF group may reflect that relationship to some degree. Conversely, the OAW group may have unmet need for therapy.

More targeted analysis is needed to assess the extent to which these results suggest excess outpatient services provided to a "captive" LT-NF resident population, as opposed to unmet need being exhibited for a comparable (OAW treatment) group in the community.

Although not surprising, these results provide underlying detail to reaffirm the previous finding in Tucker and Johnson (2009) that duals in a Medicaid-paid LT-NF stay use significantly fewer Medicare resources than do comparable duals in the community.

Conclusion

This report had three broad objectives. As a companion to the previous reports in this series, the first objective was to provide detail about the Medicare resource use of beneficiaries who are dually eligible for Medicaid. Continuously enrolled duals in Maryland during 2006 were arrayed—as a whole and by selected grouping criteria—with respect to key demographic and clinical diagnostic characteristics. Then, total and component Medicare service use and payments during the study year were presented by those characteristics, for those groupings.

A second objective, in keeping with each report in this series so far, was to provide an initial understanding of the technical detail that underlies analyses regarding the integration of Medicare and Medicaid services and costs as a primer for analysts who are new to these issues. While the first two reports emphasized differences in benefits, overall payments, and the general structure of the separate programs, this report emphasized the analytic methods required to assess quantitative differences in a series of measures across comparable groups. A full sequence of the considerations that underlie inference testing on, in this case, Medicare resource use was covered, including: providing a rationale for, and detail needed to undertake, propensity score matching to establish comparison groups; describing appropriate statistical methods to test the significance of differences between those groups on various resource measures and the technical interpretation of subsequent results; and potential refinements for future analyses that might be considered to improve the preliminary analyses reported here.

Some results regarding subgroup cohorts drawn from Maryland's LAH Waiver and those who used medical day care are included in this report even though some aspects of each of these study components indicate possible confounding factors that raise questions about the success of each analysis. An initial LAH Waiver analysis was hampered because the study cohort was small and it did not seem to account properly for key clinical factors. A revised, more tailored analysis improved on the consideration of diagnostic criteria, although it led to the same general result as the first analysis. The MDC analysis suggested that the lack of better direct information about individuals' functional status may not have been addressed as well in the propensity score matching phase as it was in the other subgroup analyses. This was largely because MDC appears to be a proxy for a higher level of functioning among those who are frail or chronically ill that is not otherwise evident using the propensity score approach in this study to identify a comparable group. Each of these analyses is retained and discussed in this report despite somewhat

questionable results regarding the more central focus on cross-payer effects because they are illustrative of practical issues that are common in such complex analyses.

The third objective of this report was to examine whether, and how, providing Medicaid LTSS affects Medicare resource use through a series of subgroup analyses of matched LTSS "treatment" and control groups. In addition to the LAH Waiver and MDC analyses noted just above, the subgroup analyses included a comparison of enrollees in Maryland's OAW to a matched group of duals in the community, and a comparison of the same OAW group to a matched group of duals who receive Medicaid support for long-term NF stays.

Although a summary of results for each subgroup analysis can be found in the main text of this report, two general aspects of the effects of Medicaid LTSS on Medicare resource are evident from those results as a whole: (1) Medicaid LTSS provided in the community are associated with an increase in the number of Medicare services used with no, or limited, additional Medicare costs overall, and (2) Medicaid institutional supports offset Medicare resource use overall.

Patterns related to Medicaid supports in the community are embodied in the results for the analysis comparing the OAW treatment group to a control group drawn from the community. Providing OAW community support services is associated with more individuals receiving more Medicare services, but *overall* Medicare resource use, particularly on a per-user cost basis, is not significantly higher for those who receive Medicaid supports. There is also evidence of an overall improvement in the quality of care associated with better de facto coordination of services under the OAW—as suggested by fewer hospital readmissions, fewer SNF stays, and fewer cases of repeated ER visits for the treatment group. Higher use rates for home health and DME for the treatment group suggest both that OAW enrollees are better "plugged-in" to the Medicare service network—than other comparable Medicaid recipients—and that those comparable recipients have unmet need related to those services to some extent.

Thus, the most notable "treatment" effects of providing Medicaid LTSS in the community are: (1) an increase in services that indicates better access to care, particularly home health and DME, and (2) a decrease in services that suggest less coordinated care, particularly repeated inpatient hospital and SNF stays and longer hospice episodes. Such treatment effects are all the more significant because they occur in the absence of a more formal managed care environment, such as a Medicare Advantage plan.

