DEPARTMENT OF HEALTH & HUMAN SERVICES
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State Demonstrations Group

CMS is pleased to release the Medicaid Section 1115 Demonstrations Interim Evaluation report on Managed Long-Term Services and Supports (MLTSS). This evaluation work was performed independently by Mathematica Policy Research. While the findings are preliminary and subject to data limitations typical of complex health services research, CMS believes that transparency will inform many stakeholders, including states and providers.

This interim evaluation examines how utilization of specific services by MLTSS enrollees compares to that of fee for service (FFS) beneficiaries using LTSS. This evaluation focused on New York's Managed Long Term Care (MLTC) program and Tennessee's CHOICES program.

Overall, findings from the interim evaluation of MLTSS indicate varied results with respect to the goal of rebalancing care from institutional settings to care in home and community based settings. Findings indicated the following:

- Home and Community Based Services (HCBS) comprised nearly 70% of total MLTSS expenditures.
- Enrollment in New York's MLTC was associated with lower utilization of institutional services and higher use of HCBS services (particularly for personal care); lower hospitalization rates; and fewer hospital stays when compared to a matched comparison group of individuals enrolled in FFS in New York.
- In Tennessee, enrollment in CHOICES was associated with an increased use of personal care services, and more hospitalization stays (especially among dually eligible beneficiaries) when compared to matched comparison groups from Alabama and Georgia.

The early results in the report demonstrate that there is more progress to be made in improving long-term services and supports for Medicaid beneficiaries, as well as improving the availability of robust data. CMS will continue to monitor these demonstrations and other findings as they become available to help inform policy regarding these types of demonstrations.

CMS is looking forward to receiving the final evaluation reports. CMS will release these reports when they are finalized likely in the Fall of 2019.

Sincerely,

/s/

Judith Cash
Director
State Demonstrations Group

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Evaluation
Report

Managed Long-Term Services and Supports

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EXECUTIVE SUMMARY

During the past decade, state Medicaid agencies have increasingly shifted the delivery of long-term services and supports (LTSS) for older adults and people with disabilities from fee-for-service (FFS) systems, which pay providers for each service delivered, to managed care delivery models, which contract with private managed care plans to arrange and pay for LTSS. As of July 2016, 21 states offered 26 managed LTSS (MLTSS) programs, a significant increase from the 8 states that had MLTSS programs in 2004 (Saucier et al. 2012).[1] States can operate MLTSS programs through federal Medicaid authorities, including Section 1115 demonstration waivers.[2]

LTSS covers a range of services, including nursing facility care, as well as personal care assistance, homemaker services, adult day care, home-delivered meals, and other supports that help people live independently at home or in other community settings rather than in institutions. Because managed care plans are paid a fixed monthly rate for all covered services for each person enrolled and rates are set at a level that blends the cost of institutional services and home and community-based services (HCBS), they have a financial incentive to provide less costly care in the community and avoid unnecessary admissions to institutions.

As states increasingly deliver LTSS through managed care models, it is important to understand how costs and beneficiary outcomes in MLTSS differ from those in traditional FFS delivery systems. Although states have adopted MLTSS programs to reduce per-user spending, enhance beneficiaries' access to HCBS, and improve the quality of care, evidence on the effectiveness of MLTSS programs in achieving these goals has been mixed. The Centers for Medicare & Medicaid Services (CMS) commissioned Mathematica Policy Research to conduct an evaluation of recent MLTSS programs to examine (1) how per-user MLTSS spending changes over time; (2) how utilization of specific services by MLTSS enrollees compares to that of FFS beneficiaries using LTSS; and (3) how the quality of care received by MLTSS enrollees compares to that received by FFS beneficiaries using LTSS.

This interim evaluation report presents preliminary findings for the first two research questions. To examine changes in per-user MLTSS spending over time, the report presents descriptive trends in total MLTSS and per-user spending across all MLTSS states. To examine differences in utilization of services between MLTSS and FFS systems, it compares MLTSS enrollees in two states' programs—New York's Managed Long Term Care (MLTC) program and Tennessee's CHOICES program—to a similar group of people receiving LTSS under FFS. The services examined in this report include (1) LTSS, including nursing home care and HCBS provided through 1915(c) waivers or under the state plans, such as personal care services; and (2) hospitalizations. For the latter, we include three measures: (1) probability of any admission during the year, (2) number of hospital stays each year, and (3) average length of stay each year.

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[1] In this study, we excluded MLTSS programs operating under the CMS Medicare-Medicaid financial alignment initiative (FAI) for Medicare-Medicaid dual enrollees because they are being evaluated through a separate contract.

[2] MLTSS can also operate under a combination of 1915(a)/1915(c) waiver or 1915(b)/1915(c) waiver authorities. This evaluation examines all state MLTSS programs, regardless of the federal authority under which they operate.

Variation in state MLTSS program design

To attribute costs, utilization, and quality outcomes to the delivery model, this evaluation seeks to compare people with similar characteristics served in MLTSS and FFS systems. Because MLTSS program features vary across states, and these features affect the characteristics of MLTSS enrollees, this evaluation does not compare outcomes between MLTSS programs operating in different states. Key program features that affect enrollee characteristics include (1) whether enrollment is voluntary or mandatory; (2) qualifying level of care need (for example, whether people's health status and need for assistance with activities of daily living (ADL) make them eligible for a nursing home level of care); and (3) which services are covered in the capitation rates paid to managed care plans. For example, if a state MLTSS program only enrolls people receiving HCBS in the community at the time of enrollment, it is likely to have different cost and utilization patterns than a program that enrolls all LTSS beneficiaries, including nursing home residents.

Because this interim evaluation focuses on an in-depth analysis of two state programs in New York and Tennessee, it is important to understand the MLTSS program features in these two states during the study periods and how they changed over time.

Populations enrolled

New York. From its launch in 1998 until July 2012, the MLTC program voluntarily enrolled (1) adults with physical disabilities ages 18 to 64, and (2) people ages 65 and older. In both cases, MLTC enrollees had to meet nursing home level of care requirements and be able to safely live in the community when joining the plan. In 2012, the state switched to mandatory enrollment and expanded eligibility to include those expected to require long-term care services for *more* than 120 days from the date of enrollment. That year, it also began enrolling newly admitted nursing home residents and expanded to additional counties starting in July. The number of enrollees in MLTC grew from 30,081 in 2009 to 46,266 in 2011; new enrollees represented 35 percent of total enrollment in 2011. MLTC enrollment grew to nearly 77,000 by the end of 2012.

Tennessee. Since it began in 2010, the CHOICES program has mandatorily enrolled two groups of LTSS beneficiaries: (1) people of all ages who receive nursing home care (CHOICES 1); and (2) adults ages 21 and older with a physical disability, as well as seniors ages 65 and older who qualify to receive nursing home care but live and receive services in home and community-based settings (CHOICES 2). In July 2012, Tennessee increased the number of ADLs that qualified people for nursing home level of care in CHOICES 2 and introduced a third group: those who do not qualify for nursing home level of care but need some home care services to delay or prevent the need for nursing home care (CHOICES 3). Despite the change in eligibility criteria, CHOICES consistently enrolled an average of 30,895 beneficiaries from 2012 to 2015.

Covered services

New York. During the study period (2009 to 2012), New York was one of four states whose MLTSS plans covered nursing facility care and HCBS, but not acute hospital services, primary and specialty care, or prescription drugs. Separate Medicaid managed care plans under contract with the state provided acute, primary, and specialty medical services for Medicaid-only

beneficiaries. Coverage for Medicare-Medicaid dual beneficiaries came from Medicare FFS or a Medicare Advantage managed care plan.[3]

Tennessee. In contrast to New York, but like most states with MLTSS programs, CHOICES covered LTSS for Medicaid-only beneficiaries, including institutional services and HCBS, as well as acute hospital, primary, and specialty care (excluding prescription drugs). Similar to MLTC, CHOICES did not cover acute and primary care services for Medicare-Medicaid dual beneficiaries. Medicare FFS or a Medicare Advantage managed care plan covered these medical services.

MLTSS spending patterns

Balance of LTSS spending on HCBS. Among 17 states that reported complete MLTSS expenditures in 2015, HCBS comprised nearly two thirds of total MLTSS expenditures (63.2 percent; Table III.2 on Page 14). Excluding three states (Michigan, North Carolina, and Pennsylvania) that operate specialty MLTSS programs that cover a limited range of HCBS under capitation, the portion of MLTSS expenditures for HCBS exceeds 70 percent in six states: Arizona, Minnesota, New Jersey, New Mexico, New York, and Wisconsin. In New York, 94 percent of total MLTC dollars were spent on HCBS in 2015 because of the exclusion of most nursing home residents from enrollment. In Tennessee, about 29 percent of total MLTSS expenditures in 2015 were devoted to HCBS, substantially less than New York, largely because CHOICES mandatorily enrolled all nursing home residents. Per-user costs for nursing home residents were substantially higher than those for people living in home or community residences.

Per-user spending. Tennessee was among the three states with the greatest total per-user expenditures: Tennessee ($50,664), Michigan ($46,288), and Hawaii ($43,661); New York ranked sixth ($36,030) (Table III.3 on Page 16). From 2012 to 2015, MLTSS per-user expenditures increased by 28 percent among states that could report them. New York saw its per-user expenditures decrease slightly (from $36,930 to $36,030). Per user spending may have increased in subsequent years, however, because new nursing facility residents, whose annual costs are much higher than those of HCBS users, were required to enroll in either a MLTC or regular Medicaid managed care plan beginning in February 2015. Tennessee's per-user expenditures increased during this time, from $43,906 to $50,644. The change in expenditures was the result of an increase in nursing facility per diem payments to reflect (1) the increasing acuity of residents who remained in facilities as Tennessee increasingly served individuals with HCBS, and (2) value-based payments for facilities that demonstrated enhanced person-centered care and outcomes.[4]

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[3] New York operates another MLTSS program called Medicaid Advantage Plus (MAP) that covers both Medicare acute care benefits and Medicaid LTSS benefits for dually eligible beneficiaries. Enrollment is voluntary, but it is an acceptable alternative for LTSS beneficiaries subject to mandatory MLTC enrollment. This evaluation did not examine the MAP program because of data quality problems.

[4] Personal communication with Patti Killingsworth, Assistant Commissioner for the Bureau of TennCare, January 9, 2018.

Preliminary analysis of MLTSS service use outcomes

Based on the goals of MLTSS and the financial incentives inherent in risk-based capitated payment, we expected enrollment in MLTSS to be associated with less institutional care and greater use of HCBS—especially personal care. We also hypothesized that MLTSS enrollees would have fewer hospital admissions and shorter stays than FFS LTSS users, particularly among Medicaid-only beneficiaries whose managed care plans covered both acute and LTSS services.

Methods

To examine how service use among MLTSS enrollees compared to that among LTSS users under FFS, we created separate comparison groups for each study state. In New York, we identified a comparison group within the state among beneficiaries who were eligible for MLTC but did not enroll. We created a matched sample of beneficiaries similar to existing MLTC enrollees as of 2009, the baseline year, and used regression modeling to estimate outcomes during the study period from 2009 to 2012. In Tennessee, we compared a group of beneficiaries who enrolled in CHOICES during the two beginning waves of the mandatory enrollment period to a matched sample of beneficiaries in Alabama and Georgia with similar characteristics who remained in FFS but would have been eligible for CHOICES had they lived in Tennessee.

In both states, we used propensity score matching techniques to ensure people in the comparison group were as similar as possible to those who enrolled in MLTSS based on observable characteristics such as demographics (age, gender, and race); location (urban or rural); category of Medicaid eligibility; dual status; and number and type of chronic conditions. We controlled for any residual differences between MLTSS enrollees and the matched comparison group using regression techniques. We examined outcomes separately for full-benefit dually eligible beneficiaries, Medicaid-only beneficiaries, and the two groups combined because of differences in their characteristics and the benefits covered by the managed care plans for each group. Because we lacked complete hospitalization data for some of the dually eligible beneficiaries who were enrolled in Medicare Advantage, results for this subgroup should be interpreted with caution. Section IV contains further information on study methods and data; Appendix A provides additional details.

New York results

- **LTSS utilization: MLTC enrollment was associated with lower use of institutional services and more use of HCBS, especially personal care.**

  - Before regression adjustment, 14 percent of 21,503 beneficiaries in the MLTC study sample used institutional care in Year 1 of the three-year study period from April 2009 to March 2012, compared to 35 percent in the matched comparison group. Nearly all (99 percent) of MLTC enrollees used some HCBS in the first study year, compared to 92 percent in the matched comparison group, and almost 92 percent of MLTC enrollees used personal care services in the first year, compared to 51 percent in the matched comparison group. Notable differences in the use of institutional care and personal care services between the two groups could indicate that the matching techniques based on observable beneficiary characteristics did not fully mitigate selection bias. That is,

people who were healthier and less functionally impaired than those who remained in FFS might have opted to enroll in MLTC.

- After adjusting for differences in demographic characteristics, location, and chronic conditions between the two groups, MLTC enrollment remained associated with less use of institutional services and greater use of HCBS and personal care.

  o The mean probability of using any institutional service during a year was 15 percent for MLTC enrollees, 16 percentage points lower than predicted if these beneficiaries received LTSS through FFS. The difference was larger for Medicaid-only beneficiaries: 24 percentage points lower, partly because we did not capture all Medicare-covered post-acute skilled nursing facility stays among dual enrollees.

  o On average, the mean probability of MLTC enrollees using any HCBS during a given year was 99 percent, 4 percentage points higher than if the beneficiary had received LTSS through FFS. The mean probability of using personal care services in any given year was estimated to be 91 percent for MLTC enrollees, compared to just 58 percent if those beneficiaries had received LTSS through FFS.

- **Hospital care: MLTC enrollment was associated with lower hospitalization rates, and fewer and shorter stays.**

  - On average, 36 percent of MLTC enrollees had at least one hospitalization during a given year, slightly less than the matched FFS comparison group (38 percent). Among the Medicaid-only population, for whom we have complete data, the share of MLTC enrollees with at least one hospitalization during a given year was 5 percentage points lower than in the matched comparison group (34 versus 39 percent). Medicaid-only MLTC enrollees also averaged fewer hospital stays (706 versus 866 per 1,000 beneficiaries) and inpatient hospital days (6 versus 9) per beneficiary per year than those in the comparison group.

  - After adjusting for differences in the characteristics of the two groups, MLTC enrollment continued to be associated with reductions in hospital use. MLTC enrollees were 0.7 percentage points less likely to have had any hospitalizations in a year, had 21 fewer hospital stays per 1,000 beneficiaries, and had 0.5 fewer inpatient hospital days than they would have if they had not enrolled in MLTC. Among the Medicaid-only enrollees, the probability of having any hospitalization was 4.5 percentage points lower than predicted if these beneficiaries received LTSS through FFS. There were also 148 fewer hospital stays per 1,000 beneficiaries and 2.6 fewer hospital days per year associated with MLTC enrollment.

Tennessee results

- **LTSS utilization: Among both CHOICES enrollees and matched comparison groups, unadjusted rates of institutional care use declined over time. We found an inconsistent association between CHOICES enrollment and the probability of use of institutional care but a strong association between enrollment and increased use of personal care services.**

  - **Institutional care.** The percentage of CHOICES enrollees using institutional care declined from 82 percent in the year before enrollment to 75 percent by the fourth year

of enrollment. Individuals in the two matched comparison groups experienced similar declines in the use of institutional services. After regression adjustment, we estimated a difference that is not statistically significant in the rate of institutional care associated with CHOICES enrollment.

- **HCBS.** After adjusting for differences in characteristics (including baseline service utilization) between CHOICES enrollees and the matched comparison group from Alabama and Georgia, the yearly average probability of any HCBS use among CHOICES enrollees was 71 percent, nearly 9 percentage points lower than predicted if these beneficiaries received LTSS through FFS. Most of this result was driven by the dually eligible population, for whom an 11 percentage point decrease in HCBS use was associated with CHOICES enrollment. However, among Medicaid-only beneficiaries, we estimated a 1.9 percentage point increase in HCBS utilization associated with enrollment in CHOICES. Medicaid-only beneficiaries were more likely than dually eligible beneficiaries to use HCBS; the regression-adjusted mean annual HCBS utilization rate among CHOICES enrollees was 97 percent among Medicaid-only beneficiaries, compared to 67 percent among dually eligible beneficiaries.

- **Personal care.** The regression-adjusted rate of personal care service use among CHOICES enrollees increased from 19 to 37 percent during the five-year study period. Although enrollment in CHOICES was associated with an increase in the probability of using personal care services in all populations (averaging 1.2 percentage point increase annually), the effect was stronger among Medicaid-only beneficiaries (3.9 percentage point increase) than dually eligible beneficiaries (0.8 percentage point increase).

• **Hospital care: CHOICES enrollment was associated with higher hospital service use.**

- Unadjusted hospital service use tended to decrease over time for CHOICES enrollees and the matched comparison groups. All groups started with 32 to 33 percent of beneficiaries being admitted to a hospital per year at the baseline; however, the likelihood of hospitalization increased in the first study year and then decreased in the subsequent two years in all states –from 36 to 32 percent among CHOICES enrollees, compared to 35 to 33 percent among the matched comparison group in Alabama and 34 to 31 percent among the matched comparison group in Georgia. We observed similar trends for number of hospital stays and days.

- Although we did not expect MLTSS to directly affect hospitalization outcomes, we found that enrollment in CHOICES was associated with increased hospital service use after regression adjustment. Over the five-year study period, the average probability of at least one hospitalization in any given year increased by 2.3 percentage points with enrollment. CHOICES enrollment was also associated with 1.5 more inpatient hospital days per beneficiary per year on average. This result was largely driven by the dually eligible beneficiaries who represent a large majority of CHOICES enrollees, but we lacked complete data for some dually eligible enrollees because of missing Medicare encounter data. In part because of their smaller sample size, results for the Medicaid-only group were mostly not statistically significant.

Discussion

Interim evaluation of MLTSS programs in New York and Tennessee indicate mixed results regarding their effect on rebalancing care from institutional settings toward care in home and community-based settings. In New York, the probability of using of any institutional care was lower after enrollment in MLTC, and in most instances the use of HCBS and personal care was higher, relative to the FFS comparison group. In Tennessee, the probability of using personal care was higher after enrollment in CHOICES, but the likelihood of any use of HCBS was lower overall (although higher for Medicaid-only beneficiaries), and changes in institutional care were insignificant, compared to matched FFS beneficiaries.

These findings were largely consistent with previous evaluations of first-generation MLTSS programs, such as those in Arizona and Wisconsin, which progressively increased the use of HCBS and diminished use of nursing home care (Saucier et al. 2005). Nonetheless, due to data constraints, we had to define study samples that ended up with slightly greater shares of female and dually eligible enrollees, compared to all enrollees in the New York and Tennessee MLTSS programs, hence we suggest caution in generalizing the findings to the entire program in the two states. In addition, several factors might have contributed to differences between the study and comparison populations (discussed in Section VI and Appendix A). Moreover, because of differences in state MLTSS program design, which lead to differences in the characteristics of individuals who enroll and how those individuals interact with acute and LTSS services, results cannot be generalized to all state MLTSS programs.

Variation in state programs. Differences in state LTSS systems, provider supply, and the design of the programs in New York and Tennessee might explain different results in the two states. For example, after regression adjustment, we found a much higher use of institutional care in Tennessee (81 percent) than in New York (15 percent) due to differences in program eligibility and enrollment policies. New York exempted current nursing home residents from enrolling in MLTC, so nearly all MLTC enrollees were existing HCBS users. In contrast, from the start of Tennessee's program, all nursing home residents were required to enroll in CHOICES, and they comprised about 84 percent of all enrollees at the time. That Tennessee's rate of institutional care did not decline significantly over time, relative to the comparison groups, might reflect LTSS system rebalancing efforts that occurred in most states from 2010–2014, including Alabama and Georgia. For example, in Georgia, HCBS as a share of total LTSS spending increased from 38.6 percent in 2010 to 48.1 percent in 2014; in Alabama, it rose from 34.7 percent in 2010 to 41.5 percent in 2014; and in Tennessee, it rose from 41.8 percent in 2010 to 53.2 percent in 2014 (Irvin et al. 2017).

Mixed results in hospital use. Hospital use measures declined among MLTC enrollees in New York and increased among CHOICES enrollees in Tennessee. However, the MLTSS programs we evaluated were not expected to have large, significant effects on hospital use by dual enrollees, because in both states the managed care plans were not responsible for their Medicare acute care benefits. Among Medicaid-only MLTC enrollees whose acute care was not covered by MLTC plans, we found that they spent an estimated three days less in the hospital per beneficiary per year than they would have if they had not enrolled in MLTC. The reason for shorter stays is unclear, but it could be voluntary enrollment during the study period, which often leads to people with better health enrolling in managed care and those in poorer health with more

chronic conditions choosing to remain in FFS. In contrast, Medicaid-only CHOICES enrollees in Tennessee were estimated to spend almost two more days in the hospital each year than those in the comparison group, even though MLTSS health plans were financially responsible for their hospital stays. Due to these mixed findings, we will analyze changes in avoidable hospitalization rates in the final evaluation report, which could shed light on whether these results are masking effects on avoidable hospitalizations.

Limitations

The preliminary findings in this report are subject to several limitations. First, the outcomes we examined are measures of utilization that we could construct from administrative claims data. We were unable to collect data directly from beneficiaries, managed care plans, providers, or states through surveys or other methods because of limited contract resources. Consequently, we could not examine important outcomes of MLTSS programs such as beneficiary experience with managed care plans and services, changes in self-reported health status, quality of life ratings, satisfaction with providers, and other key indicators of program effectiveness. As more data sources concerning MLTSS become available, including beneficiary experience measures and others directly reported by the states, we will revisit these other outcomes. In the final evaluation report, we will also consider other important measures of LTSS and hospital use and care quality, including but not limited to (1) long-term institutional stays (any nursing facility stay beyond 100 days, whether or not the admission followed a hospitalization); (2) potentially avoidable hospitalizations, which might be more indicative of care quality than any hospital use; and (3) severe pressure ulcers. In addition to identifying any use of personal care (as done in the current report), we will further explore the feasibility of examining the actual amount of such service use.

Second, the administrative data available consisted largely of Medicaid Analytic eXtract (MAX) files, based on state-reported Medicaid Statistical Information System (MSIS) data. We selected New York and Tennessee for this study because their MAX managed care encounter data are more complete and reliable than that from other states. However, encounter data remain subject to gaps or data quality problems. Accurately constructing critical measures, such as eligibility criteria for MLTSS and HCBS use, remains a challenge. There are also other important characteristics of beneficiaries, such as functional limitation, that MAX does not capture, which could further constrain our ability to construct an accurate comparison groups of FFS beneficiaries. As a result, residual selection bias could still affect our estimates.

A third set of limitations stems from the study designs. In both states, we used "intention to treat" analyses, which treated MLTSS enrollees identified at the beginning of the study period as "enrolled" even if they later disenrolled. We believe this approach avoided potential biases that could occur if enrollees switched service delivery systems midway through the study, but it means that these enrollees were not subject to MLTSS program influence throughout the study period. For the final evaluation report, we will consider adding sensitivity analyses to our study (for example, by controlling for continuous enrollment in MLTSS throughout the study periods).

Finally, in Tennessee, we chose Alabama and Georgia as comparisons. Although these two states closely resembled Tennessee on seven measures of LTSS supply, demand, and policy (see Appendix C), they were likely to differ from Tennessee in many ways, some observable and

some not. Although we attempted to control for these differences and ran distinct regression models for each state, we concluded that combining the FFS enrollees from both states into one comparison group increased the sample size and representativeness of LTSS FFS users.

I. INTRODUCTION

A. Purpose of the interim outcomes evaluation report

The Centers for Medicare & Medicaid Services (CMS) has contracted with Mathematica Policy Research to evaluate Medicaid managed long-term services and supports (MLTSS). MLTSS is a delivery system innovation often authorized by 1115 demonstrations[5] which aims to improve care quality and reduce costs for Medicaid beneficiaries who are frail and/or have disabilities by contracting with managed care plans to provide long-term services and supports (LTSS) in exchange for a per-member-per-month (PMPM) capitation payment. MLTSS programs have the potential to provide less costly, person-centered home and community-based alternatives to institutional care, improve care coordination, and reduce the use of unnecessary services. However, if managed care plans restrict access to services or do not assure the quality and coordination of services, MLTSS could have adverse effects on health and long-term care outcomes. As states increasingly deliver LTSS through managed care rather than fee-for-service (FFS), CMS is interested in understanding how outcomes at the program and beneficiary levels differ between these two delivery systems.

This report presents results of an interim evaluation conducted between October 2016 and August 2017. Among all outcomes measures identified in the updated evaluation design supplement (Libersky et al. 2017), here we focus on the service use measures that were feasible to construct with the administrative data available for this report.[6] Several other data sources we proposed initially were not available for this interim outcomes evaluation. For example, data collected through the Consumer Assessment of Healthcare Providers & Systems (CAHPS) HCBS Experience of Care Survey can be used to construct measures of HCBS beneficiary experience. However, among the study states, only Tennessee field tested this survey in 2014, and the state did not conduct the survey again during our study period, so these measures were not available for the interim evaluation. The Behavioral Risk Factor Surveillance System (BRFSS), a survey conducted in each state with U.S. adults, including those with disabilities, can include supplemental questions on the receipt of needed social and emotional support. But among the states considered for this evaluation, only Tennessee collected information on social and emotional support, and these questions were only included in 2013. The final evaluation, to be conducted in 2018-2019, will determine whether these or other data sources become available to construct additional measures of MLTSS outcomes (see Section I.B).

B. Research questions and evaluation design

This evaluation of MLTSS program outcomes addressed the following research questions:

1. How does per-user MLTSS spending change over time?

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[5] MLTSS can also operate under a combination of 1915(a)/1915(c) or 1915(b)/1915(c) authorities. This evaluation considers all MLTSS programs, regardless of the Federal authority under which they operate.

[6] We constructed LTSS utilization measures by using specifications similar to those used in the Money Follows the Person Demonstration evaluation; see Appendix A for details. CMS contracted with Mathematica to develop and test a set of MLTSS quality measures, but testing for reliability and validity of these measures had not been completed at the time of this evaluation.

2.   How does utilization and/or access to services compare between MLTSS and FFS systems?

3.   How does the quality of care provided under MLTSS compare to that provided under FFS?

To examine changes in per-user MLTSS spending (research question 1), we present descriptive trends in total MLTSS and per-user spending across all MLTSS states (see Sections II.A, III.C and III.D), using annual summary data collected for CMS's LTSS expenditure reports (Eiken et al. 2017) and Medicaid managed care enrollment report (Centers for Medicare & Medicaid Services 2013, 2014 and 2015).

To investigate how service use and access in MLTSS compares to that under FFS (research question 2), we compared measures of hospital care, institutional long-term care (ILTC), and home and community-based services (HCBS) use among people enrolled in MLTSS programs in two states (New York's Managed Long Term Care [MLTC] program and Tennessee's CHOICES program) with measures from a comparison group of people receiving LTSS under FFS (see Section IV and Appendix A). We chose New York's MLTC and Tennessee's CHOICES program because they offered LTSS under managed care in some counties for at least two years between 2009 and 2014, and the states covered LTSS under FFS in at least some counties in 2009, which allowed for a sufficient pre- and post-period and/or comparison group. Both states also had MAX encounter data of sufficient quality to support the evaluation (Libersky et al. 2017).

Because of key differences in MLTSS program design (for example, mandatory versus voluntary enrollment, statewide versus selected counties), we used two different research designs to evaluate MLTC in New York and CHOICES in Tennessee. In New York, we estimated the effects of a voluntary MLTSS program on those needing LTSS who elected to participate in the program, relative to the group of people in the state who were eligible but did not enroll. We created a matched sample of beneficiaries similar to existing MLTC enrollees as of 2009 and used regression modeling to estimate outcomes over the period of 2009 to 2012. In Tennessee, we estimated the effects of a statewide mandatory MLTSS program on those needing LTSS, if it were applied to beneficiaries needing LTSS in similar states. We compared a group of beneficiaries in Tennessee who enrolled in CHOICES during the two beginning waves of a mandatory enrollment period (March and August 2010) to a matched sample of beneficiaries in Alabama and Georgia with similar characteristics who remained in FFS but would have been eligible for CHOICES had they lived in Tennessee. We used regression modeling again to estimate outcomes over a longer study period of 2010 to 2014.

Our approach to measuring outcomes in each state allowed us to compare the effect of receiving LTSS under managed care versus FFS among people with comparable baseline characteristics. Because service use is inextricably linked to demographics, health status, and the need for LTSS, it was critical to control for these differences across states and over time, when possible. Doing so increased the likelihood that results were due to MLTSS rather than to differences in enrollee characteristics. See Appendix A for more details on the data and methods used for the outcomes evaluation.

To assess how quality of care in MLTSS compares to that provided through FFS (research question 3), we will examine avoidable hospitalizations in the final evaluation report planned for 2019. We intend to examine the percentage of HCBS users, and the percentage of institutional

residents separately, who experienced potentially avoidable hospitalizations (AHRQ ACSC PQI#90). Such measures indicate access to outpatient care as well as the quality of care coordination. We will also investigate the percentage of individuals experiencing severe pressure ulcers, a more specific measure of quality outcomes for this population.

C. Roadmap to the report

Following this introduction, the report has five other sections. It begins by describing MLTSS programs and the ways in which they vary across states and over time (Section II). Section III presents descriptive trends across all MLTSS states related to enrollment, covered services, and spending, and compares trends in two study states, New York and Tennessee, to other MLTSS states. Section IV presents the results of our analysis of outcomes related to utilization of LTSS and hospital admissions in New York and Tennessee. The report concludes with a discussion of findings to date (Section V) and major data and methodological limitations (Section VI). Appendix A describes the data and methods used in the evaluation with more details. Appendices B through D provide supplemental information to support our study methods. Appendix E presents results from the outcomes evaluation in Tennessee based on separate matched comparison groups from Alabama and Georgia. Appendix F shows key estimated regression coefficients from models used in Section IV.

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II. TRENDS IN AND EVIDENCE ON MLTSS

A. Expansion of MLTSS

State Medicaid programs are increasingly shifting payment for LTSS from a FFS model to managed care delivery models. As of January 2017, 21 states offered 26 MLTSS programs (Table II.1),[7] a significant increase from the 8 states that offered MLTSS programs in 2004 (Saucier et al. 2012). Consequently, the proportion of LTSS expenditures that managed care covers has grown. From fiscal year (FY) 2008 to FY 2015, the proportion of LTSS expenditures attributable to managed care increased from 4 to 18 percent (Appendix B)—including Financial Alignment Demonstrations but excluding Programs of All-Inclusive Care for the Elderly (PACE) in states that also operate MLTSS. During FY 2012–2015, total expenditures for MLTSS more than tripled, from $8.9 billion to nearly $28 billion. Most of this increase (75 percent) is the result of significant expansions of MLTSS programs in four states (Florida, New York, North Carolina, and Texas), as well as the implementation of new MLTSS programs in five states (Delaware, Illinois, Kansas, New Jersey, and Ohio).

States are adopting managed care models to deliver LTSS for several reasons. First, budget pressures and the high cost of LTSS prompt states to use managed care as an alternative to FFS because rates are set in advance, making payments more predictable (Gifford et al. 2011). Second, contracting with managed care plans gives states the ability to hold an entity accountable for quality and access. Although states, in general, anticipate that MLTSS programs will enhance beneficiaries' access to care, specifically to HCBS (Musumeci 2014), they may limit enrollees' access to certain services or providers, particularly those that are out-of-network.

Third, several studies of MLTSS programs indicated that they lower the use of costly services. For example, an evaluation of Arizona's Long Term Care System (ALTCS), the first MLTSS program in the United States, found that enrollees were significantly less likely to be hospitalized, have inpatient professional visits, and use laboratory services than a control group of beneficiaries with similar characteristics in New Mexico (McCall and Korb 1997). ALTCS enrollees, however, were significantly more likely to make emergency room visits and use prescription drugs. A study of Minnesota's Senior Health Options (MSHO) program found that its enrollees experienced significantly fewer preventable hospital admissions and emergency services than non-enrollees. MSHO nursing home enrollees also were significantly less likely than non-enrollees to be admitted to the hospital and had spent fewer days in the hospital (Kane et al. 2004). A study of the Massachusetts Senior Care Options (SCO) program found that its enrollees had fewer months of residence in nursing facilities than a matched FFS group (JEN Associates, Inc. 2015).

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[7] FAI demonstrations for Medicare-Medicaid enrollees, which contract with managed care plans to cover both Medicare and Medicaid benefits, including LTSS, are excluded from the 26 programs considered here. We exclude these programs because they are being evaluated separately under a different contract. However, we include the LTSS expenditures for the FAI programs when examining per-user MLTSS spending over time to provide an overall picture of how MLTSS is growing.

Fourth, by paying a fixed amount per member per month (referred to as a capitation rate) that blends the cost of institutional services and HCBS, states can create financial incentives for managed care plans to favor less costly community placement and accelerate LTSS system rebalancing (Lipson and Valenzano 2013; Centers for Medicare & Medicaid Services 2013). However, evidence from previous studies on cost savings was mixed. For example, a review of the studies of five MLTSS programs in Arizona, Minnesota, Nevada, Texas, and Wisconsin found that only two (Arizona and Texas) lowered nursing home costs relative to FFS (Grabowski 2006).

B. Variation in MLTSS program design

Although states may turn to MLTSS for similar reasons, their programs vary widely along several dimensions (Table II.1). States differ in the amount of time they have been operating MLTSS, with the oldest program (Arizona) having been in place for more than 25 years, and the newest (Iowa) beginning in 2016. States have different requirements for enrollment. Most programs (18 of 26) require people to enroll in managed care, but the other eight programs allow some groups to choose to participate in managed care (referred to as voluntary opt-in) or automatically assign them to an MLTSS plan from which they can disenroll (referred to as voluntary opt-out). Benefits offered in MLTSS programs vary as well, with most programs (20 of 26) covering both Medicaid acute care and LTSS as part of a comprehensive benefit package; the remaining six programs "carve out" LTSS services and provide them through a single, limited-benefit managed care program separate from any plans that cover acute care services. A state's choice to offer comprehensive or limited-benefit plans depends on what managed care programs are in place when MLTSS is launched, as well as the number and experience of plans providing LTSS that can participate in the managed care market in the future (Libersky et al. 2014).

States also enroll different subpopulations in MLTSS. All MLTSS programs cover adults age 65 and over, but only 10 cover children with disabilities. All but two programs (Illinois' Integrated Care Program and Tennessee's TennCare Employment and Community First Choices) covers full-benefit dual enrollees who receive all Medicaid benefits—meaning that Medicaid pays for their Medicare premiums, deductibles, and other cost sharing, as well as LTSS and other services that Medicare does not cover.[8] Variation also exists in functional level of need (that is, the need for assistance performing activities of daily living [ADL]) that states require individuals to meet to qualify for MLTSS. Although all programs admit people who qualify for institutional level of care, 12 also extend eligibility to those with no or low functional support needs. States also vary in the geographic reach of their programs; many have expanded their programs statewide.

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[8] For partial-benefit dual enrollees, Medicaid pays Medicare premiums and, depending on household income, either all or a share of Medicare deductibles and cost-sharing. Partial dual eligibles do not qualify for state Medicaid benefits.

Table II.1. MLTSS program features,[a] July 2017

State	Program Name	Start Date	Mandatory or voluntary enrollment	Populations enrolled					Minimum LOC needed to enroll	Services covered by capitation	Percent of Counties Covered by Program
				Children with Disabilities	Adults w/ PD	Adults with I/DD	Older Adults 65+	Full Benefit Medicare-Medicaid Enrollees			
AZ	Arizona Long Term Care System (ALTCS)	January 1989	Mandatory	X	X	X	X	X	Institutional LOC	Medical & LTSS	100%
CA	Managed Medi-Cal Long-Term Supports and Services	April 2014	Mandatory		X	X[b]	X	X	No LTSS need	Medical & LTSS	12%[c]
DE	Diamond State Health Plan (DSHP) Plus	April 2012	Mandatory	X	X	X	X	X	No LTSS need	Medical & LTSS	100%
FL	Statewide Medicaid Managed Care Long Term Care Program[d]	August 2013	Mandatory		X		X	X	Institutional LOC	LTSS Only	100%
HI	QUEST Expanded Access (QExA), QUEST Integration (QI)	QExA February 2009 QI January 2015	Mandatory	X	X	X	X	X	No LTSS need	Medical & LTSS	100%
IA	Iowa Health Link	April 2016	Mandatory	X	X	X	X	X	No LTSS need	Medical & LTSS	100%
IL	Medicaid Integrated Care Program (ICP)	May 2011	Mandatory		X	X	X		No LTSS need	Medical & LTSS	6%[c]
KS	KanCare (MLTSS Component)	January 2013	Mandatory	X	X	X	X	X	Less than institutional LOC	Medical & LTSS	100%
MA	Senior Care Options	March 2004	Voluntary – Opt-in				X	X	No LTSS need	Medical & LTSS	64%[c]
MI	Medicaid Managed Specialty Support & Services Program	January 1998	Mandatory	X[e]		X	X	X	Institutional LOC	LTSS Only[f]	100%
	MI Choice	October 2013	Mandatory		X		X	X	Institutional LOC	LTSS Only	100%
MN	Minnesota Senior Health Options (MSHO)	January 1997	Voluntary – Opt-in				X	X	No LTSS need	Medical & LTSS	100%
	Minnesota Senior Care Plus (MSC+)	January 2005	Mandatory				X	X	No LTSS need	Medical & LTSS	100%

Table II.1 *(continued)*

| State | Program Name | Start Date | Mandatory or voluntary enrollment | Populations enrolled | | | | | Minimum LOC needed to enroll | Services covered by capitation | Percent of Counties Covered by Program |
				Children with Disabilities	Adults w/ PD	Adults with I/DD	Older Adults 65+	Full Benefit Medicare-Medicaid Enrollees			
NC	Mental health, developmental disability, and substance abuse services	January 2005	Mandatory	X[e]		X[g]	X[h]	X	Institutional LOC	LTSS Only[i]	100%
NJ	NJ MLTSS	July 2014	Mandatory		X		X	X	Institutional LOC[j]	Medical & LTSS	100%
NM	Centennial Care[k] (MLTSS Component)	January 2014	Mandatory	X	X	X	X	X	Institutional LOC	Medical & LTSS	100%
NY	MLTC Partial Capitation	January 1998	Mandatory[l]		X		X	X	Less than institutional LOC	LTSS Only	81%[c]
	Medicaid Advantage Plus	January 2006	Voluntary – Opt-in		X		X	X	Institutional LOC	Medical & LTSS	19%[c]
OH[m]	MyCare	May 2014	Mandatory		X	X	X	X	No LTSS need	Medical & LTSS	33%
PA	Adult Community Autism Program	January 2009	Voluntary – Opt-in			X	X	X	Institutional LOC	Medical & LTSS	6%
RI	Rhody Health Options (MLTSS Component)	November 2013	Voluntary – Opt-in		X	X	X	X	Less than institutional LOC	Medical & LTSS	100%
TN	TennCare CHOICES in Long-Term Care	March 2010	Mandatory	X[n]	X		X	X	Less than institutional LOC	Medical & LTSS	100%
	TennCare Employment and Community First CHOICES	July 2016	Voluntary – Opt-in	X		X			Less than institutional LOC	Medical & LTSS	100%
TX	Texas STAR+PLUS	January 1998	Mandatory	X[o]	X	X	X	X	No LTSS need	Medical & LTSS	100%
WI	Family Care	January 1999	Voluntary – Opt-in[p]		X	X	X	X	Less than institutional LOC	LTSS Only	79%[c]
	Family Care Partnership	January 1996	Voluntary – Opt-in		X	X	X	X	Institutional LOC	Medical & LTSS	19%[c]

Source: Unpublished program features data provided by Truven Health Analytics, July 2017.

