Georgia Skilled Nursing Facility (SNF) Quality Incentive Payment Program
Technical Report 1: Assessment and Recommendations for Inclusion of Quality Measures

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Executive Summary

The State of Georgia has allocated roughly $36.3 million of the fiscal year budget to provide supplemental quality incentive payments to improve the quality care for Medicaid recipients in eligible Skilled Nursing Facilities (SNFs). The purpose of this report is to help inform the process for selecting measures to include in the quality incentive payment program from the measures collected and reported by Centers for Medicare & Medicaid Services through the Care Compare Website.

Quality measures originate from health inspections of facilities by independent experts, medical claims data, and self-reporting by SNFs. Health inspections occur too infrequently to measure and reward improvements in quality within a fiscal year and many self-reported measures have been criticized for lacking a statistically meaningful correlation with independent quality measures or in fact displaying a negative relationship with independent quality measures.

This report documents the benefits and shortcomings of these quality measures and evaluates the statistical relationship between 15 self-reported quality measures and three independent objective measures of quality, i.e., health inspection ratings, claims-based risk-adjusted hospitalization rates, and claims-based risk-adjusted ER visit rates.

It evaluates these relationships using multivariate regression analysis with comprehensive nursing home and quarterly controls using national data from 2017Q3 to 2020Q2. It identifies eleven measures that are consistently positively correlated with at least one of the three independent objective quality measures. Using these eleven nationally credible measures in regressions for the sample of SNFs within the State of Georgia, five measures demonstrate statistically significant positive relationships with quality both collectively and when evaluated independently. These measures include the percentage of long-stay residents that: (1) have a need for help with daily activities that has increased, (2) lose too much weight, (3) have a urinary tract infection, (4) received an antipsychotic medication, and (5) have pressure ulcers.

Given the strong association between most of the evaluated quality measures and the claims-based objective measures of quality using national data, a good basis for a composite quality measure is both long-stay risk-adjusted claims-based measures of (1) hospitalizations and (2) ER visits given that these measures are less subject to manipulation by SNFs. To a lesser extent, the five MDS-based measures that consistently demonstrate a positive correlation with independent quality outcomes both nationally and within the State of Georgia may provide valuable additions that capture other aspects of quality.

1. Overview of Nursing Home Compare Components

The Care Compare website provides a composite 5-star quality rating system to easily convey prospective nursing home residents and their families about the quality of SNFs that participate in Medicare and Medicaid. The 5-Star Rating System is based on three components: (1) on-site health inspections and revisits, (2) nursing home staffing levels that are self-reported through the Payroll-based Journal System, and (3) Quality Measures (QM) that originate from claims data as well as self-reported data from the Minimum Data Set (MDS).

On-site health inspections are unannounced multiday inspections by a team of health professionals. The health inspection rating is based on the three most recent visits and repeat revisits needed to verify correction of deficiencies with a lower score reflecting fewer deficiencies and revisits. Scores are converted to a 5-star rating by comparing percentiles for SNFS within each state (CMS, 2-5).

The nursing home staffing levels domain is based on case-mix adjusted total nursing hours per resident day (using RNs, LPNs, and nurse aide hours) and RN hours per resident day. These measures adjust nursing hours per resident day using Resource Utilization Group case-mix system to account for the severity of resident caseloads. For RN staffing and total staffing, 5-star ratings are assigned based on cut-points developed by CMS using clinical evidence on the relationship between staffing and quality (CMS, 6-11).

The Quality Measures (QM) Domain is developed from the MDS and Medicare claims data. Measures collected by CMS are designed to capture a variety of aspects of the degree of functionality and health (such as the decline in functioning, weight loss, falls, urinary tract infections, pressure ulcers, use of physical restraints, antipsychotic prescribing, hospitalizations, and ER visits) of both short-stay (less than 100 days) and long-stay (more than 100 days) residents. MDS-based measures are only reported if they can be calculated for at least 20 residents' assessments with quarterly observations adjusted using a four-quarter average (weighted by the number of eligible residents for the QM in each quarter). Values for claims-based measures (and short-stay pressure ulcers) are calculated using a full year of data instead of quarterly. Using the four-quarter average (or annual measure for claims-based measures), points are assigned for each QM measure based on decile (or quintiles) relative to the national distribution of the measure. Using assigned points on each measure, long-stay, short-stay, and overall QM scores are calculated by aggregating assigned points with star ratings assigned by achieving particular thresholds set by CMS (CMS, 11-18).

The overall rating for a SNF begins with the health inspection rating as its basis. It adds one star if the staff rating is four or five (and is greater than the health inspection rating). It subtracts one star if the staff rating is one star. The overall rating further adds one star if the QM overall rating is five stars and subtracts one star if the quality measure rating is one star. Overall rating cannot be increased by either staffing or QM ratings if the health inspection rating is one star and the overall rating is limited to the range of one to five stars (CMS, 18).

2. Discussion of Quality Measures, Empirical Studies, and Motivation for the Analysis

In this section, I document various aspects of each quality domain and several of the shortcomings within each quality dimension. While this discussion references several current empirical studies within the literature, it is not meant to provide an exhaustive literature review on these topics. For a more detailed discussion of these matters, I recommend Konetzka, et al. (2021) which comprehensively explores the literature.

While the health inspection ratings are carried out by independent inspectors, the nursing home staffing levels domain and many of the measures included in the quality domain are self-reported by SNFs through MDS (and more recently through the Payroll-Based Journal submission system). As a result, CMS intentionally designed the rating system to put more emphasis on health inspections given that data on health inspections should be "more object and unbiased" (Williams et al. 2010).

Given CMS' emphasis on health inspection ratings, they would seem to be a natural fit for a quality improvement program. However, an examination of the Nursing Compare archives both before and during the pandemic reveals that for many SNFs, inspections do not occur at the frequency described by CMS who states that these inspections are supposed to be conducted "annually *on average*, with very rarely more than fifteen months elapsing between inspections for any one particular nursing home" (CMS, 2). Using pre-Pandemic data from the Nursing Compare Archives (January 2020), 19% of SNFs nationally (and 45% within the State of Georgia) had not had an inspection in over a year with 5% nationally (and 26% within the State of Georgia) not having had an inspection in over 15 months. With the July 2021 release of Nursing Home Compare during the Covid-19 Pandemic, 78% of SNFs nationally and 97% of SNFS within the State of Georgia have not had an inspection in more than 15 months. Given the lag between inspections, it is not clear whether health inspection ratings accurately reflect the current quality provided at a SNF. Given that this measure represents lagged behavior and quality for almost half of the SNFs in the State of Georgia, it is not likely a good fit for a program designed to incentivize quality improvements within the fiscal year without major changes in the frequency of inspections within the state.

The nursing home staffing levels domain was included based on evidence of a relationship between nursing home staffing levels and resident outcomes conducted by staff from CMS (CMS, 6; Kramer and Fish, 2001). Nurse staffing is self-reported by SNFs. CMS has historically used algorithms to identify facilities with implausible staffing or residential characteristics. Aside from the algorithms, this data was not verified for accuracy by CMS though recently reporting has shifted from MDS to direct payroll reporting which could make auditing more credible (Perraillon et al., 2019; Konetzka, et al. 2021). Given that the nurse staffing data is submitted by SNFs, a potential criticism (with empirical support from the literature) is the potential for gaming either through the direct manipulation of documentation or through alterations in behavior that have no discernable impact on objective quality outcomes such as the reclassification of existing jobs (Sharma et al., 2019; Konetzka et al., 2021). Given that nurse staffing levels are documented as a likely target for gaming, the existing evidence of substantial daily fluctuations in staffing levels (Geng et al, 2019), and the fact that nurse staffing represents an input to the production of quality rather than a direct measure of output quality in and of itself, the nurse staffing domain is

recommended for exclusion from direct measurement within the quality incentive payment program within the State of Georgia. This is not to say that increasing staffing and better management can not lead to improved quality outcomes. SNFs attempting to improve quality are likely to effectively use these dimensions in their attempts to improve quality which can be rewarded by the program through observable changes in output rather than through changes in observed inputs.