A second aspect of the overall effects of Medicaid LTSS on Medicare resources is the reaffirmation of results from the second report in this series regarding Medicaid-paid long-term institutional care. Recipients of Medicaid LT-NF care accrued significantly fewer Medicare payments—close to $440 per-member-per-month (or 36 percent) less—than did comparable OAW recipients in the community.

This report also identified a few issues that could usefully contribute to a subsequent research agenda. Those include, but are not limited to, exploring the relationships between home health

and hospice and examining the implications of differing patterns in the provision of physical and occupational therapies for LT-NF recipients versus those in the community.

Next Steps

The fourth and final report in this series will provide a review of key findings in each of the preceding reports. It will also provide a synthesis of results from the second report (on Medicaid resource use) and the subgroup analyses in this report to explore how lessons learned across subgroups might be applied when developing better integrated/coordinated care programs for duals, particularly by state-level analysts charged to develop and administer such programs.

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Appendix

Detail on Parameter Estimates and Transformations Used in Subgroup Analyses

Table A1. Statistical Analysis Detail: Parameter Estimates and Transformation
OAW versus Community Controls

Resource Use Measure	Pairwise	Groupwise							
	Unadjusted	Unadjusted		Model A[1]			Model B[2]		
	estimate	estimate (logit)	estimate	estimate (logit)	estimate	transform	estimate (logit)	estimate	transform
Total Medicare									
Total Medicare Payments	-989.30		-989.30		0.400	0.25		0.391	0.25
Users (#)[3]					2.396			2.391	
Hospital Inpatient									
Total Hospital Payments	-456.71		-456.71		-0.027	-0.25		-0.025	-0.25
Users (#)[3]					0.151			0.139	
Hospital Stays	-0.041		-0.052	-1.320	-0.171		-1.622	-0.205	
Medicare-Paid Days	-0.094	-0.153	-0.110	-0.170	-0.013		-0.154	-0.018	
Skilled Nursing Facility									
Total SNF Payments	-358.05		-358.05		0.019	-1.25		0.021	-1.25
Users (#)[3]					-0.233			-0.260	
SNF Stays	-0.041		-0.339	0.001	-0.258		-0.768	-0.588	
Medicare-Paid SNF Days	-1.455	0.233	-0.332	0.231	-0.306		0.258	-0.298	
Home Health (HH)									
Total HH Payments	431.68		431.68		-0.069	-0.75		-0.063	-0.75
Users (#)[3]					0.513			0.470	
HH Episodes	0.078	-0.989	-0.151	-1.592	0.001		-1.653	0.005	
HH Visits	1.716	-0.466	0.062	-0.511	0.156		-0.468	0.144	
Hospice									
Total Hospice Payments	-738.07		-738.07		0.012	-3.00		0.012	-3.00
Users (#)[3]					-0.630			-0.750	
Hospice Episodes	-0.011		-0.495	-1.960	-1.031			-0.606	
Medicare-Paid Days	-5.414		-1.071	0.630	-0.513		0.750	-0.591	

Table A1 (continued). Statistical Analysis Detail: Parameter Estimates and Transformation
OAW versus Community Controls

Resource Use Measure	Pairwise	Groupwise							
	Unadjusted	Unadjusted		Model A[1]			Model B[2]		
	estimate	est. (logit)	estimate	est. (logit)	estimate	transform	est. (logit)	estimate	transform
Part B									
Total Part B Payments	131.86		131.86		0.447	0.25		0.475	0.25
Users (#)[3]					2.048			2.071	
Physician Payments	36.78		36.78		0.322	0.25		0.342	0.25
Users (#)[3]					1.759			1.781	
Outpatient Payments	-351.19		-351.19		-0.295	log		-0.291	log
Users (#)[3]					-0.175			-0.177	
DME Payments	446.27		446.27		1.783	log		1.857	log
Users (#)[3]					1.193			1.281	
User Only									
Total Medicare Payments					0.185	0.25		0.174	0.25
Hospital Payments					-0.184	0.25		-0.195	0.25
SNF Payments					-7.512	0.50		-7.270	0.50
Home Health Payments					0.397	0.25		0.359	0.25
Hospice Payments					-283,579	1.25		-326,132	1.25
Part B Payments					0.278	0.25		0.303	0.25
Physician Payments					0.162	0.25		0.179	0.25
Outpatient Payments					-0.112	log		-0.106	log
DME Payments					0.455	log		0.472	log

[1] Model A adjusts for sex, age, HCC value, months in Medicaid, ESRD, frailty, and count of CCW conditions.