Table II.1 *(continued)*

Notes: DD = Developmental disabilities, ICF-I/DD = Intermediate care facility for individuals with intellectual and developmental disabilities, I/DD = Intellectual and developmental disabilities, LOC = Level of care, PD = Physical disabilities, SED = Severe emotional disturbance, SMI = Severe mental illness, SUD = Substance use disorder.

[a] Excludes Financial Alignment Initiative (FAI) Demonstrations that align Medicare and Medicaid financing and integrate primary, acute, behavioral health and long-term services and supports for Medicare-Medicaid dual enrollees.

[b] Excludes people living in ICF-I/DD who live in a Two Plan/Geographic Managed Care County.

[c] Includes the most populous county in the State.

[d] An earlier MLTSS program, the Florida Long-Term Care Community Diversion Program, was phased out as the current program was phased in.

[e] Children with SED and/or DD.

[f] Program operates as a Behavioral Health PIHP; behavioral health services are included.

[g] Adults with SMI and/or SUD and/or DD.

[h] Older Adults with SMI and/or SUD and/or DD.

[i] North Carolina contracts with two local management entities to provide all mental health, intellectual/developmental disabilities (IDD) and substance services covered in the Medicaid State Plan (for example, inpatient, clinic and rehabilitation as well as home and community-based waiver services [HCBS]).

[j] Beneficiaries with long-term nursing home stays as of the start-up date (7/1/14) were exempt from MLTSS, but all new nursing home residents from 7/1/14 forward are included in MLTSS.

[k] An earlier MLTSS program, CoLTS, was subsumed into Centennial Care on 1/1/2014.

[l] MLTC was voluntary up until 8/31/2012 when the state began a phased mandatory roll-out program under a Section 1115 demonstration waiver.

[m] Ohio operates a FAI demonstration as well as an MLTSS program; both are called MyCare.

[n] Children in nursing homes only.

[o] This group is not mandatory.

[p] Per analysis of available information through the State's website, the Wisconsin Family Care program utilizes a voluntary opt-in enrollment process: https://www.dhs.wisconsin.gov/familycare/fcp-overview.htm.

These and other variations in program design can influence outcomes related to access, cost, and quality of care. For example, programs that have been operating longer will have had more opportunities to implement process improvements that could lead to better outcomes. Enrollment policies can determine the influence of selection bias, which most often occurs under voluntary enrollment scenarios that allow beneficiaries to self-select or plans to selectively enroll healthier people who will use less costly care. As another example, covered benefits can create incentives to reduce the use of certain services relative to others; for example, programs that include both acute care and LTSS may encourage managed care plans to provide preventive services to reduce costly events, such as avoidable hospitalizations, for Medicaid-only enrollees.[9]

The types of LTSS beneficiary groups a program covers can result in variations in overall use and spending patterns across programs; comparisons across states will be unfair or misleading unless such outcomes are divided by age, type of disability, and level of disability. Level-of-care criteria also influence service use and spending patterns, because MLTSS programs with higher level-of-care requirements are likely to enroll people who use institutional services more often, or need more services and supports in the community when they enroll in MLTSS programs, compared to MLTSS programs that enroll people with lower or no need for LTSS (Kasten et al. 2016). Moreover, geographic reach can influence access to care among program participants as a whole, with urban regions benefiting more from denser provider networks than rural or frontier regions.

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[9] For dual eligibles whose acute care is covered by Medicare, additional mechanisms, such as integrated Medicare and Medicaid financing through Dual Eligible Special Needs Plan (D-SNP) contracts, are required to align incentives across payers. For more information on D-SNP contracts, see Verdier et al. 2016.

III. COMPARISON OF MLTSS PROGRAMS IN NEW YORK AND TENNESSEE TO THOSE IN OTHER STATES

Because this interim outcomes evaluation centers on an in-depth analysis of two states (New York and Tennessee), it is important to understand how the MLTSS programs in these two states compare to those in other states. Data from CMS Medicaid managed care enrollment reports (Centers for Medicare & Medicaid Services 2015, 2016, 2017), as well as a national environmental scan of MLTSS programs (Saucier et al. 2012), demonstrate that, nationwide, enrollment in MLTSS programs has increased dramatically since 2004. At the same time, the proportion of LTSS expenditures that managed care covers has grown. Enrollment and spending in New York and Tennessee have also increased, although the populations enrolled and services covered by each MLTSS program resulted in two different trends. This section compares MLTSS enrollment, covered services, and spending nationwide to the experience of New York and Tennessee.

A. Enrollment

Between 2004 and 2015, the number of people using MLTSS nationally increased dramatically, from 105,924 to 993,265 (Table III.1). During this time, about half of the enrollment growth nationwide (52 percent) occurred in the eight states (including New York) that operated MLTSS as of 2004, as a result of expanding existing programs to new populations or geographic regions, or implementing additional programs.

New York, for example, has operated two MLTSS programs for nearly two decades: (1) the MLTC Partial Capitation program, first authorized in 1998; and (2) the Medicaid Advantage Plus (MAP) program, first authorized in 1996. Before July 2012, MLTC enrolled adults ages 18 to 64 with physical disabilities and adults age 65 and over who required nursing home level care on a voluntary basis; MAP voluntarily enrolled only people who were dually eligible for Medicare and Medicaid, covering both Medicare acute care benefits and Medicaid LTSS benefits (Saucier et al. 2012). In July 2012, New York began requiring eligible individuals to enroll in either MLTC or MAP,[10] expanded eligibility to include those expected to require long-term care services for more than 120 days from the date of enrollment, and introduced mandatory enrollment throughout most counties in the state. New nursing facility residents were required to enroll beginning in February 2015. By July of that year, enrollment in MLTC and MAP had nearly tripled (from 47,292 in 2012 to 135,551 in 2015). Because we could not appropriately identify MAP enrollees in MAX, this interim outcomes evaluation only examines the MLTC program in New York.

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[10] New York allows Medicare-Medicaid eligibles to opt into MAP to fulfill the mandatory requirement to enroll in MLTSS (Samis 2014).

Table III.1. MLTSS users, 2004 and 2012–2015

State	2004[a]	2012[a]	2013[b]	2014[b]	2015[b]
Total LTSS users	**105,924**	**389,390**	**359,690[c]**	**509,177[d]**	**993,265[e]**
Total LTSS users or enrollees[f]	**105,924**	**389,390**	**915,453**	**1,433,529**	**1,024,334**
Arizona	39,512	52,251	51,260	52,936	54,631
California	-	2,304	7,655	NA	272,648
Delaware	-	4,800	10,922	6,114	NA
Florida	3,070	19,283	20,713	83,289	87,591
Hawaii	-	6,830	NA	8,607	8,663
Illinois	-	-	38,098	23,884	34,202
Kansas	-	0	21,362	30,484	31,898
Massachusetts	100	15,568	28,212	22,827	42,718[g]
Michigan	32,841	41,272	NA	NA	18,468
Minnesota	3,910	32,693	32,523	32,005	33,242
New Jersey	-	-	0	11,345	18,221
New Mexico	-	22,446	NA	25,749	29,058
New York[h]	7,078	47,292	105,563	127,473	135,551
North Carolina	-	4,699	NA	1,017	NA
Pennsylvania	-	90	131	9	140
Rhode Island	-	-	0	11,500	NA
Tennessee	-	31,200	NA	31,153	30,333
Texas	10,671	71,239	NA	NA	151,214
Vermont	-	-	-	-	1,449
Washington	-	413	3,409	-	-
Wisconsin[h]	8,642	37,010	39,842	40,785	43,378

Notes: "-" denotes a year in which the MLTSS program did not exist in the state. "0" denotes a year in which an MLTSS program was in place, but enrollment as of the collection date was zero. "NA" denotes a year in which the state could not report MLTSS users; states reporting "NA" are not included in the MLTSS user total for the year.

[a] Saucier et al. 2012.

[b] Centers for Medicare & Medicaid Services (2015, 2016, 2017). Enrollment is reported as of July 1 of the year.

[c] Total LTSS users in 2013 excludes the following states, which only were able to report MLTSS enrollees: Hawaii (45,997 enrollees), New Mexico (40,465 enrollees), Tennessee (60,493 enrollees), and Texas (408,808 enrollees). Michigan and North Carolina also are excluded because they did not provide counts of MLTSS users for this data collection, although both had programs providing some 1915(c) waiver services through managed care during the reporting year.

[d] Total LTSS users in 2014 excludes the following states, which were able to report MLTSS enrollees only: California (510,938 enrollees) and Texas (413,414 enrollees). Michigan is excluded because it did not provide counts of MLTSS users for this data collection, although it provided some 1915(c) waiver services through managed care during the reporting year. Ohio is also excluded because it did not report MLTSS users in this data collection, though its MLTSS program (and companion FAI demonstration) has operated since 2014.

[e] Total LTSS users in 2015 excludes the following states, which were able to report MLTSS enrollees only: Delaware (12,955 enrollees) and Rhode Island (18,114 enrollees).

[f] Total LTSS users or enrollees mixes counts from (1) states that report LTSS users; and (2) states that report enrollment in comprehensive managed care programs that cover MLTSS, which may include beneficiaries who might be at risk of needing LTSS but do not receive any LTSS. States vary in their ability to report users across years; therefore, trends across years should be interpreted cautiously.

[g] Centers for Medicare & Medicaid Services (2017) reported that Massachusetts enrolled 42,718 MLTSS users in 2015, but Health Management Associates reported that the actual number of MLTSS users that year was 25,750. Nevertheless, the number reported to CMS is included in the total counts of MLTSS users (see Health Management Associates 2016).

[h] New York and Wisconsin operate comprehensive MLTSS and limited-benefit MLTSS programs. MLTSS users reported in each year is a sum of users reported for each program.

Nationwide, the remaining enrollment growth (48 percent) that occurred between 2004 and 2015 resulted from new programs in 13 states. Nine states (including Tennessee) began their MLTSS programs between 2004 and 2012.

Tennessee's MLTSS program, called CHOICES, began enrollment in March 2010. Since its inception, CHOICES has enrolled two populations of LTSS users statewide on a mandatory basis: (1) people of all ages who receive nursing home care (referred to as CHOICES 1); and (2) adults age 21 and older with a physical disability and seniors age 65 and older who qualify to receive nursing home care, but choose to receive home care services instead (referred to as CHOICES 2). In July 2012, Tennessee raised the nursing home level of care for people in CHOICES 2 and began enrolling adults with a disability and seniors who do not qualify for nursing home care, but who need a moderate package of home care services to delay or prevent the need for nursing home care (referred to as CHOICES 3). Despite the change in eligibility criteria, CHOICES consistently enrolled an average of 30,895 beneficiaries between 2012 and 2015.

B. Covered services

Enrollment in comprehensive MLTSS plans that cover acute benefits as well as LTSS is far more common nationwide than is enrollment in limited-benefit LTSS plans. Nationwide, 152,585 MLTSS users in 2015 were enrolled in limited-benefit programs, compared to 840,680 users enrolled in comprehensive MLTSS programs (Centers for Medicare & Medicaid Services 2015). As of 2015, New York was one of only four states that offered limited-benefit LTSS plans (the others were Florida, Michigan, and Wisconsin).[11] In other words, MLTC in New York covers nursing facility care and HCBS, but primary and acute medical services, as well as prescription drugs are provided on a FFS basis or covered through separate Medicaid managed care plans (for Medicaid-only beneficiaries) or through Medicare (for dual enrollees).

In contrast, like most states with MLTSS programs, Tennessee's CHOICES covers most acute care services (excluding prescription drugs) for Medicaid-only beneficiaries, as well as LTSS (including institutional services and HCBS) for Medicaid-only and dual beneficiaries (TennCare [no date]). Similar to MLTC, CHOICES does not cover acute and primary care services for Medicare-Medicaid dual beneficiaries. Medicare FFS or a Medicare Advantage managed care plans cover these medical services.

C. Spending on institutional care versus HCBS

Across all states operating MLTSS, variation exists in the proportion of total LTSS spending devoted to institutional services versus HCBS. Among states that reported MLTSS expenditures in 2015, HCBS comprised nearly two thirds of total MLTSS expenditures, and institutional care comprised over one third (Table III.2).

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[11] The list of states excludes North Carolina, which did not report providing any LTSS under managed care in CMS's 2015 Medicaid managed care enrollment report but may have had a program in place (see Table II.1 for details).

Table III.2. MLTSS expenditures by category, FY 2015

State	Total expenditures (in thousands of dollars)	Total ILTC (%)	Total HCBS (%)	ILTC expenditure categories[b], as a percentage of total		HCBS expenditure categories[b], as a percentage of total			
				Nursing facility	ICF/IDD	Personal care	Home Health	HCBS under MCA	HCBS under 1915(C) waivers
Total[a,b]	22,595,494	36.8	63.2	36.5	0.3	25.5	3.4	16.2	18.2
Arizona	1,591,979	27.1	72.9	25.4	1.7	0.0	1.5	71.3	-
Delaware	376,527	72.3	27.7	72.3	-	5.5	8.1	14.1	-
Florida	3,643,955	82.0	18.0	82.0	-	-	-	-	18.0
Hawaii	378,236	76.1	23.9	76.1	-	-	0.8	23.2	-
Kansas	1,090,814	49.1	50.9	47.7	1.4	-	2.1	-	48.8
Massachusetts[d]	883,160	33.8	66.2	33.8	-	-	-	66.2	-
Michigan[c]	854,843	-	100.0	-	-	-	-	11.9	88.1
Minnesota	536,174	8.9	91.1	8.9	-	31.3	5.6	-	54.2
New Jersey[d]	412,920	23.7	76.3	23.7	-	-	-	76.3	-
New Mexico	973,457	26.7	73.3	26.7	-	-	-	73.3	-
New York[d,e]	4,883,921	5.9	94.1	5.9	-	85.6	7.0	1.5	-
North Carolina[c]	721,131	-	100.0	-	-	-	-	-	100.0
Ohio	1,685,144	62.9	37.1	62.9	-	-	9.6	-	27.5
Pennsylvania[c]	5,562	-	100.0	-	-	-	-	100.0	-
Tennessee	1,536,783	70.9	29.1	70.9	-	-	13.5	15.6	-
Texas[d,f]	3,357,178	33.1	66.9	33.1	-	48.5	-	18.4	-
Wisconsin	1,348,852	11.4	88.6	9.8	1.7	13.5	1.0	-	74.0

Source: Eiken, S., K. Sredl, B. Burwell, R. Woodward. Medicaid Expenditures for Long-Term Services and Supports (LTSS) in FY 2015. Baltimore, MD: Centers for Medicare & Medicaid Services, April 14, 2017.

Notes: "-" indicates that no expenditure was reported for the category.

FY = fiscal year; HCBS = home and community-based services; ICF/IDD = Intermediate Care Facilities for Individuals with Intellectual Disabilities; ILTC = institutional long-term care; MCA = Managed Care Authorities, such as Section 1115 demonstrations, Section 1915(b) waivers, Section 1915(a) contracts, and Section 1932(a) state plan amendments

[a] Totals are calculated from states reported in this table. States that operate PACE but not MLTSS (Alabama, Arkansas, Colorado, Indiana, Iowa, Louisiana, Maryland, Missouri, Nebraska, New Hampshire, North Dakota, Oklahoma, Oregon, Wyoming) as well as states that only provide MLTSS through a capitated Financial Alignment demonstration (South Carolina, Virginia, and Washington) are excluded from this table. This table also excludes California, Illinois, and Rhode Island, which did not report complete MLTSS expenditures in 2015.

[b] In 2015, CMS only required states participating in the Balancing Incentive Program to report managed care expenditures into institutional and non-institutional LTSS, so expenditures by category are not reported in all states. This table also excludes unspecified ILTC and HCBS expenditures under managed care.

[c] Michigan, North Carolina, and Pennsylvania operate specialty MLTSS programs that cover a limited range of HCBS under capitation.

[d] Total expenditures in Massachusetts, New Jersey, New York, and Texas exclude possible expenditures for the Balancing Incentive Program.

[e] New York's MLTSS programs enrolled people who require 120 days or more of community-based services; therefore, nearly all MLTSS enrollees were also HCBS users.

[f] Texas did not cover nursing facility services for STAR+PLUS enrollees in 2014; these services were added to covered benefits in March 2015.

Excluding three states that provide only HCBS under MLTSS[12], the portion of MLTSS expenditures for HCBS exceeded 70 percent in six states: Arizona, Minnesota, New Jersey, New

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[12] Michigan has two programs that provide HCBS waiver services through a capitated MLTSS model: MI Choice and the Specialty Prepaid Inpatient Health Plan (SPIHP) North Carolina operates a statewide managed care program

Mexico, New York, and Wisconsin. HCBS in Tennessee represented less than 30 percent of total MLTSS expenditures in 2015. Personal care was the most common type of HCBS expenditure and accounted for the greatest portion of total LTSS expenditures among all states (25.5 percent). Although a higher proportion of LTSS expenditures devoted to HCBS may suggest progress toward "rebalancing" long-term care in favor of home and community-based care, the spending trends masked variation in the types and cost of services covered. That is, in states where the cost and intensity of institutional services was high relative to HCBS, institutional spending may have been disproportionate to the number of people receiving each category of service.

D. Spending per LTSS user

Among states that reported MLTSS expenditures and enrollment to CMS in 2015 (Table III.3), there was wide variation in per-user spending. Tennessee was among the three states with the greatest per-user expenditures: Tennessee ($50,644), Michigan ($46,228), and Hawaii ($43,661). Among states that reported both institutional and HCBS expenditures, the three states with the lowest per-user expenditures were Minnesota ($16,129), Massachusetts ($20,674), and Texas ($22,202). New York ranked sixth in per user spending ($36,030). Several factors may explain higher per-user expenditures; these factors include which benefits are covered, types of beneficiary groups enrolled, and the level of need for assistance among enrollees. In addition, per-user spending also can be higher than monthly MLTSS capitation payments in states that enroll people who are at risk for (but do not qualify for) nursing facility level of care or being dually eligible for Medicare and Medicaid, because not all of these enrollees will use LTSS in a given year.

Between 2012 and 2015, MLTSS per-user expenditures among states that could report them increased by 28 percent (Table III.3). New York saw its per-user expenditures decrease slightly (from $36,930 to $36,030). Per user spending may have increased in subsequent years, however, because new nursing facility residents, whose annual costs are much higher than those of HCBS users, were required to enroll in either a MLTC or regular Medicaid managed care plan beginning in February 2015 (NYS DOH 2015). Tennessee saw an increase in its per-user expenditures (from $43,906 to $50,664), which resulted from an increase in nursing facility per diem payments to reflect (1) the increasing acuity of residents who remained in facilities as Tennessee increasingly served individuals with HCBS, and (2) value-based payments for facilities that demonstrated enhanced person-centered care and outcomes.[13]

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that contracts with two local management entities to provide all Medicaid state plan services for mental health and substance abuse conditions (for example, inpatient, clinic and rehabilitation), as well as HCBS for persons with intellectual/developmental disabilities (IDD). Pennsylvania provides HCBS and institutional LTSS to adults with autism through its Adult Community Autism Program.

[13] Based on email communications with Patti Killingsworth, Assistant Commissioner for the Bureau of TennCare, January 9, 2018. In 2015, Tennessee passed legislation that converted a longstanding nursing home bed tax to an assessment fee, generating new revenue to increase nursing facility per diem reimbursement and support a value-based purchasing initiative that makes quality-based per diem rate adjustments to nursing facilities based on measures designed to enhance person-centered care and outcomes.

Table III.3. MLTSS expenditures per user, 2012 and 2015

State	MLTSS expenditures[a,b,c] (in thousands of dollars)		MLTSS users[d] (number)		Expenditures per user (in dollars)[e]	
	FY 2012	FY 2015	As of July 2012	As of July 2015	2012	2015
Total[b]	**8,934,177**	**22,595,494**	**387,086**	**719,308**	**24,828**	**31,746**
Arizona	1,521,335	1,591,979	52,251	54,631	29,116	29,141
Delaware	-	376,527	4,800	NR	-	NA
Florida[f]	253,921	3,643,955	19,283	87,591	13,168	41,602
Hawaii	359,050	378,236	6,830	8,663	52,570	43,661
Illinois[c,g]	-	NR	-	34,202	-	NA
Kansas	-	1,090,814	-	31,898	-	34,197
Massachusetts[c]	439,205	883,160	15,568	42,718	28,212	20,674
Michigan	429,486	854,843	41,272	18,468	10,406	46,288
Minnesota	427,993	536,174	32,693	33,242	13,091	16,129
New Jersey[c]	-	412,920	-	18,221	-	22,662
New Mexico	NR	973,457	22,446	29,058	NA	33,500
New York[c]	1,746,500	4,883,921	47,292	135,551	36,930	36,030
North Carolina[h]	138,214	721,131	4,699	NR	29,413	NA
Ohio	-	1,685,144	-	NR	-	NA
Pennsylvania[h]	3,507	5,562	90	140	38,967	39,730
Tennessee	1,369,871	1,536,783	31,200	30,333	43,906	50,664
Texas [c,i]	1,110,125	3,357,178	71,239	151,214	15,583	22,202
Washington	6,662	-	413	-	16,131	NA
Wisconsin	1,128,308	1,348,852	37,010	43,378	30,487	31,095

Notes: "-" denotes a year in which the MLTSS program did not exist in the state. "NR" denotes a year in which the state was not able to report expenditures or MLTSS users. States reporting "NR" are not included in the MLTSS user total for the year. "NA" denotes a year in which an MLTSS program was in place, but total MLTSS expenditures became zero after excluding possible expenditures associated with the Balancing Incentive Program or expenditures per user are not calculated due to missing data.

[a] Source: Eiken, S., K. Sredl, B. Burwell, R. Woodward. Medicaid Expenditures for Long-Term Services and Supports (LTSS) in FY 2015. Baltimore, MD: Centers for Medicare & Medicaid Services, April 14, 2017.

[b] Total MLTSS expenditures are the sum of expenditures across states included in the table. Data exclude expenditures for managed care programs in the following states (years of missing data in parentheses): California (2012 and 2015), Delaware (2015), New Mexico (2012), North Carolina (2015), and Rhode Island (2012 and 2015). FY 2015 expenditures exclude possible expenditures associated with the Balancing Incentive Program. Data for several states include expenditures for Medicaid Upper Payment Limit programs or provider taxes. For more detail, see Eiken et al. (2014) and Eiken et al. (2017).

[c] MLTSS expenditures exclude PACE (for all states) and, in 2015, possible expenditures associated with the Balancing Incentive Program (Illinois, Massachusetts, New Jersey, New York, and Texas).

[d] Source: 2012 data from Saucier et al. 2012; 2015 data from Centers for Medicare & Medicaid Services 2017.

[e] Due to data constraints, expenditures per user were calculated using fiscal year total expenditures data, divided by mid-calendar year point-in-time enrollment data, which may not match the real user experience exactly. The total row excludes states with "NA" for expenditures per user.

[f] Beginning in 2013, Florida required all MLTSS users statewide to enroll in a limited-benefit MLTSS program that provided HCBS and nursing facility care to enrollees.

[g] Illinois' erroneously omitted nursing facility expenses which are covered for Integrated Care Program enrollees. We have used "NA" to denote this reporting anomaly.

[h] See footnote 11 for an explanation of services covered in North Carolina and Pennsylvania.

[i] Texas did not cover nursing facility services for STAR+PLUS enrollees in 2012; these services were added to covered benefits in March 2015.

IV. ANALYSIS OF MLTSS OUTCOMES IN NEW YORK AND TENNESSEE

In this section, we present results of analyses of MLTSS outcomes in New York and Tennessee. For both states, we constructed six individual-level outcome measures related to LTSS and hospital use:

- **LTSS measures:** (1) any use of institutional long-term care (ILTC) services during the year; (2) any use of HCBS during the year, whether the services were provided through a 1915(c) waiver or the state plan, including personal care services; (3) any use of personal care visits during the year.

- **Hospitalization measures:** (4) any admission to an acute care hospital during the year; (5) number of acute care hospital stays during the year; and (6) the total length of acute care hospital stays (in days) during the year.

A. Study hypotheses

Based on the goals of MLTSS and the financial incentives inherent in risk-based capitated payment, we expected enrollment in MLTSS to lead to less institutional care and more HCBS—especially personal care—relative to receiving LTSS on an FFS basis. MLTSS programs could achieve this rebalancing by diverting people living in the community from entering institutions and helping long-term institutional residents safely transition back to the community.

We also hypothesized that MLTSS enrollees would experience fewer hospital visits and shorter stays than FFS LTSS users, although this effect was more likely to be observed among Medicaid-only beneficiaries in MLTSS plans that covered both acute and LTSS services than among Medicare-Medicaid dual enrollees if MLTSS plans did not also provide Medicare-covered acute care services. MLTSS plans could reduce acute care episodes by maintaining a safe home environment, reducing the risk of falls, and assisting participants with medication management. MLTSS plans could limit the duration of acute care by helping enrollees transition to the community with appropriate post-acute care and HCBS. In Tennessee, which enrolled individuals in MLTSS beginning in 2010, we expected stronger effects over time because the state's institutional use and spending rates as a share of total LTSS use and spending were among the highest in the country, giving MLTSS plans ample opportunity to substitute HCBS for institutional care. Because New York enrolled individuals in MLTSS for nearly a decade before our study period began, we expected stable effects during our study period, although the changes might be more pronounced for enrollees in new regions and enrollees new to MLTSS plans.

B. Study designs and methods

To test these hypotheses, we compared the experiences of individuals enrolled in MLTSS to a similar group of LTSS users who remained in FFS. For the study of New York's MLTC program, which allowed individuals to enroll on a voluntary basis until mid-2012, we identified a comparison group of adults who did not enroll in MLTC but were determined to be eligible because they lived in a county that offered MLTC and used nursing facility services or 120 days of HCBS (a proxy for meeting nursing home level of care requirements). For the study of Tennessee's CHOICES program, which required all MLTSS-eligible individuals to enroll, we

identified a comparison group of adults from Alabama and Georgia who used any LTSS (institutional or HCBS) on an FFS basis. We selected Alabama and Georgia as comparison states through seven measures of supply and demand for LTSS, as well as policy factors related to LTSS delivery, which are contextual attributes and difficult to control for directly in a regression framework (see Appendix C).

In both states, we used propensity score matching techniques to ensure people in the comparison group were as similar as possible to those who enrolled in MLTSS based on observable characteristics such as demographics (age, gender, race); location (urban/rural); category of Medicaid eligibility; dual status; number and type of chronic conditions, as identified by the Chronic Illness and Disability Payment System (CDPS); and an additional flag for dementia, which does not have a unique classification in the CDPS. We also considered prior service use for the matching in Tennessee, where we could observe such baseline information before MLTSS enrollment, including use of institutional care, total FFS expenditures in institutional care, use of HCBS,[14] use of personal care, number of days in a nursing facility, use of the emergency department (ED), and any hospital admission, as well as number of hospital stays and days. We controlled for any residual differences between MLTSS enrollees and the matched comparison group using regression techniques, which allowed us to identify changes in outcomes associated with MLTSS program enrollment, defined as the difference between the regression-adjusted mean of the outcome among MLTSS enrollees versus the predicted outcome if they had received LTSS through FFS (that is, no enrollment in MLTSS). For more information on our methods for identifying and matching MLTSS enrollees to a comparison group of FFS-based LTSS users, as well as strategies for estimating changes in outcome measures associated with MLTSS enrollment, see Appendix A.

We conducted an intention-to-treat analysis. This means that beneficiaries included in the analysis were assigned as MLTSS enrollees or comparison group members at the beginning of the study period and remained in the respective group throughout the analysis, whether or not they later joined MLTSS (comparison group) or disenrolled (the MLTSS group) in the study period (See Table IV.3). This approach avoided biases that could occur when enrollees switched service delivery systems midway through the study. However, it produced an attenuated estimate of changes associated with MLTSS enrollment, especially in the later years.

Another important consideration was the length of time we were able to observe outcome measures. We tracked outcomes for each study year, defined based on the first time an outcome was measured (for New York) or the first month of MLTSS enrollment (for Tennessee). In New York, we included three full years of observation (April 2009–March 2012). For the Tennessee study, we focused on beneficiaries enrolled in CHOICES during either March or August 2010. MAX data were available through the end of 2014 for Tennessee and Georgia but only until the end of 2013 for Alabama. As a result, outcome measures for the last year of observation consist

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[14] To define HCBS, we identified any MAX claim (for either state plan or waiver services) for which (1) the type of service indicated home health, state plan personal care, targeted case management, rehabilitation, hospice provided in the patient's home, private duty nursing, residential care, or adult day care; or (2) the claim was flagged as HCBS according to the HCBS taxonomy. See Appendix A for more details about the HCBS taxonomy.

of partial-year data (Study Year 5: April/September–December 2014 for Tennessee and Georgia; Study Year 4: April/September–December 2013 for Alabama).[15]

Furthermore, our analytic sample size changed from year to year because of attrition due to death and other causes. For example, in the New York analysis, 8 percent of the population from the baseline matched sample died in the first study year, another 8 percent died in Year 2, and an additional 7 percent died in Year 3. In the Tennessee analysis, annual mortality rates were even higher: 23, 16 and 12 percent during the first three study years, respectively. We found similar mortality rates between MLTSS enrollees and the matched comparison groups in both states. Time trends in observed outcomes reflect the diminishing analytic sample size. However, our regression analysis accounts for the number of months that each beneficiary contributed to a given study year (see Appendix A for details).

We conducted analyses separately for full-benefit dually eligible beneficiaries, Medicaid-only beneficiaries, and the two groups combined, for several reasons. First, MLTSS health plans that enroll dually eligible beneficiaries but do not cover Medicare acute care benefits have little control over their use of Medicare-covered acute (such as hospital care and physician's visits) or post-acute (such as skilled nursing facility stays) care services. Specifically, beyond LTSS, CHOICES plans in Tennessee were only at risk for acute care for Medicaid-only beneficiaries, whereas New York only offered limited-benefit LTSS plans (that is, no coverage of acute care, even for Medicaid-only beneficiaries within the same plan). Second, about 20 percent of dually eligible beneficiaries nationwide are enrolled in Medicare Advantage (MedPAC and MACPAC 2017), but encounter data from such plans were not available for our study period. Third, dually eligible beneficiaries are generally older and tend to have greater health needs than Medicaid-only beneficiaries, so their patterns of LTSS use and costs are different. For example, in 2012, 69 percent of dually eligible beneficiaries had three of more chronic conditions, compared to 30 percent of Medicaid-only beneficiaries (Centers for Medicare & Medicaid Services, Medicare-Medicaid Coordination Office 2012).

C. New York

This section presents findings for New York; findings from Tennessee are presented in Section IV.D. For each state, we describe the sample selected for the evaluation and compare the enrollment patterns and characteristics of the study population to all MLTSS enrollees in the state and the matched comparison group. The unadjusted outcome measures are then compared between the two matched groups, followed by regression-adjusted results: first for the three LTSS outcomes, then for the hospital utilization measures.

1. Sample selection

Although New York has enrolled individuals in MLTC since 1998, this study focuses on existing enrollees at the beginning of 2009 and examines changes in their LTSS and hospital use between 2009 and early 2012, before MLTC became mandatory (see Appendix A for more details). During this time, the number of individuals enrolled in MLTC grew from 30,081 in 2009 to 46,266 in 2011 (Table IV.1). In 2010 and 2011, new enrollees represented 25 and 35 percent of total enrollment, respectively. Enrollment continued to grow in 2012 (to 76,997) as

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[15] Unless otherwise noted, we use Year 1 and Study Year 1 interchangeably for the remainder of the report.

MLTC became mandatory and expanded to additional counties around the state beginning in July of that year. According to the New York Department of Health, enrollment as of June 2012 was 52,479, and an additional 19,291 individuals enrolled between July and December.

Table IV.1. Enrollment patterns among individuals who enrolled in MLTC (New York)

	2009	2010	2011	2012
Total Enrollees (N)	**30,081**	**34,436**	**46,266**	**76,997**
Average number of months enrolled during the year	9.6	9.7	8.8	8.3
Beneficiaries enrolled in 2009 and earlier (N)	**30,081**	**-**	**-**	**-**
Average number of months enrolled during the study period	34.6	-	-	-
Average number of enrollment spells per enrollee	1.1	-	-	-
Average length of uncensored enrollment spells (months)	18.7	-	-	-
Average length of censored enrollment spells (months)	43.7	-	-	-
Average length of first enrollment (months)	33.6	-	-	-
Average number of months between enrollment spells for enrollees with more than one spell	11.8	-	-	-
Beneficiaries newly enrolled during the year (N)	**-**	**8,734**	**16,263**	**35,456**
Average number of months enrolled during the study period	-	23.7	15.1	5.0
Average number of enrollment spells per enrollee	-	1.1	1.0	1.0
Average length of uncensored enrollment spells (months)	-	12.5	8.1	4.0
Average length of censored enrollment spells (months)	-	28.4	16.6	5.0
Average length of first enrollment (months)	-	23.1	14.9	5.0
Average number of months between enrollment spells for enrollees with more than one spell	-	8.1	4.2	2.6

Source: Mathematica Policy Research analyses of 2009–2012 MAX and other data.

Notes: Enrollment spells are uninterrupted periods of MLTC enrollment; multiple enrollment spells for a single enrollee are defined by gaps in enrollment of one or more days.

Enrollees can appear in more than one column.

Uncensored enrollment spells include only individuals with valid end dates of enrollment.

Censored enrollment spells include only individuals whose enrollment records contain missing or invalid end dates, which have been converted to align with the end of the study period.

Beneficiaries who enrolled in MLTC before or during 2009 exhibited different enrollment patterns over the study period than those who enrolled in 2010 or after (Table IV.1). Enrollees as of 2009 had longer durations of enrollment, averaging 35 months of 48 possible months, compared to those who enrolled in 2010 (24 months on average) and 2011 (15 months on average). Although all enrollees tended to participate in MLTC over a single spell, among those who disenrolled and reenrolled (that is, their enrollment was not continuous and spanned more than one enrollment spell), the time between spells was more than twice as long for beneficiaries enrolled before or during 2009 than for those who enrolled after 2010 (12 months, compared to an average of 5 months for years 2010–2012 [not shown]). However, these differences may be partly explained by the shorter observation period for beneficiaries who enrolled in 2010 or later. For the later enrollees, we only observed their enrollment patterns from 2010 through 2014, whereas for those in the earlier period, 2009 and before, we observed enrollment for at least one additional year or more.

Because existing enrollees as of 2009 represented a significant part of overall MLTC enrollees and had a longer observation period for tracking outcomes, we chose to focus on this subset for the New York study. Consequently, the study population is defined as beneficiaries who were continuously enrolled in MLTC January through April 2009—a total of 21,503 individuals (see Appendix A for details on the inclusion/exclusion criteria for our study population).

2. Comparison of the matched sample in New York

Table IV.2 shows the characteristics of the study population at baseline (2009), relative to all MLTC enrollees in New York during the study period (January 2009 through March 2012), and the FFS comparison group.

Overall, the MLTC study sample and matched FFS comparison group were similar in demographic characteristics, Medicare dual eligibility, and chronic illnesses and conditions, defined by the CDPS classification system. Most beneficiaries in both groups were over age 65 (84 percent in both groups), female (74 and 77 percent), eligible for full Medicare benefits (87 percent in both groups), and resided in New York City (93 percent in both groups). The most pronounced demographic differences were in the racial makeup of the two groups. A lower percentage of MLTC enrollees than comparison group members were black (24 versus 34 percent) and a higher percentage were white (31 versus 25 percent). MLTC enrollees and the comparison group had similar average CDPS scores (4.2 for MLTC enrollees and 4.3 for the comparison group), and the percentage of enrollees identified with each of eight common condition types was also similar.