The final QM domain encompasses both MDS self-reported measures and claims-based measures. Claims-based measures include risk-adjusted rates of hospitalizations and ER visits (evaluated separately for short- and long-stay residents), and successful return to home and the community (for short-stay residents). Claims-based measures should not be subject to the same level of strategic manipulation as measures constructed from self-reported data. Further, researchers evaluating hospitalizations among the relevant nursing home population have documented that 44% of this group's hospitalizations can be classified as potentially preventable hospitalizations for ambulatory care sensitive conditions implying that measuring hospitalizations and ER visits from the nursing home population should provide a more accurate gauge into the objective quality of care within the nursing home (Xu et al., 2019). Since two of these measures (risk-adjusted number of hospitalizations per 1000 long-stay resident days and 2. risk-adjusted number of outpatient emergency department visits per 1000 long-stay resident days) are explicitly focused on long-stay residents that are primarily Medicaid residents and given that these measures are updated each quarter with rolling annual data, they are a seemingly excellent fit for measuring the quality of care within a quality improvement program geared towards improving quality across the fiscal year.

MDS-based quality measures on the other hand are subject to some of the same criticisms expressed for the components of the nursing home staffing domain, given that self-reporting provides the opportunity for direct manipulation. Unlike the staffing domain, many of these measures are direct aspects of the quality of care that have been examined by researchers relative to independent claims-based measures of quality. Empirical evidence from these studies has found that some measures are correlated with hospitalizations and mortality while others have no statistically significant correlation at all. For example, Neuman et al. (2014) examined the association between SNF quality measures and hospital readmissions/deaths among Medicare beneficiaries receiving post-acute care in the United States between 2009 and 2010 using the MDS and Medicare beneficiary summary files. In fully adjusted models that controlled for a variety of patient and SNF factors, they found that SNFs with better inspection ratings or lower rates of new or worsened pressure sores had lower rates of 30-day readmissions and death. They also found that that staff ratings did not affect these outcomes.

In another example, Brauner et al. (2018) examined the relationship of several quality measures including MDS-based measures and subcomponents of the health inspection rating and overall performance through aggregate nursing home compare star ratings/health inspection star ratings. Pearson correlation coefficients for the first quarter 2017 data suggest that pressure sores and medication error rates were correlated with overall and health inspection domains though most correlations were very weak. They also find that MDS-based measures for the percentage of long-stay residents with urinary tract infection and injurious falls were positively correlated with improvements in the health inspection domain nursing home compare star rating suggesting that

improvements in these domains are associated with lower levels of patient safety. Examining the distribution across star ratings, they find meaningful differences and a monotonic trend in MDS-based pressure sores and overall star ratings and little meaningful difference among most other measures for nursing homes rated in the two-to-four-star range.

Further, Xu et al. (2019) used data on Minnesota nursing homes from 2011-2012 to examine the relationship between MDS-based quality measures and several independent measures of quality generated from Medicaid claims data for inpatient care including hospitalizations/deaths and potentially preventable hospitalizations for ambulatory care sensitive conditions controlling for nursing home characteristics such as ownership status, hospital affiliation, chain membership, and facility size, resident characteristics. Their analysis was conducted at the resident-quarter level. Among the 23 factors examined only 10 factors had a statistically significant relationship with hospitalizations and deaths (such as unexplained weight loss, the prevalence of pressure sores, worsening ADLs, improving ADLs, prevalence of UTIs), and improvement in some measures were statistically associated with worse outcomes from the standpoint of hospitalizations/deaths (such as improving bladder continence and prevalence of antipsychotics without a diagnosis of psychosis).

In summary, health inspection ratings and claims-based QMs represent some of the most objective and unbiased measures of nursing home quality that can be used for a quality incentive payment program. However, the infrequency of health inspections makes them less credible from the standpoint of motivating immediate improvements in delivered care across a single fiscal year. Claims-based measures that focus on long-stay residents are updated each quarter using annual data and may provide more immediate incentives for SNFs to improve quality.

Further, while the current literature has found evidence of some strategic gaming of self-reported MDS measures, it has also found that some self-reported QM measures have statistically significant correlations with independently constructed (more objective) quality measures. If self-reported QM measures can be identified that have a strong statistically significant correlation with independent measures, they could provide valuable insights into the quality of care provided by SNFs. The remainder of this report focuses on identifying self-report QMs that correlate well with objective quality measures nationally and specifically for the State of Georgia.

3. Data

Data for the analysis comes from the 2017-2021 archives of monthly releases for Nursing Home Compare. This period contains quarterly and 4-quarter moving averages for select MDS-based quality measures from 2015Q3 through 2021Q1, 4-quarter risk-adjusted scores for claims-based QM measures from 2015Q4 through 2020Q2, and site inspection quality ratings between 2015Q1 and 2021Q2.

4. Methods

All data used in the analysis were imported and analyzed using Stata 17. Using Nursing Home Federal provider numbers and quarterly identifiers, all unique quality reports for each quality

measure by SNF and quarter were identified. Given that the underlying motive of the analysis is to assess the validity of measures for inclusion in a composite quality measure, seven measures that are no longer collected/reported by Nursing Home Compare were excluded from the analysis (See Technical Appendix Table A1 for a list and description of excluded measures). As a result, the analysis focuses on assessing the validity and stability of the 18 MDS-based measures reported and described in Panels A and B of Table 1.

To examine the variability of MDS-based measures over time, I examined the quarterly score for each measure as well as the 4-quarter moving average, used by CMS in the computation of the Nursing Home Compare 5-star Quality Rating System. Appendix Figures A1-A18 illustrate the average and 4-quarter moving average for each quarter for SNFs nationally and in the States of Georgia. Examining the plots, one observes substantial variation in quality measures using the quarterly scores. The observed variability is substantially smoothed using 4-quarter moving averages. To reduce the level of noise within the data and remain consistent with CMS' calculations, I only use the 4-quarter moving averages of each MDS-based measure for the remainder of the analysis.

Several of the MDS measures reported in Table 1 are identical measures that are constructed for the distinct populations of short- and long-stay residents. These include MDS measures for appropriate pneumococcal vaccine administration (MDS 415/430), percentage of residents given an antipsychotic medication (MDS 419/434), and appropriate seasonal influenza vaccination administration (MDS 454/472). The Pearson's correlation coefficients for these measures indicate that they are positive, and in several cases highly correlated.[1] Given this positive correlation between short- and long-stay MDS measures and the emphasis of the quality incentive program on improving quality among the Medicaid nursing home population which is predominantly long-stay residents, MDS 430, 434, 472 short-stay measures are excluded from the remainder of the analysis.

For most measures in Table 1, a higher score indicates a reduction in quality. However, for MDS 415, 454, and 471 a higher percentage is associated with a quality improvement. To make the analysis and reporting of coefficient estimates more consistent across measures, each of these MDS measures is converted to (100-MDS Measure Percentage of residents). For example, MDS Measure 471 is converted to the percentage of short-stay residents who did not make improvements in functioning.

[1] Pearson's Correlation coefficients between MDS 419/434, MDS 419/434, and MDS 454/472 were 0.7267, .3074, and .4749, respectively.

Table 1: MDS Based Quality Measures from Nursing Home Compare

Measure Code	Description	Available Years
Panel A: Long Term Quality Measures		
401	Percentage of long-stay residents whose need for help with daily activities has increased	2016-2021
404	Percentage of long-stay residents who lose too much weight	2016-2021
405	Percentage of low risk long-stay residents who lose control of their bowels or bladder	2016-2021
406	Percentage of long-stay residents with a catheter inserted and left in their bladder	2016-2021
407	Percentage of long-stay residents with a urinary tract infection	2016-2021
408	Percentage of long-stay residents who have depressive symptoms	2016-2021
409	Percentage of long-stay residents who were physically restrained	2016-2021
410	Percentage of long-stay residents experiencing one or more falls with major injury	2016-2021
415	Percentage of long-stay residents assessed and appropriately given the pneumococcal vaccine	2016-2021
419	Percentage of long-stay residents who received an antipsychotic medication	2016-2021
451	Percentage of long-stay residents whose ability to move independently worsened	2016-2021
452	Percentage of long-stay residents who received an antianxiety or hypnotic medication	2016-2021
453	Percentage of high risk long-stay residents with pressure ulcers	2018-2021
454	Percentage of long-stay residents assessed and appropriately given the seasonal influenza vaccine	2018-2021
Panel B: Short Term Quality Measures		
430	Percentage of short-stay residents assessed and appropriately given the pneumococcal vaccine	2016-2021
434	Percentage of short-stay residents who newly received an antipsychotic medication	2016-2021
471	Percentage of short-stay residents who made improvements in function	2016-2021
472	Percentage of short-stay residents who were assessed and appropriately given the seasonal influenza vaccine	2018-2021

Notes: Available years reflect observed year range observed in 2017-2021 archives of monthly releases for Nursing Home Compare.