[2] Model B is the same as Model A but also adjusts for additional clinical conditions (EDCs): dementia & delirium, other paralytic syndromes, incontinence, and schizophrenia & affective psychosis.

[3] P-values shown in the main text for unadjusted pairwise and groupwise tests are derived from McNemar and chi-square tests, respectively, which do not provide associated parameter estimates.

Notes: Linear regression was used to test payment outcomes. Logistic regression was used to test dichotomous (user/nonuser) outcomes. Poisson or negative binomial methods were used for count outcomes such as stays and days. Two-part (zero-inflated) Poisson (ZIP) or negative binomial (ZINB) models that include a logistic (logit) component were used for some count outcomes with many zeros. Results for count outcomes that require Poisson tests are highlighted with a *background in salmon* to distinguish them from negative binomial-based results.

Table A2. Statistical Analysis Detail: Parameter Estimates and Transformation
LAH Waiver versus Community Controls

	Pairwise	Groupwise							
	Unadjusted	Unadjusted		Model A[1]			Model B[2]		
Resource Use Measure	estimate	estimate (logit)	estimate	estimate (logit)	estimate	transform	estimate (logit)	estimate	transform
Total Medicare									
Total Medicare Payments	1279.72		1279.72		0.793	0.25		0.231	0.25
Users (#)3					1.271			1.310	
Hospital Inpatient									
Total Hospital Payments	-2068.86		-2068.86		0.106	-0.25		0.089	-0.25
Users (#)3					-0.608			-0.515	
Hospital Stays	-0.475		-0.528	1.466	-0.193		1.856	-0.125	
Medicare-Paid Days	-1.634	0.666	0.065	0.906	-0.124		0.726	-0.266	
Skilled Nursing Facility									
Total SNF Payments	-404.34		-404.34		0.019	-3.00		0.025	-3.00
Users (#)3					-0.540			-0.732	
SNF Stays	-0.054		-0.944		-1.152			-1.078	
Medicare-Paid SNF Days	-1.317		-1.130		-1.782			-2.159	
Home Health (HH)									
Total HH Payments	2599.14		2599.14		-0.256	-0.50		-0.128	-0.50
Users (#)3					2.075			1.227	
HH Episodes	0.416		1.782		1.774			1.342	
HH Visits	19.762	-1.739	1.065		2.952			2.620	
Hospice									
Total Hospice Payments	217.84		217.84		-0.005	-3.00		-0.008	-3.00
Users (#)3					9.924			10.213	
Hospice Episodes	0.005		11.692		14.107			14.682	
Medicare-Paid Days	1.653		20.262		24.998			24.730	

Table A2 (continued). Statistical Analysis Detail: Parameter Estimates and Transformation
LAH Waiver versus Community Controls

Resource Use Measure	Pairwise	Groupwise							
	Unadjusted	Unadjusted		Model A[1]			Model B[2]		
	estimate	est. (logit)	estimate	est. (logit)	estimate	transform	est. (logit)	estimate	transform
Part B									
Total Part B Payments	935.95		935.95		0.710	0.25		0.278	0.25
Users (#)3					0.840			0.878	
Physician Payments	-1064.15		-1064.15		-0.315	0.25		-0.474	0.25
Users (#)3					-0.603			-0.427	
Outpatient Payments	-306.98		-306.98		-0.492	0.25		-0.634	0.25
Users (#)3					-0.401			-0.323	
DME Payments	2307.09		2307.09		4.261	log		3.160	log
Users (#)3					2.859			2.273	
User Only									
Total Medicare Payments					0.733	0.25		0.125	0.25
Hospital Payments					-0.236	0.25		-0.865	0.25
SNF Payments					-0.740	0.25		34.254	0.50
Home Health Payments					1.535	0.25		0.715	0.25
Hospice Payments					n/a	n/a		n/a	n/a
Part B Payments					0.673	0.25		0.208	0.25
Physician Payments					-0.208	0.25		-0.368	0.25
Outpatient Payments					-0.213	0.25		-0.404	0.25
DME Payments					1.439	0.25		0.979	0.25

[1] Model A adjusts for HCC value, ESRD, frailty, and count of CCW chronic conditions.