MLTC enrollees included in the study sample, however, differed from all MLTC enrollees in several ways. Compared to all MLTC enrollees, the MLTC enrollees in the matched study sample were slightly more likely to be female (74 versus 71 percent), older than age 65 (84 versus 81 percent), dually eligible for full Medicare benefits (87 versus 80 percent), and have more chronic conditions as identified by the CDPS (4.2 average score versus 3.8 average score). These differences suggest that caution is needed when extending interpretation of the results from the following analyses beyond the current study population, because it may not represent the experience of all beneficiaries ever enrolled in MLTC.

As mentioned previously, we used the intention-to-treat approach for this interim evaluation, which produced a conservative estimate of changes associated with MLTSS enrollment for both study states, especially in the later years. Table IV.3 provides an example of how individuals assigned to the MLTSS and comparison groups at the beginning of the study period might have changed status, from New York. Among the 21,503 MLTC enrollees at the beginning of 2009, 10 percent disenrolled from MLTC over the next three years, and 23 percent of the matched FFS comparison population subsequently enrolled in MLTC, representing 16 percent of person-months enrolled during Study Year 3—that is, April 2011–March 2012. Regardless of these status changes, individuals remained in their originally assigned group throughout the study period.

Table IV.2. Baseline demographic characteristics and Medicare dual eligibility among beneficiaries in the MLTC and FFS comparison groups in New York

	All MLTC Enrollees[a]	MLTC-Enrolled Study Population[b]	Matched Comparison Group
Total beneficiaries (N)	**61,511**	**21,503**	**21,503**
Age* (%)			
<21	0.2	0.0	0.1
21-44	3.2	3.2	2.6
45-64	16.1	12.7	13.4
65-74	27.0	23.1	23.3
75-84	35.1	36.9	34.0
85+	18.4	24.2	26.8
Gender (%)			
Male	29.2	26.0	22.8
Female	70.8	74.0	77.2
Race (%)			
White	30.3	31.0	25.2
Latino	29.3	32.6	32.3
Black	22.5	23.6	33.5
Asian	16.9	11.8	8.3
Native American	0.7	0.7	0.5
Pacific Islander	0.3	0.3	0.3
Other	-	-	-
Dual Eligibility (%)			
Medicaid only beneficiaries	17.6	12.5	12.5
Full-benefit dually eligible beneficiaries	80.4	87.0	87.0
Partial-benefit dually eligible beneficiaries	2.0	0.5	0.5
Residence (%)			
NYC	93.5	92.6	92.6
Non-NYC Urban	6.3	7.3	7.3
Rural	0.2	0.2	0.2
CDPS Conditions			
CDPS Score (Average)	3.8	4.2	4.3
Specific Types of Conditions (%)			
Cardiovascular (%)	27.3	32.9	33.8
Central nervous system (%)	4.5	5.7	5.5
Dementia (%)	21.8	29.1	27.9
Metabolic (%)	11.9	14.1	14.7
Psychiatric (%)	5.9	5.4	7.0
Renal (%)	13.3	16.2	16.2
Skeletal (%)	14.3	16.4	16.4
Skin (%)	4.4	5.8	6.6

Source: Mathematica Policy Research analyses of 2009–2012 MAX and other data.

Notes: All characteristics are reported based on information at baseline (2009).

Percentages may not sum to 100 due to rounding.

*Age is calculated as of January 1, 2009.

[a] All MLTC enrollees include all beneficiaries enrolled in MLTC at any point during the study period.

[b] The MLTC-enrolled study population includes all MLTC enrollees who were included in our matched sample.

Table IV.3. Confirmed MLTC enrollment among MLTC enrollees in the study population and a matched comparison group, Years 1 through 3

	Year 1	Year 2	Year 3
MLTC enrollees			
Total number of MLTC enrollees included in the study population	21,503	19,695	17,868
Number of MLTC enrollees with confirmed enrollment during the study year	21,503	18,309	16,077
Percent of MLTC enrollees with confirmed enrollment during the study year	100.0	93.0	90.0
Percent of person-months with any MLTC enrollment	95.8	90.5	87.6
Matched comparison group			
Total number of individuals in the matched comparison group	21,503	19,541	17,518
Number of individuals in the matched comparison group with confirmed MLTC enrollment during the study year	1,231	2,127	3,962
Percent of individuals in the matched comparison group with confirmed MLTC enrollment during the study year	5.7	10.9	22.6
Percent of person-months with any MLTC enrollment	3.3	8.3	16.3

Source: Mathematica Policy Research analyses of 2009–2012 MAX and other data.

3. MLTC enrollment and LTSS use

In this section, we present observed measures on LTSS use first, followed by regression-adjusted results for New York.

a. How MLTC enrollees and the comparison group compared on LTSS use

We examined the percentage of individuals in the matched MLTC and comparison groups that used three service types: (1) ILTC services during the year; (2) any use of HCBS during the year, whether the services were provided through a 1915(c) waiver or the state plan, including personal care services; and (3) any use of personal care visits during the year (Table IV.4).

Fewer MLTC enrollees used institutional services and more used HCBS, especially personal care, than individuals in the matched comparison group, suggesting self-selection into the voluntary MLTC program at the time. Of the 21,503 beneficiaries included in the MLTC study sample, 14 percent used institutional care the first year of outcome measures (Year 1) compared to 35 percent in the matched comparison group. Ninety-nine percent of MLTC enrollees used any HCBS in Study Year 1, compared to 92 percent of individuals in the matched comparison group. Almost 92 percent of MLTC enrollees used a personal care service in Year 1, compared to 51 percent in the matched comparison group. From Study Years 1 to 3, the differences in unadjusted rates of use of these three services between the MLTC group and those in the matched comparison group remained but decreased slightly. This is likely because of the intention-to-treat nature of our analysis.

Table IV.4. Unadjusted LTSS use among individuals enrolled in MLTC and their matched comparison group, by year

Measure	MLTC Enrollees			Matched Comparison Group		
	Year 1	Year 2	Year 3	Year 1	Year 2	Year 3
Total beneficiaries in the study sample	21,503	19,668	17,830	21,503	19,488	17,476
Any use of ILTC[a] services (%)						
All beneficiaries	13.5	14.1	15.9	34.6	32.2	31.3
Full-benefit dually eligible beneficiaries	13.9	14.4	16.3	34.1	32.0	31.0
Medicaid-only beneficiaries	10.8	11.3	12.2	39.0	35.0	34.4
Any use of HCBS[b] (%)						
All beneficiaries	99.0	97.7	97.8	92.3	93.2	94.7
Full-benefit dually eligible beneficiaries	99.5	97.9	98.0	92.2	93.2	94.7
Medicaid-only beneficiaries	95.1	95.8	96.6	94.7	94.6	95.3
Any use of personal care services (%)						
All beneficiaries	91.9	88.5	87.8	50.7	54.7	60.2
Full-benefit dually eligible beneficiaries	92.5	88.9	88.1	53.6	57.4	63.1
Medicaid-only beneficiaries	87.0	85.3	85.0	28.8	30.7	32.7

Source: Mathematica Policy Research analyses of 2009–2012 MAX and other data.

HCBS = Home and community-based services; ILTC = Institutional long-term care.

[a] ILTC was defined as services received in nursing facilities, mental hospitals for the aged, or institutional care facilities for people with developmental disabilities.

[b] HCBS was defined as any claims with (1) a type of service indicating home health, personal care, case management, rehabilitation, hospice provided in the patient's home, private duty nursing, residential day care, or adult day care or (2) a flag according to the MAX HCBS taxonomy.

b.   Regression-adjusted results on LTSS use in New York

Because the use of LTSS may be influenced by any post-matching differences in beneficiary characteristics (such as demographics, location, and chronic conditions), we used statistical regression techniques to adjust the mean values presented above and estimate changes in LTSS use associated with MLTC enrollment. Tables IV.5 through IV.7 present regression-adjusted results.

ILTC use. Regression results (Table IV.5) indicated that MLTC enrollment was associated with less use of institutional services, consistent with the unadjusted findings. Over the three study years (April 2009–March 2012), the average regression-adjusted mean probability of using any institutional service during a year was 15 percent when a beneficiary was enrolled in MLTC. This is 16.1 percentage points lower (95 percent confidence interval, CI: −16.7, −15.4) than we would expect for these beneficiaries if they had received LTSS through FFS. However, the estimated change decreased over time (Figure IV.1), likely due to disenrollment and attrition (Table IV.4).

We found stronger results among Medicaid-only beneficiaries when compared to dually eligible beneficiaries. This pattern may reflect that our measure of ILTC use captured only Medicaid-covered institutional care and omitted Medicare-covered post-acute skilled nursing

facility stays among dually eligible beneficiaries. For Medicaid-only MLTC enrollees, we estimated that the mean probability of using any institutional services during a year was 24.0 percentage points lower (95 percent CI: −26.1, −21.9) than it would be if they had received LTSS through FFS. For full-benefit dually eligible enrollees, we estimated the difference associated with MLTC enrollment to be 15.2 percentage points. All estimates are highly statistically significant ($p < 0.001$).

Table IV.5. Changes in ILTC use associated with MLTC enrollment in New York

Population and Year	Regression-adjusted means among MLTC enrollees		Difference in means		
	With program (%)	Without program (%)	Difference	95% CI	*p*-value
All beneficiaries					
Year 1	13.9	32.4	-18.5	(-19.2, -17.8)	<0.001
Year 2	14.6	30.7	-16.1	(-16.9, -15.4)	<0.001
Year 3	16.4	30.1	-13.6	(-14.4, -12.8)	<0.001
3-year average	15.0	31.1	-16.1	(-16.7, -15.4)	<0.001
Full-benefit dually eligible beneficiaries					
Year 1	14.4	31.7	-17.4	(-18.1, -16.6)	<0.001
Year 2	15.0	30.3	-15.3	(-16.1, -14.5)	<0.001
Year 3	16.9	29.7	-12.8	(-13.6, -11.9)	<0.001
3-year average	15.4	30.6	-15.2	(-15.8, -14.5)	<0.001
Medicaid-only beneficiaries					
Year 1	11.0	38.7	-27.7	(-29.9, -25.4)	<0.001
Year 2	11.6	34.6	-23.0	(-25.4, -20.7)	<0.001
Year 3	12.5	33.8	-21.2	(-23.9, -18.6)	<0.001
3-year average	11.7	35.7	-24.0	(-26.1, -21.9)	<0.001

Source: Mathematica Policy Research analyses of 2009–2012 MAX and other data.

Notes: Program refers to the MLTC program. Regression-adjusted means without program show the expected level of the outcome among MLTC enrollees had they not experienced the program (that is, no enrollment in MLTC).

Any discrepancy between the difference in means shown and that calculated from numbers presented in the table is because of minor rounding adjustment.

CI = Confidence interval.

ILTC = Institutional long-term care. ILTC was defined as services received in nursing facilities, mental hospitals for the aged, or institutional care facilities for people with developmental disabilities.

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Figure IV.1. Expected probability of ILTC use among MLTC enrollees in New York
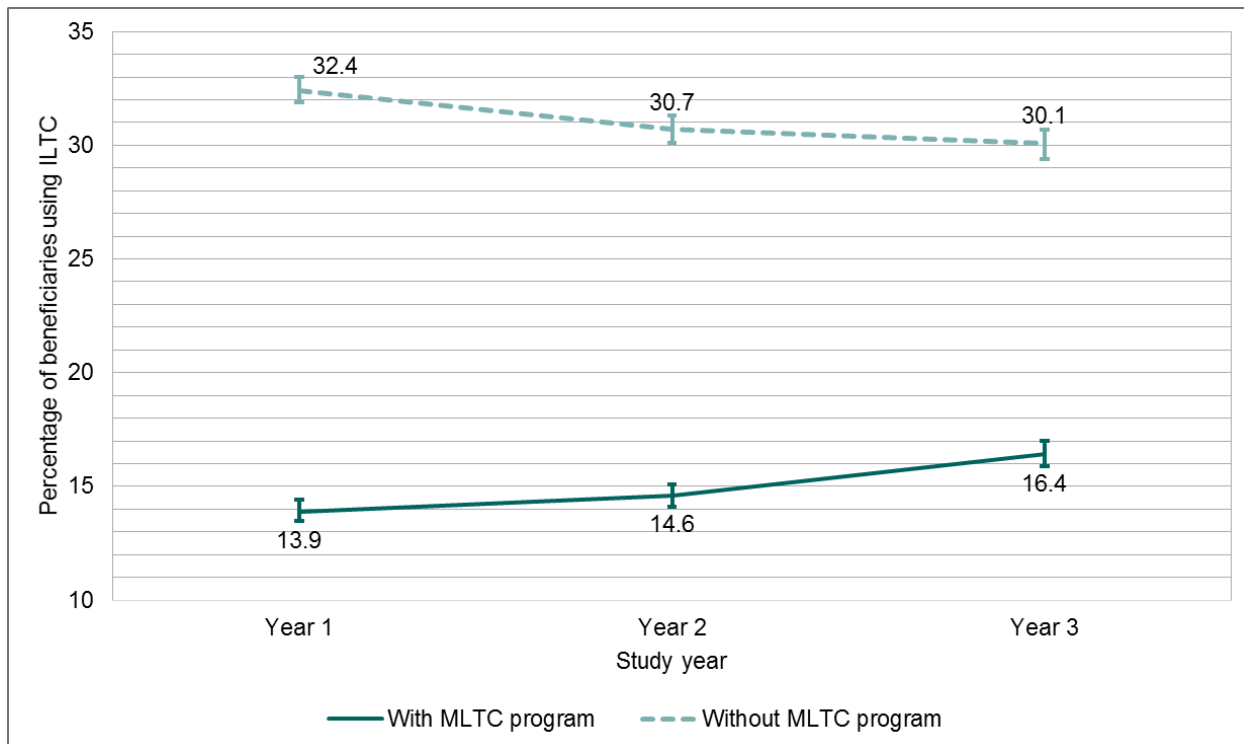
Source: Mathematica Policy Research analyses of 2009–2012 MAX and other data.

Notes: Confidence intervals are shown as the vertical bars around the regression-adjusted means.

ILTC = Institutional long-term care. ILTC was defined as services received in nursing facilities, mental hospitals for the aged, or institutional care facilities for people with developmental disabilities.

HCBS use. Regression-adjusted HCBS use rates (Table IV.6) show that MLTC enrollees were more likely to use HCBS when enrolled in MLTC than they would have been if they had received LTSS through FFS, which is again consistent with the unadjusted findings. On average over the three years of our study, we estimate the mean probability of using any HCBS during a given year to be 99 percent when a beneficiary was enrolled in MLTC, 4.1 percentage points (95 percent CI: 3.8, 4.3) higher than we would expect if the beneficiary had received LTSS through FFS. Similar to the findings for institutional services, we estimate the change in HCBS use decreased (Figure IV.2), from 5.6 percentage points (95 percent CI: 5.3, 5.9) in Year 1 to 2.7 percentage points (95 percent CI: 2.3, 3.0) in Year 3. Again, this result is likely a consequence of our intention-to-treat design.

Table IV.6. Changes in HCBS use associated with MLTC enrollment in New York

Population and Year	Regression-adjusted means among MLTC enrollees		Difference in means		
	With program (%)	Without program (%)	Difference	95% CI	*p*-value
All beneficiaries					
Year 1	99.2	93.6	5.6	(5.3, 5.9)	<0.001
Year 2	98.2	94.3	3.9	(3.6, 4.3)	<0.001
Year 3	98.2	95.6	2.7	(2.3, 3.0)	<0.001
3-year average	98.6	94.5	4.1	(3.8, 4.3)	<0.001
Full-benefit dually eligible beneficiaries					
Year 1	99.7	93.5	6.2	(5.8, 6.5)	<0.001
Year 2	98.5	94.3	4.2	(3.8, 4.5)	<0.001
Year 3	98.4	95.6	2.8	(2.4, 3.1)	<0.001
3-year average	98.9	94.5	4.4	(4.1, 4.6)	<0.001
Medicaid-only beneficiaries					
Year 1	95.3	95.5	-0.2	(-1.3, 0.9)	0.729
Year 2	96.5	95.7	0.8	(-0.4, 1.9)	0.174
Year 3	97.3	96.0	1.3	(0.1, 2.4)	0.031
3-year average	96.4	95.7	0.6	(-0.3, 1.5)	0.174

Source: Mathematica Policy Research analyses of 2009–2012 MAX and other data.

Notes: Program refers to the MLTC program. Regression-adjusted means without program show the expected level of the outcome among MLTC enrollees had they not experienced the program (that is, no enrollment in MLTC).

Any discrepancy between the difference in means shown and that calculated from numbers presented in the table is because of minor rounding adjustment.

CI = Confidence interval.

HCBS = Home and community-based services. HCBS was defined as any claims with (1) a type of service indicating home health, personal care, case management, rehabilitation, hospice provided in the patient's home, private duty nursing, residential day care, or adult day care or (2) a flag according to the MAX HCBS taxonomy.

Figure IV.2. Expected probability of HCBS use among MLTC enrollees in New York
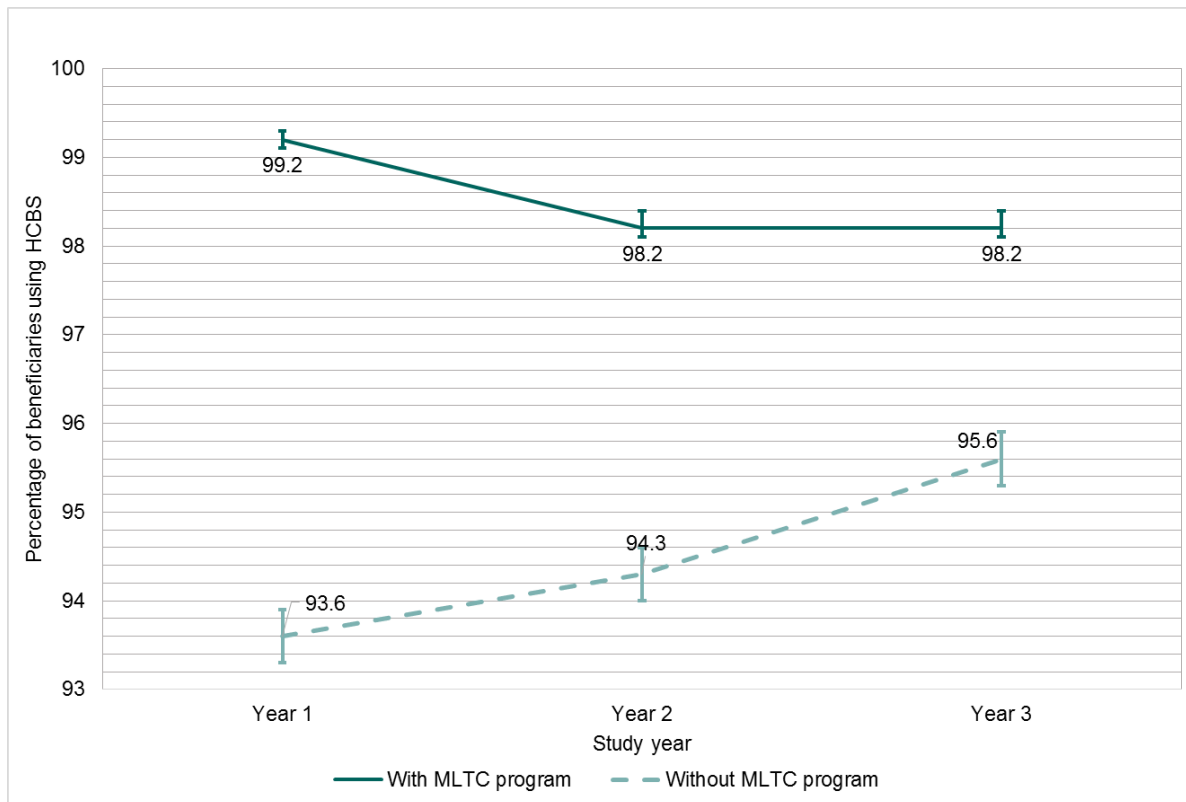
Source: Mathematica Policy Research analyses of 2009–2012 MAX and other data.

Notes: Confidence intervals are shown as the vertical bars around the regression-adjusted means.

HCBS = Home and community-based services. HCBS was defined as any claims with (1) a type of service indicating home health, personal care, case management, rehabilitation, hospice provided in the patient's home, private duty nursing, residential day care, or adult day care or (2) a flag according to the MAX HCBS taxonomy.

Expected rates of HCBS use were high for MLTC enrollees, with or without the program, ranging from 95 to 99 percent. The change associated with MLTC enrollment was stronger among the dually eligible population than among Medicaid-only beneficiaries. While results were statistically significant for the dually eligible population in all three years, the result was only statistically significant for the Medicaid-only population during Year 3, and this result could represent a spurious effect. Although the change in HCBS use associated with MLTC enrollment decreased over the three-year period among full dual beneficiaries, it increased over the same period among Medicaid-only beneficiaries.

Personal care services. The regression-adjusted probability of using personal care services when enrolled in MLTC compared to receiving LTSS through FFS showed stark differences (Table IV.7, Figure IV.3). On average over the three years, the mean probability of using personal care services in any given year was estimated to be 91 percent for beneficiaries enrolled in MLTC, compared to just 58 percent if those beneficiaries had received LTSS through FFS. Although the estimated difference associated with MLTC enrollment decreased from 39.7 (95 percent CI: 38.9, 40.4) to 26.7 (95 percent CI: 25.9, 27.5) percentage points from Year 1 to Year 3, it remained highly statistically significant ($p < 0.001$).

Table IV.7. Changes in personal care services use associated with MLTC enrollment in New York

Population and Year	Regression-adjusted means among MLTC enrollees		Difference in means		
	With program (%)	Without program (%)	Difference	95% CI	*p*-value
All beneficiaries					
Year 1	92.9	53.2	39.7	(38.9, 40.4)	<0.001
Year 2	90.2	57.3	32.8	(32.0, 33.6)	<0.001
Year 3	89.5	62.7	26.7	(25.9, 27.5)	<0.001
3-year average	90.8	57.8	33.1	(32.4, 33.7)	<0.001
Full-benefit dually eligible beneficiaries					
Year 1	93.5	56.3	37.2	(36.5, 38.0)	<0.001
Year 2	90.6	60.3	30.2	(29.4, 31.0)	<0.001
Year 3	89.8	66.0	23.9	(23.1, 24.7)	<0.001
3-year average	91.3	60.9	30.5	(29.7, 31.2)	<0.001
Medicaid-only beneficiaries					
Year 1	87.8	30.5	57.3	(55.1, 59.6)	<0.001
Year 2	86.7	33.1	53.6	(51.1, 56.1)	<0.001
Year 3	86.4	35.1	51.3	(48.6, 54.1)	<0.001
3-year average	87.0	32.9	54.1	(51.9, 56.2)	<0.001

Source: Mathematica Policy Research analyses of 2009–2012 MAX and other data.

Notes: Program refers to the MLTC program. Regression-adjusted means without program show the expected level of the outcome among MLTC enrollees had they not experienced the program (that is, no enrollment in MLTC).

Any discrepancy between the difference in means shown and that calculated from numbers presented in the table is because of minor rounding adjustment.

CI = Confidence interval.

Figure IV.3. Expected probability of personal care services use among MLTC enrollees in New York
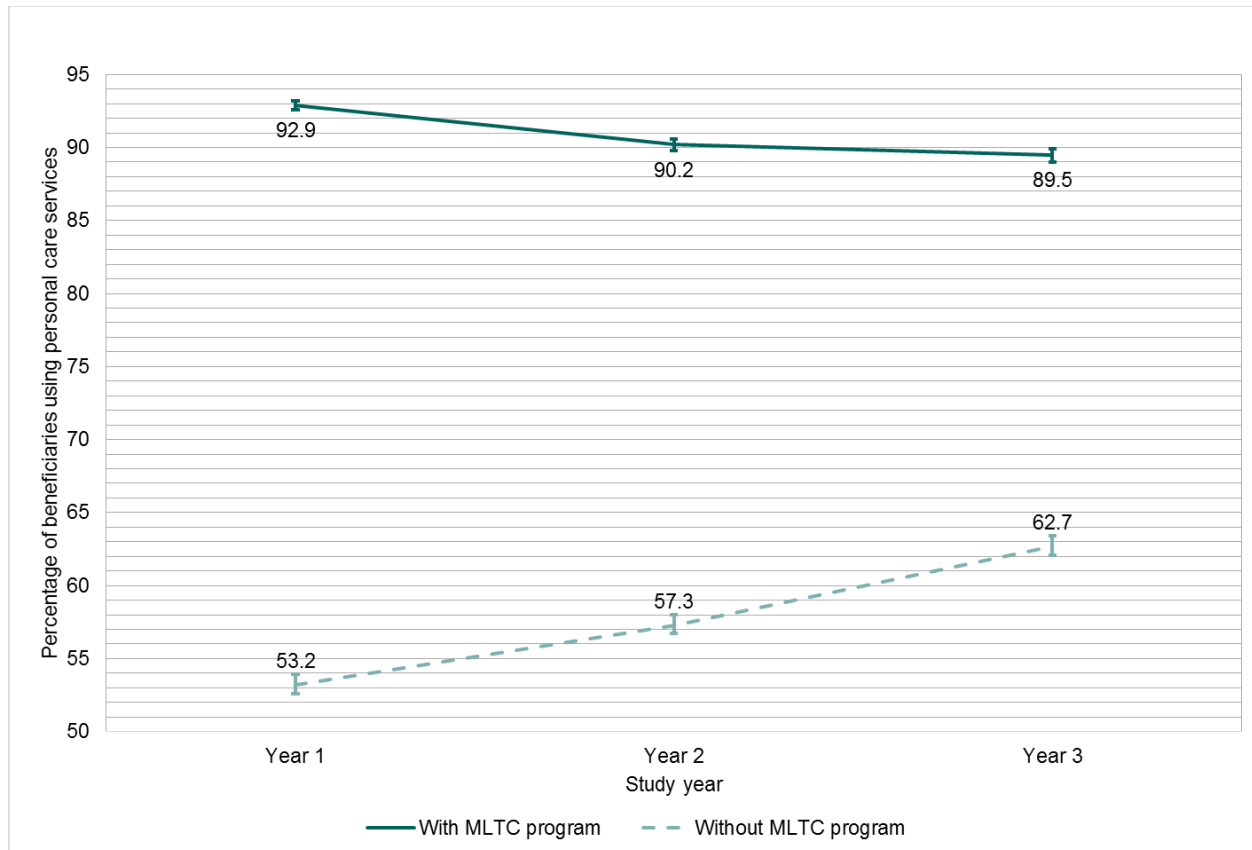
Source: Mathematica Policy Research analyses of 2009–2012 MAX and other data.

Notes: Confidence intervals are shown as the vertical bars around the regression-adjusted means.

ILTC = Institutional long-term care. ILTC was defined as services received in nursing facilities, mental hospitals for the aged, or institutional care facilities for people with developmental disabilities.

Expected rates of personal care service use were slightly higher among dually eligible MLTC enrollees than among Medicaid-only enrollees during all three years (three-year average 91 versus 87 percent). However, the expected rate of personal care use if these beneficiaries had received LTSS through FFS was much lower among the Medicaid-only population than among the dually eligible population (33 versus 61 percent). The difference in these rates equated to stronger results among the Medicaid-only population than among the dual eligibles. Among the Medicaid-only group, the changes in the rate of personal care use associated with MLTC enrollment were more than 50 percentage points for each of the three years.

4.   MLTC enrollment and use of hospital care

Similar to the previous section, we present observed measures of use of hospital care first, followed by regression-adjusted results for New York.

a. How MLTC enrollees and the comparison group compared on hospital use

We measured hospital use in three ways: (1) whether the beneficiary was ever admitted to an acute care hospital during the year, (2) the total number of acute care hospital stays during the year, and (3) the total number of acute care hospital days during the year. By all three of these measures, MLTC enrollees used fewer hospital services than the matched comparison group (Table IV.8), although some differences were small. On average over the three-year study period, 36 percent of MLTC enrollees experienced at least one hospitalization during a year, compared to 38 percent in the matched FFS comparison group. This translates to an unadjusted average difference of 1 percentage point fewer beneficiaries with hospital stays and 0.8 fewer hospital days per beneficiary among MLTC enrollees versus the comparison group. The proportion of beneficiaries with at least one hospitalization decreased over time in the MLTC group, while remaining relatively constant in the matched comparison group, so the difference between the two groups grew larger from Year 1 to Year 3.

Table IV.8. Unadjusted hospital use among individuals enrolled in MLTC and their matched comparison group, by year

	MLTC Enrollees			Matched Comparison Group		
	Year 1	Year 2	Year 3	Year 1	Year 2	Year 3
Total beneficiaries	21,503	19,668	17,830	21,503	19,488	17,476
Any admission to an acute care hospital (%)						
All beneficiaries	37.4	36.1	35.0	38.2	38.7	38.1
Full-benefit dually eligible beneficiaries	37.8	36.3	35.4	38.1	38.6	38.2
Medicaid-only beneficiaries	34.9	34.6	32.2	39.0	39.9	37.7
Number of acute care hospital stays (per 1,000 beneficiaries)						
All beneficiaries	735	700	663	757	767	747
Full-benefit dually eligible beneficiaries	735	700	663	740	755	739
Medicaid-only beneficiaries	737	708	669	904	882	823
Number of acute care hospital days (per beneficiary)						
All beneficiaries	6.2	5.9	5.4	6.4	6.9	6.6
Full-benefit dually eligible beneficiaries	6.3	5.9	5.5	6.2	6.6	6.4
Medicaid-only beneficiaries	5.9	5.8	5.1	8.2	8.9	8.7

Source: Mathematica Policy Research analyses of 2009–2012 MAX and other data.

Due to MLTSS plans' lack of control over hospital care for dually eligible beneficiaries, as well as our lack of access to hospitalization data for beneficiaries enrolled in Medicare Advantage plans, it is important to compare hospital use separately for dually eligible and Medicaid-only beneficiaries. Because the majority (88 percent) of the MLTC study population in New York was dually eligible, patterns in hospital use for all MLTC enrollees mirrored those of dually eligible beneficiaries. Among the Medicaid-only population, for whom we had complete data, we observed somewhat larger differences in hospital use between the MLTC enrollees and the matched comparison group. Averaged over the three-year period, the proportion of Medicaid-only beneficiaries who had at least one hospitalization during a year was 5 percentage points

lower among MLTC enrollees than in the matched comparison group (34 versus 39 percent). The Medicaid-only matched MLTC enrollees also averaged fewer hospital stays (706 versus 866 per 1,000 beneficiaries) and inpatient hospital days (6 versus 9) per beneficiary than the comparison group.

b.   Regression-adjusted results on use of hospital care in New York

Our regression analysis found that enrollment in MLTC was associated with reductions in the average individual's hospital use, after controlling for potential confounding factors. Averaged over the three-year study period, we estimated that, if the MLTC enrollees had received LTSS through FFS, they would have been 0.7 percentage points (95 percent CI: -1.3, -0.1) more likely to have had any hospitalizations in a year ($p = 0.032$) (Table IV.9a). We also predicted that they would have had 21 more hospital stays per 1,000 beneficiaries (95 percent CI: -38, -4) and 0.5 longer inpatient hospital days (95 percent CI: -0.7, -0.3, $p < 0.001$) per beneficiary if they had received LTSS through FFS (Tables IV.9b and IV.9c). The result improved from Year 1 to Year 3, despite the attenuation expected from the intention-to-treat approach. Our estimates suggested a slight (but statistically insignificant) increase in the probability of at least one hospitalization and an increase in the number of hospital stays in Year 1 associated with enrollment in MLTC. However, by Year 3, we estimated statistically significant reductions in hospital use for all three hospitalization measures considered. This pattern may reflect the indirect effect MLTSS has on hospital care and the longer time it takes for any effect to show, especially for New York, where MLTC plans did not cover acute care services for enrollees.

Because dually eligible beneficiaries comprised 88 percent of the study population in this analysis, the general patterns observed above were also present when focusing only on this subgroup. One notable difference is that the estimated increase in hospital use associated with enrollment in MLTC during Year 1 was stronger among the dually eligible beneficiaries than in the full sample. We estimated that dually eligible MLTC enrollees were 1.1 percentage points (95 percent CI: 0.3, 2.0) more likely to be hospitalized during Year 1 than what we predicted would have happened if they had received LTSS through FFS ($p = 0.009$), and we also would have expected 27 more hospital stays per 1,000 beneficiaries (95 percent CI: 6, 48, $p = 0.013$) and 0.2 more inpatient hospital days (95 percent CI: 0.0, 0.4, $p = 0.081$) per beneficiary enrolled in MLTC. As in the full sample, by Year 3, we observed statistically significant reductions in hospitalizations associated with the MLTC program for these dually eligible enrollees in all three measures.

Among the Medicaid-only population, we estimated a much stronger reduction in hospital use associated with the MLTC program in all three study years. On average over the three-year period, we estimated that enrollment in MLTC reduced the likelihood of at least one hospitalization by 4.5 percentage points (95 percent CI: -6.6, -2.4) for Medicaid-only enrollees, and also resulted in 148 fewer hospital stays per 1,000 beneficiaries (95 percent CI: -218, -78) and 2.6 fewer inpatient hospital days (95 percent CI: -3.5, -1.8) per beneficiary (all $p < 0.001$). These results increased from Year 1 to Year 3.

Table IV.9a. Changes in any acute care hospital admission (percentage of beneficiaries) associated with MLTC enrollment in New York

| Population and Year	Regression-adjusted means among MLTC enrollees		Difference in means		
	With program (%)	Without program (%)	Difference	95% CI	p-value
All beneficiaries					
Year 1	37.9	37.3	0.6	(-0.2, 1.4)	0.131
Year 2	36.8	37.8	-1.1	(-2.0, -0.2)	0.021
Year 3	35.7	37.3	-1.5	(-2.5, -0.6)	0.002
3-year average	36.8	37.5	-0.7	(-1.3, -0.1)	0.032
Full-benefit dually eligible beneficiaries					
Year 1	38.2	37.1	1.1	(0.3, 2.0)	0.009
Year 2	37.0	37.6	-0.7	(-1.7, 0.3)	0.175
Year 3	36.1	37.2	-1.2	(-2.2, -0.2)	0.024
3-year average	37.1	37.3	-0.2	(-0.9, 0.4)	0.452
Medicaid-only beneficiaries					
Year 1	35.2	39.0	-3.7	(-6.4, -1.1)	0.006
Year 2	35.1	40.0	-4.9	(-7.8, -1.9)	0.001
Year 3	32.9	37.7	-4.8	(-8.0, -1.6)	0.003
3-year average	34.4	38.9	-4.5	(-6.6, -2.4)	<0.001

Source: Mathematica Policy Research analyses of 2009–2012 MAX and other data.

Notes: Program refers to the MLTC program. Regression-adjusted means without program show the expected level of the outcome among MLTC enrollees had they not experienced the program (that is, no enrollment in MLTC).

Any discrepancy between the difference in means shown and that calculated from numbers presented in the table is because of minor rounding adjustment.

CI = Confidence interval.

Table IV.9b. Changes in total acute care hospital stays (per 1,000 beneficiaries) associated with MLTC enrollment in New York

Population and Year	Regression-adjusted means among MLTC enrollees		Difference in means		
	With program (count per 1,000 beneficiaries)	Without program (count per 1,000 beneficiaries)	Difference	95% CI	p-value
All beneficiaries					
Year 1	750	739	11	(-10, 32)	0.321
Year 2	777	803	-26	(-53, 0)	0.053
Year 3	738	784	-47	(-75, -18)	0.001
3-year average	755	776	-21	(-38, -4)	0.017
Full-benefit dually eligible beneficiaries					
Year 1	750	723	27	(6, 48)	0.013
Year 2	782	794	-12	(-39, 15)	0.393
Year 3	743	778	-36	(-65, -7)	0.015
3-year average	758	765	-7	(-24, 10)	0.423
Medicaid-only beneficiaries					
Year 1	754	880	-125	(-215, -36)	0.006
Year 2	740	903	-163	(-262, -64)	0.001
Year 3	690	844	-154	(-256, -52)	0.003
3-year average	728	876	-148	(-218, -78)	<0.001

Source: Mathematica Policy Research analyses of 2009–2012 MAX and other data.

Notes: Program refers to the MLTC program. Regression-adjusted means without program show the expected level of the outcome among MLTC enrollees had they not experienced the program (that is, no enrollment in MLTC).

Any discrepancy between the difference in means shown and that calculated from numbers presented in the table is because of minor rounding adjustment.

CI = Confidence interval.

Table IV.9c. Changes in number of acute care hospitalized days (per beneficiaries) associated with MLTC enrollment in New York

Population and Year	Regression-adjusted means among MLTC enrollees		Difference in means		
	With program (count per beneficiary)	Without program (count per beneficiary)	Difference	95% CI	*p*-value
All beneficiaries					
Year 1	6.1	6.1	0.0	(-0.3, 0.2)	0.824
Year 2	6.9	7.5	-0.6	(-0.9, -0.2)	0.001
Year 3	6.4	7.2	-0.8	(-1.2, -0.5)	<0.001
3-year average	6.4	6.9	-0.5	(-0.7, -0.3)	<0.001
Full-benefit dually eligible beneficiaries					
Year 1	6.1	5.9	0.2	(0.0, 0.4)	0.081
Year 2	7.0	7.3	-0.4	(-0.7, 0.0)	0.045
Year 3	6.5	7.0	-0.6	(-0.9, -0.2)	0.002
3-year average	6.5	6.8	-0.2	(-0.4, 0.0)	0.020
Medicaid-only beneficiaries					
Year 1	5.9	7.9	-2.0	(-3.0, -1.0)	<0.001
Year 2	6.3	9.0	-2.8	(-3.9, -1.6)	<0.001
Year 3	5.5	8.6	-3.2	(-4.6, -1.8)	<0.001
3-year average	5.9	8.5	-2.6	(-3.5, -1.8)	<0.001

Source: Mathematica Policy Research analyses of 2009–2012 MAX and other data.