To assess the validity of the remaining 15 self-report MDS-based quality measures, I examine the correlation and partial correlation of 4-quarter moving averages for each MDS-based quality measure with independently reported quality measures that should not be subject to the influence of the reporting SNF. If objective independent quality measures are either directly influenced by a SNF's performance on self-reported quality measures or if these measures are jointly influenced by other unobserved SNF behaviors (such as adjustments in the behavior of nursing staff or better SNF management) that improve multiple quality dimensions, then targeting MDS-based quality measures for a quality improvement incentive payment program has the potential to improve nursing home quality within the state.[2]

Independent objective quality measures used to assess the validity of MDS-based measures originate from claims data and through health inspection site visits. From the claims-based quality measures which are reported in nursing compare using four quarters of claims data, I examine (1) Measure 551: Risk-Adjusted Number of hospitalizations per 1000 long-stay resident days, and (2) Measure 552: Risk-Adjusted Number of outpatient emergency department visits per 1000 long-stay resident days. Both measures are statistically adjusted by CMS to account for the probability of these adverse events based on the characteristics of the SNF's residential population. As a result, these outcomes should be less influenced by the health status/case-mix of a SNF's residents assuming appropriate risk adjustment.

Table 2: Claims and Inspection Based Quality Measures from Nursing Home Compare

Measure Code/Name	Description	Available Years
551	Risk-Adjusted Number of hospitalizations per 1000 long-stay resident days	2017-2020
552	Risk-Adjusted Number of outpatient emergency department visits per 1000 long-stay resident days	2018-2020
Weighted All Cycle Score	Total Weighted Health Survey Score (for three cycles)	2015-2021

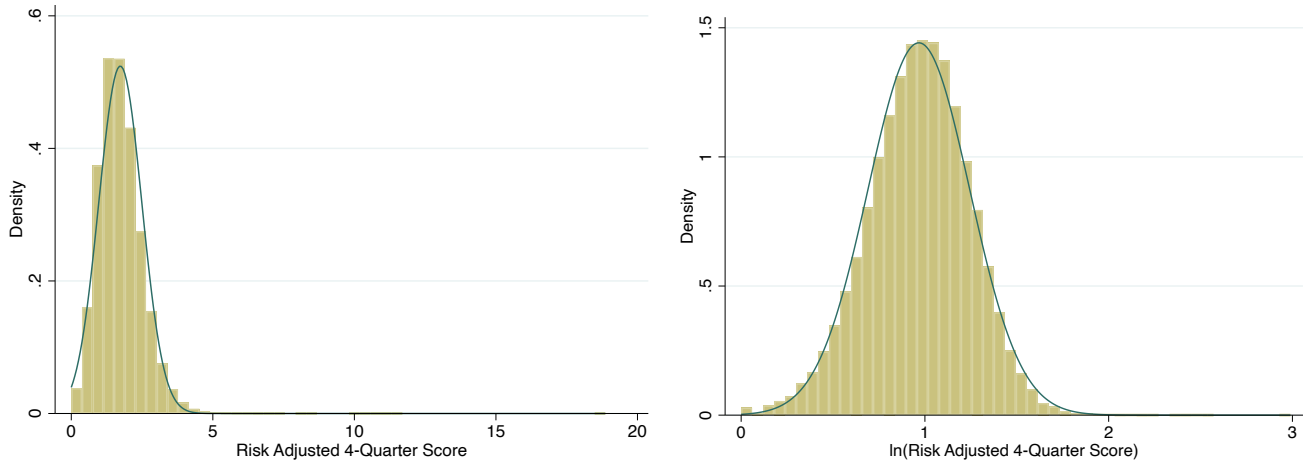
The last object quality measure is the 3-cycle health inspection score. Nursing homes are subject to unannounced onsite recertification inspections conducted by a team of health care professionals who spend several days at a nursing home to evaluate their compliance with federal requirements. The 3-cycle composite health inspection score is based on the most recent three site inspection visits and considers complaint deficiencies and the need for revisits to verify correction of deficiencies (CMS, 2).

Using Stata, 4-quarter moving average MDS-based measures were merged with claims-based measures using unique nursing home federal identification numbers and the quarter of observation.

[2] Any quality incentive payment program that uses MDS-based measures as the basis for quality, should continually validate the reliability of MDS-based quality measures relative to independent measures to ensure that the observed statistical correlation/partial correlation between MDS-based measures and objective quality measures continues to remain valid across the duration of a quality incentive program. If this relationship does not hold or weakens over time, it could indicate strategic reporting behavior by SNFs that will need to be accounted for in revisions to a quality incentive payment program.

For 3-cycle health inspection scores, the quarter of the most recent site inspection was used to identify the quarter of observation before merging with MDS-based measures using unique nursing home federal identification numbers and quarter of observation. Examining the sample of observations for which these external quality measures and the MDS-based measures are collectively reported, I find 11,634 unique nursing homes nationally and 285 observed across this period within the State of Georgia.[3] To give the analysis more degrees of freedom to evaluate the statistical relationship across measures, I first evaluate the relationship between MDS-based measures and objective quality measures using national data permitting for greater control of potential confounders. Following the national analysis, I examine whether the observed relationships continue to hold restricting the analysis to the sample of Georgia SNFs. Figures 1, 2, and 3 illustrate the distribution of each external quality measure. Figure 1a illustrates the unadjusted histogram for the risk-adjusted number of hospitalizations per 1000 long-stay resident days. Given the skewed distribution of each measure, I perform a common data transformation namely a natural log transformation to approximate normality for each variable.

Figure 1: Histogram of Claims-Based Measure 551 Risk-Adjusted Number of hospitalizations per 1000 long-stay resident days



[3] For Measures 551, 552, and inspection scores, I observe 11,564, 11,634, and 7,304 unique nursing homes with both the objective quality measure and the MDS-based measures, nationally, and 285, 278, 147 within Georgia.

Figure 2: Histogram of Claims-Based Measure 552 Risk-Adjusted Number of outpatient emergency department visits per 1000 long-stay resident days

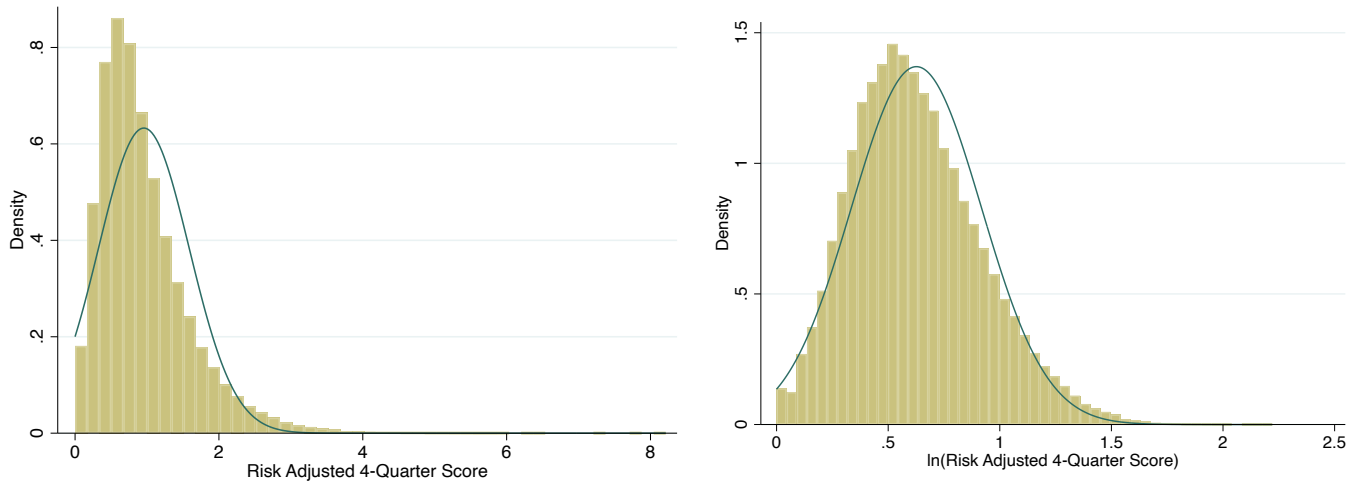
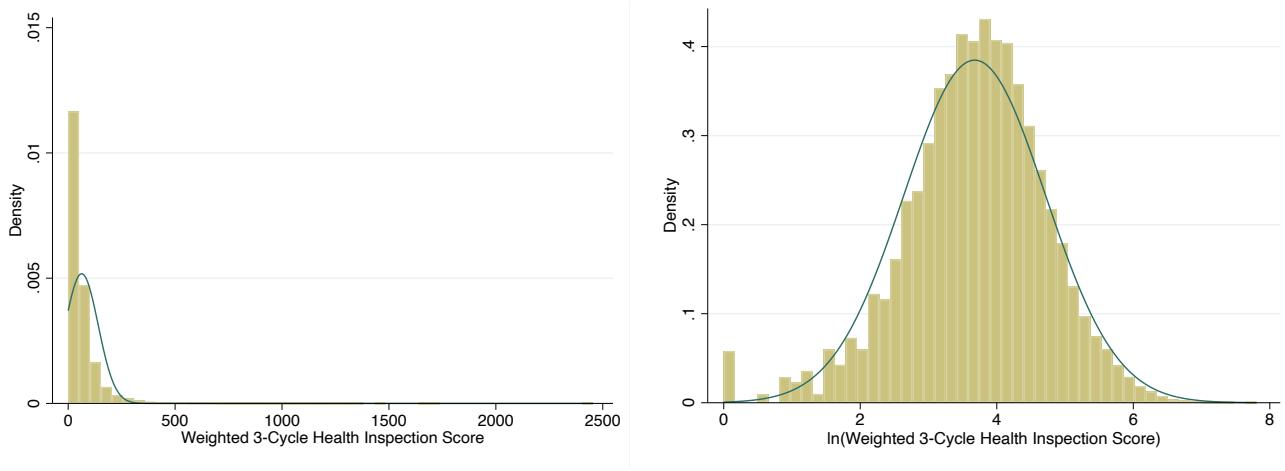