[2] Model B is the same as Model A but also adjusts for additional clinical conditions (EDCs): multiple sclerosis, quadriplegia & paraplegia, substance abuse, schizophrenia & affective psychosis.

[3] P-values shown in the main text for unadjusted pairwise and groupwise tests are derived from McNemar and chi-square tests, respectively, which do not provide associated parameter estimates.

Notes: Linear regression was used to test payment outcomes. Logistic regression was used to test dichotomous (user/nonuser) outcomes. Poisson or negative binomial methods were used for count outcomes such as stays and days. Two-part (zero-inflated) Poisson (ZIP) or negative binomial (ZINB) models that include a logistic (logit) component were used for some count outcomes with many zeros. Results for count outcomes that require Poisson tests are highlighted with a *background in salmon* to distinguish them from negative binomial-based results.

Table A3. Statistical Analysis Detail: Parameter Estimates and Transformation
LAH Waiver (Revised) versus Community Controls

	Pairwise	Groupwise				
	Unadjusted	Unadjusted		Model A1		
Resource Use Measure	estimate	estimate (logit)	estimate	estimate (logit)	estimate	transform
Total Medicare						
Total Medicare Payments	3496.44		3496.44		0.928	0.25
Users (#)2					1.301	
Hospital Inpatient						
Total Hospital Payments	-264.85		-264.85		0.072	-0.25
Users (#)2					-0.388	
Hospital Stays	-0.109		-0.155	0.339	-0.187	
Medicare-Paid Days	-0.598	0.398	0.126	0.552	-0.187	
Skilled Nursing Facility						
Total SNF Payments	-105.44		-105.44		0.009	-3.00
Users (#)2					-0.447	
SNF Stays	-0.027	-8617.000	-1.329		-0.273	
Medicare-Paid SNF Days	-0.310		-0.371	0.151	-1.311	
Home Health (HH)						
Total HH Payments	1554.76		1554.76		-0.120	-0.50
Users (#)2					0.815	
HH Episodes	0.207	-0.797	0.180	-0.490	0.440	
HH Visits	-13.413	-0.733	0.497	-0.801	0.488	
Hospice						
Total Hospice Payments	239.15		239.15		-0.005	-3.00
Users (#)2					10.777	
Hospice Episodes	0.005		11.785		16.291	
Medicare-Paid Days	1.815		20.363		22.929	

Table A3 (continued). Statistical Analysis Detail: Parameter Estimates and Transformation
LAH Waiver (Revised) versus Community Controls

	Pairwise	Groupwise				
	Unadjusted	Unadjusted		Model A1		
Resource Use Measure	estimate	est. (logit)	estimate	est. (logit)	estimate	transform
Part B						
Total Part B Payments	2072.83		2072.83		0.856	0.25
Users (#)2					0.874	
Physician Payments	-324.34		-324.34		0.013	0.25
Users (#)2					0.119	
Outpatient Payments	468.31		468.31		0.017	0.25
Users (#)3					-0.153	
DME Payments	1928.86		1928.86		2.726	log
Users (#)2					1.759	
User Only						
Total Medicare Payments					0.751	0.25
Hospital Payments					-0.526	0.25
SNF Payments					not valid	not valid
Home Health Payments					0.712	0.25
Hospice Payments					n/a	n/a
Part B Payments					0.754	0.25
Physician Payments					-0.043	0.25
Outpatient Payments					0.215	0.25
DME Payments					1.331	0.25

[1] Adjusts for sex, age, HCC value, ESRD flag, substance abuse, and schizophrenia ^ affective psychosis.

[2] P-values shown in the main text for unadjusted pairwise and groupwise tests are derived from McNemar and chi-squared tests, respectively, which do not provide associated parameter estimates

Notes: Linear regression was used to test payment outcomes. Logistic regression was used to test dichotomous (user/nonuser) outcomes. Poisson or negative binomial methods were used for count outcomes such as stays and days. Two-part (zero-inflated) Poisson (ZIP) or negative binomial (ZINB) models that include a logistic component were used for some count outcomes with many zeros. Results for count outcomes that require require Poisson tests shown with a *backgound in salmon* to distinguish them from negative binomial results.