Notes: Program refers to the MLTC program. Regression-adjusted means without program show the expected level of the outcome among MLTC enrollees had they not experienced the program (that is, no enrollment in MLTC).

Any discrepancy between the difference in means shown and that calculated from numbers presented in the table is because of minor rounding adjustment.

CI = Confidence interval.

D. Tennessee

Next, we present findings from the Tennessee study, where we used a combined matched comparison group from Alabama and Georgia to examine changes in outcome measures associated with CHOICES enrollment.

1.   Sample selection

The Tennessee study examined outcomes among Medicaid beneficiaries who first enrolled in CHOICES in 2010. That year, CHOICES enrolled 19,576 individuals, and enrollment increased to 23,069 by 2014 (Table IV.10). In each year following the initial wave of enrollment, new enrollees joined the program, representing nearly a quarter or more of total enrollment each year.

Table IV.10. Enrollment patterns among individuals who enrolled in CHOICES (Tennessee)

	2010	2011	2012	2013	2014
Total Enrollees (N)	19,576	23,826	24,513	24,243	23,069
Average number of months enrolled during the year	5.6	8.8	9.0	9.0	9.2
Beneficiaries newly enrolled during the year (N)	19,576	7,477	6,870	6,239	5,385
Average number of months enrolled over the study period	28.9	23.1	18.0	12.3	5.3
Average number of enrollment spells per enrollee	1.0	1.0	1.0	1.0	1.0
Average length of uncensored enrollment spells (months)	19.5	13.9	10.1	6.4	3.4
Average length of censored enrollment spells (months)	52.6	41.2	29.7	17.8	5.9
Average length of first enrollment (months)	28.3	22.4	17.5	12.0	5.3
Average number of months between enrollment spells	8.5	7.2	6.7	5.0	2.6

Source: Mathematica Policy Research analyses of state submitted finder file, 2009–2014 MAX and other data.

Notes: Enrollment spells are uninterrupted periods of CHOICES enrollment; multiple enrollment spells for a single enrollee are defined by gaps in enrollment of one or more days.

Enrollees can appear in more than one column.

Uncensored enrollment spells include only individuals with valid end dates of enrollment.

Censored enrollment spells include only individuals whose enrollment records contain missing or invalid end dates, which have been converted to align with the end of the study period.

CHOICES enrollees who joined in 2010 and later years have some similar enrollment patterns. Beneficiaries in Tennessee tended to participate in CHOICES over a single enrollment spell, and the average duration of enrollment lasted for about half of the observed period (for example, the average length of enrollment among individuals who enrolled in 2010 was 29 months, and the maximum length of time that those individuals could be observed during the study is 60 months). Among those who disenrolled and reenrolled (that is, their enrollment consisted of multiple enrollment spells), the time between spells was longer for 2010 enrollees than for those who enrolled in 2011 or later (9 months, compared to an average of 5 months for 2011–2012 [not shown]); however, this difference may be partly explained by the short time period we have to observe enrollment for beneficiaries who enrolled in CHOICES in 2011 or later.

Although the enrollment patterns of individuals who joined CHOICES in 2010 may be similar to those who joined in later years, other aspects of their care may have differed in ways we could not observe. Statewide, mandatory enrollment in CHOICES introduced the possibility of significant changes to the LTSS delivery system in Tennessee (for example, changes in the availability of LTSS across settings and providers, and different care coordination practices). Recent enrollees may have benefited more from these changes, compared to the first waves of CHOICES enrollees. For this and other reasons detailed in Appendix A, we chose to limit the study population to the subset of 10,153 Medicaid beneficiaries who enrolled in CHOICES when mandatory enrollment was first required (March and August 2010).

2.   Comparison of the matched sample in Tennessee

As we did for the New York analysis, in Tennessee we compared characteristics across all CHOICES enrollees during the study period (January 2009 through December 2014) as identified in the finder file provided by the state, CHOICES enrollees in our matched sample, and the comparison FFS groups included in our matched sample. Detailed information about these comparisons are available in Table IV.11, which includes information for the comparison groups from Alabama and Georgia individually, as well as for the combined comparison group. We first compare the matched groups and then assess the representativeness of the CHOICES enrollees in the matched sample.

CHOICES enrollees were similar to the combined comparison group on all of the characteristics we included. Most beneficiaries in both CHOICES and the combined comparison group were elderly (76 percent in both groups), female (73 percent for both groups), white (78 percent and 77 percent), eligible for full Medicare benefits (87 percent for both groups), and residing in an urban area (57 and 58 percent). The average CDPS score was 4.5 for CHOICES enrollees and 4.3 for the comparison group. There were no notable differences in the percentage of enrollees identified with eight common conditions in the two groups.

We observed a few significant differences between all CHOICES enrollees during the study period and those included in the matched study sample and the rest of the analysis. Compared to all CHOICES enrollees, those included in the matched sample were slightly more likely to be female (73 versus 69 percent) and above age 85 (30 versus 23 percent), as well as more likely to be dually eligible for full Medicare benefits (87 versus 74 percent) and to have chronic conditions as identified by the CDPS (4.5 average score versus 3.7 average score). In particular, CHOICES enrollees included in the analysis were more likely to have cardiovascular conditions when compared to all CHOICES enrollees (34 versus 28 percent). Due to these differences, caution should be exercised in extrapolating the results of this analysis to the population of all CHOICES enrollees.

Table IV.11. Baseline demographic characteristics and Medicare dual eligibility among beneficiaries in the CHOICES and FFS comparison groups for the Tennessee Study

	All CHOICES Enrollees[a]	CHOICES-Enrolled Study Population[b]	Alabama Comparison Population	Georgia Comparison Population	Combined Comparison Population
Total beneficiaries (N)	46,018	10,153	10,153	10,153	20,306
Age* (%)					
<21	0.7	0.1	0.8	0.5	0.7
21-44	4.5	4.4	5.0	4.8	4.9
45-64	21.0	19.6	18.2	18.8	18.5
65-74	19.1	16.3	18.5	17.7	18.1
75-84	31.7	29.4	28.7	28.0	28.4
85+	23.0	30.1	28.7	30.2	29.5
Gender (%)					
Male	30.7	27.2	27.4	27.7	27.6
Female	69.3	72.8	72.6	72.3	72.5
Race (%)					
White	78.2	78.2	76.1	77.2	76.6
Black	19.8	20.6	23.4	21.8	22.6
Latino	0.4	0.4	0.2	0.4	0.3
Pacific Islander	0.3	0.2	0.0	0.0	0.0
Native American	0.1	0.1	0.1	0.1	0.1
Asian	0.1	0.0	0.2	0.6	0.4
Other	1.1	0.5	0.0	0.0	0.0
Dual Eligibility (%)					
Medicaid only	26.1	12.9	12.9	12.9	12.9
Full-benefit dually eligible beneficiaries	73.9	87.1	87.1	87.1	87.1
Residence (%)					
Urban	57.1	56.5	58.0	57.6	57.8
Rural	42.9	43.5	42.0	42.5	42.2

Table IV.11 *(continued)*

	All CHOICES Enrollees[a]	CHOICES-Enrolled Study Population[b]	Alabama Comparison Population	Georgia Comparison Population	Combined Comparison Population
CDPS Conditions					
CDPS Score (Average)	3.7	4.5	4.3	4.2	4.3
Specific Types of Conditions (%)					
Cardiovascular (%)	27.6	33.5	32.3	30.3	31.3
Central nervous system (%)	6.1	8.7	8.6	7.9	8.3
Dementia (%)	13.4	15.6	15.4	15.3	15.3
Metabolic (%)	11.0	13.1	12.4	12.7	12.6
Psychiatric (%)	17.6	24.7	24.1	20.7	22.4
Renal (%)	12.9	14.5	13.7	14.2	14.0
Skeletal (%)	11.9	13.5	13.8	13.4	13.6
Skin (%)	5.9	8.7	8.2	8.8	8.5

Source: Mathematica Policy Research analyses of state submitted finder file, 2009–2014 MAX and other data.

Notes: All characteristics are reported based on information at baseline (2009).

Percentages may not sum to 100 due to rounding.

*Age is calculated as of January 1, 2009.

[a] All CHOICES enrollees include all beneficiaries enrolled in CHOICES at any point during the study period.

[b] The CHOICES-enrolled study population includes all CHOICES enrollees who were included in our matched sample.

3. CHOICES enrollment and LTSS use

Next, we present observed measures on LTSS use, followed by regression-adjusted results for Tennessee.

a. How CHOICES and the comparison group compared on LTSS use

Table IV.12 presents the number and percentage of individuals in CHOICES and the matched comparison groups in Alabama and Georgia that used LTSS. We considered three LTSS outcomes: (1) any use of ILTC services during the year; (2) any use of HCBS during the year, whether the services were provided through a 1915(c) waiver or the state plan, including personal care services; and (3) any use of personal care visits during the year.

As mentioned earlier, the last study year (Year 5 for Tennessee and Georgia; Year 4 for Alabama) contained partial-year observations of outcome measures. Therefore, the results here focus on the earlier years for which we observed full-year data. Rates of institutional care use were high but declined across CHOICES enrollees and the matched comparison groups, although CHOICES enrollees experienced a slower decline in institutional care use following enrollment than the decline comparison group members experienced. Of the 10,153 CHOICES enrollees, 82 percent received institutional care during the year before enrollment. The percentage of CHOICES enrollees using institutional care declined from 79 percent the first year following enrollment (Year 1) to 75 percent by Year 4. Individuals in the two matched comparison groups experienced similar declines in their use of institutional services; the proportion of beneficiaries using institutional services in Alabama declined from 79 percent in Year 1 to 73 percent by Year 3, and the proportion in Georgia declined from 78 percent in Year 1 to 70 percent in Year 4. Such decreasing trends in all three states could reflect attrition in our study population (mostly due to mortality) or could be associated with other types of rebalancing efforts across states, also evidenced by the increasing trend in the next outcome, rate of HCBS use.

Before matching, we observed very large differences in the baseline rate of HCBS use between CHOICES enrollees (65 percent) and the potential comparison populations from Alabama (93 percent) and Georgia (93 percent) (see Appendix A, Table A.5). Although we used matching techniques to try to identify a comparison population that was similar to CHOICES enrollees on all observed characteristics, including baseline use of HCBS, the populations were ultimately too different to find a comparison population with a similar history of HCBS use. Therefore, there were still large (although smaller than before matching) differences in HCBS use at baseline (Year 0) between CHOICES enrollees and the matched comparison groups (Table IV.12). In Alabama, 89 percent of our matched comparison group were HCBS users. In Georgia, this number was 74 percent. In Years 1 through 3, CHOICES enrollees and the comparison group from Georgia both experienced a slight increase in HCBS use. However, the comparison group from Alabama experienced relatively stable HCBS use during this time.

Table IV.12. Unadjusted LTSS use among individuals enrolled in CHOICES and their matched comparison groups, by year

	CHOICES Enrollees						Alabama Matched Comparison Group						Georgia Matched Comparison Group					
	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5*	Year 0	Year 1	Year 2	Year 3	Year 4*	Year 5	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5*
Total beneficiaries in the study sample (N)	10,153	10,153	7,940	6,127	4,740	3,715	10,153	10,153	7,659	6,013	4,756	n/a	10,153	10,153	7,574	5,927	4,649	3,752
Any use of ILTC[a] services (%)																		
All beneficiaries	81.7	78.5	78.7	76.6	74.9	72.0*	81.2	78.5	76.0	73.2	67.7*	n/a	81.7	78.2	73.4	72.1	70.2	66.8*
Full-benefit dually eligible beneficiaries	82.9	79.6	80.1	78.3	76.5	73.9*	82.7	80.8	78.8	76.1	70.8*	n/a	83.0	80.4	76.5	74.9	73.0	69.9*
Medicaid-only beneficiaries	69.4	68.9	67.6	65.5	64.5	60.6*	69.4	62.2	59.2	56.8	53.9*	n/a	71.5	59.5	51.1	54.3	54.0	52.4*
Any use of HCBS[b] (%)																		
All beneficiaries	66.2	68.8	70.2	70.2	62.4	50.2*	89.2	88.9	89.1	89.9	72.2*	n/a	74.3	74.0	75.8	78.4	80.7	70.5*
Full-benefit dually eligible beneficiaries	63.4	65.6	67.1	66.9	57.5	43.0*	88.3	88.1	88.7	89.3	69.9*	n/a	72.3	72.0	74.5	76.7	79.0	67.6*
Medicaid-only beneficiaries	95.1	95.7	95.5	95.1	97.0	95.3*	96.7	96.1	94.2	97.2	88.8*	n/a	94.1	92.8	88.0	93.5	96.2	93.4*
Any use of personal care services (%)																		
All beneficiaries	18.3	17.1	18.1	19.0	20.2	20.7*	20.7	17.9	19.1	20.6	21.3*	n/a	18.9	16.4	17.6	18.9	19.8	20.5*
Full-benefit dually eligible beneficiaries	17.1	15.6	16.5	17.5	18.7	19.1*	19.0	16.2	17.5	19.1	20.1*	n/a	17.6	14.8	16.2	17.5	18.7	20.0*
Medicaid-only beneficiaries	30.4	29.6	31.0	29.8	31.0	30.5*	33.7	31.4	31.7	32.4	29.9*	n/a	29.4	31.3	29.4	30.7	29.6	25.9*

Source: Mathematica Policy Research analyses of state submitted finder file, 2009–2014 MAX and other data.

*Utilization appears lower in the final study year for all three groups because no beneficiaries are observed for a full year.

[a] ILTC was defined as services received in nursing facilities or mental hospitals for the aged.

[b] HCBS was defined as any claims with (1) a type of service indicating home health, personal care, case management, rehabilitation, hospice provided in the patient's home, private duty nursing, residential day care, or adult day care or (2) a flag according to the MAX HCBS taxonomy.

HCBS = Home and community-based services; ILTC = Institutional long-term care; n/a = Data not available for Year 5 in Alabama.

Personal care use presented a different trend. Each study group experienced a slight decrease in the percentage of individuals using personal care after the baseline year; use of personal care then increased from the second through penultimate years of the study for all groups. For example, 18 percent of CHOICES enrollees used personal care in the year before enrollment, compared to 17 percent in Year 1 and 20 percent in Year 4. By the last full-year observation, Alabama saw a slightly higher percentage of personal care users in its matched comparison group (from 18 to 21 percent in Year 3), and Georgia saw a similar increase (from 16 to 20 percent in Year 4).

b. Regression-adjusted results on LTSS use in Tennessee

The regression-adjusted results presented below are based on analysis of the combined matched comparison group, which provided a single point of comparison for CHOICES enrollees and may temper any state-specific differences in program design that exist in single-state comparisons. Appendix E contains separate regression-adjusted results for Alabama and Georgia. The regressions also include an adjustment for partial-year observations of data in the last study year in all states in the Tennessee study.

ILTC use. The estimated changes in use of institutional care services associated with CHOICES enrollment were inconsistent over the five years of the study and mostly statistically insignificant. For the change in rate of institutional service use associated with CHOICES, averaged over the five-year period, we estimated a slight increase of 0.4 percentage points (95 percent CI: −0.1, 1.0), although this result is not statistically significant ($p = 0.108$) (Table IV.13, Figure IV.4). On a year-by-year basis, the difference ranged from a 0.9 percentage point (95 percent CI: −1.4, −0.5) decrease (Year 1), to a 1.4 percentage point (95 percent CI: 0.9, 2.0) increase (Year 2). We also estimated statistically significant increases in institutional care use during Years 3 and 5, and a nonsignificant decrease during Year 4. The absence of an overall association between CHOICES and the rate of institutional care when controlling for observable characteristics of the beneficiaries suggests that the changing demographics and health characteristics of the study population might explain the decline in the unadjusted rate of institutional care.

The estimated decreases in institutional care use associated with CHOICES during Years 1 and 4 were driven by the dually eligible population. In fact, among the Medicaid-only population, we estimated an increase in institutional care use during each of the five years; the five-year average for this change was a statistically significant increase of 2.9 percentage points (95 percent CI: 1.0, 4.7, $p = 0.002$). In contrast, the five-year average of the change in institutional care use among dually eligible beneficiaries was an increase of only 0.1 percentage points (95 percent CI: −0.5, 0.6)—not statistically significant ($p = 0.780$). The difference between the two groups may reflect lack of complete institutionalization data for dually eligible beneficiaries. Overall, we estimated higher probabilities of institutional service use for dually eligible beneficiaries than Medicaid-only beneficiaries. The five-year average of the regression-adjusted mean probability of using these services was 82 percent among the dually eligible CHOICES enrollees, compared to 70 percent among the Medicaid-only CHOICES enrollees.

Table IV.13. Changes in ILTC use associated with CHOICES enrollment in Tennessee

Population and Year	Regression-adjusted means among CHOICES enrollees		Difference in means		
	With program (%)	Without program (%)	Difference	95% CI	*p*-value
All beneficiaries					
Year 1	80.7	81.7	-0.9	(-1.4, -0.5)	<0.001
Year 2	81.1	79.7	1.4	(0.9, 2.0)	<0.001
Year 3	79.0	78.1	0.9	(0.2, 1.6)	0.014
Year 4	77.0	77.2	-0.2	(-1.1, 0.7)	0.651
Year 5	85.4	84.4	1.0	(0.0, 2.0)	0.048
5-year average	80.7	80.2	0.4	(-0.1, 1.0)	0.108
Full-benefit dually eligible beneficiaries					
Year 1	82.0	83.4	-1.3	(-1.9, -0.8)	<0.001
Year 2	82.7	81.7	1.0	(0.4, 1.6)	0.001
Year 3	80.7	80.1	0.6	(-0.1, 1.4)	0.114
Year 4	78.9	79.3	-0.5	(-1.4, 0.5)	0.316
Year 5	86.7	86.1	0.6	(-0.4, 1.6)	0.263
5-year average	82.2	82.1	0.1	(-0.5, 0.6)	0.780
Medicaid-only beneficiaries					
Year 1	70.1	67.7	2.4	(0.9, 3.9)	0.002
Year 2	68.6	64.0	4.6	(2.4, 6.8)	<0.001
Year 3	67.4	64.3	3.1	(0.6, 5.5)	0.014
Year 4	65.4	64.0	1.3	(-1.5, 4.2)	0.362
Year 5	77.6	74.6	3.1	(-0.1, 6.2)	0.060
5-year average	69.8	66.9	2.9	(1.0, 4.7)	0.002

Source: Mathematica Policy Research analyses of state submitted finder file, 2009–2014 MAX and other data.

Notes: Results based on the combined matched comparison group from Georgia and Alabama.

Program refers to the CHOICES program. Regression-adjusted means without program show the expected level of the outcome among CHOICES enrollees had they not experienced the program (that is, no enrollment in CHOICES).

Any discrepancy between the difference in means shown and that calculated from numbers presented in the table is because of minor rounding adjustment.

ILTC = Institutional long-term care. ILTC was defined as services received in nursing facilities or mental hospitals for the aged.

Figure IV.4. Expected probability of ILTC use among CHOICES enrollees in Tennessee
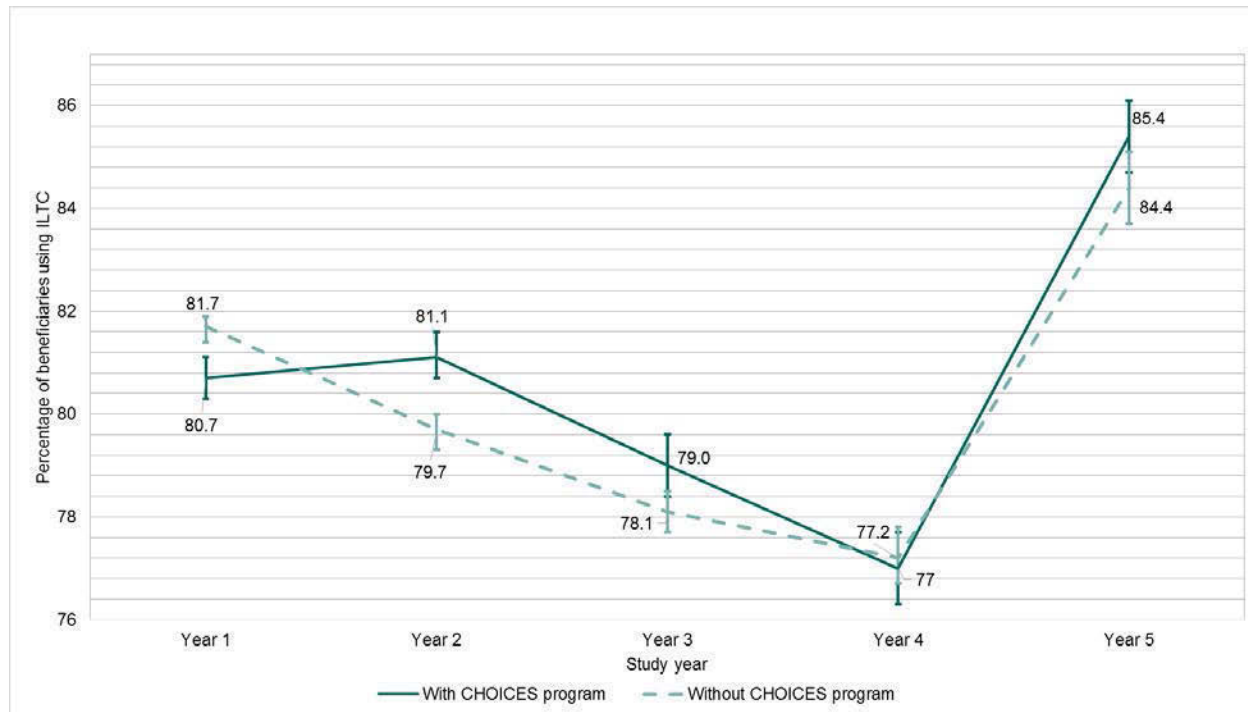
Source: Mathematica Policy Research analyses of 2009–2012 MAX and other data.

Notes: Confidence intervals are shown as the vertical bars around the regression-adjusted means.

ILTC = Institutional long-term care. ILTC was defined as services received in nursing facilities, mental hospitals for the aged, or institutional care facilities for people with developmental disabilities.

HCBS use. We estimated a 1.9 percentage point (95 percent CI: 0.9, 2.9) increase in HCBS use associated with CHOICES enrollment, averaged over the five-year period among Medicaid-only beneficiaries ($p < 0.001$) (Table IV.14). This result does not hold among dually eligible beneficiaries: we estimated a 10.5 percentage point (95 percent CI: −11.5, −9.6) decrease in the average probability of HCBS use associated with CHOICES, averaged over the five-year period ($p < 0.001$). Overall, Medicaid-only beneficiaries were much more likely than dually eligible beneficiaries to use HCBS, as the five-year average of the regression-adjusted mean rate of HCBS use of CHOICES enrollees is 97 percent among the Medicaid-only beneficiaries and only 67 percent among the dually eligible beneficiaries.

Because the dually eligible beneficiaries represented a large majority of our study population, results found among this subgroup drove our findings on the whole study population. We found that enrollment in CHOICES was associated with a reduction in the average beneficiary's probability of using HCBS during all five study years (Figure IV.5). The five-year average is a decrease of 8.7 percentage points (95 percent CI: −9.5, −7.9).

Table IV.14. Changes in HCBS use associated with CHOICES enrollment in Tennessee

Population and Year	Regression-adjusted means among CHOICES enrollees		Difference in means		
	With program (%)	Without program (%)	Difference	95% CI	*p*-value
All beneficiaries					
Year 1	72.2	77.6	-5.4	(-6.4, -4.4)	<0.001
Year 2	73.7	78.4	-4.7	(-5.8, -3.6)	<0.001
Year 3	73.7	80.6	-6.9	(-8.2, -5.6)	<0.001
Year 4	65.5	78.8	-13.4	(-14.9, -11.8)	<0.001
Year 5	69.6	82.8	-13.2	(-14.9, -11.5)	<0.001
5-year average	70.9	79.6	-8.7	(-9.5, -7.9)	<0.001
Full-benefit dually eligible beneficiaries					
Year 1	69.2	75.5	-6.3	(-7.4, -5.2)	<0.001
Year 2	70.8	76.5	-5.7	(-6.9, -4.4)	<0.001
Year 3	70.6	78.7	-8.1	(-9.6, -6.6)	<0.001
Year 4	60.7	76.5	-15.8	(-17.5, -14.0)	<0.001
Year 5	63.1	79.9	-16.8	(-18.8, -14.7)	<0.001
5-year average	66.9	77.4	-10.5	(-11.5, -9.6)	<0.001
Medicaid-only beneficiaries					
Year 1	96.2	94.9	1.3	(0.0, 2.6)	0.059
Year 2	95.8	93.3	2.5	(1.0, 4.1)	0.001
Year 3	96.3	94.8	1.4	(-0.1, 3.0)	0.074
Year 4	97.5	94.6	2.9	(1.3, 4.5)	<0.001
Year 5	97.6	96.3	1.3	(-0.2, 2.8)	0.080
5-year average	96.7	94.8	1.9	(0.9, 2.9)	<0.001

Source: Mathematica Policy Research analyses of state submitted finder file, 2009–2014 MAX and other data.

Notes: Results based on the combined matched comparison group from Georgia and Alabama.

Program refers to the CHOICES program. Regression-adjusted means without program show the expected level of the outcome among CHOICES enrollees had they not experienced the program (that is, no enrollment in CHOICES).

Any discrepancy between the difference in means shown and that calculated from numbers presented in the table is because of minor rounding adjustment.

HCBS = Home and community-based services. HCBS was defined as any claims with (1) a type of service indicating home health, personal care, case management, rehabilitation, hospice provided in the patient's home, private duty nursing, residential day care, or adult day care or (2) a flag according to the MAX HCBS taxonomy.

Figure IV.5. Expected probability of HCBS use among CHOICES enrollees in Tennessee
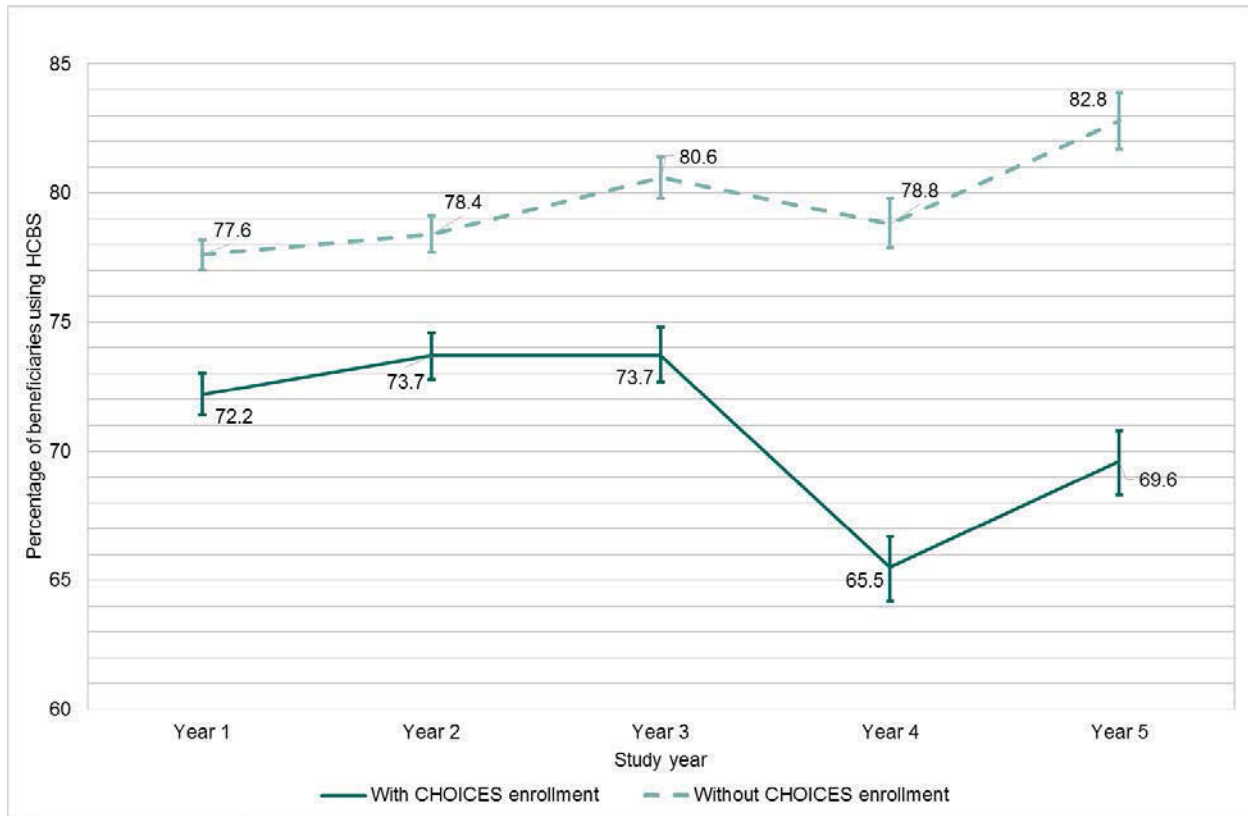
Source: Mathematica Policy Research analyses of 2009–2012 MAX and other data.

Notes: Confidence intervals are shown as the vertical bars around the regression-adjusted means.

HCBS = Home and community-based services. HCBS was defined as any claims with (1) a type of service indicating home health, personal care, case management, rehabilitation, hospice provided in the patient's home, private duty nursing, residential day care, or adult day care or (2) a flag according to the MAX HCBS taxonomy.

Personal care services. Analysis of the use of personal care services found that CHOICES was associated with an increase in the probability of using these services during all five years of the study (Table IV.15). The five-year average of this change was an increase of 1.2 percentage points (95 percent CI: 0.6, 1.8), and the result was statistically significant in all years, other than Year 4 ($p = 0.167$). We estimated a higher likelihood of personal care service use during each successive study year (Figure IV.6), increasing from 19 to 37 percent among the CHOICES enrollees, and from 18 to 35 percent if the same beneficiaries had not enrolled in CHOICES.

Table IV.15. Changes in personal care services use associated with CHOICES enrollment in Tennessee

Population and Year	Regression-adjusted means among CHOICES enrollees		Difference in means		
	With program (%)	Without program (%)	Difference	95% CI	*p*-value
All beneficiaries					
Year 1	18.9	18.3	0.6	(0.3, 0.9)	<0.001
Year 2	20.2	18.8	1.4	(0.9, 1.9)	<0.001
Year 3	21.2	19.7	1.4	(0.8, 2.1)	<0.001
Year 4	22.2	21.6	0.6	(-0.2, 1.4)	0.167
Year 5	36.9	34.9	2.0	(0.7, 3.3)	0.002
5-year average	23.9	22.7	1.2	(0.6, 1.8)	<0.001
Full-benefit dually eligible beneficiaries					
Year 1	17.4	16.9	0.5	(0.2, 0.8)	0.001
Year 2	18.5	17.5	1.0	(0.6, 1.5)	<0.001
Year 3	19.7	18.6	1.1	(0.4, 1.8)	0.002
Year 4	20.7	20.5	0.2	(-0.6, 1.0)	0.651
Year 5	34.7	33.5	1.2	(-0.1, 2.5)	0.080
5-year average	22.2	21.4	0.8	(0.2, 1.4)	0.006
Medicaid-only beneficiaries					
Year 1	32.6	31.4	1.2	(-0.1, 2.5)	0.069
Year 2	33.8	29.8	4.0	(2.1, 5.8)	<0.001
Year 3	32.9	28.8	4.1	(1.8, 6.4)	<0.001
Year 4	33.1	30.1	3.0	(0.3, 5.8)	0.032
Year 5	50.7	43.3	7.4	(2.8, 12)	0.002
5-year average	36.6	32.7	3.9	(1.9, 5.9)	<0.001

Source: Mathematica Policy Research analyses of state submitted finder file, 2009–2014 MAX and other data.

Notes: Results based on the combined matched comparison group from Georgia and Alabama.

Program refers to the CHOICES program. Regression-adjusted means without program show the expected level of the outcome among CHOICES enrollees had they not experienced the program (that is, no enrollment in CHOICES).

Any discrepancy between the difference in means shown and that calculated from numbers presented in the table is because of minor rounding adjustment.

Figure IV.6. Expected probability of personal care services use among CHOICES enrollees in Tennessee
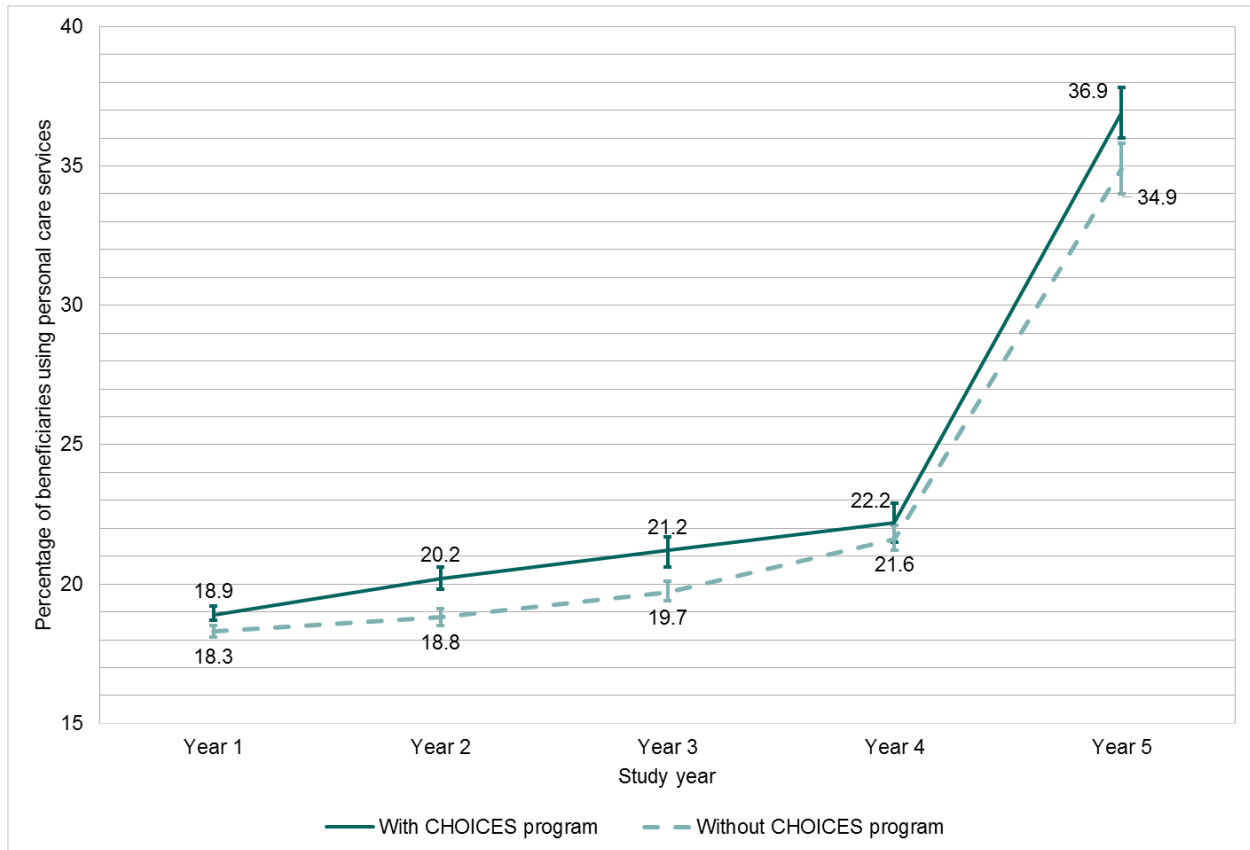
Source: Mathematica Policy Research analyses of 2009–2012 MAX and other data.
Notes: Confidence intervals are shown as the vertical bars around the regression-adjusted means.

We observed similar trends among both dually eligible and Medicaid-only beneficiaries. Enrollment in CHOICES was associated with increased use of personal care services in all populations in all years, but the result was stronger among Medicaid-only beneficiaries (five-year average of 3.9 percentage points [95 percent CI: 2.0, 6.0]) than among dually eligible beneficiaries (five-year average of 0.8 percentage points [95 percent CI: 0.2, 1.4]). Overall, a smaller percentage of dually eligible CHOICES enrollees used personal care services (22 percent over five years) compared to Medicaid-only beneficiaries (37 percent over five years). The opposite results on the use of HCBS and personal care services among the dually eligible beneficiaries suggests additional investigation on non–personal care HCBS, such as home services, may be necessary.

4.   CHOICES enrollment and use of hospital care

Finally, we present observed measures on use of hospital care, followed by regression-adjusted results for Tennessee.

a.   How CHOICES enrollees and the comparison groups compared on hospital use

Table IV.16 presents the unadjusted rates of hospital use among CHOICES enrollees, as well as the matched comparison groups from Alabama and Georgia. As in the New York

analysis, we considered three measures of hospital use: (1) whether the beneficiary was ever admitted to an acute care hospital during the year, (2) the total number of acute care hospital stays during the year, and (3) the total number acute care hospital days during the year.