Figure 3: Histogram of 3-Cycle Weighted Health Inspection Survey Score



In addition to examining the natural log of each score, I construct a binary variable which is equal to 1 if the score is in the 10th decile (i.e., the lowest 10% of performers), 0 if the score is in the 1st-9th decile (top 90% of performers). The second binary variable is set equal to 1 if the score is NOT in the first decile i.e., the bottom 90% of performers), and is set to 0 if the score is in the top 10% of performers. Since a higher score for each of these external quality measures indicates reduced quality, these binary variables are used to evaluate whether MDS-based quality measures impact quality on either the low or high ends of the quality continuum. For example, for an MDS-based quality measure for which a higher score indicates lower quality, such as MDS 407: Percentage of long-stay residents with a urinary tract infection, a quality improvement could be indicated by either a reduction in the probability of being in the 10th decile (on the low-quality end of the performance spectrum) or a reduction in the probability not being in the first decile (on the high-quality end of the performance spectrum).

5. Assessing Partial Correlation of MDS-Based Quality Measures Nationally

For each of the three objective quality measures, I evaluate three ordinary least squares regression models to assess the partial correlation of each MDS-based measure in the assessment of quality:

$$Quality_{it} = \beta_0 + \boldsymbol{MDSScore_{it}}\,\boldsymbol{\beta} + \theta_i + T_t + \epsilon \qquad (1)$$

where $Quality_{it}$ is the outcome measure, i.e., ln(Score), the binary for not in 1st decile, or the binary for 10th decile for Measure 551, 552, or 3-cycle inspection rating for nursing home *i* evaluated in quarter *t*. Under these models, β_0 is a constant, $\boldsymbol{MDSScore_{it}}$ is a vector of MDS-based quality measures, θ_i is a vector of nursing home-specific fixed effects, T_t represents a vector of quarterly fixed effects, where ϵ is any residual error. This model is estimated with robust standard errors that are clustered at the nursing home level which explicitly accounts for any potential serial correlation in the analysis. The use of nursing home fixed effects eliminates and location-specific time-independent effects on quality (such as for-profit/not-for-profit status or chain affiliation) and the time fixed effects eliminated any inter-temporal variation in quality that is specific to seasonality or the period of observation. Using this approach, I estimate coefficient estimates for each MDS-based measure (collectively included in the vector $\boldsymbol{\beta}$). Evaluating the statistical significance and direction of each coefficient permits the model to determine whether a particular MDS-based measure explains a portion of the variation in the objective quality measure independent of the other MDS-based quality measures, i.e., has a statistically significant partial correlation considering the correlations of the other MDS-based measures.

In estimating Equation 1, I use several different specifications and samples to evaluate the robustness of the findings. For example, MDS measures 453 and 454 are missing for a large number of nursing facility/years within the sample. As a result, I estimate results from models where $\boldsymbol{MDSScore_{it}}$ excludes MDS 453 and 454 to increase the sample size and evaluate the regression model over a longer period and where $\boldsymbol{MDSScore_{it}}$ includes MDS 453 and 454 to evaluate the ability of these measures to partially correlated with objective quality. In addition, I estimate models that include a complete set of available periods and models that limit observations to those before 2020Q1 to eliminate any unobserved changes that may be due to the structural impact of the Covid-19 pandemic or data reporting during the pandemic.

Using the previously described variations in the estimation of Equation 1, I iteratively eliminate MDS-based measures that either (1) provide no evidence of partial correlation or (2) provide only evidence of a negative relationship with the objective quality measures.

6. National Results for Partial Correlation of MDS-Based Quality Measures with Claims-Based Measures and Health Inspection Scores.

A summary of the direction and statistical relationship for each MDS-based measure for claims-based quality measures and health inspection scores is reported in Table 3 with a summary of coefficient estimates for estimated models reported in Appendix Tables A2-A4. Examining the strength and statistical significance of coefficient estimates, several MDS-based measures clearly stand out. MDS measures 401: Percentage of long-stay residents whose need for help with daily activities has increased, and 404: Percentage of long-stay residents who lose too much weight are strongly associated with higher quality for health inspections and claims-based measures for almost all evaluated models indicating that these measures have a strong association with nursing home quality across the range of estimated scores.

Improvements in quality for measures 401 and 404 (which would be indicated by respective reductions in the percentage of long-stay residents whose need for help with activities of daily living increased and who lose too much weight) are strongly associated with a reduced probability of a nursing home being in the 10^{th} decile (lowest 10% of quality reporting) for measures 551 (hospitalizations), 552 (ER visits), and health inspection scores. Improvements in measures 401 and 404 are strongly statistically associated with a higher probability of a nursing home being in the 1^{st} decile (top 10% of quality reporting) for hospitalizations and ER visits, and health inspections (for measure MDS 404 only).

Several measures when evaluated jointly with other MDS-based measures indicate either no statistically significant partial correlation or negative partial correlations with claims-based measures and health inspection scores. First, MDS 408: Percentage of long-stay residents who have depressive symptoms displayed no statistically significant relationship with either hospitalizations or health inspection ratings. Further examining ER visits, statistically significant coefficients indicate that improvements in quality for MDS 408 are associated with significant reductions in quality for ER visits primarily through the increased probability of being in the 10^{th} decile (lowest 10% of nursing homes).

Second, MDS measures 409: Percentage of long-stay residents who were physically restrained and 454: Percentage of long-stay residents assessed and appropriately given the seasonal influenza vaccine were not found to have any statistical association with hospitalizations, ER visits, or health inspection ratings, implying that while these measures may independently measure quality, in their own right, they do not provide a good explanation for the observed variation in claims-based measures or inspection ratings.

Finally, MDS measure 471: Percentage of short-stay residents who made improvements in function displays mixed results for claims-based and health inspection-based quality measures.