Table A4. Statistical Analysis Detail: Parameter Estimates and Transformation
MDC versus Community Controls

Resource Use Measure	Pairwise	Groupwise							
	Unadjusted	Unadjusted		Model A[1]			Model B[2]		
	estimate	estimate (logit)	estimate	estimate (logit)	estimate	transform	estimate (logit)	estimate	transform
Total Medicare									
Total Medicare Payments	-1904.13		-1904.13		0.331	0.25		0.283	0.25
Users (#)[3]					2.003			1.979	
Hospital Inpatient									
Total Hospital Payments	-1539.61		-1539.61		0.009	-0.25		0.013	-0.25
Users (#)[3]					-0.048			-0.074	
Hospital Stays	-0.121		-0.244	-0.312	-0.399		-0.218	-0.332	
Medicare-Paid Days	-0.582	-0.046	-0.283	-0.030	-0.288		0.025	-0.206	
Skilled Nursing Facility									
Total SNF Payments	-272.32		-272.32		0.021	-2.00		0.022	-2.00
Users (#)[3]					-0.416			-0.463	
SNF Stays	-0.032		-0.431		-0.466			-0.495	
Medicare-Paid SNF Days	-0.842	0.388	-0.156	0.414	-0.130		0.462	-0.158	
Home Health (HH)									
Total HH Payments	-262.26		-262.26		0.056	-1.75		0.052	-1.75
Users (#)[3]					-0.866			-0.827	
HH Episodes	-0.064		-0.774	0.034	-0.800		-0.027	-0.792	
HH Visits	-1.552	0.766	-0.693	0.840	-0.610		0.801	-0.613	
Hospice									
Total Hospice Payments	-364.50		-364.50		0.010	-3.00		0.011	-3.00
Users (#)[3]					-12.994			-13.048	
Hospice Episodes	-0.010		-14.404		-16.348			-16.493	
Medicare-Paid Days	-2.683		-20.797		-39.183			-44.631	

Table A4 (continued). Statistical Analysis Detail: Parameter Estimates and Transformation
MDC versus Community Controls

Resource Use Measure	Pairwise	Groupwise							
	Unadjusted	Unadjusted		Model A[1]			Model B[2]		
	estimate	est. (logit)	estimate	est. (logit)	estimate	transform	est. (logit)	estimate	transform
Part B									
Total Part B Payments	534.56		534.56		0.591	0.25		0.551	0.25
Users (#)[3]					2.003			1.979	
Physician Payments	776.33		776.33		0.712	0.25		0.685	0.25
Users (#)[3]					1.300			1.218	
Outpatient Payments	-199.88		-199.88		-0.087	log		-0.160	log
Users (#)[3]					-0.009			-0.051	
DME Payments	-41.89		-41.89		-0.080	-0.25		-0.077	-0.25
Users (#)[3]					0.457			0.454	
User Only									
Total Medicare Payments					0.225	log		0.191	log
Hospital Payments					-0.165	log		-0.105	log
SNF Payments					-0.154	0.25		-0.052	0.25
Home Health Payments					-10.854	0.50		-9.982	0.50
Hospice Payments					n/a	n/a		n/a	n/a
Part B Payments					0.467	0.25		0.435	0.25
Physician Payments					0.592	0.25		0.568	0.25
Outpatient Payments					-0.110	log		-0.129	log
DME Payments					-0.034	log		-0.037	log

[1] Model A adjusts for HCC value, ever-disabled status, ESRD, frailty, and count of CCW chronic conditions.

[2] Model B is the same as Model A but also adjusts for additional clinical conditions (EDCs): dermotophytoses, schizophrenia & affective psychosis, thyroid disease, and other paralytic syndromes.

[3] P-values shown in the main text for unadjusted pairwise and groupwise tests are derived from McNemar and chi-square tests, respectively, which do not provide associated parameter estimates.

Notes: Linear regression was used to test payment outcomes. Logistic regression was used to test dichotomous (user/nonuser) outcomes. Poisson or negative binomial methods were used for count outcomes such as stays and days. Two-part (zero-inflated) Poisson (ZIP) or negative binomial (ZINB) models that include a logistic (logit) component were used for some count outcomes with many zeros. Results for count outcomes that require Poisson tests are highlighted with a *background in salmon* to distinguish them from negative binomial-based results.