By design, the matched comparison groups from Alabama and Georgia had patterns of hospital use relatively similar to those of the CHOICES enrollees at baseline (Year 0): 33 percent of the CHOICES population had at least one hospitalization before enrollment, compared to 33 and 32 percent in Alabama and Georgia, respectively. The three groups also had a very similar number of total hospital stays per 1,000 beneficiaries in the baseline year, although those hospitalizations did appear to result in more hospital days among CHOICES enrollees (six days per beneficiary), compared to beneficiaries in Alabama and Georgia (five days in both states).

After enrollment, we observed more hospital use, in general, among CHOICES enrollees than in the matched comparison groups. Due to partial-year observation of the last study year across states, we focus our description of the unadjusted results on the first three study years. On average over these years, 35 percent of CHOICES enrollees had at least one hospitalization in a given year, compared to 34 and 32 percent in the Alabama and Georgia comparison groups, respectively. The CHOICES enrollees also had slightly more hospital stays per 1,000 beneficiaries per year (629, compared to 570 and 552 in Alabama and Georgia, respectively), and more total hospital days per beneficiary (six, compared to five and four in Alabama and Georgia, respectively). Differences in hospitalization outcomes between CHOICES enrollees and the comparison groups were similar in the dually eligible and Medicaid-only subgroups. For example, over the first three study years, dually eligible CHOICES enrollees averaged 628 hospital stays per 1,000 beneficiaries per year, compared to 569 and 553 for the comparison groups in Alabama and Georgia, respectively. Similarly, among Medicaid-only beneficiaries, these numbers were 636 for CHOICES enrollees and 565 and 538 in Alabama and Georgia.

b. Regression-adjusted results on use of hospital care in Tennessee

Although MLTSS was not expected to directly affect hospitalization outcomes, our regression analysis found that enrollment in CHOICES was associated with an increase in hospital use. On average over the five-year study period, we found the average probability of at least one hospitalization in any given year increased by 2.3 percentage points (95 percent CI: 1.4, 3.2, $p < 0.001$) with CHOICES enrollment (Table IV.17a). We also found that CHOICES enrollment was associated with a higher total number of hospital stays by 96 stays per 1,000 beneficiaries per year (95 percent CI: 71, 120), and a higher total number of inpatient hospital days by 1.5 days per beneficiary per year (95 percent CI: 1.2, 1.8) (Tables IV.17b and IV.17c). The average number of hospital stays and inpatient hospital days per beneficiary was expected to decrease over time for CHOICES enrollees, with or without the program.

Table IV.16. Unadjusted hospital use among individuals enrolled in CHOICES and their matched comparison group, by year

	CHOICES Enrollees						Alabama Matched Comparison Group						Georgia Matched Comparison Group					
	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5*	Year 0	Year 1	Year 2	Year 3	Year 4*	Year 5	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5*
Total beneficiaries	10,153	10,153	7,940	6,127	4,740	3,715	10,153	10,153	7,659	6,013	4,756	n/a	10,153	10,153	7,574	5,927	4,649	3,752
Any admission to an acute care hospital (%)																		
All beneficiaries	32.8	36.4	35.0	32.2	30.1	18.7*	32.8	35.3	33.9	32.9	15.6*	n/a	32.1	33.9	31.1	30.6	28.5	16.4*
Full-benefit dually eligible beneficiaries	32.6	36.8	35.2	32.4	30.5	19.0*	32.9	35.5	34.1	33.1	16.3*	n/a	31.8	34.3	31.5	30.8	28.6	16.6*
Medicaid-only beneficiaries	34.4	33.4	33.6	31.0	27.1	17.1*	30.8	33.2	32.5	31.0	10.6*	n/a	33.8	30.7	27.6	29.3	27.9	15.3*
Number of acute care hospital stays (per 1,000 beneficiaries)																		
All beneficiaries	614	673	635	579	542	279*	588	595	567	547	212*	n/a	596	593	545	517	479	223*
Full-benefit dually eligible beneficiaries	603	677	631	576	550	284*	589	595	568	544	222*	n/a	585	593	548	518	476	227*
Medicaid-only beneficiaries	721	636	668	605	489	254*	539	590	557	548	134*	n/a	695	593	509	514	516	203*
Number of acute care hospitalized days (per beneficiary)																		
All beneficiaries	5.5	6.0	5.6	5.2	5.1	2.5*	4.8	4.8	4.5	4.5	1.8*	n/a	4.7	4.6	4.2	4.1	4.0	1.8*
Full-benefit dually eligible beneficiaries	5.3	5.9	5.4	5.1	5.2	2.6*	4.8	4.9	4.6	4.6	1.9*	n/a	4.5	4.6	4.2	4.1	4.0	1.8*
Medicaid-only beneficiaries	7.9	6.5	6.8	6.4	4.5	2.2*	4.0	4.3	3.9	3.8	1.0*	n/a	6.0	4.8	4.0	4.1	4.3	1.8*

Source: Mathematica Policy Research analyses of state submitted finder file, 2009–2014 MAX and other data.

*Utilization appears lower in the final available data year for all three states in the study because no beneficiaries are observed for a full year.

Table IV.17a. Changes in any acute care hospital admission (percentage of beneficiaries) associated with CHOICES enrollment in Tennessee

| Population and Year	Regression-adjusted means among CHOICES enrollees		Difference in means		
	With program (%)	Without program (%)	Difference	95% CI	*p*-value
All beneficiaries					
Year 1	38.5	37.1	1.4	(0.2, 2.5)	0.017
Year 2	37.3	34.4	2.9	(1.6, 4.2)	<0.001
Year 3	34.5	33.5	1.0	(-0.5, 2.4)	0.202
Year 4	32.0	29.7	2.3	(0.7, 4.0)	0.006
Year 5	34.3	30.4	3.9	(1.3, 6.5)	0.003
5-year average	35.3	33.0	2.3	(1.4, 3.2)	<0.001
Full-benefit dually eligible beneficiaries					
Year 1	39.0	37.9	1.2	(-0.1, 2.4)	0.064
Year 2	37.6	35.1	2.5	(1.1, 3.9)	<0.001
Year 3	34.8	34.3	0.6	(-1.0, 2.1)	0.489
Year 4	32.7	30.8	1.9	(0.1, 3.7)	0.040
Year 5	34.8	31.5	3.3	(0.5, 6.1)	0.022
5-year average	35.8	33.9	1.9	(0.9, 2.9)	<0.001
Medicaid-only beneficiaries					
Year 1	34.3	34.6	-0.3	(-3.7, 3.1)	0.861
Year 2	34.4	32.7	1.7	(-2.0, 5.5)	0.360
Year 3	32.1	31.7	0.5	(-3.6, 4.5)	0.827
Year 4	27.7	25.8	1.9	(-2.6, 6.4)	0.412
Year 5	31.5	29.2	2.3	(-4.4, 9.0)	0.506
5-year average	32.0	30.8	1.2	(-1.4, 3.8)	0.361

Source: Mathematica Policy Research analyses of state submitted finder file, 2009–2014 MAX and other data.

Notes: Results based on the combined matched comparison group from Georgia and Alabama.

Program refers to the CHOICES program. Regression-adjusted means without program show the expected level of the outcome among CHOICES enrollees had they not experienced the program (that is, no enrollment in CHOICES).

Any discrepancy between the difference in means shown and that calculated from numbers presented in the table is because of minor rounding adjustment.

Table IV.17b. Changes in total acute care hospital stays (per 1,000 beneficiaries) associated with CHOICES enrollment in Tennessee

Population and Year	Regression-adjusted means among CHOICES enrollees		Difference in means		
	With program (count per 1,000 beneficiaries)	Without program (count per 1,000 beneficiaries)	Difference	95% CI	*p*-value
All beneficiaries					
Year 1	764	690	74	(43, 105)	<0.001
Year 2	719	620	99	(64, 133)	<0.001
Year 3	657	590	68	(30, 106)	<0.001
Year 4	605	509	96	(53, 138)	<0.001
Year 5	638	495	143	(71, 216)	<0.001
5-year average	677	581	96	(71, 120)	<0.001
Full-benefit dually eligible beneficiaries					
Year 1	775	701	74	(41, 107)	<0.001
Year 2	721	632	89	(52, 125)	<0.001
Year 3	657	601	57	(16, 97)	0.006
Year 4	619	527	92	(46, 138)	<0.001
Year 5	647	515	132	(52, 211)	0.001
5-year average	684	595	89	(62, 115)	<0.001

Table IV.17b. *(continued)*

Population and Year	Regression-adjusted means among CHOICES enrollees		Difference in means		
	With program (count per 1,000 beneficiaries)	Without program (count per 1,000 beneficiaries)	Difference	95% CI	*p*-value
Medicaid-only beneficiaries					
Year 1	683	673	10	(-81, 100)	0.838
Year 2	709	595	114	(11, 217)	0.030
Year 3	665	573	91	(-23, 205)	0.119
Year 4	507	441	66	(-46, 178)	0.249
Year 5	585	467	118	(-64, 299)	0.204
5-year average	630	550	80	(12, 148)	0.022

Source: Mathematica Policy Research analyses of state submitted finder file, 2009–2014 MAX and other data.

Notes: Results based on the combined matched comparison group from Georgia and Alabama.

Program refers to the CHOICES program. Regression-adjusted means without program show the expected level of the outcome among CHOICES enrollees had they not experienced the program (that is, no enrollment in CHOICES).

Any discrepancy between the difference in means shown and that calculated from numbers presented in the table is because of minor rounding adjustment.

Table IV.17c. Changes in number of acute care hospitalized days (per beneficiaries) associated with CHOICES enrollment in Tennessee

Population and Year	Regression-adjusted means among CHOICES enrollees		Difference in means		
	With program (count per beneficiary)	Without program (count per beneficiary)	Difference	95% CI	*p*-value
All beneficiaries					
Year 1	6.8	5.5	1.4	(1.0, 1.7)	<0.001
Year 2	6.3	4.8	1.4	(1.1, 1.8)	<0.001
Year 3	5.9	4.7	1.3	(0.8, 1.7)	<0.001
Year 4	5.8	4.3	1.5	(1.0, 2.0)	<0.001
Year 5	5.9	4.0	1.9	(1.1, 2.8)	<0.001
5-year average	6.1	4.6	1.5	(1.2, 1.8)	<0.001
Full-benefit dually eligible beneficiaries					
Year 1	6.8	5.6	1.3	(0.9, 1.6)	<0.001
Year 2	6.1	4.9	1.2	(0.8, 1.6)	<0.001
Year 3	5.8	4.8	1.0	(0.6, 1.5)	<0.001
Year 4	5.9	4.4	1.5	(0.9, 2.0)	<0.001
Year 5	6.1	4.1	2.0	(1.0, 2.9)	<0.001
5-year average	6.1	4.8	1.4	(1.1, 1.7)	<0.001
Medicaid-only beneficiaries					
Year 1	7.1	5.2	1.8	(0.6, 3.0)	0.003
Year 2	7.2	4.8	2.4	(1.1, 3.7)	<0.001
Year 3	7.0	4.3	2.6	(1.2, 4.1)	<0.001
Year 4	4.7	3.8	0.9	(-0.4, 2.1)	0.181
Year 5	5.3	3.7	1.5	(-0.4, 3.4)	0.121
5-year average	6.2	4.4	1.8	(1.1, 2.6)	<0.001

Source: Mathematica Policy Research analyses of state submitted finder file, 2009–2014 MAX and other data.

Notes: Results based on the combined matched comparison group from Georgia and Alabama.

Program refers to the CHOICES program. Regression-adjusted means without program show the expected level of the outcome among CHOICES enrollees had they not experienced the program (that is, no enrollment in CHOICES).

Any discrepancy between the difference in means shown and that calculated from numbers presented in the table is because of minor rounding adjustment.

Estimates did not differ substantially between dually eligible and Medicaid-only beneficiaries. Both groups demonstrated modest increases in hospital use associated with enrollment in CHOICES. However, due in part to the smaller sample size, results for the Medicaid-only group are less likely to be statistically significant. Over the five-year study period, we estimated that CHOICES enrollment was associated with an increased average probability of at least one hospitalization in any given year of 1.9 percentage points for dually eligible beneficiaries (95 percent CI: 0.9, 2.9) and 1.2 percentage points for Medicaid-only beneficiaries (95 percent CI: −1.4, 3.8). Similarly, we estimated that CHOICES enrollment was associated with 89 additional hospital stays per 1,000 beneficiaries (95 percent CI: 62, 115) and 1.4 additional inpatient days (95 percent CI: 1.1, 1.7) for dually eligible enrollees, similar to the 80 additional hospital stays per 1,000 beneficiaries (95 percent CI: 12, 148) and 1.8 additional inpatient days (95 percent CI: 1.1, 2.6) we estimated for Medicaid-only enrollees. In general, we estimated slightly higher hospital use among Medicaid-only enrollees, regardless of CHOICES enrollment, than we do for the dually eligible enrollees. Lower estimates for dually eligible enrollees are likely a consequence of having incomplete encounter data for Medicare Advantage enrollees.

V. DISCUSSION

A. Current findings

This interim evaluation of MLTSS programs in New York and Tennessee yielded mixed results for the goal of rebalancing care from institutional settings toward care in home and community-based settings. In New York, the probability of using any institutional care was lower after enrollment in MLTC and the probability of using HCBS and personal care was higher. In Tennessee, the probability of using personal care was higher after enrollment in CHOICES. We also found a higher likelihood of HCBS use among Medicaid-only beneficiaries but a lower likelihood among dually eligible beneficiaries. Institutional care showed relatively small and inconsistent results across years in the Tennessee study.

These findings are largely consistent with previous evaluations of first-generation MLTSS programs, such as those in Arizona and Wisconsin, which progressively increased the use of HCBS and diminished the use of nursing home care (Saucier et al. 2005). Nonetheless, slightly greater shares of female and dually eligible enrollees in the two study samples, compared to all enrollees in the New York and Tennessee MLTSS programs during the study period, suggests caution in generalizing the findings to the entire programs in the two states. In addition, several factors may have contribute to differences between the study and comparison populations (discussed in Section VI). Moreover, because of differences in state MLTSS program design, which lead to differences in the characteristics of individuals who enroll and how they interact with acute and LTSS services, results cannot be generalized to all state MLTSS programs.

At the same time, differences in how New York and Tennessee designed their programs, such as voluntary versus mandatory enrollment, varying eligibility criteria, and different sets of benefits covered (LTSS only versus LTSS and acute care), may explain some of the inconsistent findings in outcomes across the two states. Although not a design feature per se, New York's balance between institutional and HCBS care spending at the start of the study period was more equal than that in Tennessee. Each state also had different LTSS provider supply patterns during the study period. These and other factors are discussed below, as potential explanations for differences in the results across the two states.

MLTSS enrollment was associated with lower use of institutional care in New York but produced little change in Tennessee. Rates of institutional care among MLTSS enrollees varied greatly between New York, with a regression-adjusted mean of 15 percent across three study years, and Tennessee, with a regression-adjusted mean of 81 percent across five study years. The size of the gap appeared to be largely due to differences in program eligibility and enrollment policies. Because New York exempted current nursing home residents from enrolling in MLTC, and allowed voluntary enrollment among LTSS users living in the community who required 120 days or more of HCBS, nearly all MLTC enrollees were existing HCBS users. In contrast, from the start of Tennessee's program, nursing home residents, as well as those who qualified for nursing home care but could be served in home and community-based settings, were required to enroll in CHOICES managed care plans. Consequently, when CHOICES began in 2010, approximately 84 percent of all elderly and individuals under age 65 with physical disabilities receiving Medicaid LTSS resided in nursing homes (TennCare n.d.).

That Tennessee's rate of institutional care did not decline significantly over time, relative to the comparison groups, may reflect LTSS system rebalancing efforts that occurred in most states in 2010–2014, including Georgia and Alabama. In Georgia, HCBS as a share of total LTSS spending increased from 39 percent in 2010 to 48 percent in 2014; in Alabama, HCBS as a share of total LTSS spending rose from 35 percent in 2010 to 42 percent in 2014; whereas in Tennessee, the share increased from 42 to 53 percent between 2010 and 2014 (Irvin et al. 2017).

MLTSS enrollment was associated with higher use of personal care in both states, but significantly more in New York than in Tennessee. Of the six measures of LTSS and hospital use examined, only personal care showed similar results across both study states. That is, a higher percentage of individuals in both states used personal care following MLTSS enrollment. However, the increase was much greater in New York (33 percentage point) than in Tennessee (1 percentage point). Actual use of personal care in Tennessee could be higher than what we found in Medicaid encounter claims, however, if it was provided through self-direction, often paid as a monthly lump sum. For example, in 2013, approximately 1,600 CHOICES enrollees were reported to be self-directing their services (Crisp et al. 2014), whereas New York's MLTC program did not offer self-direction options during nearly all of the study period.[16]

Another factor that may influence personal care use is provider supply, as beneficiaries may have easier access to personal care if more providers are available. During the study period, New York had the largest supply of personal care providers in the country, with 43 home health and personal care aides per 100 adults with limitations in ADLs in 2010–2012 (Reinhard et al. 2017). The supply of home health and personal care aides in Tennessee and its comparison states was much lower (10 aides per 100 adults with limitations in ADLs in Tennessee and Georgia, and 7 in Alabama in 2010–2012), despite modest growth (3 percent growth in the number of aides per 100 adults with limitations in ADLs in Tennessee and Alabama, and 1 percent growth in Georgia by 2013–2015 [Reinhard et al. 2017]).

Use of HCBS differed in the two states and across subpopulations. MLTC enrollment was associated with a higher likelihood of using HCBS (99 versus 95 percent), whereas CHOICES enrollment in Tennessee was associated with a lower likelihood of HCBS use (71 versus 80 percent). However, the latter was mostly driven by results from the dually eligible beneficiaries who represented 87 percent of our study population in Tennessee. Among Medicaid-only beneficiaries in Tennessee, CHOICES enrollment was associated with a 2 percentage point increase in an already high use of HCBS at baseline. Given our previous finding of higher personal care use associated with CHOICES enrollment, it is certainly worth further investigation to tease out a separate trend in HCBS use that is not personal care (such as home health), to better understand this result for the dually eligible beneficiaries in Tennessee. In addition, although we do not have comparable data to evaluate the functional level of need

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[16] New York subsequently added self-direction to MLTC; as of November 1, 2012, the Consumer-Directed Personal Assistance Program was included in the MLTC benefit package.

among MLTSS enrollees across the two states, the changes in CHOICES' program policies during our study period may partly explain the difference.[17]

Results on hospital use were mixed. In New York, MLTC enrollment was associated with a decrease in all three measures of hospital care (any admission, number of stays, and days). In Tennessee, by contrast, CHOICES enrollment was associated with a slightly increased likelihood of hospital admissions and more stays and days. Among the three measures of hospital use, only hospital days show statistically significantly changes associated with MLTSS enrollment for both dual eligibles and Medicaid-only beneficiaries in both states. However, the changes were negative for New York and positive for Tennessee.

Because health plans in both states were not responsible for Medicare acute spending among dually eligible enrollees and because we do not have hospitalization data from Medicare Advantage plans, it is important to separately examine changes in hospital use for Medicaid-only beneficiaries. For this group, New York's MLTC program covered LTSS only, whereas Tennessee's CHOICES program covered LTSS and acute care. Even though MLTC plans did not cover acute care services, enrollees in New York were estimated to spend almost three days less in the hospital per beneficiary per year than they would have if they had not been enrolled in MLTC. This could be due to voluntary enrollment during the study period, which usually results in people with better health enrolling in managed care and those in poorer health with more chronic conditions choosing to remain in FFS (Burns 2009; Billings et al. 2000). Consequently, even though the CDPS scores were similar for the MLTC study population and the comparison group, MLTC enrollees may have been healthier or better off in other respects, such as living with a spouse or family member, than those in the comparison group. In contrast, Medicaid-only CHOICES enrollees in Tennessee were estimated to spend almost two more days in the hospital each year after enrollment, even though MLTSS health plans were financially responsible for their hospital stays. The mixed results on hospital use for Medicaid-only enrollees suggests that MLTSS health plans in Tennessee focused on reducing long-term institutional admissions, rather than acute care admissions. Analyses of avoidable hospitalization rates in the final evaluation report may shed more light on whether health plans are increasing access to primary care and improving control of chronic health conditions. Further investigation on post-acute care transition and coordination efforts would help us better understand these results.

There were few differences in LTSS outcomes between dual and Medicaid-only enrollees. Except for HCBS use in Tennessee, there were no discernible patterns in LTSS outcomes for dually eligible enrollees compared to Medicaid-only MLTSS enrollees in either state, suggesting that MLTSS enrollment did not have a stronger association with LTSS outcomes for one group over the other. This result likely reflects the fact that MLTSS health plans bore the same financial risk for LTSS for both types of beneficiaries.

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[17] The increase in use of HCBS in Years 2 and 3 of CHOICES may be explained by the state's increased number of "slots" for new applicants to receive HCBS. In state fiscal year 2011–2012, the cap was lifted from 11,000 to 12,500 people, and in state fiscal year 2012–2013, the cap was lifted from 12,500 to 15,000 (TennCare, Fiscal Year 2011–2012 Annual Report, https://www.tn.gov/content/dam/tn/tenncare/documents/tenncareannual1112.pdf). The reasons for the subsequent drop in HCBS use in Years 4 and 5 of the study period (remainder of 2013 and in 2014) remain unclear.

Differences in program maturity at the start of the study periods may have contributed to differences in findings. Differences in the length of time each program had been operating at the start of the study period may have contributed to the relatively stronger performance of MLTC compared to CHOICES. In the first study year (April 2009–March 2010), MLTC had been in place for over a decade, which may have given participating managed care plans greater experience in providing home and community supports to divert individuals from nursing facilities. In contrast, in Tennessee the beginning of the first study year was the start of CHOICES, when the state's LTSS system ranked 37th in share of total LTSS spending on HCBS among all states (Wenzlow et al. 2016). However, the expected time trend in changes of outcomes associated with MLTSS enrollment (that is, a stable trend for New York and an increasing trend for Tennessee) was not well supported, suggesting the relationship between program maturity and outcomes over time requires further investigation and perhaps a longer follow-up period.

B. Future analyses

For this interim evaluation report, we examined a subset of utilization outcome measures associated with MLTSS program enrollment. In the future, we will consider whether it is possible to add measures of LTSS use, hospital use, and care quality that can be constructed with administrative data, for example: (1) long-term institutional stays (that is, any nursing facility stay beyond 100 days, whether or not the admission followed a hospitalization); (2) potentially avoidable hospitalizations; and (3) severe pressure ulcers. We will also explore the feasibility of examining the actual amount of personal care services used, in addition to whether there is any use of personal care as identified in the current report. Furthermore, we will obtain data to identify, and potentially drop from our sample, any individuals enrolled in a Medicare Advantage plan for whom encounter data are not available. We will also consider adding sensitivity analyses to our study. These could include estimates controlling for continuous enrollment in MLTSS throughout the study period to understand how attrition affects our analysis, and adding a measure of any HCBS use that excludes personal care to better explain the opposite results on use of HCBS and personal care services in Tennessee among dually eligible beneficiaries.

In 2019, we also plan to conduct a final evaluation of MLTSS programs that expands the scope to potentially include additional measures and additional data sources (for example, the Transformed Medicaid Statistical Information System, or T-MSIS). It may also rely on different evaluation designs. For example, it may examine trends among individuals who join MLTSS after the initial wave of enrollment or use a matching strategy that relies on variables specified at the monthly, rather than annual, level.

VI. LIMITATIONS

Every evaluation faces limitations. The outcomes we examined are measures of utilization that we could construct from administrative claims data. We were unable to collect data directly from beneficiaries, managed care plans, providers, or states through surveys or other methods due to limited contract resources. Consequently, we could not examine important outcomes of MLTSS programs, such as beneficiary experience with managed care plans and services, changes in self-reported health status, quality of life ratings, satisfaction with providers, and other key indicators of program effectiveness. Focusing on utilization outcome measures, the most important limitations we faced when evaluating the MLTSS programs in New York and Tennessee were related to data availability and quality. Data limitations and the program features together further constrained our choices of methodology. We discuss both below.

We encountered three important data-related limitations when conducting the evaluation for New York and Tennessee. First, we found variation in the completeness and quality of Medicaid encounter data in MAX across states and years, which led to our inclusion of only two states for the rigorous evaluation presented in Section IV (see Libersky et al. 2017 for more details on the selection of New York and Tennessee). Second, we were unable to obtain encounter data for Medicare Advantage enrollees in our study. The absence of these data does not affect our analysis of LTSS outcomes, which focused on Medicaid services only. However, for the hospital use outcomes, our data are incomplete for an estimated 20 percent of dually eligible beneficiaries in 2012 who enrolled in Medicare Advantage or another type of managed care plan, such as PACE (MedPAC and MACPAC 2017). For this reason, we present the hospitalization outcomes separately for dually eligible and Medicaid-only beneficiaries. Finally, MAX's lack of (or limited) information about beneficiaries constrained our ability to find an ideal comparison group, which in turn, might have caused bias in the regression-adjusted estimates. We provide more details about this last data limitation next.

MAX does not contain a single variable or set of variables that can be used to identify beneficiaries enrolled in or eligible for MLTSS across states. MLTSS enrollees in MAX are reported across multiple plan types, including comprehensive plans (which cover acute care and LTSS under a single plan), MLTSS only plans (which cover only limited LTSS benefits), and other plan types. States report plan-specific codes in plan ID fields, but if any managed care plan provides comprehensive medical services with and without MLTSS, MAX users cannot combine the plan type and plan ID fields to isolate MLTSS enrollees. In New York, we identified MLTC enrollees based on a combination of uniform eligibility group, plan ID, and plan type from MAX's person summary file, which could suffer from the usual data quality concerns. In Tennessee, we identified CHOICES enrollees using a finder file obtained directly from the state, which gives us higher confidence in capturing the enrollees accurately. Identifying MLTSS enrollees requires a specific approach for each state, which can be increasingly challenging if more states are included in the evaluation.

To identify a matched comparison group as similar as possible to MLTSS enrollees, we ideally would apply the same eligibility criteria that are used to qualify enrollees to the potential comparison population. Unfortunately, the precise criteria used by each state for determining MLTSS eligibility was not possible to replicate exactly with the administrative data available for the analysis. We developed our own criteria for each state based on observed utilization patterns,

but we know that our criteria did not align perfectly with what was actually used by the MLTC and CHOICES programs. The result is that we likely included some individuals as potential comparison beneficiaries who would not have been eligible for the program, and excluded others who would have been eligible. Table VI.1 gives an example from Tennessee. Using our own criteria, we would have identified 55,927 beneficiaries eligible for CHOICES, all of whom should have been enrolled, because enrollment is mandatory. In reality, only 18,554 were enrolled, suggesting our eligibility criteria, which are used to identify the comparison groups in Alabama and Georgia, might be too loose. Although matching helped mitigate this effect by ensuring the comparison group was similar to enrollees on observed characteristics, it did not eliminate it completely.

Table VI.1. Comparison of beneficiaries meeting eligibility criteria to those with actual CHOICES enrollment, 2010

	Beneficiary Meeting Eligibility Criteria	Beneficiaries Not Meeting Eligibility Criteria
Beneficiaries with actual CHOICES enrollment	18,554	1,023
Beneficiaries without actual CHOICES enrollment	37,373	1,494,084

Source: Mathematica Policy Research analyses of state submitted finder file, 2009–2014 MAX and other data.

The HCBS taxonomy is not available on encounter data (any years) or FFS data before 2010. The HCBS taxonomy provides a common language for identifying and analyzing HCBS claims across states, because states label HCBS claims using state-specific coding schemes that can change from one year to the next. MAX began applying the HCBS taxonomy to FFS HCBS claims submitted under 1915(c) waivers beginning in 2010 but not to HCBS provided through the state plan or to encounter claims for HCBS. Because our analysis studies HCBS provided under managed care as well as FFS, we replicated the methodology that MAX uses to apply the taxonomy to FFS claims for encounter claims in New York and Tennessee. Any problems in the underlying HCBS encounter data could have created inaccuracies during this application. To enable the study to include data from calendar year 2009, we also applied the taxonomy to FFS claims in all states for 2009, using state-submitted crosswalks from 2010. We do not have a way to verify that the state codes on which the taxonomy is based were the same in 2009 and 2010; any differences between years (particularly in codes for prevalent services, such as personal care) could lead to an inaccurate categorization of services in the HCBS taxonomy.

Individual HCBS taxonomy codes include multiple service types, some of which may not be covered by a given state. To construct a comparison group for Tennessee, we used the uniform eligibility groups in combination with service utilization, including HCBS taxonomy codes, to identify people in Alabama and Georgia who used service categories covered under CHOICES. This method was imprecise because the service categories in the taxonomy could include subcategories of services covered in Georgia and Alabama but not Tennessee (see Appendix D). For example, we used the taxonomy code for "round-the-clock services" to catch community-based residential alternatives[18] available in CHOICES; however, this could have also

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[18] Tennessee's Medicaid agency defines *community-based residential alternatives* as places to live that offer care and support for someone who can no longer live alone. Such places include (1) assisted care living facilities, (2)

picked up any group living, shared living, or in-home residential habilitation services, mental health or otherwise, covered in Alabama or Georgia but not Tennessee. Any differences in services available to the MLTSS enrollees and matched comparison group could have influenced outcomes.

MAX does not have information on the functional need of Medicaid beneficiaries. Information on enrollees' functional need (such as the ability to perform various ADLs) can help explain variation in outcomes observed across a diverse MLTSS population, but someone's functional status is not captured in MAX data. Without functional assessment information, we are unable to control for variation in the underlying level of functional need that influences service use or determines eligibility for a nursing facility level of care, usually defined by a minimum number of functional deficits. For both studies, we addressed this limitation by approximating a nursing facility level of care based on past service use, as part of the eligibility criteria. We also used CDPS to help adjust for differences in medical risk. However, the CDPS algorithm does not examine diagnoses contained on long-term care records, nor does it examine functional limitations. Because it is not clear how the functional limitations of beneficiaries in each MLTSS program differed from the matched comparison groups, we cannot determine the direction of the bias that might be in our estimates as a result of our inability to control precisely for functional status.

Other unobserved beneficiary characteristics. The goal of matching is to identify comparison groups as similar as possible to the MLTSS enrollees on all characteristics before enrollment. However, matching can only be based on observed data: if there are unobserved beneficiary characteristics that differ between the enrollees and the comparison groups, and these features are associated with outcomes, it can induce selection bias that affects our estimates. For example, beneficiaries often gain eligibility for MLTSS as a result of some acute medical event, such as a fall, stroke, or other debilitating episode. For enrollees who experienced such an acute event, it is important that they be matched to a comparison beneficiary who also experienced a similar event around the same time. Failing to do so could lead to very different patterns of service use during follow-up, having nothing to do with MLTSS enrollment. Unfortunately, we do not currently have data detailed enough to accurately identify individuals with all possible acute events. To mitigate the effect of this problem on our evaluation, we limited our study population to beneficiaries who were less likely to enroll in MLTSS only as a result of recent acute events: the existing MLTC enrollees as of early 2009 and those enrolled in CHOICES during the mandatory rollout months in 2010. One consequence of this approach is that it limited the generalizability of our results. If MLTSS works differently in the time period immediately following an acute event than it does months or years later, this difference would not be captured in our estimates.

In addition to the above data limitations, the program features for MLTC and CHOICES have implications for our approach, too. The MLTC program has existed in New York and remained voluntary for nearly two decades. Our study period, however, started in 2009. This means we are unable to observe information before enrollment for the existing enrollees as of

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community living supports (individual and family models), (3) critical adult care homes, and (4) companion care. More information is available at https://www.tn.gov/tenncare/long-term-services-supports/choices/what-home-care-services-are-covered-in-choices.html

early 2009. The only information we can control for in the New York analysis, either in matching or through regression adjustment, is variables that are strictly exogenous: those not affected by one's enrollment in MLTC. Beneficiary demographics are obvious examples of such variables. We also assume that chronic conditions, as measured by the CDPS system, as well as the presence of dementia, are not affected by MLTSS enrollment. We cannot adjust for utilization, including baseline levels of LTSS or hospital use, ED visits, time spent in a skilled nursing facility, or ILTC expenditures, because enrollment in MLTC is likely to affect these measures. By matching on patient demographics and chronic conditions, we tried to mitigate the unobserved imbalance in one's experience before enrollment, but there may still be residual selection bias in our estimates. Readers should use caution when interpreting results for New York.

   For Tennessee, because CHOICES started with mandatory enrollment, we had to look elsewhere to find a comparison group. The choice of Alabama and Georgia as comparison states for Tennessee may have influenced the relative performance of CHOICES. Among the potential comparison states, Alabama and Georgia most closely resembled Tennessee on seven measures of LTSS supply, demand, and policy (Appendix C). It is likely that these two states differed from Tennessee on other observable and unobservable characteristics; therefore, we separately matched CHOICES enrollees with beneficiaries in each state and ran regression models for each state respectively (Appendix E).

   The previously presented result on the increasing use of ILTC associated with CHOICES enrollment seemed to be mainly driven by Georgia (Appendix E, Table E.1). For use of HCBS, separately comparing Tennessee to Georgia and Alabama demonstrates decreasing use associated with CHOICES enrollment, similar to the combined comparison group, but the reduction is smaller in Georgia relative to Alabama (6.8 versus 12.3 percent) (Appendix E, Table E.2). Results from the models that compare Georgia to Tennessee showed more positive association of CHOICES enrollment with the use of personal care than models that compared Alabama to Tennessee (Appendix E, Table E.3). It is tempting to identify the single comparison state that presented the most favorable results on each measure; however, both Alabama and Georgia were similar to Tennessee on the same number of LTSS supply, demand, and policy factors examined for their selection. Therefore, we present results in Tennessee relative to a comparison group that combined individuals in both states in the main body of this report. Although this approach makes it more difficult to tease out state-specific effects, it provides a greater sample size and may better represent the experience of LTSS users under FFS, in the absence of MLTSS.

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APPENDIX A

**DATA AND METHODS USED TO EVALUATE OUTCOMES
IN NEW YORK AND TENNESSEE**

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Here we describe in details data and methods used to evaluate the LTSS and hospital care outcomes associated with MLTSS enrollment in New York and Tennessee, as well as their limitations.

A. Data sources

The analyses presented in Section IV used individual-level Medicaid and Medicare administrative data collected by CMS. Medicaid information from 2009–2014 was derived from the MAX data files, which contain individual-level information on eligibility, managed care plan enrollment, and claims for all Medicaid beneficiaries in all states and the District of Columbia. Service claims include those paid on an FFS or capitated basis (referred to as "encounter claims"). Medicare information was derived from two files: (1) the Master Beneficiary Summary File, which contains annual summary level variables on eligibility, spending, and service use for all Medicare beneficiaries; and (2) the Medicare Provider Analysis and Review (MedPAR) file, which summarizes inpatient hospital and skilled nursing facility final action stay records. Reliable encounter claims for dual eligibles enrolled in Medicare Advantage were not available for our study period.

B. Outcomes measures

We include two set of outcome measures in this evaluation—one on utilization of LTSS, the other on utilization of inpatient hospital service.

1. Long-term care measures

We calculated three beneficiary-level measures of long-term care use on a yearly basis: (1) a 0/1 indicator of whether an individual used any Medicaid ILTC during the year, (2) a 0/1 indicator of whether an individual used any Medicaid HCBS during the year, and (3) a 0/1 indicator of whether an individual received a Medicaid personal care visit during the year. To identify individuals who used HCBS provided under the state plan or through a waiver, including personal care, we used a combination of type of service provided on claims and the HCBS taxonomy. The taxonomy uses a combination of procedure and place of service codes to categorize state-specific HCBS into 18 common categories of service (Peebles and Bohl 2014).[19] MAX applies the taxonomy to all FFS claims for services provided through a 1915(c) waiver from 2010 and later. We used state-specific crosswalks of procedure codes from 2010 to replicate the MAX taxonomy for all claims in 2009, and encounter claims in 2010–2014.

For Measure 1, we considered institutional long-term care users to be anyone with a MAX claim in which the type of service indicated a stay in a nursing facility, mental hospital for the aged, or institutional care facility for people with developmental disabilities (New York only). For Measure 2, we considered HCBS users to be anyone with a MAX claim in which (1) the type of service indicated home health, state plan personal care, targeted case management, rehabilitation, hospice provided in the patient's home, private duty nursing, residential care, or adult day care; or (2) the claim was flagged as HCBS according to the HCBS taxonomy. For

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[19] More information about the HCBS taxonomy is available at:
https://www.cms.gov/mmrr/Downloads/MMRR2014_004_03_b01.pdf

Measure 3, we defined personal care visits as claims that indicated that the type of service was state plan personal care or had an HCBS flag for home-based services, including personal care.

2. Inpatient hospital measures

We calculated three beneficiary-level measures of inpatient hospital care on a yearly basis: (1) a 0/1 indicator of whether an individual was ever admitted to an acute care hospital during the year, (2) the number of acute care hospital stays during the year, and (3) the number of inpatient hospital days each year. Using MAX inpatient claims, we defined a hospital stay based on one or more inpatient claims from the same provider in which the service begin and end dates for the claims overlapped or were separated by one day or less. For dually eligible beneficiaries, we linked the stays we constructed from MAX data with predefined stays reported in MedPAR data. Any stays that occurred over the same service period in both MAX and MedPAR but did not indicate that Medicare benefits were exhausted were counted as one unique stay. For Measures 1 and 2, stays that spanned study years were only counted in the year in which the admission occurred. For Measure 3, inpatient days were counted according to the study year which those days belonged to.