Table 3: Summary of Direction of Relationship of Claims-Based Quality Measures and Health Inspection Scores with MDS-Self Reported Measures Using National Data

Measure	Description	Measure Code 551			Measure Code 552			Health Inspections		
		ln(rating)	Decile		ln(rating)	Decile		ln(rating)	Decile	
Code			1st	10th		1st	10th		1st	10th
401	Percentage of long-stay residents whose need for help with daily activities has increased	+++	+++	+++	+++	+++	++	+++		++
404	Percentage of long-stay residents who lose too much weight	+++	+++	+++	+++	++	+++	+++	+	+++
405	Percentage of low risk long-stay residents who lose control of their bowels or bladder	+++								
406	Percentage of long-stay residents with a catheter inserted and left in their bladder	+++	++	+++	+++			+++		
407	Percentage of long-stay residents with a urinary tract infection	+++	+++	+++	+++		+++			
408	Percentage of long-stay residents who have depressive symptoms				--		-			
409	Percentage of long-stay residents who were physically restrained									
410	Percentage of long-stay residents experiencing one or more falls with major injury	+++	+++	+++	+++	+++	+++			
415	Percentage of long-stay residents assessed and appropriately given the pneumococcal vaccine	++			+++			+++		+++
419	Percentage of long-stay residents who received an antipsychotic medication	++	+	+	+++			+++		+
451	Percentage of long-stay residents whose ability to move independently worsened				+++					
452	Percentage of long-stay residents who received an antianxiety or hypnotic medication	++			+++		++			
453	Percentage of high risk long-stay residents with pressure ulcers	+++	+++	+++	+++	++	+			
454	Percentage of long-stay residents assessed and appropriately given the seasonal influenza vaccine									
471	Percentage of short-stay residents who made improvements in function		--			++		+++	++	+++

Notes: Each column reports whether the quality measure is associated with improvements (+) or reductions (-) in quality and its statistical significance for separate regressions which contain each MDS measure, nursing home fixed effects, quarter fixed effects, and with nursing home clustered robust standard errors. -/+ P-value < 0.10, --/++ P-value < 0.05, ---/+++ P-value < 0.01.

While improvements in quality for MDS 471 are significantly associated with increased probability of a nursing home being in the 1st decile (top 10% of nursing homes) for ER visits and health inspections, it is associated with a strong reduction in the probability of being in the 1st decile for hospitalizations.

Among the other MDS-based measures, strong positive statistically significant associations are found for MDS 405, 406, 407, 410, 419, 451, 452, 453, 415, and 471 measures.

In summary, among the first evaluated models, 11 MDS measures displayed statistically significant partial correlations with claims-based quality measures and/or health inspection scores (MDS 401, 404, 405, 406, 407, 410, 415, 451, 452, 453), two displayed no statistical relationship (409, 454), and two displayed some signs of inverse correlation with claims-based quality measures and/or health inspection quality (408, 471). Given these relationships, I eliminate measures (408, 409, 454, and 471) from the $\boldsymbol{MDSScore_{it}}$ vector of MDS-based quality measures included in Equation 1 and re-estimate the model. Estimates for these nine regressions are presented in Table 4 (with a summary of coefficient estimates reported in Appendix Tables A5-A7). Each of these MDS-based measures continues to display evidence of statistically significant partial correlations consistent with joint improvements in quality.

Table 4: Summary of Direction of Relationship of Claims-Based Quality Measures and Health Inspection Scores with MDS-Self Reported Measures Using National Data (Eliminating MDS 408, 409, 454, and 471)

Measure	Description	Measure Code 551			Measure Code 552			Health Inspections		
		ln(rating)	Decile		ln(rating)	Decile		ln(rating)	Decile	
Code			1st	10th		1st	10th		1st	10th
401	Percentage of long-stay residents whose need for help with daily activities has increased	+++	+++	+++	+++	+++	++	+++		++
404	Percentage of long-stay residents who lose too much weight	+++	+++	+++	+++	++	+++	+++	++	+++
405	Percentage of low risk long-stay residents who lose control of their bowels or bladder	+++								
406	Percentage of long-stay residents with a catheter inserted and left in their bladder	+++	++	+++	+++			+++		+
407	Percentage of long-stay residents with a urinary tract infection	+++	+++	+++	+++		+++			
410	Percentage of long-stay residents experiencing one or more falls with major injury	+++	+++	+++	+++	+++	+++	+		
415	Percentage of long-stay residents assessed and appropriately given the pneumococcal vaccine	++			+++			+++		+++
419	Percentage of long-stay residents who received an antipsychotic medication	++	+	+	+++			+++		++
451	Percentage of long-stay residents whose ability to move independently worsened				+++					
452	Percentage of long-stay residents who received an antianxiety or hypnotic medication	++			+++		++			
453	Percentage of high risk long-stay residents with pressure ulcers	+++	+++	+++	+++	++				

Notes: Each column reports whether the quality measure is associated with improvements (+) or reductions (-) in quality and its statistical significance for separate regressions which contain each MDS measure, nursing home fixed effects, quarter fixed effects, and with nursing home clustered robust standard errors. -/+ P-value < 0.10, --/++ P-value < 0.05, ---/+++ P-value < 0.01.

7. Assessing the Validity of Nationally Established Partial Correlation of MDS-Based Quality Measures Within the State of Georgia

The 11 remaining MDS-based quality measures demonstrate a statistically significant partial correlation with claims-based hospitalizations, ER visits, and/or health inspection scores at a national level with concordance in their movement of quality. The purpose of this section is to evaluate whether these relationships hold for SNFs within the State of Georgia. However, given that Georgia represents only a small fraction of the nursing homes observed across the US, the number of degrees of freedom for any analysis focusing on the state is substantially reduced relative to a nation-level analysis. To evaluate the validity of the established relationships for MDS-based quality measures with our claims-based measures and health inspection scores within the State of Georgia, I estimate several modifications of Equation 1 for the sample of SNFs operating within the State of Georgia:

$$Quality_{it} = \beta_0 + \boldsymbol{MDSScore_{it}}\,\boldsymbol{\beta} + T_t + \epsilon \qquad (2)$$

Equation 2 modifies Equation 1 by removing the nursing home-specific fixed effects. To ensure that any observed statistically significant partial correlations continue to hold with or without controlling for the period of observation, I also estimate a modification of Equation 1 that excludes both the nursing home-specific fixed effects and quarter fixed effects through Equation 3:

$$Quality_{it} = \beta_0 + \boldsymbol{MDSScore_{it}}\,\boldsymbol{\beta} + \epsilon \qquad (3)$$

8. Results for Assessing the Validity of Nationally Established Partial Correlation of MDS-Based Quality Measures Within the State of Georgia

A summary of the direction and statistical significance of the partial correlation of MDS-based quality measures with claims-based hospitalizations, ER visits, and/or health inspection scores is reported in Table 5 with a summary of key coefficients for each model reported in Appendix Tables A8-A13. The results suggest that the nationally established statistically significant partial correlations between MDS-based quality measures and claims-based measures and/or health inspection scores remain valid for nursing homes within the State of Georgia for five MDS-based measures (MDS 401, 407, 410, 419, and 453), become invalid for two measures for which the only statistically significant evidence demonstrates a negative relationship to quality (MDS 406 and 452). The remaining four MDS-based measures provide mixed evidence of their significant partial correlation with quality (MDS 404 405, 451, and 415).

For measure MDS 404: Percentage of long-stay residents who lose too much weight, statistically significant results indicate that the measure is positively correlated with improvements in the hospitalization rate among poor performers, i.e. those in the 10th decile at the 5% significance level, as well as improvements in the continuously measured health inspection score/health inspection score as measured through reductions in the probability of observing a nursing home in the 10th decile at the 10% level. Improvements in the quality score for MDS 404 are found to statistically reduce the probability of being in the first decile for ER visits at the 10% level. Given

that this measure only has weak evidence of negative partial correlation with ER visits, weak evidence of a positive partial correlation with health inspection ratings, and strong evidence of improvements in hospitalizations, coupled with the measure's exceptionally strong performance in the national regressions reported in Table 4, this evidence supports continuing to include measure 404 in the iterative analysis. Measure MDS 405: Percentage of low risk long-stay residents who lose control of their bowels or bladder, displays weak evidence (at the 10% level) of an improvement in health inspection quality for low performers (reduced probability of a nursing home being in the 10^{th} decile) simultaneous with weak evidence (at the 10% level) of reduced quality through the increased probability of being in the 10^{th} decile for hospitalizations. The findings further suggest that improvements in Measure 405 are strongly associated (at the 5% and 1% significance levels) with reductions in quality for ER visits rates. Given the weak improvement in health inspection ratings, strong evidence of reductions in quality for ER visits, and the lack of supporting evidence across specifications among the national regressions in Table 4, one can conclude that MDS 405 is not necessarily a strong fit for measuring quality in the State of Georgia. Measure MDS 451 Percentage of long-stay residents whose ability to move independently worsened has mixed evidence suggesting improvements in its quality are associated with improvements in the quality of hospitalization rates through the reduced probability of a nursing home is in the 10^{th} decile significant at the 10% level. However, improvements are strongly associated (at the 1% level) with reductions in the probability of being in the 1^{st} decline. Given such strong evidence of a negative partial correlation and given the lack of supporting evidence across specifications among the national regressions in Table 4, it is reasonable to conclude that MDS 451 is not necessarily a good fit for measuring quality in the State of Georgia. Finally, measure 415 for Percentage of long-stay residents assessed and appropriately given the pneumococcal vaccine has strong evidence (at the 1% level) of both improvements and reductions in quality. The direction of the effects suggests that this measure is good at predicting quality among high performers but is negatively associated with quality among low performers. Overall, the high level of significance for negative partial correlations and the mix of evidence for this variable at the state level imply that MDS 415 is not necessarily a good fit for measuring quality in the State of Georgia.