Table A5. Statistical Analysis Detail: Parameter Estimates and Transformation
OAW versus LT-NF

Resource Use Measure	Pairwise	Groupwise							
	Unadjusted	Unadjusted		Model A[1]			Model B[2]		
	estimate	estimate (logit)	estimate	estimate (logit)	estimate	transform	estimate (logit)	estimate	transform
Total Medicare									
Total Medicare Payments	5297.59		5297.59		0.417	log		0.404	log
Users (#)[3]					-0.981			-0.967	
Hospital Inpatient									
Total Hospital Payments	2785.05		2785.05		-0.141	-0.25		-0.140	-0.25
Users (#)[3]					0.775			0.786	
Hospital Stays	0.356	-19.217	0.299	-1.236	0.386		-1.080	0.469	
Medicare-Paid Days	1.562	-0.765	0.031	-0.808	0.091		-0.781	0.171	
Skilled Nursing Facility									
Total SNF Payments	-96.52		-96.52		0.037	-1.00		0.040	-1.00
Users (#)[3]					-0.406			-0.411	
SNF Stays	-0.051	0.404	-0.058	0.349	-0.144		2.269	-0.164	
Medicare-Paid SNF Days	-0.905	0.391	0.012	0.407	0.015		0.422	0.015	
Home Health (HH)									
Total HH Payments	1064.64		1064.64		-0.230	-1.00		-0.245	-1.00
Users (#)[3]					6.312			6.566	
HH Episodes	0.289		6.219		6.207			6.347	
HH Visits	5.684	-6.157	1.244	-6.288	0.676		-6.513	0.893	
Hospice									
Total Hospice Payments	514.67		514.67		-0.017	-3.00		-0.020	-3.00
Users (#)[3]					1.678			1.812	
Hospice Episodes	0.020		1.768		1.741			1.801	
Medicare-Paid Days	3.845	-1.666	1.763	-1.667	1.562			4.887	

Table A5 (continued). Statistical Analysis Detail: Parameter Estimates and Transformation
OAW versus LT-NF

Resource Use Measure	Pairwise	Groupwise							
	Unadjusted	Unadjusted		Model A[1]			Model B[2]		
	estimate	est. (logit)	estimate	est. (logit)	estimate	transform	est. (logit)	estimate	transform
Part B									
Total Part B Payments	1029.75		1029.75		0.306	0.25		0.259	0.25
Users (#)[3]					-1.313			-1.352	
Physician Payments	753.83		753.83		0.346	0.25		0.267	0.25
Users (#)[3]					-0.794			-0.746	
Outpatient Payments	-165.66		-165.66		-0.998	0.25		-1.041	0.25
Users (#)[3]					-1.466			-1.442	
DME Payments	441.58		441.58		-0.360	-0.25		-0.362	-0.25
Users (#)[3]					2.137			2.224	
User Only									
Total Medicare Payments					0.428	log		0.424	log
Hospital Payments					0.361	0.25		0.396	0.25
SNF Payments					0.544	0.25		0.507	0.25
Home Health Payments					0.343	0.25		-0.027	0.25
Hospice Payments					3.771	0.25		3.062	0.25
Part B Payments					0.317	0.25		0.278	0.25
Physician Payments					0.360	0.25		0.294	0.25
Outpatient Payments					-0.105	log		-0.144	log
DME Payments					0.121	log		0.155	log

[1] Adjusts for age, HCC value, ESRD, frailty, ever-disabled status, osteoporosis, and TIA/stroke. [2]Model B is the same as Model A, but also adjusts for additional clinical conditions (EDCs): quadra/paraplegia, schizophrenia & affective psychosis, disorders of lipoid metabolism, dementia/delirium, chronic skin ulcer, seizure disorder, iron deficiency, incontinence, and hypertension 2/major complications.

[3] P-values shown in the main text for unadjusted pairwise and groupwise tests are derived from McNemar and chi-square tests, respectively, which do not provide associated parameter estimates.

Notes: Linear regression was used to test payment outcomes. Logistic regression was used to test dichotomous (user/nonuser) outcomes. Poisson or negative binomial methods were used for count outcomes such as stays and days. Two-part (zero-inflated) Poisson (ZIP) or negative binomial (ZINB) models that include a logistic (logit) component were used for some count outcomes with many zeros. Results for count outcomes that require Poisson tests are highlighted with a *background in salmon* to distinguish them from negative binomial-based results.

The Hilltop Institute

University of Maryland, Baltimore County
Sondheim Hall, 3rd Floor
1000 Hilltop Circle
Baltimore, MD 21250
410-455-6854
www.hilltopinstitute.org