C. Study population

Using two different approaches and inclusion/exclusion criteria, we identified MLTSS enrollees and potential comparison groups for New York and Tennessee, which we describe separately below.

1. Identifying MLTSS enrollees

New York. We identified individuals who ever enrolled in the MLTC program from 2009 to 2012 based on the plan type and plan ID variables in the MAX person summary file. Specifically, we considered a beneficiary to be enrolled in MLTC during the month if he or she was enrolled in a plan type indicating MLTSS-only benefits or had a plan ID with "72" or "74" in positions 9 and 10 (indicating that the plan was an MLTC plan). We did not track enrollment past 2012 because we made a decision to end our study period before June 2012. After that month, MLTC became mandatory in New York, so the conditions surrounding enrollment and implementation of the program changed enough that we did not consider it appropriate to model outcomes before and after that date in the same analysis.

Tennessee. We identified individuals who ever enrolled in the CHOICES MLTSS program from 2010 to 2014 using a finder file produced by Tennessee in September 2016. Although CHOICES offers three levels of benefits that correspond with different levels of eligibility (referred to as CHOICES 1, 2, and Interim CHOICES 3), we did not distinguish enrollment by benefit group.

2. Identifying potential comparison group members

New York. For the New York study, we compared MLTC enrollees to a group of individuals who were eligible for MLTC but chose not to enroll (that is, an individual received all LTSS on an FFS basis). To be eligible for MLTC during our study period, an individual had to meet the state's nursing facility level of care criteria. When New York introduced mandatory MLTSS in 2012, it relaxed the program's eligibility and also extended eligibility to individuals

who needed more than 120 days of community-based long-term care services. Because MAX does not include an indicator for nursing facility level of care during any time period, we used a more general definition of eligibility (that is, claims indicated that a beneficiary either used institutional care or 120 days or more of community-based LTSS) as a proxy for eligibility for MLTC. Analyses from the New York State Department of Health confirmed that the overall functional scores of individuals eligible for MLTC during our study period were relatively comparable to those who met the mandatory MLTSS requirement of 120 days of community-based long-term care (New York State Department of Health 2012 and 2013).

Following MLTC program eligibility rules, we included in the potential comparison group any Medicaid-only or dually eligible adults age 18 and older who (1) resided in a county in which MLTC was available; and (2) used nursing facility care or 120 days or more of community-based long-term services, as indicated by the MAX type of service or HCBS taxonomy codes found on ambulatory claims records. MLTC provides the following services to its enrollees: nursing facility care, private duty nursing, home health care, personal care, and adult day health care. Therefore, we considered any beneficiary to be meeting the program eligibility criteria if the first and last day of the use of an MLTC-covered service spanned 120 days or more, with gaps of no more than 30 days between consecutive services. We considered eligibility to begin during the month in which the HCBS use began, continuing through the remainder of the year. We excluded any individuals enrolled in 1915(c) waivers or other special programs that prevented them from participating in MLTC.[20]

Tennessee. For the Tennessee study, we compared CHOICES enrollees to a group of beneficiaries in Georgia and Alabama who received LTSS under FFS but would have been eligible for CHOICES had they lived in Tennessee. We derived the FFS comparison group from beneficiaries in states other than Tennessee because CHOICES required mandatory enrollment for all eligible individuals; therefore, an in-state comparison group did not exist. We identified Georgia and Alabama to be appropriate comparison states because they were most like Tennessee on seven measures of supply and demand for LTSS, geography, and policy factors related to LTSS delivery, which are contextual attributes and difficult to control for directly in a regression framework (Appendix C).[21]

Using eligibility and claims information from MAX, we included Medicaid beneficiaries from Alabama and Georgia in our potential comparison group if they (1) used at least one CHOICES-covered LTSS during the study period, as defined by the type of service or HCBS

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[20] We excluded individuals (1) enrolled in the services provided by the Office for People with Developmental Disabilities (OPWDD), Traumatic Brain Injury, Nursing Home Transition & Diversion, or Long Term Home Health Care Program 1915(c) waivers or (2) eligible for Medicaid due to the breast and cervical cancer program, or family planning expansion.

[21] The seven indicators were (1) HCBS spending as a share of total LTSS spending for adults over age 65 or under age 65 with physical disabilities; (2) whether personal care was provided under a state plan or HCBS waiver; (3) number of Medicaid LTSS participant-years per 100 people age 21 or older with a disability that limits activities of daily living and income at or below 250 percent of the federal poverty level; (4) number of home health/personal care aides per 1,000 people age 65 and over; (5) number of assisted living units per 1,000 people age 65 and over; (6) number of nursing facility beds per 1,000 people age 65 and over; and (7) number of people on HCBS waiver waiting lists.

taxonomy codes found in MAX ambulatory claims records; and (2) would have been eligible for CHOICES had they lived in Tennessee (that is, they were age 21 or older and qualified for full Medicaid benefits; partial benefit dually eligible beneficiaries were not included). We defined CHOICES-covered services as nursing facility care, personal care services, adult day care, residential care, round-the-clock services, home-based services, home-delivered meals caregiver support, services supporting participant direction, and day services, which includes pest control. CHOICES covered some services under the HCBS taxonomy categories for equipment, technology, and modifications (such as home modification) and other services (such as pest control); however, we did not use these services to identify individuals in the comparison population because Alabama and Georgia covered a different set of services under these same categories. Overall, we identified 70,751 individuals from Alabama and 147,447 individuals from Georgia to serve as potential comparison beneficiaries.

3. Inclusions and exclusions

New York. Because MLTC was first authorized in 1998, a significant number of individuals had already enrolled before 2009, the beginning of our study period. For these people, we do not observe any baseline information. In addition, MLTC enrollment changed from voluntary to mandatory in July 2012. These program features required us to use different evaluation designs to study three groups of MLTC enrollees: (1) existing enrollees at the beginning of 2009, (2) new enrollees between 2010 and June 2012, and (3) new enrollees after July 2012. Because of time and data constraints, we focused on the first group for the current analysis and will consider adding the other two groups in future evaluation reports. Because we only observed a person's enrollment in MLTC through the monthly plan type or plan ID variable in the MAX person summary file and we do not know the exact enrollment date, we would not know if a person identified as enrolled in January 2009 was an existing or new enrollee. Therefore, we implemented a three-month look-back period to ensure we captured only existing MLTC enrollees. Our outcome measures, as a result, started from April 2009. More specifically, we defined our initial MLTC population to be the 21,525 MLTC enrollees who had consecutive MLTC enrollment in January through April 2009. The initial comparison group consisted of 113,907 individuals who were *eligible* for Medicaid and MLTC in March and April 2009 at least, but did not enroll in MLTC for the entire first quarter. From this sample, we then excluded 14 MLTC and 330 potential comparison beneficiaries who died before April 1, 2009, and 8 MLTC and 73 potential comparison beneficiaries who were either under 12 years old or missing data on geographic location or chronic conditions (based on the CDPS). This brought our final samples for matching to 21,503 MLTC enrollees and 113,504 potential comparison beneficiaries (Table A.1).

Table A.1. Selection of the New York study population

	MLTC	Comparison group
Continuous enrollment (MLTC) or non-enrollment (comparison) January 2009 to April 2009†	21,525	292,522
Not Medicaid-eligible at start of study (April 2009)		-75,357
Not MLTC-eligible at start of study (April 2009)		-103,258
Death before study period	-14	-330
Additional exclusions*	-8	-73
Total potential beneficiaries for matching	21,503	113,504

Source: Mathematica Policy Research analyses of 2009–2012 MAX data.

† We identified 316,426 Medicaid beneficiaries for the New York study. An additional 2,379 people were excluded because they were not continuously enrolled during January to April 2009 for the complete four months.

*Additional exclusions are beneficiaries younger than age 12 or missing geographic or Chronic Illness and Disability Payment System (CDPS) information.

Tennessee. Mandatory enrollment in TennCare CHOICES began in March 2010 for eligible individuals in 41 of 95 counties and extended to the rest of the state in August 2010. Using a finder file provided by the state, we found a large majority (56 percent) of all CHOICES enrollees included in the finder file indeed started their enrollment during these two waves of mandatory enrollment. As we discuss in Section VI, many of the remaining 44 percent of beneficiaries possibly enrolled immediately following some sort of acute event, such as a stroke, that granted them MLTSS eligibility. Because we did not have data available to identify these acute events in either the CHOICES or comparison populations, we felt that including them in our analysis without being able to match on the acute event that resulted in MLTSS eligibility would have introduced selection bias into our results. We therefore opted to drop them from our study. Thus, we focus on the 15,874 beneficiaries who enrolled in CHOICES in either March or August 2010, as these cohorts are less likely to have had an acute event that precipitated enrollment and affected their outcomes.

To be included in the final study population, we further required 12-month continuous enrollment in Medicaid during 2009. Utilization measures from this baseline year were incorporated into our matching procedure to identify a comparison group with similar histories of service use as the CHOICES enrollees. Of the 15,874 enrollees we identified above, 4,121 were not eligible for Medicaid for all or part of 2009 and were therefore excluded. In addition, we excluded anyone who did not meet our MLTSS eligibility criteria during either 2009 or 2010. Finally, we excluded from the potential comparison groups anyone below age 12 who was a partial dually eligible beneficiary and/or missing data on geographic region (rural versus urban), none of which occur among CHOICES enrollees. After applying these exclusions, we ended up with 10,836 CHOICES enrollees and 26,937 individuals from Alabama's potential comparison group, as well as 55,145 individuals from Georgia's to perform the propensity score matching (Table A.2).

Table A.2. Selection of the Tennessee study population

	Tennessee	Alabama	Georgia
Total potential beneficiaries (N)	**15,874**	**70,751**	**147,447**
Less than 12 months Medicaid enrollment in the baseline	-4,121	-23,839	-53,689
Does not meet LTSS eligibility criteria in the year	-167	-14,792	-29,781
Does not meet LTSS eligibility criteria in the baseline	-750	-4,515	-8,410
Additional exclusions[a]	0	-668	-422
Total potential beneficiaries for matching	10,836	26,937	55,145
Total beneficiaries after matching	**10,836**	**10,836**	**10,836**
Post-matching correction[b]	-683	-683	-683
Analytic sample	**10,153**	**10,153**	**10,153**

Source: Mathematica Policy Research analyses of state submitted finder file, 2009–2014 MAX and other data.

[a] Additional exclusions are beneficiaries younger than age 12, Medicare-Medicaid dual eligible beneficiaries with partial benefits, and beneficiaries with missing geographic information

[b] Post-matching correction was made to ensure study population was eligible for Medicaid in the first Study Year after CHOICES enrollment.

D. Matching comparison group to MLTSS enrollees

The key methodological challenge in estimating the effects of MLTSS was approximating the counterfactual: the outcomes that would have happened in the absence of MLTSS. Because participation in MLTSS is nonrandom, we needed to construct a comparison group that appeared similar to the MLTSS enrollees on key observable characteristics that affected MLTSS enrollment and outcomes.

To find a comparison group that resembled the sample of MLTSS enrollees we included for this interim evaluation, we used a procedure commonly referred to as propensity score matching (Rosenbaum and Rubin 1983). This approach allows for an approximation of an experimental design by assuming that the decision to participate is random, conditional on a set of observable characteristics. The propensity score is estimated from a logistic regression model fit to the sample of beneficiaries that includes both MLTSS enrollees and the potential comparison group who met the inclusion/exclusion criteria. The dependent variable in this model is MLTSS enrollment, and the independent variables include factors hypothesized to be related to participation in the MLTSS program.

Propensity score matching is a widely used and effective method of identifying a matched comparison group based on a set of observed variables. However, the propensity score model treats each of the observed variables equally; it does not allow the analyst to specify certain variables as higher priority than others. In designing our matching procedure, we grouped observed variables into three levels in terms of how important we felt they were to ensure a good balance between the MLTSS and comparison groups during the baseline period. For the highest-priority variables, we used exact matching: only allowing an MLTSS enrollee to be matched to a potential comparison beneficiary with the same value for this variable. For the next level of variables, we applied a caliper: only allowing an MLTSS enrollee to be matched to a potential comparison beneficiary if their values of the variable are within a certain prespecified range.

Applying calipers is a matching method commonly used to improve the difference in covariate distribution between two populations (Stuart 2010). The lowest-priority variables are balanced through their contribution to the propensity score. A list of independent variables and their levels of control in the two analyses can be found in Table A.3. Variables included in the propensity score estimation are discussed in more detail in the following sections.

Table A.3. Variables included in the propensity score estimation

Characteristics	Level of control	
	Tennessee	New York
Dual status	Exact	Exact
Medicaid eligibility category (Age at least 65)	Exact	Exact
Location: New York City	-	Exact
Baseline total nursing facility days (log)	Calipers	-
Baseline total institutional long-term care expenditure (log)	Calipers	-
Baseline institutional long-term care user	Propensity	-
Baseline personal care service user	Propensity	-
Baseline HCBS user	Propensity	-
Baseline total number of ED visits (log)	Propensity	-
Baseline hospital user	Propensity	-
Baseline number of hospital stays per month	Propensity	-
Baseline number of hospital days per month (log)	Propensity	-
Rural	Propensity	-
Age	Propensity	Propensity
Race	Propensity	Propensity
Gender	Propensity	Propensity
Dementia	Propensity	Propensity
Total number of CDPS conditions	Propensity	Propensity
Cancer	Propensity	Propensity
Cardiovascular	Propensity	Propensity
Cerebrovascular	Propensity	Propensity
Central nervous system	Propensity	Propensity
Developmental disability	Propensity	Propensity
Diabetes	Propensity	Propensity
Ear	Propensity	Propensity
Eye	Propensity	Propensity
Genital	Propensity	Propensity
Gastrointestinal	Propensity	Propensity
Hematological	Propensity	Propensity
Infectious	Propensity	Propensity
Metabolic	Propensity	Propensity
Psychiatric	Propensity	Propensity
Pulmonary	Propensity	Propensity
Renal	Propensity	Propensity
Skeletal	Propensity	Propensity
Skin	Propensity	Propensity
Substance abuse	Propensity	Propensity

Note: "-" indicates the variable is not included in the propensity score estimation.

We matched on not only the presence of a condition, but also the cost level the CDPS associates with the form of the condition.

1. Matching conducted by state

New York. As discussed above, we identified 21,503 MLTC enrollees and 113,504 potential comparison beneficiaries as our population for matching in the New York analysis. We matched each MLTC enrollee to one individual from the potential comparison group, and matching was performed without replacement. That is, once someone from the comparison group was matched to someone in the MLTC group, that comparison group member could not be matched to additional members of the MLTC group.

We matched the MLTC enrollees to comparison beneficiaries based on demographic characteristics and baseline health status. As discussed in Section VI, we could not match on prior utilization because the MLTC program preceded the study period for which we had available data (2009–2012), so we did not have access to utilization measures that took place before MLTC enrollment. Health status was measured through the CDPS system; for these variables, as well as for demographic characteristics, we used MAX data from calendar year 2009, the first year for which we had data. Although it is true that we may have been matching on data measured after our study period began (April 1, 2009), our subject matter experts deemed these variables exogenous, meaning they were unlikely to be affected by enrollment in MLTC and could thus be used for matching. We exact matched on dual status (full dual, partial dual, or Medicaid only) and whether a beneficiary was at least 65 years old. We implemented optimal propensity score matching using the "optmatch" package (Hansen and Klopfer 2006), which is available for the R statistical software environment through the Comprehensive R Archive Network.

Tennessee. As discussed above, we identified 26,937 individuals from Alabama and 55,145 individuals from Georgia as potential comparison beneficiaries for the 10,836 CHOICES enrollees who met our inclusion/exclusion criteria. From our exploratory data analysis (data not shown), we observed significant differences between potential comparison groups from Alabama and Georgia on key covariates. For example, 55 percent of the potential comparison group from Alabama used ILTC, whereas only 42 percent did in Georgia. Therefore, we decided to carry out matching separately for Alabama and Georgia, resulting in matching each CHOICES enrollee from Tennessee to two comparison beneficiaries, one from each state.

We matched the CHOICES enrollees to comparison beneficiaries based on their demographic characteristics, prior utilization, and health status. Prior utilization and health status were measured during the 2009 calendar year, the calendar year preceding enrollment. As in the New York analysis, we exact matched on dual status (non-dual and full dual) and whether a MLTSS enrollee was at least 65 years old. We also applied calipers on two baseline utilization variables: total nursing facility days and total ILTC expenditures. For each of these variables, we set the caliper width to one standard deviation of the variable, indicating that potential comparison beneficiaries must have values of these two variables within one standard deviation of the CHOICES enrollee. As for the New York matching, optimal propensity score matching was implemented using the "optmatch" package in R without replacement.

Many of the matching variables we used for either state come from the MAX annual person summary files. A consequence of this is that these variables are only available at the calendar year level. Because our study years were based on time of enrollment (or first observation of outcomes for New York) rather than calendar years, this presents some issues for the analysis.

For example, in Tennessee we used 2009 as the baseline year, but because beneficiaries were not enrolled until either March or August of the following year, there would be a gap (between the end of 2009 and the enrollment month) that we could not adjust for in the analysis. If a CHOICES enrollee's experience during this gap period differed from the experience of the comparison beneficiaries to which he or she was matched, this discrepancy would not be accounted for by our analysis. Although we did observe the 2010 covariate data, we were unable to differentiate the portion of these annual summaries that occurred before versus after CHOICES enrollment. Digging into MAX monthly eligibility/claims files and conducting the matching monthly would be much more time-consuming but would likely provide more precise matching and could be considered as an alternative strategy in the future.

After matching, we noticed 703 individuals (19 from Tennessee, 380 from Alabama, and 304 from Georgia) who were not eligible for Medicaid in the first study year, thus had missing outcome from year 1. To avoid selection bias, we removed them as well as the individuals to whom they were matched to from our analytic sample; the result is the post-matching correction of excluding 683 people from each state (Table A.2).

2. Assessment of the quality of the match

Using matching to select a comparison group will produce unbiased estimates if two assumptions are met: (1) the set of observable characteristics used in the matching procedure includes all factors related to both MLTSS enrollment and the outcomes; and (2) enrollees and comparison group members are "balanced" on observable characteristics conditional on their propensity score within each stratum—that is, for each enrollee, there must be a matched comparison group member(s) similar to the participant on observed characteristics (Rosenbaum and Rubin 1985). Section VI discusses several potential unobserved characteristics that could affect our results, as well as the steps we took to minimize effects that remain.

To determine whether the latter condition was met, we performed several statistical tests to assess the quality of our matches. Following Stuart (2010), we examined differences in means and standardized differences of the variables used in the matching process. Results are summarized in Table A.4 for New York and Table A.5 for Tennessee. Rubin (2001) recommends ensuring that the standardized bias for all covariates be less than 0.25. We found almost all covariates in the matched data set met this criteria for all three matches. The only suboptimal balance was for the variable "HCBS user" between Tennessee and Alabama, which was due to a very large standardized difference before matching and could be explained by the difference in the types of HCBS provided by the two states (Appendix D). For both the New York match and the Tennessee to Georgia match, our resulting standardized differences were less than the stricter cutoff of 0.10 on almost all matching variables. These results indicate that our matching procedure produces comparison groups that look similar to MLTSS enrollees for each covariate in the model.

Although matching improved the covariate balance between our MLTSS and comparison populations, some small differences remained on individual variables. As a result, differences in the raw outcomes between MLTSS enrollees and the matched comparison group may not be solely due to the implementation of the MLTSS program. To control for these differences and identify how MLTSS enrollment affects outcomes on its own, we performed regression analysis of each of our six primary outcomes.

Table A.4. Means and standardized differences for variables included in the propensity score estimation for New York

Characteristics	MLTC enrollees (n=21,503)	Comparison group		Standard Difference: MLTC enrollees vs. matched comparison group
		Unmatched (n=113,504)	Matched (n=21,503)	
Dual status				
Non-dual	0.125	0.210	0.125	0.000
Full dual	0.870	0.782	0.870	0.000
Partial dual	0.005	0.008	0.005	0.000
Medicaid eligibility category				
Over 65	0.842	0.733	0.842	0.000
Under 65 disabled	0.152	0.242	0.152	0.000
Under 65 not disabled	0.006	0.025	0.006	0.000
Location				
New York City	0.926	0.754	0.926	0.000
Urban non-NYC	0.072	0.243	0.072	0.000
Rural	0.002	0.003	0.002	0.000
Age	75.473	72.895	75.895	-0.032
Race				
White	0.307	0.475	0.249	0.128
Non-White	0.683	0.509	0.742	-0.130
Missing	0.010	0.015	0.008	0.018
Female	0.740	0.653	0.772	-0.075
Total number of CDPS conditions	7.728	7.316	7.831	-0.024
Dementia	0.228	0.366	0.250	-0.051
Cancer				
None	0.763	0.814	0.770	-0.017
Benign	0.086	0.060	0.082	0.016
Low	0.067	0.056	0.064	0.012
Medium	0.023	0.021	0.023	-0.002
High	0.032	0.029	0.033	-0.008
Very high	0.029	0.020	0.027	0.011
Cardiovascular				
None	0.191	0.274	0.180	0.027
Super low	0.003	0.004	0.002	0.011
Extra low	0.191	0.138	0.194	-0.006
Low	0.287	0.272	0.286	0.002
Medium	0.311	0.297	0.320	-0.020
Very high	0.018	0.014	0.018	-0.002
Cerebrovascular				
None	0.752	0.766	0.743	0.022
Super low	0.090	0.065	0.090	0.001
Low	0.158	0.169	0.167	-0.027
Central Nervous System				
None	0.453	0.497	0.451	0.004
Super low	0.225	0.169	0.228	-0.008
Low	0.266	0.284	0.266	0.000
Medium	0.043	0.033	0.042	0.008
High	0.013	0.016	0.014	-0.004
Developmental Disability				
None	0.995	0.986	0.994	0.018
Low	0.004	0.011	0.006	-0.020
Medium	0.001	0.003	0.001	0.002

Table A.4 (continued)

Characteristics	MLTC enrollees (n=21,503)	Comparison group Unmatched (n=113,504)	Matched (n=21,503)	Standard Difference: MLTC enrollees vs. matched comparison group
Diabetes				
None	0.451	0.585	0.442	0.018
Type 2 low	0.258	0.256	0.279	-0.045
Type 2 medium	0.111	0.072	0.114	-0.010
Type 1 medium	0.174	0.083	0.159	0.039
Type 1 high	0.006	0.003	0.006	-0.002
Ear				
None	0.808	0.847	0.815	-0.018
Super low	0.192	0.153	0.185	0.018
Eye				
None	0.507	0.503	0.495	0.024
Super low	0.166	0.172	0.171	-0.013
Very low	0.287	0.299	0.292	-0.012
Low	0.040	0.026	0.042	-0.010
Genital				
None	0.760	0.795	0.767	-0.017
Genital, super low	0.109	0.094	0.117	-0.024
Genital, extra low	0.131	0.111	0.116	0.045
Gastrointestinal				
None	0.587	0.610	0.583	0.009
Super low	0.086	0.073	0.087	-0.004
Low	0.240	0.218	0.239	0.003
Medium	0.064	0.048	0.064	0.001
High	0.022	0.051	0.027	-0.030
Hematological				
None	0.549	0.553	0.539	0.020
Super low	0.362	0.362	0.369	-0.015
Low	0.062	0.063	0.064	-0.008
Medium	0.025	0.021	0.025	-0.005
Very high	0.000	0.000	0.000	-0.003
Extra high	0.002	0.001	0.002	0.009
Infectious				
None	0.774	0.729	0.768	0.015
Super low	0.113	0.116	0.114	-0.001
Low	0.039	0.030	0.039	-0.001
Medium	0.061	0.099	0.066	-0.018
HIV, medium	0.003	0.005	0.002	0.021
High	0.004	0.005	0.004	-0.011
AIDS, high	0.005	0.015	0.007	-0.024
Metabolic				
None	0.314	0.397	0.305	0.019
Super low	0.473	0.400	0.477	-0.008
Very low	0.073	0.073	0.071	0.007
Medium	0.115	0.113	0.122	-0.020
High	0.025	0.016	0.025	0.000
Psychiatric				
None	0.587	0.448	0.562	0.051
Super low	0.072	0.051	0.075	-0.011
Low	0.181	0.224	0.185	-0.010
Medium low	0.106	0.112	0.108	-0.008
Medium	0.037	0.068	0.044	-0.039
High	0.017	0.097	0.026	-0.057

Table A.4 *(continued)*

Characteristics	MLTC enrollees (n=21,503)	Comparison group		Standard Difference: MLTC enrollees vs. matched comparison group
		Unmatched (n=113,504)	Matched (n=21,503)	
Pulmonary				
None	0.473	0.484	0.463	0.020
Super low	0.149	0.137	0.142	0.022
Low	0.207	0.204	0.222	-0.035
Medium	0.143	0.142	0.143	0.001
High	0.012	0.011	0.014	-0.011
Very high	0.016	0.021	0.018	-0.017
Renal				
None	0.519	0.536	0.508	0.021
Super low	0.173	0.198	0.172	0.002
Low	0.147	0.134	0.158	-0.031
Medium	0.009	0.009	0.010	-0.004
Very high	0.128	0.106	0.128	0.000
Extra high	0.025	0.017	0.024	0.001
Skeletal				
None	0.416	0.502	0.415	0.002
Super low	0.088	0.077	0.089	-0.004
Very low	0.103	0.090	0.099	0.012
Low	0.230	0.194	0.232	-0.007
Medium	0.164	0.138	0.164	-0.002
Skin				
None	0.391	0.388	0.391	0.000
Super low	0.340	0.319	0.329	0.023
Very low	0.139	0.128	0.140	-0.002
Low	0.072	0.063	0.074	-0.010
High	0.058	0.102	0.066	-0.032
Substance abuse				
None	0.982	0.970	0.978	0.030
Very low	0.008	0.014	0.010	-0.019
Low	0.010	0.016	0.012	-0.024

Source: Mathematica Policy Research analyses of 2009–2012 MAX data.

Table A.5. Means and standardized differences for variables included in the propensity score estimation for Tennessee

Characteristics	Tennessee CHOICES enrollees (n=10,836)	Alabama Comparison group Unmatched (n=26,937)	Alabama Comparison group Matched (n=10,836)	Alabama Standard difference: CHOICES enrollees vs. matched comparison group	Georgia Comparison group Unmatched (n=55,145)	Georgia Comparison group Matched (n=10,836)	Georgia Standard difference: CHOICES enrollees vs. matched comparison group
Dual status							
Non-dual	0.125	0.196	0.125	0.000	0.262	0.125	0.000
Full dual	0.875	0.804	0.875	0.000	0.738	0.875	0.000
Under 65							
No	0.767	0.596	0.767	0.000	0.535	0.767	0.000
Yes	0.233	0.404	0.233	0.000	0.465	0.233	0.000
Baseline total nursing facility days (log)	4.819	3.133	4.698	0.055	2.438	4.787	0.014
Baseline total institutional long-term care expenditure (log)	8.645	5.824	8.643	0.000	4.359	8.589	0.014
Baseline institutional long-term care user	0.820	0.548	0.816	0.010	0.421	0.820	0.000
Baseline personal care service user	0.182	0.323	0.214	-0.078	0.392	0.202	-0.049
Baseline HCBS user	0.648	0.934	0.842	-0.457	0.931	0.716	-0.148
Baseline total number of ED visits (log)	0.513	0.507	0.536	-0.036	0.583	0.540	-0.042
Baseline hospital user	0.334	0.323	0.339	-0.010	0.292	0.342	-0.016
Baseline number of hospital stays per month	0.052	0.049	0.051	0.010	0.045	0.054	-0.017
Baseline number of hospital days per month (log)	0.246	0.215	0.242	0.009	0.194	0.247	-0.002
Rural	0.438	0.413	0.420	0.036	0.473	0.424	0.028
Age	74.972	66.487	74.156	0.053	63.783	74.471	0.033
Race							
White	0.782	0.619	0.761	0.051	0.516	0.772	0.024
Non-white	0.215	0.371	0.236	-0.049	0.466	0.226	-0.027
Missing	0.003	0.010	0.004	-0.011	0.018	0.002	0.021
Female	0.728	0.677	0.726	0.004	0.659	0.725	0.006
Total number of CDPS conditions	7.967	6.918	7.757	0.054	6.298	7.438	0.133
Dementia	0.565	0.357	0.526	0.078	0.278	0.522	0.088
Cancer							
None	0.880	0.860	0.883	-0.011	0.885	0.883	-0.011
Benign	0.039	0.038	0.038	0.005	0.046	0.039	-0.001
Low	0.048	0.056	0.044	0.017	0.039	0.046	0.007
Medium	0.016	0.016	0.016	-0.005	0.012	0.014	0.014
High	0.013	0.022	0.014	-0.010	0.013	0.013	0.000
Very high	0.005	0.008	0.004	0.010	0.006	0.004	0.008

Table A.5 (continued)

Characteristics	Tennessee	Alabama			Georgia		
		Comparison group		Standard difference:	Comparison group		Standard difference:
	CHOICES enrollees (n=10,836)	Unmatched (n=26,937)	Matched (n=10,836)	CHOICES enrollees vs. matched comparison group	Unmatched (n=55,145)	Matched (n=10,836)	CHOICES enrollees vs. matched comparison group
Cardiovascular							
None	0.194	0.294	0.210	-0.039	0.321	0.233	-0.094
Super low	0.003	0.003	0.002	0.005	0.004	0.003	-0.008
Extra low	0.208	0.197	0.207	0.004	0.238	0.207	0.004
Low	0.259	0.219	0.254	0.011	0.214	0.250	0.021
Medium	0.322	0.275	0.314	0.018	0.208	0.294	0.062
Very high	0.014	0.012	0.013	0.004	0.014	0.014	-0.002
Cerebrovascular							
None	0.699	0.771	0.704	-0.012	0.794	0.709	-0.022
Super low	0.053	0.041	0.050	0.011	0.041	0.052	0.004
Low	0.249	0.187	0.246	0.007	0.164	0.240	0.021
Central Nervous System							
None	0.350	0.444	0.362	-0.026	0.503	0.385	-0.074
Super low	0.154	0.129	0.149	0.016	0.138	0.153	0.005
Low	0.410	0.349	0.403	0.014	0.285	0.384	0.055
Medium	0.055	0.058	0.058	-0.012	0.049	0.052	0.014
High	0.030	0.020	0.028	0.017	0.024	0.026	0.027
Developmental Disability							
None	0.959	0.880	0.969	-0.052	0.853	0.978	-0.109
Low	0.035	0.086	0.028	0.042	0.107	0.019	0.095
Medium	0.006	0.034	0.004	0.034	0.040	0.002	0.055
Diabetes							
None	0.604	0.635	0.604	0.001	0.633	0.612	-0.016
Type 2 low	0.241	0.222	0.241	0.000	0.203	0.235	0.014
Type 2 medium	0.058	0.054	0.058	0.000	0.062	0.060	-0.008
Type 1 medium	0.094	0.086	0.094	0.001	0.097	0.089	0.015
Type 1 high	0.003	0.004	0.004	-0.008	0.005	0.003	-0.007
Ear							
None	0.919	0.904	0.921	-0.008	0.918	0.923	-0.016
Super low	0.081	0.096	0.079	0.008	0.082	0.077	0.016
Eye							
None	0.611	0.581	0.605	0.012	0.688	0.646	-0.071
Super low	0.117	0.166	0.117	-0.001	0.116	0.115	0.006
Very low	0.260	0.234	0.264	-0.009	0.183	0.227	0.077
Low	0.012	0.018	0.013	-0.014	0.013	0.012	-0.004
Genital							
None	0.829	0.834	0.831	-0.005	0.868	0.858	-0.080
Genital, super low	0.100	0.113	0.103	-0.010	0.084	0.084	0.053
Genital, extra low	0.071	0.053	0.066	0.020	0.048	0.057	0.056

Table A.5 *(continued)*

Characteristics	Tennessee CHOICES enrollees (n=10,836)	Alabama Comparison group Unmatched (n=26,937)	Matched (n=10,836)	Standard difference: CHOICES enrollees vs. matched comparison group	Georgia Comparison group Unmatched (n=55,145)	Matched (n=10,836)	Standard difference: CHOICES enrollees vs. matched comparison group
Gastrointestinal							
None	0.556	0.617	0.567	-0.021	0.650	0.587	-0.062
Super low	0.049	0.043	0.049	0.000	0.042	0.045	0.017
Low	0.311	0.264	0.299	0.026	0.242	0.286	0.055
Medium	0.033	0.032	0.035	-0.008	0.032	0.033	0.003
High	0.050	0.043	0.050	0.001	0.034	0.049	0.006
Hematological							
None	0.543	0.600	0.550	-0.014	0.639	0.569	-0.053
Super low	0.387	0.334	0.384	0.006	0.303	0.363	0.049
Low	0.048	0.051	0.046	0.007	0.044	0.049	-0.007
Medium	0.020	0.014	0.019	0.014	0.013	0.017	0.025
Very high	0.001	0.000	0.001	0.029	0.001	0.001	0.026
Extra high	0.001	0.001	0.001	-0.007	0.001	0.001	0.000
Infectious							
None	0.745	0.811	0.764	-0.045	0.832	0.770	-0.060
Super low	0.144	0.112	0.135	0.024	0.089	0.128	0.047
Low	0.032	0.023	0.030	0.014	0.021	0.028	0.022
Medium	0.064	0.044	0.058	0.024	0.045	0.060	0.015
HIV, medium	0.012	0.005	0.009	0.030	0.006	0.010	0.015
High	0.002	0.002	0.002	0.000	0.002	0.002	-0.002
AIDS, high	0.002	0.003	0.002	0.002	0.004	0.002	0.019
Metabolic							
None	0.372	0.435	0.393	-0.045	0.463	0.414	-0.087
Super low	0.354	0.334	0.350	0.008	0.328	0.332	0.047
Very low	0.142	0.121	0.130	0.032	0.098	0.126	0.044
Medium	0.122	0.099	0.116	0.020	0.098	0.118	0.013
High	0.010	0.011	0.010	0.003	0.013	0.010	0.005
Psychiatric							
None	0.254	0.462	0.295	-0.093	0.510	0.315	-0.136
Super low	0.053	0.067	0.056	-0.015	0.070	0.060	-0.029
Low	0.265	0.190	0.255	0.023	0.191	0.275	-0.023
Medium low	0.178	0.099	0.152	0.069	0.082	0.145	0.088
Medium	0.188	0.132	0.180	0.020	0.077	0.153	0.092
High	0.063	0.051	0.061	0.007	0.071	0.052	0.048
Pulmonary							
None	0.431	0.509	0.451	-0.040	0.556	0.475	-0.088
Super low	0.139	0.141	0.133	0.017	0.137	0.126	0.038
Low	0.238	0.186	0.231	0.016	0.175	0.216	0.051
Medium	0.159	0.140	0.154	0.015	0.109	0.149	0.030
High	0.008	0.007	0.008	0.005	0.006	0.009	-0.009
Very high	0.025	0.017	0.024	0.009	0.018	0.026	-0.004

Table A.5 *(continued)*

Characteristics	Tennessee CHOICES enrollees (n=10,836)	Alabama			Georgia		
		Comparison group		Standard difference: CHOICES enrollees vs. matched comparison group	Comparison group		Standard difference: CHOICES enrollees vs. matched comparison group
		Unmatched (n=26,937)	Matched (n=10,836)		Unmatched (n=55,145)	Matched (n=10,836)	
Renal							
None	0.357	0.516	0.374	-0.036	0.574	0.413	-0.116
Super low	0.325	0.243	0.314	0.023	0.217	0.309	0.034
Low	0.171	0.122	0.173	-0.005	0.075	0.135	0.100
Medium	0.007	0.008	0.007	0.001	0.006	0.007	0.003
Very high	0.129	0.096	0.121	0.022	0.107	0.125	0.012
Extra high	0.012	0.015	0.011	0.008	0.021	0.012	-0.003
Skeletal							
None	0.384	0.510	0.395	-0.023	0.562	0.426	-0.086
Super low	0.175	0.125	0.169	0.014	0.112	0.162	0.033
Very low	0.058	0.077	0.060	-0.010	0.067	0.059	-0.004
Low	0.248	0.174	0.235	0.029	0.148	0.219	0.067
Medium	0.136	0.114	0.140	-0.011	0.112	0.134	0.007
Skin							
None	0.374	0.454	0.389	-0.031	0.479	0.392	-0.037
Super low	0.369	0.343	0.364	0.011	0.317	0.358	0.022
Very low	0.127	0.111	0.124	0.009	0.097	0.118	0.028
Low	0.042	0.033	0.041	0.007	0.040	0.043	-0.007
High	0.088	0.058	0.083	0.019	0.067	0.088	-0.001
Substance abuse							
None	0.974	0.964	0.975	-0.005	0.973	0.973	0.002
Very low	0.015	0.013	0.014	0.005	0.014	0.015	-0.002
Low	0.011	0.023	0.011	0.002	0.012	0.011	0.000

Source: Mathematica Policy Research analyses of state submitted finder file, 2009–2014 MAX and other data.

E. Regression analysis of outcome measures

Next, we describe the overall framework and specific models used for the regression analysis. We also discuss limitations, such as sample attrition, and their implications for our analysis.

1.   General modeling framework and design

Analysis of outcome measures is based on multivariate generalized linear models. Outcomes were measured at the person-year level, meaning that each beneficiary contributed one observation for each study year they were alive and Medicaid-eligible, within the study period. Study year is defined relative to each beneficiary's month of MLTSS enrollment (or the first month of outcome measure, in the New York study), or in the comparison group, the first month of enrollment/outcome measure of the enrollee to which he or she was matched.