Table 5: Summary of Direction of Relationship of Claims-Based Quality Measures and Health Inspection Scores with MDS-Self Reported Measures Using Georgia Nursing Homes

Measure	Description	Measure Code 551			Measure Code 552			Health Inspections		
		ln(rating)	Decile		ln(rating)	Decile		ln(rating)	Decile	
Code			1st	10th		1st	10th		1st	10th
401	Percentage of long-stay residents whose need for help with daily activities has increased	++	+		++					
404	Percentage of long-stay residents who lose too much weight			++		-		+		+
405	Percentage of low risk long-stay residents who lose control of their bowels or bladder			-	--	---				+
406	Percentage of long-stay residents with a catheter inserted and left in their bladder			-						-
407	Percentage of long-stay residents with a urinary tract infection			++						
410	Percentage of long-stay residents experiencing one or more falls with major injury		++				+			
415	Percentage of long-stay residents assessed and appropriately given the pneumococcal vaccine		+	--	-	+++	---	+++	+++	
419	Percentage of long-stay residents who received an antipsychotic medication						+	++	++	
451	Percentage of long-stay residents whose ability to move independently worsened		---	+						
452	Percentage of long-stay residents who received an antianxiety or hypnotic medication							-	--	
453	Percentage of high risk long-stay residents with pressure ulcers	+++	+++		+	+				

Notes: Each column reports whether the quality measure is associated with improvements (+) or reductions (-) in quality and its statistical significance for separate regressions which contain each MDS measure, some of which contain quarter fixed effects, and with nursing home clustered robust standard errors. -/+ P-value < 0.10, --/++ P-value < 0.05, ---/+++ P-value < 0.01.

9. Assessing the Validity of Georgia State Level Established Partial Correlation of MDS-Based Quality Measures to Independently Correlated with Claims-Based Measures and Health Inspection Scores.

The analysis of the previous sections focused on finding a group of MDS-based measures that have a strong positive correlation between improvements in their quality dimension and quality as demonstrated through claims-based measures and/or health inspection scores. The analysis of these measures focused on the partial correlation, i.e., measuring the relationship between each measure while simultaneously controlling for the relationship with other MDS-based measures. It may be true that due to a lack of available data, censoring due to small nursing home population sizes, or changes in CMS reporting that some measures are unavailable. In such cases, it becomes important to demonstrate that the remaining measures continue to independently measure quality.

The purpose of this section is to evaluate whether improvements in the quality of each measure continue to positively correlate with improvements in claims-based measures and/or health inspection scores without controlling for any other MDS-based measures. If the statistical relationship between these measures continues to hold without controlling for other MDS-based measures, this will imply that variations of a composite quality measure that are constructed due to a lack of available data should continue to measure quality even if such measures do not measure quality as objectively.

To evaluate whether the statistically significant positive relationships between each MDS-based quality measure, claims-based measures and/or health inspection scores continue to hold within the state of Georgia for each measure independently, I evaluate the following

$$Quality_{it} = \beta_0 + \beta_1 \, MDS \; Measure_{it} \; + T_t + \epsilon \qquad (4)$$

$$Quality_{it} = \beta_0 + \beta_1 \, MDS \; Measure_{it} \; + \epsilon \qquad (5)$$

where $MDS \; Measure_{it}$ is the score for an individual MDS-based measure and where T_t continues to represent quarter fixed effects.

10. Results for Assessing the Validity of Georgia State Level Established Partial Correlation of MDS-Based Quality Measures to Independently Correlated with Claims-Based Measures and Health Inspection Scores.

A summary of the direction and statistical significance of the partial correlation of MDS-based quality measures in independent regressions with claims-based hospitalizations, ER visits, and/or health inspection scores for Nursing Homes in the State of Georgia is reported in Table 6 with a summary of key coefficients for each model reported in Appendix Tables A14-A16. For MDS Measures 401, 407, 419, and 453, all statistically significant coefficient estimates support the conclusion that these measures are positively correlated with external quality measures in independent regressions. Measure 404 continues to exhibit a strong positive relationship with claims-based hospitalizations and health inspections with weak evidence at the 10% level of

reductions in the probability of being in the first decile for claims-based ER visits. Quality improvements in measure 410 for the percentage of long-stay residents with one or more falls with major injury exhibits statistically significant evidence at the 5% level of a negative relationship with health inspection quality.

Table 6: Summary of Direction of Relationship of Claims-Based Quality Measures and Health Inspection Scores with MDS-Self Reported Measures Using Georgia Nursing Homes in Independent Regressions

Measure	Description	Measure Code 551			Measure Code 552			Health Inspections		
			Decile			Decile			Decile	
Code		ln(rating)	1st	10th	ln(rating)	1st	10th	ln(rating)	1st	10th
401	Percentage of long-stay residents whose need for help with daily activities has increased						+	+++		
404	Percentage of long-stay residents who lose too much weight	+		++		-		++	++	+
407	Percentage of long-stay residents with a urinary tract infection			++						
410	Percentage of long-stay residents experiencing one or more falls with major injury				+		+++	--		
419	Percentage of long-stay residents who received an antipsychotic medication	+			++		++			
453	Percentage of high risk long-stay residents with pressure ulcers	+++	+++	+	+			+		

Notes: Each row and column reports whether the quality measure is associated with improvement (+) or reductions (-) in quality and its statistical significance for separate regressions which contain each MDS measure, some of which contain quarter fixed effects, and with nursing home clustered robust standard errors. -/+ P-value < 0.10, --/++ P-value < 0.05, ---/+++ P-value < 0.01.

11. Broad Conclusions about QM measures for Inclusion

Given that both claims-based measures of long-stay quality (risk-adjusted hospitalization rates, and risk-adjusted ER visit rates) were positively related to most MDS-based quality measures, the fact that these measures are reported on a more regular interval than health inspections, and since these measures are less susceptible to strategic manipulation by SNFs, it is recommended that both of these measures form the basis for a composite measure of quality for the Georgia Skilled Nursing Facility (SNF) Quality Incentive Payment Program.

In addition, the five MDS-based measures for the percentage of long-stay residents that: (1) have a need for help with daily activities that has increased, (2) lose too much weight, (3) have a urinary tract infection, (4) received an antipsychotic medication, and (5) have pressure ulcers consistently

demonstrate a positive correlation with independent quality outcomes including health inspections. These measures may represent valuable additions that capture other aspects of quality of care in nursing homes and should be included to a lesser extent than claims-based measures.

Given that these measures are potentially subject to strategic behavior by SNFs, the program should regularly monitor the relationship between these measures, independent quality measures, and MDS-based measures not targeted by the program to test for evidence of weakening statistical relationships and correlations which could suggest strategic behavior as well as the potential for declining quality in non-targeted dimensions.

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Technical Appendix

Appendix Table A1: Excluded MDS-Based Quality Measures

Measure Code	Description	Available Years
402	Percentage of long-stay residents who self-report moderate to severe pain	2016-2019
403	Percentage of high risk long-stay residents with pressure ulcers	2016-2018
411	Percentage of long-stay residents assessed and appropriately given the seasonal influenza vaccine	2016-2018
424	Percentage of short-stay residents who self-report moderate to severe pain	2016-2019
425	Percentage of short-stay residents with pressure ulcers that are new or worsened	2016-2018
426	Percentage of short-stay residents who were assessed and appropriately given the seasonal influenza vaccine	2016-2018

Notes: Available years reflect observed year range observed in 2017-2021 archives of monthly releases for Nursing Home Compare.

Figure A1: Quarterly and Four Quarter Moving Average Plots of MDS-Based Measure 401-Percentage of long-stay residents whose need for help with daily activities has increased

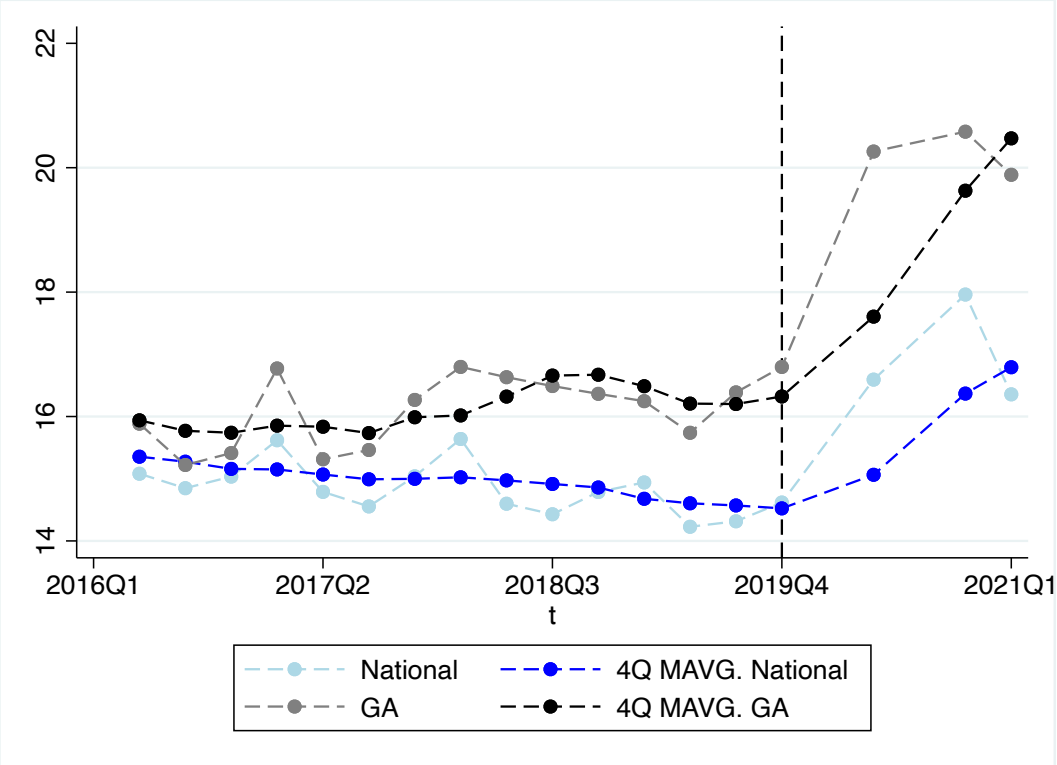


Figure A2: Quarterly and Four Quarter Moving Average Plots of MDS-Based Measure 404-Percentage of long-stay residents who lose too much weight

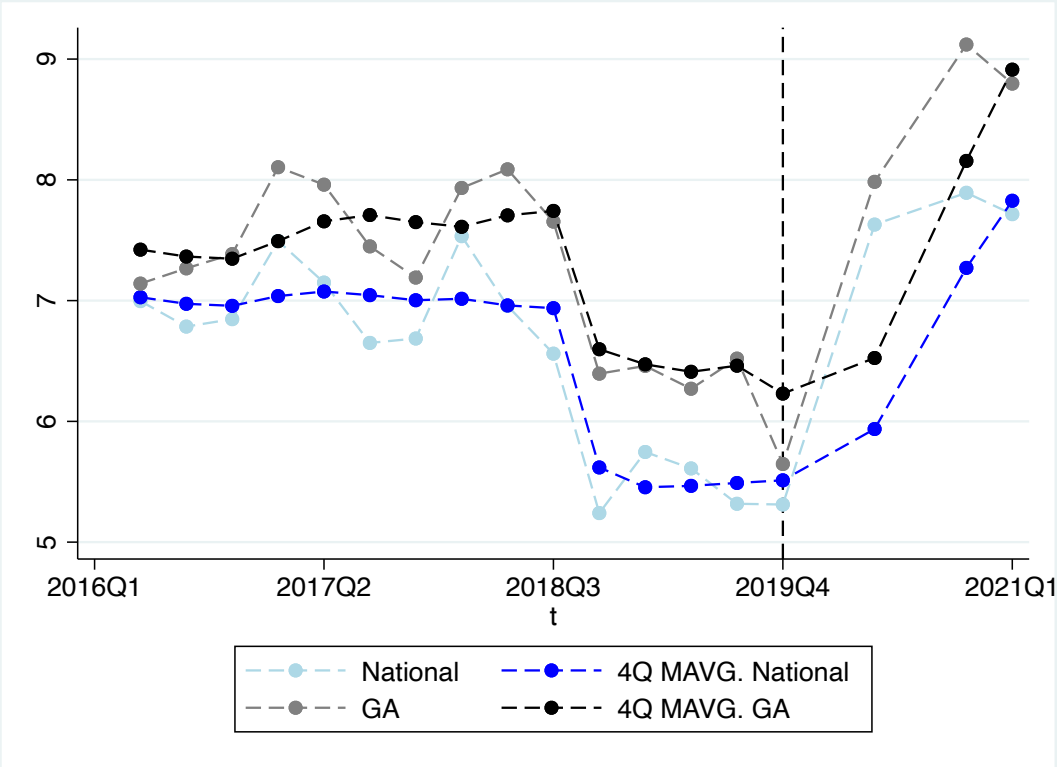


Figure A3: Quarterly and Four Quarter Moving Average Plots of MDS-Based Measure 405-Percentage of low risk long-stay residents who lose control of their bowels or bladder

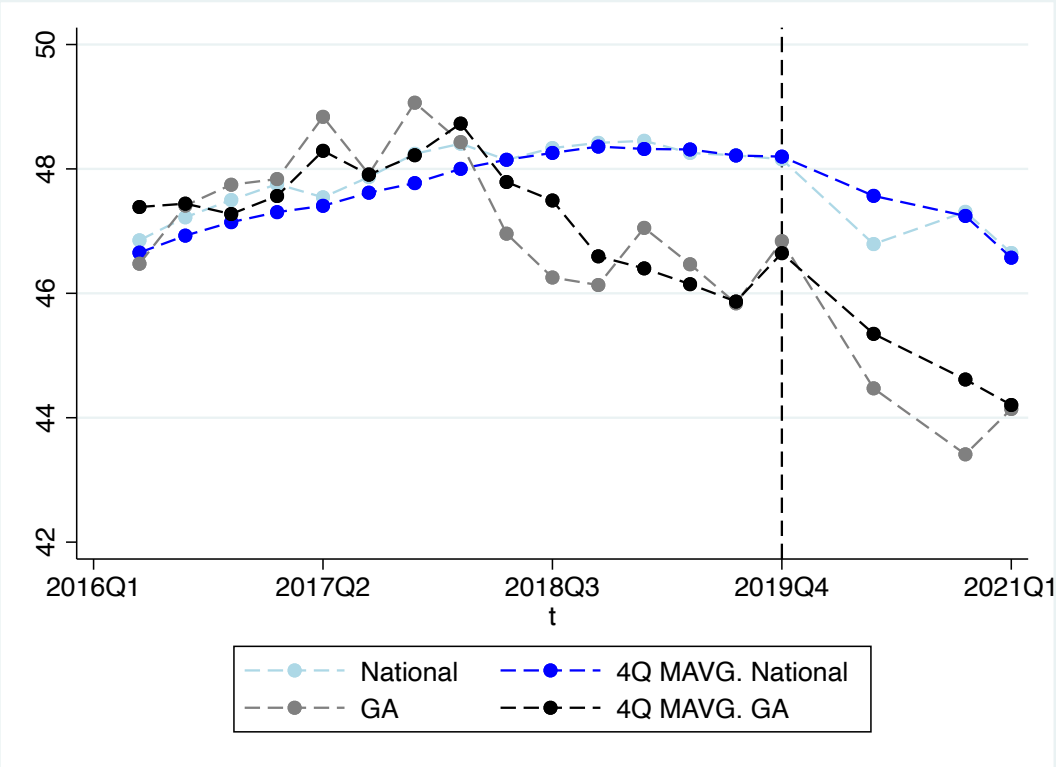


Figure A4: Quarterly and Four Quarter Moving Average Plots of MDS-Based Measure 406-Percentage of long-stay residents with a catheter inserted and left in their bladder