As an example, consider a beneficiary who was enrolled in MLTSS in March 2010. We define Study Year 1 for this beneficiary as the period from April 2010 through March 2011. We omit the month of enrollment, because part of the time spent in this month may have occurred before enrollment in the program. Similarly, Study Year 2 spans April 2011 through March 2012, and Study Year 3 spans April 2012 through March 2013. These same dates define the study period for an individual in the comparison group to whom the enrollee was matched. Because each beneficiary (among both MLTSS enrollees and the comparison group) could contribute multiple observations that might not be independent, standard errors for all model parameters were adjusted using the clustered sandwich estimator, to produce cluster-robust standard errors.

Observations of outcomes from years before enrollment are not modeled in these analyses. This approach contrasts from an alternative econometric model, known as difference-in-differences (DD), in which both pre- and post-intervention outcomes are modeled. The reasoning behind our decision not to implement a DD model differed between the two studies. For the New York analysis, DD would not have been possible, because we do not have data before enrollment for the study population. For Tennessee, we considered a DD model and proposed it in the evaluation design plan. However, after mining through the data and careful consideration, we felt that one key assumption of the DD approach, the parallel trends assumption, may have been violated. This assumption states that we would have observed the same difference in outcomes between the post-period and the pre-period in the MLTSS enrollees as the difference we saw in the comparison group, if they had not enrolled in the MLTSS. Due to the limitations in our matching procedure (Section VI), primarily in the inability to observe some variables during the months immediately before enrollment (for example, experience of acute events), we do not feel confident that this assumption held. Instead, we selected a more flexible approach that controlled for a beneficiary's baseline experience through regression covariates and interactions. This approach is described in detail in the Model Specification section below.

All analyses follow the intention-to-treat principle, meaning that once beneficiaries were identified as in the MLTSS delivery system, they were analyzed as if they remained in that group throughout the study, regardless of the beneficiaries' actual MLTSS enrollment history. The same was applied to the comparison group. For example, this means that once the comparison group was formed for the New York analysis, we considered each beneficiary to remain in that

group, even if he or she eventually enrolled in an MLTC plan. Intention-to-treat analyses are used to avoid bias due to informative dropout and crossover, but may lead to attenuated estimated intervention effects if a substantial proportion of an intervention group is not receiving the intervention to which they are assigned.

As discussed in Section VI, hospitalization outcomes may be undercounted for dually eligible beneficiaries in Medicare Advantage plans. To explore the effect of this limitation on our results and to provide a clean analysis for one subgroup (Medicaid-only beneficiaries), we fit models separately for all beneficiaries—including full dually eligible beneficiaries, partial dually eligible beneficiaries (in New York), and Medicaid-only—as well as for the full dual and Medicaid-only subgroups, respectively.

2. Outcomes and model type

For each state, we analyzed six different outcomes, each defined at the annual level. Four of these outcomes are dichotomous variables: any hospital use, any ILTC use, any HCBS use, and any personal care service use, during each study year. These outcomes are modeled using logistic regression, the most widely used and applicable approach for modeling dichotomous outcomes. The remaining two outcomes (number of hospital days and number of hospital stays) are count variables. The distributions of these outcomes demonstrated two complicating features, which often are present in counts of medical data: a large group of observations with a value of zero (no hospitalization during the year), and a heavily right-skewed distribution for the nonzero observations. We considered several regression approaches for modeling these variables, including Poisson regression, negative binomial regression, zero-inflated models, and two-part models. Based on an analysis of the distributions for these variables, as well as the residuals from fitting each model, we opted for a two-part, logistic/gamma model (Belotti et al. 2015). In this model, a logistic regression models the probability of a count outcome being nonzero versus zero, and a gamma regression models the count among the observations with a nonzero value. This is a flexible modeling approach, designed to accommodate the two complicating features described above.

3. Attrition and incomplete observations

Observations in our regression models are defined at the person-year level; if a beneficiary was alive and Medicaid-eligible in the state they lived in at baseline, they contributed an observation during the given study year. Due to beneficiaries losing Medicaid eligibility, death, or otherwise leaving our study population, each beneficiary did not contribute equally to each study year. Attrition due to death and other causes results in our analytic sample size changing from year to year. Of course, not all attrition occurs exactly at the end of a study year. The result is that outcomes for some person-years are defined over a period shorter than 12 months. For example, in the New York analysis, each study year begins in April. If a beneficiary in this analysis died during October, he or she contributed seven months of information (April–October) toward his or her outcomes for that particular study year.

In addition, we have a shorter period of observation for everyone in the last study year of the Tennessee analysis. For Tennessee and Georgia, we have data available through the end of the 2014 calendar year. Study Year 5 in this analysis begins in either March or August 2014, depending on the beneficiary's enrollment month (or for the comparison group, that of the

beneficiary to which they were matched). Thus, Study Year 5 will be incomplete for all beneficiaries, with a maximum of either four (August enrollees) or nine (March enrollees) months of observed data. For Alabama, we only observed data through 2013, so this same pattern occurs for Study Year 4. The result (Tables IV.12 and IV.16) is that the observed rates of all outcomes were much lower during these study years in the Tennessee analysis.

Our regression analysis takes these incomplete observations into account, using common weighting techniques. The precise technique we use differs slightly by outcome type. For dichotomous outcomes (hospital use, HCBS use, ILTC use, and personal care service use), we fully observe the outcome when we either observe the full 12 months of data for the person-year, or when we observe the presence of the outcome within the observed period. For example, if there is a person-year for which we observe five months of data, and that beneficiary used HCBS during those five months, we know that their outcome for the full year (had it been observed) would also be that they used HCBS. Thus, we assign a weight of 1 to these observations. For all other observations (that is, no use of service during observed months), we assign a weight equal to the number of observed months divided by 12, as this quantity represents the fraction of the year that was observable.

For count outcomes (hospital stays and days), we account for incomplete observations in two steps. First, we annualize the outcomes, by multiplying the observed count for the year times the number of observed months, divided by 12. The annualized outcome represents the expected count for that individual had their rate of events (hospital stays or days) during the observed portion of the year remained constant over the rest of the year. Second, we assign each observation a weight, equal to the number of observed months, divided by 12. Note that, in contrast to the binary outcomes, this procedure does not differ between individuals who were and were not hospitalized during the observed portion of one's year. This is because the observation of a count is not complete for any individual, unless they were observed for a full 12 months.

4. Model specification

New York. For the New York analysis, the first three months in our study period (January through March 2009) were used as a look-back period to identify existing MLTC enrollees as of 2009 and the comparison group. Thus, outcomes are measured from April 2009 forward for all beneficiaries. Up to three study years per beneficiary are included in the analysis: April 2009 through March 2010 (Study Year 1); April 2010 through March 2011 (Study Year 2); and April 2011 through March 2012 (Study Year 3). Because only three months of data would be available during a fourth study year before MLTC enrollment became mandatory in July 2012, we excluded this fourth year.

The regression models used for the analysis take the following form:

$$(1) \qquad g\left(\mu_{ij}\right) = \alpha_j + \theta_j MLTSS_i + \beta X_i.$$

In this model, μ_{ij} is the expected outcome for subject i in study year j, $MLTSS_i$ is an indicator that the beneficiary is one of the MLTC enrollees (versus the comparison group), X_i are baseline covariates measured in 2009, and $g()$ is an appropriate generalized linear model

link function. We use the logit link for logistic regression models and the log link for gamma regression models, which are commonly used defaults. There are three types of parameters in this model:

- α_j is the log odds of having the outcome (log expected count for gamma models) during study year j in the comparison group, when all baseline covariates take the value of zero

- θ_j is the log odds ratio (log relative rate for gamma models) comparing the MLTC to the comparison group in study year j, holding baseline covariates constant

- β is a vector of the log odds ratios (log relative rate for gamma models) for any one-unit change in each baseline covariate

The parameters of interest in these models are the θ_j parameters (θ_1, θ_2 and θ_3), which represent the effect of the intervention (MLTC enrollment) during each of the three study years, expressed as log odds ratios (or log relative rates for gamma models).

Because we did not have data from before the implementation of the intervention for all beneficiaries, we only included baseline variables that would not have been affected by the intervention itself. These variables included age (modeled as a spline term with a knot at age 65), gender, race, geographic location (New York City, urban area not in New York City, or rural), race, dual eligibility status (full dual, partial dual, or non-dual), presence of dementia, total CDPS score, 19 CDPS domain flags, and an indicator for not having any CDPS flags present. Each of the 19 CDPS flags is a dichotomized version of the 19 CDPS domain categories. For most of the domains, the flags used in the model are based on dichotomizing the domain category at "medium" severity or above. The exceptions to this rule were the cerebrovascular, developmental disability, and eye domains ("low" or above), the ear domain ("super low" and above), genital domain ("extra low" and above), and substance abuse domain ("very low" and above). These exceptions were made due to the inexistence of any levels of "medium" severity or higher for the respective domains, or in the case of developmental disability, very low counts of beneficiaries with higher than medium severity.

Tennessee. For the Tennessee analysis, we focused on beneficiaries enrolled during the months associated with the initiation of the CHOICES program in that state, which were March 2010 and August 2010, depending on the beneficiary's county. Beneficiaries from Tennessee and Georgia contributed up to five years of data; those from Alabama could only contribute up to four years, because 2015 MAX data were not available for this state; the five study years are defined relative to the enrollment month (either March or August 2010), as described above.

For the New York analysis, we allowed the intervention effect to vary for each of the three study years. For Tennessee, two additional variables could modify the intervention effect: the baseline value of the outcome, and whether the beneficiary was enrolled in March or August (or for the comparison group, enrollment month of the beneficiary to which they were matched). To allow for this flexibility, we fit a model that includes interactions between these four important variables: MLTSS enrollment indicator, study year, August enrollment (versus March), and the

baseline value of the outcome. The baseline year is defined as the 12-month period leading up to the month of enrollment. The regression models take the following form:

$$(2) \quad g\left(\mu_{ij}\right) = \alpha_j + \theta_j MLTSS_i + \delta_j AUG_i + \gamma_j BLY_i + \xi_j MLTSS_i \times BLY_i + \zeta_j AUG_i \times BLY_i + \beta X_i.$$

Here, μ_{ij} is the expected outcome for subject i in study year j, $MLTSS_i$ is an indicator that the beneficiary is a CHOICES enrollee (TN, as opposed to AL or GA), Aug_i is an indicator for August 2010 enrollment, BLY_i is the value of the outcome in the baseline year, X_i are baseline covariates, and $g()$ is the generalized linear model link function (as in the New York analysis). The net effect of including the terms parameterized by α_j, θ_j, δ_j, γ_j, ξ_j, and ζ_j allows the expected level of the outcome in both the MLTSS and comparison groups to vary, depending on (1) study year, (2) August enrollment, and (3) the baseline value of the outcome. The parameters of interest in the model are θ_j and ξ_j, which define the effect of the MLTSS intervention during each of the five study years, depending on baseline level of the outcome. August enrollment is assumed to affect outcomes in both the MLTSS and comparison groups equally, so it does not affect the intervention effect (difference between the two groups).

Covariates (X_i) for these models include all covariates used in the New York analysis, plus additional covariates available because we were able to observe the period before program implementation. Because these covariates are available within MAX at the calendar year level, we used the values from 2009, which was the last calendar year before enrollment. The additional covariates included in the model are the total number of nursing facility days, ED visits, and ILTC expenditures for the year. All three variables were modeled on the log scale. Binary indicators of no nursing facility use and no ED visits were also included in the model. Finally, in addition to including the baseline value of the outcome being analyzed by any particular model (BLY_i), we included the baseline value of each of the other five outcomes that are part of the analysis as separate model covariates (without interactions).

The regression model described above compares outcomes between CHOICES enrollees from Tennessee to a comparison group made up of matched beneficiaries from both Alabama and Georgia. In addition to fitting this model, we also fit an alternative version of this model that separates the comparison group into its two constituent states (Alabama and Georgia). We did this by replacing the binary variable $MLTSS_i$ above with a three-level categorical variable $STATE_i$. Results for this analysis appear in Appendix E. Estimated coefficients for key covariates from each model in each state are presented in Appendix F.

5.   Difference in regression-adjusted means

Our goal in these analyses was to estimate the association of MLTSS with a set of outcome measures. We define this to be the expected outcome for an MLTSS enrollee, compared to the expected outcome for the same enrollee, if he or she had not enrolled in MLTSS (that is, the counterfactual condition). The regression models discussed above estimate this difference for each individual in the study, but due to the complexity of the model, that difference is allowed to differ for each beneficiary based on his or her baseline characteristics and the study year. To

summarize these results and present them in a more interpretable format, we calculate the expected outcomes under both MLTSS and the counterfactual, and average them over all MLTSS enrollees. These estimates are called regression-adjusted means, and we refer to the difference between them (MLTSS versus counterfactual) as the changes in outcome associated with MLTSS enrollment.

To be more concrete, consider the ILTC utilization outcome: whether or not an individual used ILTC services during a given study year. The regression-adjusted mean for this outcome under the MLTSS program is the expected probability of ILTC use during a given year if the individual had enrolled in MLTSS, averaged over the MLTSS population. Similarly, the regression-adjusted mean for the counterfactual is the expected probability of ILTC utilization for the given year, if the individual had not enrolled in MLTSS (that is, turning $MLTSS_i$ from the above equations to zero for everyone in the enrollee sample), averaged over the same MLTSS population. The difference between the two regression-adjusted means is change in ILTC utilization rate associated with MLTSS enrollment.

6. Software

We fit all regression models and calculate regression-adjusted means and intervention effects using Stata v. 14 (StataCorp 2015). All other data processing steps were completed using R 3.3.3 (R Core Team 2017).

APPENDIX B

MLTSS EXPENDITURES, 2008–2015

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Table B.1. MLTSS expenditures (in thousands of dollars), 2008–2015[a]

State	2008	2009	2010	2011	2012	2013	2014	2015
Total LTSS[b,c]	123,371,565	131,329,608	139,180,699	138,872,088	141,539,160	146,408,393	152,602,505	158,201,035
Total MLTSS[d]	4,665,096	5,907,537	6,563,696	7,334,155	8,934,177	13,005,854	20,462,578	27,704,446
MLTSS as a proportion of total LTSS (percentage)	4	4	5	5	6	9	13	18
Arizona	1,355,692	1,456,213	1,440,489	1,467,768	1,521,335	1,493,242	1,554,042	1,591,979
California[c]	443,901	450,380	NR	NR	NR	20,676	NR	327,935
Delaware	-	-	-	-	-	338,087	351,357	384,915
Florida[e]	228,597	280,546	249,182	247,586	253,921	263,983	2,565,536	3,674,587
Hawaii[c]	-	NR	NR	305,501	359,050	359,050	346,807	378,236
Illinois	-	-	-	-	-	66,212	425,921	682,012
Kansas	-	-	-	-	-	370,599	836,405	1,103,470
Massachusetts[c]	NR	194,817	237,755	337,182	439,205	531,737	293,343	1,345,595
Michigan	396,417	400,414	426,184	423,031	429,486	418,351	439,919	902,459
Minnesota	407,124	430,220	354,684	436,473	427,993	415,542	456,119	536,174
New Jersey	-	-	-	-	-	344,227	775,960	1,110,190
New Mexico[c]	-	444,067	596,522	NR	NR	NR	581,273	985,289
New York	675,047	761,616	879,017	1,072,806	1,746,500	3,440,565	5,733,117	5,183,277
North Carolina	30,745	36,945	34,841	38,438	138,214	482,108	670,839	771,132
Ohio	-	-	-	-	-	-	518,107	1,685,144
Pennsylvania	-	29	823	2,409	3,507	4,766	5,578	226,651
Tennessee	313,548	242,356	798,368	1,327,736	1,369,871	1,337,661	1,329,394	1,547,315
Texas	335,450	390,446	471,746	607,895	1,110,125	1,915,260	2,331,460	3,919,234
Washington[c]	NR	NR	NR	NR	6,662	7,004	-	-
Wisconsin	478,575	819,488	1,074,084	1,067,330	1,128,308	1,196,784	1,249,401	1,348,852

[a] Unpublished MLTSS expenditure data collected by Eiken et al. (2017) in conjunction with the 2015 LTSS expenditure report.

[b] 2012-2015 : Eiken et al. 2017 ; 2008-2012: Eiken et al.2016. Balancing Incentive Payment (BIP) expenditures are not included in the calculation of total LTSS because the program does not increase total expenditures—it increases the federal share of spending.

[c] Total LTSS expenditures includes all LTSS reported under managed care or FFS. Data exclude expenditures for managed care programs in the following states (years of missing data in parentheses): California (2010–2012, 2014); Hawaii (2009, 2010); Massachusetts (2008, 2014); New Mexico (2011–2013); Rhode Island (2013-2015); Washington (2008–2011). Data for several states include expenditures for Medicaid Upper Payment Limit programs or provider taxes. For more detail, see Eiken et al. (2014) and Eiken et al. (2016).

[d] MLTSS expenditures include LTSS costs reported under managed care (including Financial Alignment Demonstrations and BIP but excluding Programs of All-Inclusive Care for the Elderly) for states that operate MLTSS programs. MLTSS totals exclude states that do not operate MLTSS programs but reported expenditures for BIP (Indiana, Iowa, Louisiana, and New Hampshire) or Financial Alignment Demonstrations (South Carolina 2015, Virginia 2014-2015, and Washington in 2014).

[e] Florida's MLTSS expenditures increased from 2013 to 2014 as a result of mandatory enrollment in statewide managed long-term care, part of the Statewide Medicaid Managed Care (SMMC) Program.

NR = MLTSS program expenditures were not reported. The two states featured in this evaluation (New York and Tennessee) are highlighted in blue.

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APPENDIX C

MEASURES OF LTSS SUPPLY, DEMAND, AND POLICY IN TENNESSEE AND ITS NEIGHBORING STATES

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To identify a comparison state for Tennessee, we reviewed the following seven measures. Table C.1 presents the values for each measure in neighboring states.

1. **HCBS spending as a share of total LTSS spending for adults over age 65 or under age 65 with physical disabilities.** We included this measure because researchers have observed stronger growth in the share allocated to HCBS among states with an initially low share (or low "investment"; Miller and Kirk 2015).

2. **Whether personal care was provided under a state plan or HCBS waiver.** States with state plan personal care programs tend to have more success rebalancing HCBS expenditures (Ng et al. 2015; Ruttner and Irvin 2013).

3. **The number of Medicaid LTSS participant-years per 100 people age 21 or older with an ADL-limiting disability and income at or below 250 percent of the federal poverty level (FPL).** This indicator is included in our set and in the AARP rebalancing scorecard because it examines the likelihood that people with disabilities and modest incomes will actually receive Medicaid LTSS; a higher percentage indicates a more effective Medicaid LTSS safety net (Reinhard et al. 2011).

4. **Number of home health/personal care aides per 1,000 people over age 65.** This measure is also derived from the AARP scorecard. A higher ratio promotes access to community living (Reinhard et al. 2011).

5. **Number of assisted-living units per 1,000 people age 65 and over.** Like the previous measure, research suggests that a high ratio of assisted-living units promotes access to community living (Stevenson and Grabowski 2010).

6. **Number of nursing facility beds per 1,000 people age 65 and over.** Also derived from the AARP scorecard, lower ratios reported for this measure suggest that access to institutional care is limited (Reinhard et al. 2011).

7. **Number of people on HCBS waiver waiting lists.** Methods of reporting HCBS waiver waiting lists can vary widely; however, high numbers generally indicate that demand is higher than supply, and current LTSS policy results in unmet need (Ng et al. 2012).

Table C.1. Measures used to indicate LTSS capacity in Tennessee and neighboring states

State	State share of LTSS that is HCBS for people age 65+ or <65 w/physical disabilities, 2000[a]	Personal care provided under state plan (PCS) or HCBS waiver (W), 2010[b]	Number of Medicaid LTSS participant-years per 100 people age 21+ with ADL disability and income ≤250 FPL, 2007[c]	Number of home health/personal care aides per 1,000 people age 65+, 2009[c]	Number of assisted-living units per 1,000 people age 65+, 2007[d]	Number of nursing facility beds per 1,000 people age 65+[c]	Number of people on HCBS waiver waiting list[e]
Tennessee	0.55	W	15.9	27	18	37.1–44.4	2,666
Alabama	10.97	W	21.9	20	11	37.1–44.4	3,750
Georgia	14.21	W	20.5	20	17	29.1–37.0	11,242
Arkansas	30.00	PCS and W	30.0	30	13	56.1–68.7	2,252
Florida	10.11	PCS and W	24.1	14	20	11.4–29.0	44,596
Kentucky	23.20	W	*	13	17	37.1–44.4	0
Mississippi	6.69	W	24.8	14	10	37.1–44.4	8,104
Missouri	20.91	PCS and W	45.9	34	23	56.1–68.7	301
North Carolina	34.59	PCS and W	45.7	75	32	29.1–37.0	10,722
South Carolina	22.53	W	23.6	25	24	11.4–29.0	6,004
Virginia	16.35	W	*	31	46	29.1–37.0	7,188

The three states featured in this evaluation (Tennessee, Alabama, and Georgia) are highlighted.

* Data not available for this state.

[a] Miller and Kirk 2015.

[b] Ng et al. 2015.

[c] Reinhard et al. 2011.

[d] Stevenson and Grabowski 2010.

[e] Ng et al. 2012.

APPENDIX D

COMPARISON OF HOME AND COMMUNITY BASED SERVICES COVERED IN ALABAMA, GEORGIA, NEW YORK, AND TENNESSEE

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Table D.1. HCBS covered in Alabama, Georgia, New York, and Tennessee[a]

HCBS taxonomy service definition[b]	Covered service, as defined by the state	Alabama[c]	Georgia[d]	New York[e,f]	Tennessee[g]
Caregiver support	In-home respite care	Not covered	Covered	Not covered	Covered
	In-patient respite care	Not covered	Not covered	Not covered	Covered
	Out-of-home respite	Not covered	Covered	Not covered	Not covered
	Skilled respite	Covered	Not covered	Not covered	Not covered
	Unskilled respite	Covered	Not covered	Not covered	Not covered
Case management	Care/case management	Covered	Covered	Covered	Not covered
	Enhanced primary care case management	Not covered	Covered	Not covered	Not covered
Community transition services	Transitional assistance services	Covered	Not covered	Not covered	Not covered
Day services	Adult day health	Covered	Covered	Covered	Covered
	Social and environmental supports	Not covered	Not covered	Covered	Not covered
	Social day care	Not covered	Not covered	Covered	Not covered
Equipment, technology, and modifications	Assistive technology	Covered	Not covered	Not covered	Covered
	Durable medical equipment, including Medical//Surgical Supplies, Enteral and Parenteral Formula, and Hearing Aid Batteries, Prosthetics, Orthotics and Orthopedic Footwear	Not covered	Not covered	Covered	Not covered
	Environmental modifications/ adaptations	Covered	Covered	Not covered	Not covered
	Home modifications	Covered	Not covered	Not covered	Covered
	Medical supplies	Covered	Not covered	Not covered	Not covered
	Personal Emergency Response Systems	Covered	Covered	Covered	Covered
	Specialized medical equipment	Not covered	Covered	Not covered	Not covered
	Vehicle adaptation	Not covered	Covered	Not covered	Not covered
Home-based services	Attendant care	Covered	Not covered	Not covered	Covered
	Companion services	Covered	Not covered	Not covered	Not covered
	Home health aide	Not covered	Not covered	Covered	Not covered
	Homemaker services	Covered	Not covered	Not covered	Covered
	Personal care	Covered	Covered	Covered	Covered
	Personal support services	Not covered	Covered	Not covered	Not covered
Home-delivered meals	Home-delivered meals	Covered	Covered	Covered	Covered
Nonmedical transportation	Non-emergent transportation	Not covered	Not covered	Covered	Not covered
Nursing	Home care, nursing	Not covered	Not covered	Covered	Not covered
	Private duty nursing	Covered	Not covered	Covered	Not covered
	Skilled nursing	Covered	Covered	Not covered	Not covered

Table D.1 *(continued)*

HCBS taxonomy service definition[b]	Covered service, as defined by the state	Alabama[c]	Georgia[d]	New York[e,f]	Tennessee[g]
Other health and therapeutic services	Dental services	Not covered	Not covered	Covered	Not covered
	Home-delivered services	Not covered	Covered	Not covered	Not covered
	Medical social services	Not covered	Not covered	Covered	Not covered
	Nutrition	Not covered	Not covered	Covered	Not covered
	Occupational therapy	Not covered	Covered	Covered	Not covered
	Physical therapy	Not covered	Covered	Covered	Not covered
	Respiratory therapy	Not covered	Not covered	Covered	Not covered
	Speech therapy	Not covered	Covered	Covered	Not covered
Other mental health and behavioral services	Behavioral support services	Not covered	Covered	Not covered	Not covered
	Counseling	Not covered	Covered	Not covered	Not covered
Other services	Pest control	Not covered	Not covered	Not covered	Covered
Round-the-clock services	Alternative living services	Not covered	Covered	Not covered	Not covered
	Community-based residential alternatives	Not covered	Not covered	Not covered	Covered
Services supporting participant direction	Financial management services	Not covered	Covered	Not covered	Not covered

[a] Covered services vary by population and may be subject to service limits.

[b] Peebles, Victoria and Alex Bohl. "The HCBS Taxonomy: A New Language for Classifying Home- and Community-Based Services." Medicare & Medicaid Research Review, vol. 4, no.3, 2014.

[c] Sources: Elderly & Disabled Waiver (0068.91.R3.04), State of Alabama Independent Living (SAIL) Waiver (0241.R04.00), Technology Assisted Waiver (0407.R03.00), and ACT Waiver (0878.R01.00) Available at: https://www.medicaid.gov/medicaid/section-1115-demo/demonstration-and-waiver-list/waivers_faceted.html.

[d] Sources: GA Elderly & Disabled Waiver (0112.R06.00) and GA Independent Care Waiver Program (4170.R05.00). Available at: https://www.medicaid.gov/medicaid/section-1115-demo/demonstration-and-waiver-list/waivers_faceted.html.

[e] Source: New York State Department of Health. 2007 Managed Long Term Care (MLTC) Model Contract, updated January 2011. Appendix G. Available at: https://www.health.ny.gov/health_care/managed_care/mltc/pdf/mltc_contract.pdf.

[f] All covered services provided as medically necessary. Covered services also include podiatry, dentistry, optometry/eyeglasses, and audiology/hearing aids.

[g] Source: Centers for Medicare & Medicaid Services. TennCare II Special Terms and Conditions, July 1, 2010 through June 30, 2013. Accessed May 17, 2017. Available at: https://www.medicaid.gov/Medicaid-CHIP-Program-Information/By-Topics/Waivers/1115/downloads/tn/TennCare-II/tn-tenncare-ii-stc-07012010-06302013.pdf.

APPENDIX E

RESULTS FROM OUTCOMES EVALUATION IN TENNESSEE BASED ON SEPARATE MATCHED COMPARISON GROUPS FROM ALABAMA AND GEORGIA

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Table E.1. Changes in ILTC[a] use associated with CHOICES enrollment in Tennessee (matched comparison groups presented separately)

	Regression-adjusted means among CHOICES enrollees			Difference in means					
		Without program							
Population and year	With program	Based on regression using comparison group from Alabama	Based on regression using comparison group from Georgia	Based on regression using matched comparison group from Alabama			Based on regression using matched comparison group from Georgia		
	(%)	(%)	(%)	Estimate (%)	95% CI (%)	*p*-value	Estimate (%)	95% CI (%)	*p*-value
All beneficiaries									
Year 1	80.7	82.3	81.1	-1.5	(-1.0, -2.1)	<0.001	-0.4	(0.1, -0.9)	0.156
Year 2	81.1	80.8	78.5	0.3	(0.9, -0.4)	0.422	2.6	(3.3, 2.0)	<0.001
Year 3	79.0	79.2	77.0	-0.2	(0.7, -1.0)	0.679	2.0	(2.8, 1.1)	<0.001
Year 4	77.0	79.8	75.3	-2.8	(-1.7, -3.8)	<0.001	1.7	(2.8, 0.7)	0.001
Year 5	85.4	-	84.5	n/a	n/a	n/a	1.0	(2.0, 0.0)	0.053
5-year average	80.7	80.5	79.3	-1.1	(-0.5, -1.7)	<0.001	1.4	(2.0, 0.8)	<0.001
Full-benefit dually eligible beneficiaries									
Year 1	82.0	83.9	82.9	-1.9	(-1.3, -2.4)	<0.001	-0.9	(-0.3, -1.4)	0.002
Year 2	82.7	82.7	80.8	0.1	(0.8, -0.6)	0.814	2.0	(2.7, 1.3)	<0.001
Year 3	80.7	81.0	79.2	-0.3	(0.6, -1.2)	0.500	1.5	(2.4, 0.6)	0.001
Year 4	78.9	81.7	77.7	-2.9	(-1.7, -4.0)	<0.001	1.2	(2.2, 0.0)	0.036
Year 5	86.7	-	86.1	n/a	n/a	n/a	0.6	(1.6, -0.5)	0.273
5-year average	82.2	82.3	81.3	-1.2	(-0.6, -1.9)	<0.001	0.9	(1.5, 0.2)	0.007
Medicaid-only beneficiaries									
Year 1	70.1	69.0	66.6	1.1	(2.7, -0.6)	0.203	3.5	(5.3, 1.7)	<0.001
Year 2	68.6	67.3	60.9	1.4	(3.8, -0.9)	0.242	7.7	(10.5, 5.0)	<0.001
Year 3	67.4	66.7	62.1	0.6	(3.3, -1.9)	0.632	5.3	(8.3, 2.3)	0.001
Year 4	65.4	68.0	60.2	-2.6	(0.5, -5.8)	0.099	5.2	(8.7, 1.6)	0.004
Year 5	77.6	-	74.4	n/a	n/a	n/a	3.3	(6.5, 0.1)	0.046
5-year average	69.8	67.8	64.8	0.1	(1.9, -1.7)	0.913	5.0	(7.2, 2.8)	<0.001

Source: Mathematica Policy Research analyses of state submitted finder file, 2009–2014 MAX and other data.

Notes: Any discrepancy between the difference in means shown and that calculated from numbers presented in the table is because of minor rounding adjustment.

Program refers to the CHOICES program. Regression-adjusted means without program show the expected level of the outcome among CHOICES enrollees had they not experienced the program (that is, no enrollment in CHOICES).

[a] ILTC was defined as services received in nursing facilities or mental hospitals for the aged.

ILTC = Institutional long-term care.

Table E.2. Changes in HCBS[a] use associated with CHOICES enrollment in Tennessee (matched comparison groups presented separately)

	Regression-adjusted means among CHOICES enrollees			Difference in means					
		Without program							
Population and year	**With program**	**Based on regression using matched comparison group from Alabama**	**Based on regression using matched comparison group from Georgia**	**Based on regression using matched comparison group from Alabama**			**Based on regression using matched comparison group from Georgia**		
	(%)	**(%)**	**(%)**	**Estimate (%)**	**95% CI (%)**	***p*-value**	**Estimate (%)**	**95% CI (%)**	***p*-value**
All beneficiaries									
Year 1	72.2	83.6	74.1	-11.4	(-10.1, -12.7)	<0.001	-1.8	(-0.7, -2.9)	0.001
Year 2	73.7	84.3	74.9	-10.6	(-9.1, -12.0)	<0.001	-1.2	(0.1, -2.5)	0.067
Year 3	73.7	86.0	77.5	-12.2	(-10.6, -13.9)	<0.001	-3.8	(-2.3, -5.2)	<0.001
Year 4	65.5	80.5	79.3	-15.1	(-13.1, -17.1)	<0.001	-13.8	(-12.2, -15.5)	<0.001
Year 5	69.6	n/a	82.7	n/a	n/a	n/a	-13.2	(-11.5, -14.8)	<0.001
5-year average	70.9	83.6	77.7	-12.3	(-11.2, -13.4)	<0.001	-6.8	(-5.9, -7.7)	<0.001
Full-benefit dually eligible beneficiaries									
Year 1	69.2	82.0	71.6	-12.8	(-11.4, -14.3)	<0.001	-2.4	(-1.2, -3.6)	<0.001
Year 2	70.8	82.8	72.7	-12.0	(-10.4, -13.7)	<0.001	-1.9	(-0.5, -3.3)	0.009
Year 3	70.6	84.6	75.4	-14.0	(-12.1, -15.9)	<0.001	-4.8	(-3.2, -6.4)	<0.001
Year 4	60.7	78.7	76.9	-18.0	(-15.7, -20.2)	<0.001	-16.2	(-14.3, -18.1)	<0.001
Year 5	63.1	n/a	79.8	n/a	n/a	n/a	-16.7	(-14.7, -18.7)	<0.001
5-year average	66.9	82.0	75.3	-14.2	(-13.0, -15.4)	<0.001	-8.4	(-7.4, -9.4)	<0.001
Medicaid-only beneficiaries									
Year 1	96.2	96.7	93.7	-0.5	(1.3, -2.2)	0.603	2.5	(3.8, 1.2)	<0.001
Year 2	95.8	95.7	91.6	0.1	(1.9, -1.7)	0.934	4.2	(5.9, 2.5)	<0.001
Year 3	96.3	97.1	93.0	-0.8	(1.0, -2.6)	0.363	3.3	(5.1, 1.5)	<0.001
Year 4	97.5	93.7	95.5	3.8	(5.8, 1.9)	<0.001	2.0	(4.2, -0.2)	0.077
Year 5	97.6	n/a	96.2	n/a	n/a	n/a	1.4	(3.0, -0.1)	0.061
5-year average	96.7	95.8	94.0	0.7	(1.9, -0.6)	0.304	2.7	(3.8, 1.5)	<0.001

Source: Mathematica Policy Research analyses of state submitted finder file, 2009–2014 MAX and other data.

Notes: Any discrepancy between the difference in means shown and that calculated from numbers presented in the table is because of minor rounding adjustment.

Program refers to the CHOICES program. Regression-adjusted means without program show the expected level of the outcome among CHOICES enrollees had they not experienced the program (that is, no enrollment in CHOICES).

[a] HCBS was defined as any claims with (1) a type of service indicating home health, personal care, case management, rehabilitation, hospice provided in the patient's home, private duty nursing, residential day care, or adult day care or (2) a flag according to the MAX HCBS taxonomy.

HCBS = Home and community-based services.

n/a = Data not available for Year 5 in Alabama.

Table E.3. Changes in personal care services use associated with CHOICES enrollment in Tennessee (matched comparison groups presented separately)

Population and year	Regression-adjusted means among CHOICES enrollees			Difference in means					
	With program	Without program		Based on regression using matched comparison group from Alabama			Based on regression using matched comparison group from Georgia		
		Based on regression using matched comparison group from Alabama	Based on regression using matched comparison group from Georgia						
	(%)	(%)	(%)	Estimate (%)	95% CI (%)	p-value	Estimate (%)	95% CI (%)	p-value
All beneficiaries									
Year 1	18.9	18.3	18.3	0.6	(0.9, 0.3)	0.001	0.6	(0.9, 0.2)	0.001
Year 2	20.2	18.8	18.7	1.3	(1.9, 0.8)	<0.001	1.5	(2.1, 0.9)	<0.001
Year 3	21.2	19.7	19.7	1.5	(2.2, 0.8)	<0.001	1.5	(2.3, 0.7)	<0.001
Year 4	22.2	23.1	20.0	-0.9	(-0.1, -1.8)	0.034	2.2	(3.2, 1.3)	<0.001
Year 5	36.9	n/a	34.9	n/a	n/a	n/a	2.1	(3.4, 0.8)	0.002
5-year average	23.9	20.0	22.3	0.6	(1.1, 0.1)	0.014	1.6	(2.2, 0.9)	<0.001
Full-benefit dually eligible beneficiaries									
Year 1	17.4	17.0	16.8	0.4	(0.7, 0.0)	0.025	0.6	(1.0, 0.3)	0.001
Year 2	18.5	17.6	17.3	0.9	(1.5, 0.4)	0.001	1.2	(1.8, 0.6)	<0.001
Year 3	19.7	18.7	18.5	1.0	(1.7, 0.2)	0.011	1.2	(2.0, 0.4)	0.004
Year 4	20.7	22.1	18.8	-1.4	(-0.5, -2.3)	0.002	1.9	(2.8, 0.9)	<0.001
Year 5	34.7	n/a	33.4	n/a	n/a	n/a	1.2	(2.6, -0.1)	0.074
5-year average	22.2	18.8	21.0	0.2	(0.7, -0.3)	0.402	1.2	(1.9, 0.6)	<0.001
Medicaid-only beneficiaries									
Year 1	32.6	30.5	32.2	2.0	(3.5, 0.6)	0.006	0.3	(1.9, -1.2)	0.673
Year 2	33.8	29.6	29.7	4.2	(6.1, 2.2)	<0.001	4.0	(6.4, 1.7)	0.001
Year 3	32.9	28.4	28.9	4.6	(6.9, 2.2)	<0.001	4.0	(6.9, 1.0)	0.009
Year 4	33.1	31.2	27.7	1.9	(4.7, -0.9)	0.180	5.4	(8.9, 1.9)	0.003
Year 5	50.7	n/a	43.3	n/a	n/a	n/a	7.4	(12.0, 2.8)	0.002
5-year average	36.6	29.9	32.4	3.2	(4.9, 1.4)	<0.001	4.2	(6.6, 1.8)	0.001

Source: Mathematica Policy Research analyses of state submitted finder file, 2009–2014 MAX and other data.

Notes: Any discrepancy between the difference in means shown and that calculated from numbers presented in the table is because of minor rounding adjustment.

Program refers to the CHOICES program. Regression-adjusted means without program show the expected level of the outcome among CHOICES enrollees had they not experienced the program (that is, no enrollment in CHOICES).

n/a = Data not available for Year 5 in Alabama.

Table E.4. Changes in admissions to acute care hospitals associated with CHOICES enrollment in Tennessee (matched comparison groups presented separately)

	Regression-adjusted means among CHOICES enrollees			Difference in means					
		Without program							
Population and year	With program	Based on regression using matched comparison group from Alabama	Based on regression using matched comparison group from Georgia	Based on regression using matched comparison group from Alabama			Based on regression using matched comparison group from Georgia		
	(%)	(%)	(%)	Estimate (%)	95% CI (%)	*p*-value	Estimate (%)	95% CI (%)	*p*-value
All beneficiaries									
Year 1	38.5	37.6	36.8	1.0	(2.3, -0.4)	0.154	1.8	(3.1, 0.4)	0.008
Year 2	37.3	35.5	33.4	1.8	(3.3, 0.3)	0.021	3.9	(5.4, 2.4)	<0.001
Year 3	34.5	34.5	32.6	0.0	(1.7, -1.7)	0.990	1.9	(3.6, 0.2)	0.029
Year 4	32.0	28.8	30.2	3.2	(5.3, 1.1)	0.002	1.8	(3.7, 0.0)	0.056
Year 5	34.3	n/a	30.5	n/a	n/a	n/a	3.9	(6.4, 1.3)	0.004
5-year average	35.3	34.1	32.7	1.5	(2.5, 0.5)	0.004	2.6	(3.7, 1.6)	<0.001
Full-benefit dually eligible beneficiaries									
Year 1	39.0	38.0	37.8	1.1	(2.5, -0.4)	0.145	1.2	(2.6, -0.2)	0.088
Year 2	37.6	35.9	34.4	1.7	(3.3, 0.1)	0.038	3.3	(4.9, 1.7)	<0.001
Year 3	34.8	35.0	33.5	-0.2	(1.6, -2.0)	0.828	1.3	(3.1, -0.5)	0.162
Year 4	32.7	30.1	31.1	2.5	(4.8, 0.3)	0.028	1.5	(3.6, -0.5)	0.135
Year 5	34.8	n/a	31.5	n/a	n/a	n/a	3.3	(6.1, 0.5)	0.022
5-year average	35.8	34.8	33.7	1.3	(2.3, 0.2)	0.020	2.1	(3.2, 1.0)	<0.001
Medicaid-only beneficiaries									
Year 1	34.3	35.1	33.9	-0.7	(3.3, -4.8)	0.715	0.4	(4.3, -3.5)	0.843
Year 2	34.4	34.2	30.9	0.2	(4.6, -4.1)	0.918	3.5	(7.8, -0.9)	0.117
Year 3	32.1	32.0	31.3	0.1	(4.8, -4.6)	0.965	0.8	(5.6, -4.0)	0.754
Year 4	27.7	21.0	29.0	6.7	(12.1, 1.4)	0.013	-1.3	(3.9, -6.5)	0.623
Year 5	31.5	n/a	29.3	n/a	n/a	n/a	2.3	(9.0, -4.4)	0.508
5-year average	32.0	30.6	30.9	1.6	(4.6, -1.4)	0.298	1.1	(4.0, -1.8)	0.448

Source: Mathematica Policy Research analyses of state submitted finder file, 2009–2014 MAX and other data.

Notes: Any discrepancy between the difference in means shown and that calculated from numbers presented in the table is because of minor rounding adjustment.

Program refers to the CHOICES program. Regression-adjusted means without program show the expected level of the outcome among CHOICES enrollees had they not experienced the program (that is, no enrollment in CHOICES).

n/a = Data not available for Year 5 in Alabama.

Table E.5. Changes in acute care hospital stays per 1,000 beneficiaries associated with CHOICES enrollment in Tennessee (matched comparison groups presented separately)

	Regression-adjusted means among CHOICES enrollees			Difference in means					
		Without program							
Population and year	With program (Count per 1,000 beneficiaries)	Based on regression using matched comparison group from Alabama (Count per 1,000 beneficiaries)	Based on regression using matched comparison group from Georgia (Count per 1,000 beneficiaries)	Based on regression using matched comparison group from Alabama			Based on regression using matched comparison group from Georgia		
				Estimate (Count per 1,000 beneficiaries)	95% CI (Count per 1,000 beneficiaries)	p-value	Estimate (Count per 1,000 beneficiaries)	95% CI (Count per 1,000 beneficiaries)	p-value
All beneficiaries									
Year 1	763	691	690	73	(109, 37)	<0.001	74	(109, 39)	<0.001
Year 2	719	629	611	90	(129, 51)	<0.001	108	(147, 69)	<0.001
Year 3	657	606	574	51	(95, 8)	0.020	83	(126, 40)	<0.001
Year 4	605	481	524	124	(175, 72)	<0.001	81	(127, 34)	0.001
Year 5	638	n/a	495	n/a	n/a	n/a	143	(215, 70)	<0.001
5-year average	676	602	579	85	(110, 59)	<0.001	98	(124, 72)	<0.001
Full-benefit dually eligible beneficiaries									
Year 1	775	697	705	78	(116, 40)	<0.001	70	(107, 33)	<0.001
Year 2	721	635	627	85	(127, 43)	<0.001	93	(135, 52)	<0.001
Year 3	657	612	589	45	(91, -2)	0.059	68	(114, 23)	0.003
Year 4	619	509	536	110	(167, 53)	<0.001	83	(133, 32)	0.001
Year 5	647	n/a	515	n/a	n/a	n/a	132	(211, 52)	0.001
5-year average	684	613	594	80	(107, 52)	<0.001	89	(117, 61)	<0.001
Medicaid-only beneficiaries									
Year 1	683	637	699	46	(153, -61)	0.397	-15	(95, -126)	0.785
Year 2	710	594	583	116	(227, 4)	0.042	127	(249, 6)	0.040
Year 3	665	575	557	90	(216, -36)	0.162	108	(241, -25)	0.110
Year 4	507	301	511	206	(324, 89)	0.001	-3	(125, -132)	0.960
Year 5	585	n/a	466	n/a	n/a	n/a	119	(300, -63)	0.200
5-year average	630	527	563	115	(186, 43)	0.002	67	(143, -9)	0.082

Source: Mathematica Policy Research analyses of state submitted finder file, 2009–2014 MAX and other data.

Notes: Any discrepancy between the difference in means shown and that calculated from numbers presented in the table is because of minor rounding adjustment.

         Program refers to the CHOICES program. Regression-adjusted means without program show the expected level of the outcome among CHOICES enrollees had they not experienced the program (that is, no enrollment in CHOICES).

n/a = Data not available for Year 5 in Alabama.

Table E.6. Changes in admissions to acute care hospitalized days per beneficiary associated with CHOICES enrollment in Tennessee (matched comparison groups presented separately)

	Regression-adjusted means among CHOICES enrollees			Difference in means					
		Without program							
Population and year	With program	Based on regression using matched comparison group from Alabama	Based on regression using matched comparison group from Georgia	Based on regression using matched comparison group from Alabama			Based on regression using matched comparison group from Georgia		
				Estimate	95% CI	*p*-value	Estimate	95% CI	*p*-value
	(Count per beneficiary)	(Count per beneficiary)	(Count per beneficiary)	(Count per beneficiary)	(Count per beneficiary)		(Count per beneficiary)	(Count per beneficiary)	
All beneficiaries									
Year 1	6.8	5.6	5.4	1.3	(1.7, 0.8)	<0.001	1.5	(1.9, 1.1)	<0.001
Year 2	6.3	5.0	4.7	1.3	(1.7, 0.9)	<0.001	1.6	(2.0, 1.1)	<0.001
Year 3	5.9	4.9	4.5	1.1	(1.5, 0.6)	<0.001	1.5	(1.9, 1.0)	<0.001
Year 4	5.8	4.1	4.4	1.7	(2.2, 1.1)	<0.001	1.4	(1.9, 0.8)	<0.001
Year 5	5.9	n/a	4.0	n/a	n/a	n/a	1.9	(2.8, 1.1)	<0.001
5-year average	6.1	4.9	4.6	1.3	(1.6, 1.0)	<0.001	1.6	(1.9, 1.3)	<0.001
Full-benefit dually eligible beneficiaries									
Year 1	6.8	5.7	5.5	1.1	(1.6, 0.7)	<0.001	1.3	(1.8, 0.9)	<0.001
Year 2	6.1	5.1	4.8	1.1	(1.5, 0.6)	<0.001	1.4	(1.8, 0.9)	<0.001
Year 3	5.8	5.0	4.6	0.8	(1.3, 0.3)	0.002	1.2	(1.7, 0.7)	<0.001
Year 4	5.9	4.4	4.4	1.5	(2.2, 0.9)	<0.001	1.5	(2.1, 0.9)	<0.001
Year 5	6.1	n/a	4.1	n/a	n/a	n/a	2.0	(2.9, 1.0)	<0.001
5-year average	6.1	5.0	4.7	1.1	(1.4, 0.8)	<0.001	1.5	(1.8, 1.2)	<0.001
Medicaid-only beneficiaries									
Year 1	7.1	4.8	5.5	2.2	(3.5, 1.0)	<0.001	1.5	(2.9, 0.2)	0.026
Year 2	7.2	4.6	4.8	2.6	(4.0, 1.3)	<0.001	2.4	(3.8, 1.0)	0.001
Year 3	7.0	4.1	4.5	2.9	(4.4, 1.4)	<0.001	2.5	(4.1, 0.9)	0.002
Year 4	4.7	2.5	4.5	2.2	(3.5, 0.9)	0.001	0.2	(1.7, -1.2)	0.755
Year 5	5.3	n/a	3.7	n/a	n/a	n/a	1.5	(3.4, -0.4)	0.121
5-year average	6.2	4.0	4.6	2.5	(3.3, 1.7)	<0.001	1.6	(2.5, 0.8)	<0.001

Source: Mathematica Policy Research analyses of state submitted finder file, 2009–2014 MAX and other data.

Notes: Any discrepancy between the difference in means shown and that calculated from numbers presented in the table is because of minor rounding adjustment.

　　　　　Program refers to the CHOICES program. Regression-adjusted means without program show the expected level of the outcome among CHOICES enrollees had they not experienced the program (that is, no enrollment in CHOICES).

n/a = Data not available for Year 5 in Alabama.

APPENDIX F

**KEY ESTIMATED COEFFICIENTS FROM REGRESSION MODELS OF THE
OUTCOMES EVALUATION IN NEW YORK AND TENNESSEE**

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Table F.1. Results from logit model of institutional care utilization

Variable definition	New York			Tennessee		
	Odds ratio	95% CI	*p*-value	Odds ratio	95% CI	*p*-value
Dual status						
Full duals (ref)	--	--	--	--	--	--
Non-duals	1.409	(1.246, 1.594)	<0.001	0.638	(0.525, 0.775)	<0.001
Partial duals	0.570	(0.368, 0.883)	0.012	0.004	(0.002, 0.009)	<0.001
Age						
Continuous age	1.046	(1.038, 1.054)	<0.001	1.035	(1.029, 1.042)	<0.001
Age > 65	2.189	(1.324, 3.621)	0.002	7.488	(4.042, 13.872)	<0.001
Age spline at 65	0.983	(0.975, 0.992)	<0.001	0.971	(0.962, 0.979)	<0.001
Female	0.622	(0.587, 0.660)	<0.001	0.960	(0.870, 1.060)	0.422
Race						
White (ref)	--	--	--	--	--	--
Black	1.231	(1.157, 1.309)	<0.001	0.869	(0.789, 0.958)	0.005
Hispanic	0.690	(0.648, 0.735)	<0.001	--	--	--
Asian	0.501	(0.455, 0.552)	<0.001	--	--	--
Other	0.797	(0.665, 0.956)	0.015	0.808	(0.578, 1.132)	0.215
Geographic category						
Rural	3.693	(3.402, 4.008)	<0.001	1.390	(1.275, 1.517)	<0.001
Non-NYC urban	5.841	(3.835, 8.895)	<0.001	--	--	--
Presence of dementia	3.623	(3.432, 3.825)	0	1.161	(1.044, 1.290)	0.006
No CDPS conditions	2.349	(2.080, 2.653)	<0.001	1.271	(1.016, 1.589)	0.036
CDPS score	1.038	(1.016, 1.061)	0.001	0.975	(0.933, 1.019)	0.265
Zero nursing facility days	--	--	--	3.960	(2.581, 6.074)	<0.001
Log nursing facility days if > 0	--	--	--	1.856	(1.649, 2.089)	<0.001
Log institutional expenditures + 1	--	--	--	0.990	(0.948, 1.034)	0.653
Zero emergency department visits	--	--	--	0.941	(0.789, 1.121)	0.494
Log emergency department visits if > 0	--	--	--	1.042	(0.894, 1.214)	0.598
Baseline outcome levels						
ILTC use	--	--	--	19.707	(14.347, 27.070)	<0.001
HCBS use	--	--	--	0.964	(0.856, 1.087)	0.551
Personal care use	--	--	--	0.528	(0.443, 0.629)	<0.001
Hospital stays						
0 (ref)	--	--	--	--	--	--
[1, 2)	--	--	--	1.216	(0.638, 2.319)	0.552
[2, 5)	--	--	--	1.429	(0.744, 2.745)	0.283
> 5	--	--	--	1.594	(0.757, 3.357)	0.220
Hospital days						
0 (ref)	--	--	--	--	--	--
[1, 8)	--	--	--	0.791	(0.413, 1.517)	0.481
[8, 30)	--	--	--	0.763	(0.399, 1.460)	0.414
> 30	--	--	--	0.830	(0.419, 1.645)	0.593

Source: Mathematica Policy Research analyses of state submitted finder file (TN), 2009–2014 MAX and other data.

Table F.2. Results from the logit model of home and community-based services utilization

Variable definition	New York			Tennessee		
	Odds ratio	95% CI	*p*-value	Odds ratio	95% CI	*p*-value
Dual status						
Full duals (ref)	--	--	--	--	--	--
Non-duals	5.777	(4.661, 7.160)	<0.001	5.674	(4.590, 7.015)	<0.001
Partial duals	0.121	(0.081, 0.182)	<0.001	0.047	(0.031, 0.071)	<0.001
Age						
Continuous age	0.984	(0.970, 0.998)	0.022	0.993	(0.986, 1.000)	0.039
Age > 65	0.329	(0.136, 0.794)	0.013	0.947	(0.590, 1.520)	0.823
Age spline at 65	1.009	(0.993, 1.024)	0.268	0.998	(0.990, 1.005)	0.574
Female	1.486	(1.340, 1.647)	<0.001	0.890	(0.834, 0.950)	0.000
Race						
White (ref)	--	--	--	--	--	--
Black	0.994	(0.884, 1.118)	0.926	1.095	(1.024, 1.171)	0.008
Hispanic	1.060	(0.943, 1.192)	0.327	--	--	--
Asian	1.527	(1.274, 1.831)	<0.001	--	--	--
Other	1.286	(0.891, 1.857)	0.180	1.386	(1.049, 1.829)	0.021
Geographic category						
Rural	0.413	(0.359, 0.474)	<0.001	0.996	(0.945, 1.050)	0.885
Non-NYC urban	0.534	(0.239, 1.196)	0.127	--	--	--
Presence of dementia	0.658	(0.585, 0.739)	<0.001	1.091	(1.027, 1.160)	0.005
No CDPS conditions	0.540	(0.441, 0.661)	<0.001	0.775	(0.666, 0.901)	0.001
CDPS score	2.052	(1.866, 2.258)	<0.001	1.070	(1.037, 1.104)	<0.001
Zero nursing facility days	--	--	--	0.531	(0.309, 0.912)	0.022
Log nursing facility days if > 0	--	--	--	0.660	(0.573, 0.760)	<0.001
Log institutional expenditures + 1	--	--	--	1.173	(1.109, 1.240)	<0.001
Zero emergency department visits	--	--	--	1.187	(1.062, 1.327)	0.003
Log emergency department visits if > 0	--	--	--	1.268	(1.142, 1.407)	<0.001
Baseline outcome levels						
ILTC use	--	--	--	0.196	(0.134, 0.285)	<0.001
HCBS use	--	--	--	14.184	(12.349, 16.293)	<0.001
Personal care use	--	--	--	1.750	(1.363, 2.248)	<0.001
Hospital stays						
0 (ref)	--	--	--	--	--	--
[1, 2)	--	--	--	1.031	(0.668, 1.592)	0.889
[2, 5)	--	--	--	1.041	(0.664, 1.633)	0.860
> 5	--	--	--	0.927	(0.543, 1.585)	0.783
Hospital days						
0 (ref)	--	--	--	--	--	--
[1, 8)	--	--	--	0.928	(0.602, 1.429)	0.733
[8, 30)	--	--	--	0.960	(0.615, 1.501)	0.859

Source: Mathematica Policy Research analyses of state submitted finder file (TN), 2009–2014 MAX and data.

Table F.3. Results from the logit model of personal care services utilization

Variable definition	New York			Tennessee		
	Odds ratio	95% CI	*p*-value	Odds ratio	95% CI	*p*-value
Dual status						
Full duals (ref)	--	--	--	--	--	--
Non-duals	0.738	(0.657, 0.829)	<0.001	1.181	(0.889, 1.568)	0.252
Partial duals	0.430	(0.309, 0.599)	<0.001	--	--	--
Age						
Continuous Age	1.000	(0.995, 1.006)	0.936	0.992	(0.984, 1.001)	0.086
Age > 65	0.673	(0.447, 1.014)	0.058	3.242	(1.425, 7.378)	0.005
Age Spline at 65	1.006	(1.000, 1.013)	0.066	0.982	(0.970, 0.994)	0.003
Female	1.628	(1.536, 1.726)	<0.001	1.073	(0.926, 1.243)	0.350
Race						
White (ref)	--	--	--	--	--	--
Black	0.820	(0.769, 0.875)	<0.001	1.669	(1.450, 1.920)	<0.001
Hispanic	1.141	(1.070, 1.218)	<0.001	--	--	--
Asian	0.969	(0.885, 1.060)	0.490	--	--	--
Other	0.979	(0.826, 1.161)	0.810	1.435	(0.947, 2.175)	0.089
Geographic category						
Rural	0.273	(0.250, 0.298)	<0.001	0.814	(0.722, 0.917)	0.001
Non-NYC urban	0.248	(0.160, 0.387)	<0.001	--	--	--
Presence of dementia	0.363	(0.342, 0.385)	<0.001	0.559	(0.481, 0.649)	<0.001
No CDPS conditions	0.539	(0.480, 0.606)	<0.001	0.833	(0.609, 1.141)	0.255
CDPS score	1.059	(1.032, 1.087)	<0.001	1.058	(0.997, 1.122)	0.065
Zero nursing facility days	--	--	--	0.203	(0.117, 0.353)	<0.001
Log nursing facility days if > 0	--	--	--	0.554	(0.472, 0.649)	<0.001
Log institutional expenditures + 1	--	--	--	1.102	(1.046, 1.160)	0.000
Zero emergency department visits	--	--	--	0.973	(0.771, 1.228)	0.819
Log emergency department visits if > 0	--	--	--	1.011	(0.834, 1.224)	0.915
Baseline outcome levels						
ILTC use	--	--	--	0.092	(0.066, 0.128)	<0.001
HCBS use	--	--	--	1.878	(1.269, 2.781)	0.002
Personal care use	--	--	--	90.482	(62.686, 130.603)	<0.001
Hospital stays						
0 (ref)	--	--	--	--	--	--
[1, 2)	--	--	--	1.317	(0.473, 2.664)	0.599
[2, 5)	--	--	--	1.115	(0.397, 3.135)	0.836
> 5	--	--	--	0.792	(0.253, 2.479)	0.688
Hospital days						
0 (ref)	--	--	--	--	--	--
[1, 8)	--	--	--	0.733	(0.263, 2.046)	0.553
[8, 30)	--	--	--	0.608	(0.217, 1.703)	0.344
> 30	--	--	--	0.675	(0.227, 2.004)	0.479

Source: Mathematica Policy Research analyses of state submitted finder file (TN), 2009–2014 MAX and other data.

Table F.4. Results from the two-part model of hospital admissions

Variable definition	New York			Tennessee		
	Odds ratio	95% CI	p-value	Odds ratio	95% CI	p-value
Dual status						
Full duals (ref)	--	--	--	--	--	--
Non-duals	1.823	(1.684, 1.974)	<0.001	1.181	(1.080, 1.292)	0.000
Partial duals	0.996	(0.759, 1.307)	0.978	0.889	(0.669, 1.180)	0.415
Age						
Continuous age	1.006	(1.002, 1.010)	0.003	1.009	(1.006, 1.012)	<0.001
Age > 65	0.647	(0.489, 0.857)	0.002	2.306	(1.744, 3.049)	<0.001
Age spline at 65	1.005	(1.001, 1.010)	0.024	0.988	(0.983, 0.992)	<0.001
Female	0.980	(0.942, 1.018)	0.299	0.870	(0.833, 0.909)	<0.001
Race						
White (ref)	--	--	--	--	--	--
Black	1.391	(1.333, 1.451)	<0.001	0.981	(0.938, 1.026)	0.396
Hispanic	1.521	(1.460, 1.583)	<0.001	--	--	--
Asian	0.770	(0.726, 0.815)	<0.001	--	--	--
Other	1.061	(0.942, 1.196)	0.328	0.851	(0.724, 0.999)	0.048
Geographic category						
Rural	1.133	(1.065, 1.205)	<0.001	1.133	(1.092, 1.175)	<0.001
Non-NYC urban	1.251	(0.865, 1.808)	0.234	--	--	--
Presence of dementia	1.132	(1.090, 1.176)	<0.001	0.991	(0.948, 1.035)	0.675
No CDPS conditions	1.590	(1.466, 1.725)	<0.001	0.999	(0.906, 1.101)	0.979
CDPS score	1.177	(1.155, 1.200)	<0.001	1.117	(1.094, 1.141)	<0.001
Zero nursing facility days	--	--	--	1.425	(1.137, 1.787)	0.002
Log nursing facility days if > 0	--	--	--	1.079	(1.007, 1.156)	0.032
Log institutional expenditures + 1	--	--	--	1.024	(0.995, 1.054)	0.100
Zero emergency department visits	--	--	--	1.090	(1.015, 1.170)	0.017
Log emergency department visits if > 0	--	--	--	1.416	(1.333, 1.505)	<0.001
Baseline outcome levels						
ILTC use	--	--	--	0.759	(0.639, 0.901)	0.002
HCBS use	--	--	--	1.250	(1.191, 1.313)	<0.001
Personal care use	--	--	--	1.138	(1.026, 1.263)	0.014
Hospital stays						
0 (ref)	--	--	--	--	--	--
[1, 2)	--	--	--	1.239	(0.860, 1.787)	0.250
[2, 5)	--	--	--	1.646	(1.137, 2.383)	0.008
> 5	--	--	--	2.880	(1.891, 4.387)	<0.001
Hospital days						
0 (ref)	--	--	--	--	--	--
[1, 8)	--	--	--	0.914	(0.697, 1.199)	0.517
[8, 30)	--	--	--	1.000	(0.760, 1.315)	0.997
> 30	--	--	--	1.040	(0.773, 1.400)	0.794

Source: Mathematica Policy Research analyses of state submitted finder file (TN), 2009–2014 MAX and other data.

Table F.5. Results from the two-part model of hospital stays

Variable definition	New York						Tennessee					
	Logistic submodel			Gamma submodel			Logistic submodel			Gamma submodel		
	Odds ratio	95% CI	*p*-value	Relative rate	95% CI	*p*-value	Odds ratio	95% CI	*p*-value	Relative rate	95% CI	*p*-value
Dual status												
Full duals (ref)	--	--	--	--	--	--	--	--	--	--	--	--
Non-duals	1.791	(1.654, 1.938)	<0.001	1.221	(1.155, 1.290)	<0.001	1.177	(1.074, 1.288)	0.000	0.880	(0.837, 0.926)	<0.001
Partial duals	0.996	(0.756, 1.311)	0.975	1.037	(0.894, 1.203)	0.630	0.855	(0.640, 1.143)	0.290	1.038	(0.906, 1.189)	0.589
Age												
Continuous age	1.005	(1.001, 1.009)	0.016	0.999	(0.996, 1.003)	0.740	1.007	(1.004, 1.011)	<0.001	1.000	(0.998, 1.002)	0.711
Age > 65	0.748	(0.565, 0.991)	0.043	0.840	(0.695, 1.015)	0.071	2.973	(2.231, 3.960)	<0.001	1.086	(0.936, 1.259)	0.277
Age spline at 65	1.003	(0.999, 1.008)	0.164	1.002	(0.998, 1.005)	0.328	0.984	(0.979, 0.988)	<0.001	0.999	(0.997, 1.001)	0.425
Female	1.003	(0.965, 1.044)	0.862	0.979	(0.958, 1.000)	0.049	0.906	(0.866, 0.949)	<0.001	0.951	(0.931, 0.971)	<0.001
Race												
White (ref)	--	--	--	--	--	--	--	--	--	--	--	--
Black	1.401	(1.342, 1.462)	<0.001	1.061	(1.038, 1.085)	<0.001	0.995	(0.950, 1.042)	0.825	1.016	(0.994, 1.038)	0.151
Hispanic	1.544	(1.483, 1.609)	<0.001	1.061	(1.038, 1.084)	<0.001	--	--	--	--	--	--
Asian	0.778	(0.734, 0.825)	<0.001	0.964	(0.932, 0.997)	0.031	--	--	--	--	--	--
Other	1.070	(0.948, 1.208)	0.271	0.996	(0.944, 1.051)	0.889	0.835	(0.706, 0.986)	0.034	1.007	(0.918, 1.104)	0.882
Geographic category												
Rural	1.118	(1.050, 1.190)	0.000	1.031	(0.999, 1.064)	0.057	1.133	(1.091, 1.177)	<0.001	1.003	(0.985, 1.021)	0.770
Non-NYC urban	1.293	(0.897, 1.863)	0.168	0.888	(0.772, 1.022)	0.097	--	--	--	--	--	--
Presence of dementia	1.113	(1.071, 1.156)	<0.001	1.026	(1.007, 1.045)	0.007	0.973	(0.930, 1.019)	0.246	0.980	(0.960, 1.000)	0.052
No CDPS conditions	1.542	(1.421, 1.673)	<0.001	1.347	(1.271, 1.427)	<0.001	0.984	(0.891, 1.087)	0.755	1.195	(1.127, 1.266)	<0.001
CDPS score	1.174	(1.152, 1.196)	<0.001	1.050	(1.043, 1.057)	<0.001	1.117	(1.093, 1.142)	<0.001	1.023	(1.014, 1.032)	<0.001
Zero nursing facility days	--	--	--	--	--	--	1.430	(1.132, 1.807)	0.003	1.104	(0.998, 1.221)	0.055
Log nursing facility days if > 0	--	--	--	--	--	--	1.089	(1.014, 1.168)	0.019	1.020	(0.990, 1.051)	0.199
Log institutional expenditures + 1	--	--	--	--	--	--	1.021	(0.992, 1.051)	0.165	1.000	(0.988, 1.011)	0.951
Zero emergency department visits	--	--	--	--	--	--	1.090	(1.014, 1.173)	0.020	1.069	(1.034, 1.107)	0.000
Log emergency department visits if > 0	--	--	--	--	--	--	1.440	(1.354, 1.533)	<0.001	1.104	(1.073, 1.136)	<0.001
Baseline outcome levels												
ILTC use	--	--	--	--	--	--	0.725	(0.608, 0.866)	<0.001	0.961	(0.897, 1.031)	0.269
HCBS use	--	--	--	--	--	--	1.251	(1.189, 1.316)	<0.001	1.029	(1.005, 1.053)	0.018

Table F.5 *(continued)*

Variable definition	New York						Tennessee					
	Logistic submodel			Gamma submodel			Logistic submodel			Gamma submodel		
	Odds ratio	95% CI	*p*-value	Relative rate	95% CI	*p*-value	Odds ratio	95% CI	*p*-value	Relative rate	95% CI	*p*-value
Personal care use	--	--	--	--	--	--	1.154	(1.038, 1.282)	0.008	1.014	(0.963, 1.067)	0.603
Hospital stays												
0 (ref)	--	--	--	--	--	--	--	--	--	--	--	--
[1, 2)	--	--	--	--	--	--	1.631	(1.203, 2.211)	0.002	1.088	(0.949, 1.247)	0.228
[2, 5)	--	--	--	--	--	--	2.378	(1.731, 3.266)	<0.001	1.172	(1.019, 1.348)	0.026
> 5	--	--	--	--	--	--	3.793	(2.177, 6.608)	<0.001	1.516	(1.255, 1.833)	<0.001
Hospital days												
0 (ref)	--	--	--	--	--	--	--	--	--	--	--	--
[1, 8)	--	--	--	--	--	--	0.937	(0.707, 1.244)	0.654	1.001	(0.884, 1.134)	0.988
[8, 30)	--	--	--	--	--	--	1.015	(0.763, 1.351)	0.918	1.032	(0.909, 1.171)	0.628
> 30	--	--	--	--	--	--	1.066	(0.784, 1.451)	0.683	1.057	(0.925, 1.207)	0.415

Source: Mathematica Policy Research analyses of state submitted finder file (TN), 2009–2014 MAX and other data.

Table F.6. Results from the two-part model of hospital days

	New York						Tennessee					
	Logistic submodel			Gamma submodel			Logistic submodel			Gamma submodel		
Variable definition	Odds ratio	95% CI	p-value	Relative rate	95% CI	p-value	Odds ratio	95% CI	p-value	Relative rate	95% CI	p-value
Dual status												
Full duals (ref)	--	--	--	--	--	--	--	--	--	--	--	--
Non-duals	1.802	(1.664, 1.952)	<0.001	1.219	(1.108, 1.341)	<0.001	1.184	(1.082, 1.297)	0.000	0.780	(0.714, 0.852)	<0.001
Partial duals	0.983	(0.746, 1.295)	0.904	1.185	(0.951, 1.475)	0.130	0.827	(0.617, 1.108)	0.203	1.058	(0.849, 1.320)	0.614
Age												
Continuous age	1.005	(1.001, 1.009)	0.017	0.993	(0.988, 0.997)	0.001	1.007	(1.004, 1.011)	<0.001	1.000	(0.997, 1.002)	0.765
Age > 65	0.741	(0.558, 0.984)	0.038	0.701	(0.524, 0.937)	0.017	2.973	(2.229, 3.964)	<0.001	2.083	(1.672, 2.596)	<0.001
Age spline at 65	1.003	(0.999, 1.008)	0.154	1.006	(1.001, 1.011)	0.015	0.984	(0.979, 0.988)	<0.001	0.989	(0.986, 0.993)	<0.001
Female	0.998	(0.959, 1.038)	0.921	0.904	(0.872, 0.937)	<0.001	0.904	(0.864, 0.947)	<0.001	0.916	(0.886, 0.948)	<0.001
Race												
White (ref)	--	--	--	--	--	--	--	--	--	--	--	--
Black	1.403	(1.344, 1.465)	<0.001	1.101	(1.063, 1.141)	<0.001	0.995	(0.950, 1.042)	0.829	1.126	(1.087, 1.167)	<0.001
Hispanic	1.550	(1.488, 1.615)	<0.001	0.945	(0.913, 0.979)	0.002	--	--	--	--	--	--
Asian	0.778	(0.734, 0.825)	<0.001	0.959	(0.906, 1.016)	0.156	--	--	--	--	--	--
Other	1.066	(0.944, 1.204)	0.305	1.062	(0.947, 1.190)	0.306	0.828	(0.702, 0.978)	0.026	1.078	(0.957, 1.216)	0.217
Geographic category												
Rural	1.120	(1.052, 1.193)	0.000	1.020	(0.970, 1.073)	0.436	1.131	(1.089, 1.174)	<0.001	0.918	(0.893, 0.945)	<0.001
Non-NYC urban	1.270	(0.881, 1.832)	0.200	0.742	(0.586, 0.940)	0.013	--	--	--	--	--	--
Presence of dementia	1.116	(1.074, 1.160)	<0.001	1.106	(1.073, 1.141)	<0.001	0.977	(0.934, 1.023)	0.319	0.998	(0.965, 1.032)	0.915
No CDPS conditions	1.554	(1.431, 1.686)	<0.001	1.685	(1.523, 1.864)	<0.001	0.977	(0.885, 1.079)	0.646	1.315	(1.189, 1.454)	<0.001
CDPS score	1.177	(1.155, 1.200)	<0.001	1.069	(1.057, 1.080)	<0.001	1.117	(1.093, 1.142)	<0.001	1.029	(1.015, 1.044)	<0.001
Zero nursing facility days	--	--	--	--	--	--	1.382	(1.090, 1.753)	0.008	0.942	(0.799, 1.110)	0.474
Log nursing facility days if > 0	--	--	--	--	--	--	1.077	(1.003, 1.158)	0.042	0.964	(0.920, 1.011)	0.130
Log institutional expenditures + 1	--	--	--	--	--	--	1.022	(0.993, 1.053)	0.140	1.019	(1.000, 1.038)	0.045
Zero emergency department visits	--	--	--	--	--	--	1.084	(1.007, 1.166)	0.031	1.054	(1.003, 1.109)	0.038
Log emergency department visits if > 0	--	--	--	--	--	--	1.433	(1.347, 1.525)	<0.001	1.038	(0.998, 1.080)	0.062
Baseline outcome levels												
ILTC use	--	--	--	--	--	--	0.729	(0.609, 0.872)	<0.001	0.915	(0.818, 1.023)	0.117
HCBS use	--	--	--	--	--	--	1.246	(1.184, 1.311)	<0.001	1.067	(1.025, 1.110)	0.002

Table F.6 *(continued)*

	New York						Tennessee					
	Logistic submodel			Gamma submodel			Logistic submodel			Gamma submodel		
Variable definition	Odds ratio	95% CI	*p*-value	Relative rate	95% CI	*p*-value	Odds ratio	95% CI	*p*-value	Relative rate	95% CI	*p*-value
Personal care use	--	--	--	--	--	--	1.140	(1.026, 1.268)	0.015	0.969	(0.891, 1.055)	0.471
Hospital stays												
0 (ref)	--	--	--	--	--	--	--	--	--	--	--	--
[1, 2)	--	--	--	--	--	--	1.473	(1.099, 1.975)	0.010	1.173	(1.005, 1.370)	0.044
[2, 5)	--	--	--	--	--	--	1.949	(1.447, 2.625)	<0.001	1.221	(1.042, 1.431)	0.014
> 5	--	--	--	--	--	--	3.392	(2.368, 4.859)	<0.001	1.337	(1.111, 1.610)	0.002
Hospital days												
0 (ref)	--	--	--	--	--	--	--	--	--	--	--	--
[1, 8)	--	--	--	--	--	--	1.006	(0.729, 1.388)	0.970	0.920	(0.764, 1.108)	0.378
[8, 30)	--	--	--	--	--	--	1.187	(0.860, 1.639)	0.297	1.106	(0.922, 1.326)	0.278
> 30	--	--	--	--	--	--	1.512	(1.013, 2.258)	0.043	1.363	(1.104, 1.683)	0.004

Source: Mathematica Policy Research analyses of state submitted finder file (TN), 2009–2014 MAX and other data.

APPENDIX G

LIST OF ABBREVIATIONS USED IN THE REPORT

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Table G.1. List of Abbreviations

Abbreviations:	
ADL:	activities of daily living
AHRQ:	Agency for Healthcare Research and Quality
ALTCS:	Arizona's Long Term Care System
BIP:	Balancing Incentive Payment
CDPS:	Chronic Illness and Disability Payment System
CHIP:	Children's Health Insurance Program
CHOICES:	Tennessee's long-term services and supports program
CI:	confidence interval
CMS:	Centers for Medicare and Medicaid Services
DD:	difference-in-differences
DD:	Developmental Disabilities
D-SNP:	Dual Eligible Special Needs Plan
ED:	emergency department
FAI:	financial alignment initiative
FFS:	fee-for-service
FPL:	federal poverty line
FY:	fiscal year
HCBS:	home and community-based services
ICF/IDD:	intermediate care facilities for individuals with intellectual disabilities
ICP:	Integrated Care Program
IDD:	intellectual/developmental disabilities
ILTC:	institutional long-term care
LOC:	level of care
LTSS:	long-term services and supports
MACPAC:	Medicaid and CHIP Payment and Access Commission
MAP:	Medicaid Advantage Plus
MAX:	Medicaid Analytic eXtract
MCA:	Managed Care Authorities
MedPAC:	Medicare Payment Advisory Commission
MedPAR:	Medicare Provider Analysis and Review
MFP:	Money Follows the Person
MLTC:	(New York's) Managed Long Term Care
MLTSS:	managed long-term services & supports
MMLTSS:	Medicaid Managed Long-Term Services and Supports
MSC+:	Minnesota Senior Care Plus
MSHO:	Minnesota's Senior Health Options
MSIS:	Medicaid Statistical Information System
NY:	New York
NYC:	New York City
OPWDD:	Office for People with Developmental Disabilities
PACE:	Programs of All-Inclusive Care for the Elderly
PD:	physical disabilities
PMPM:	per-member-per-month
QExA:	QUEST Expanded Access
QI:	QUEST Integration
SAIL:	State of Alabama Independent Living Waiver
SCO:	(Massachusetts) Senior Care Options
SED:	severe emotional disturbance
SMI:	severe mental illness
SMMC:	(Florida) Statewide Medicaid Managed Care Program
SPIHP:	Specialty Prepaid Inpatient Health Plan
SUD:	substance use disorder
TN:	Tennessee

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