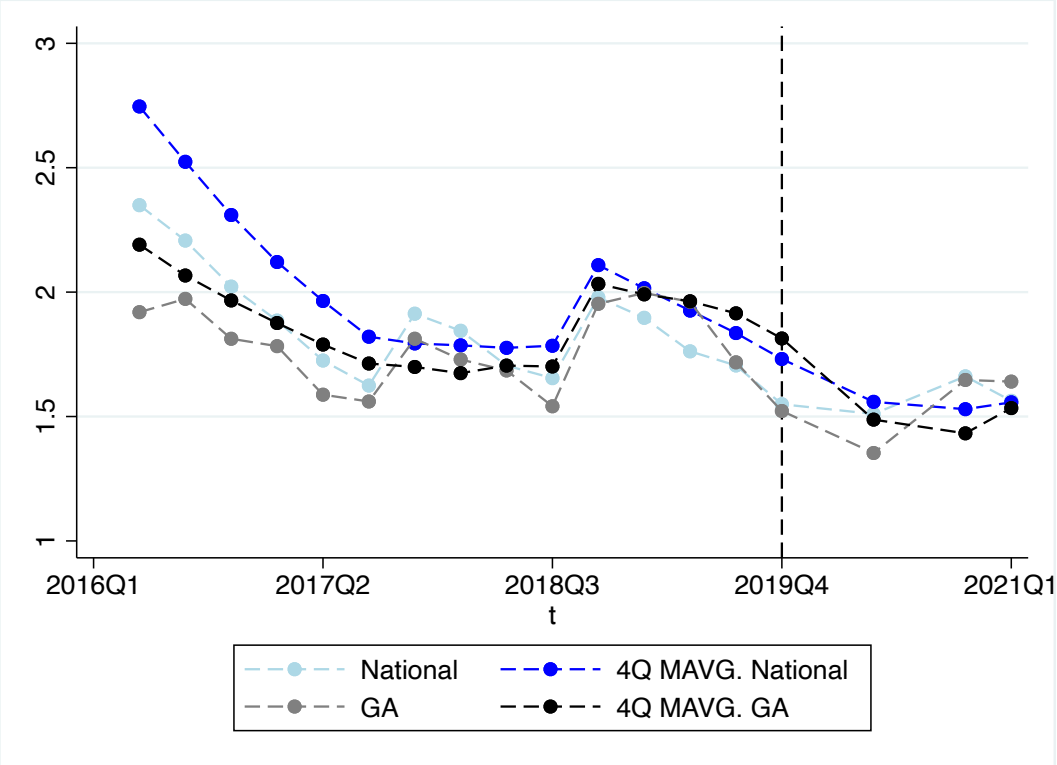


Figure A5: Quarterly and Four Quarter Moving Average Plots of MDS-Based Measure 407-Percentage of long-stay residents with a urinary tract infection

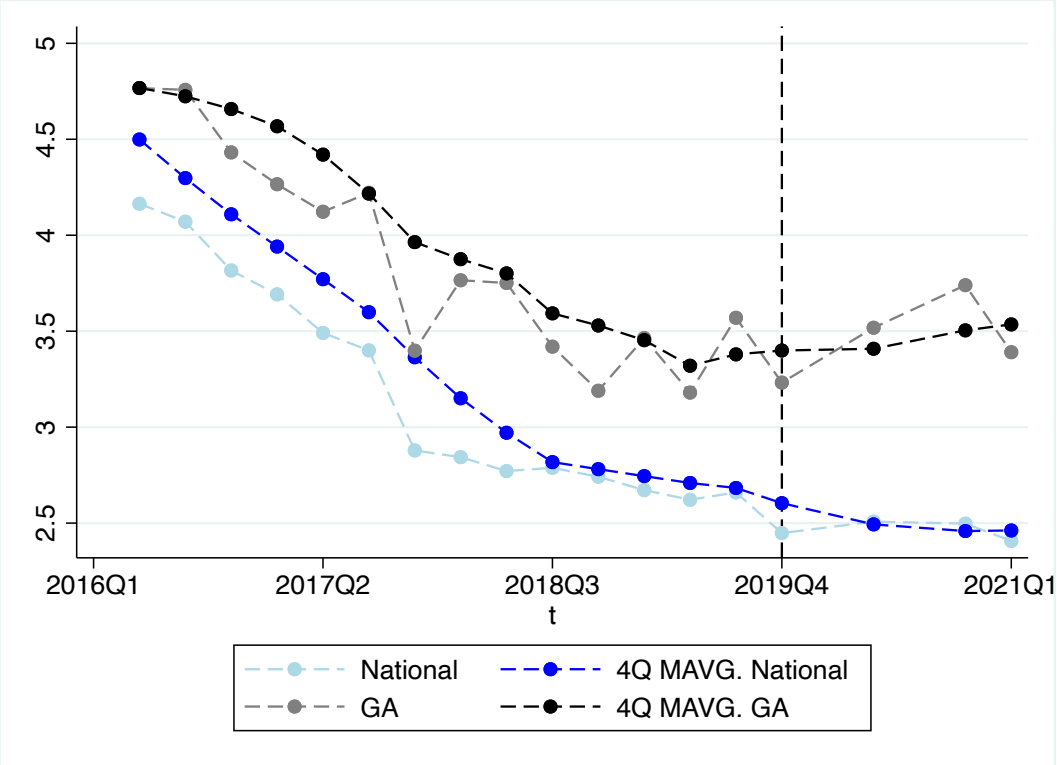


Figure A6: Quarterly and Four Quarter Moving Average Plots of MDS-Based Measure 408-Percentage of long-stay residents who have depressive symptoms

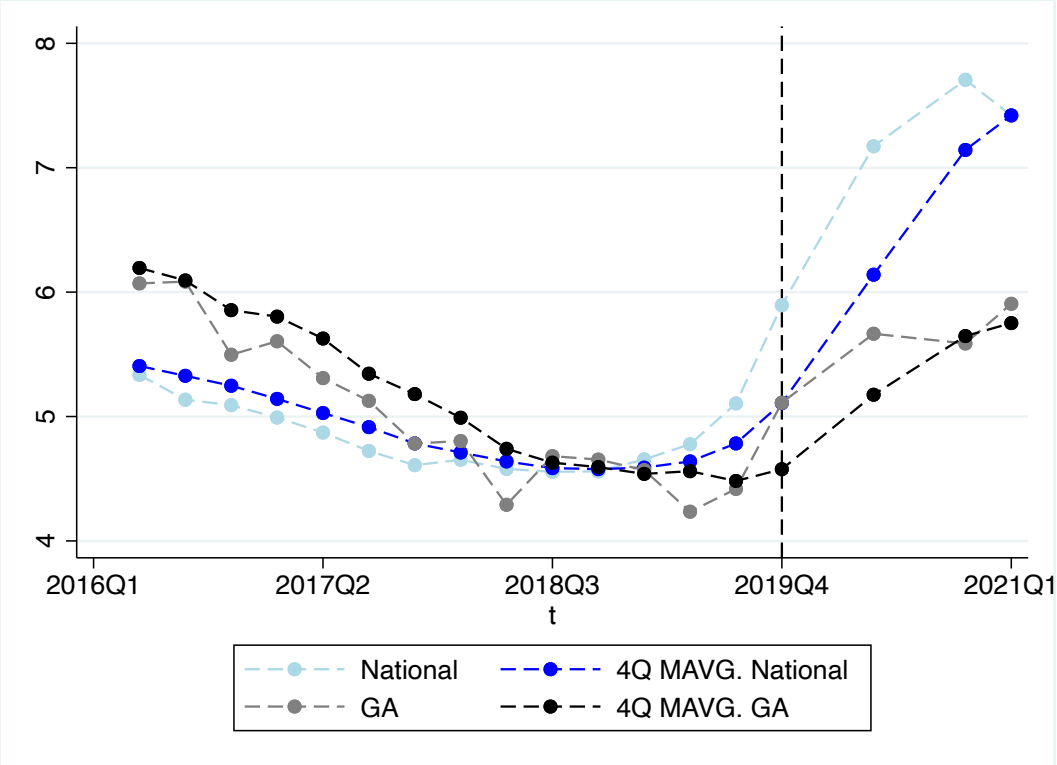


Figure A7: Quarterly and Four Quarter Moving Average Plots of MDS-Based Measure 409-Percentage of long-stay residents who were physically restrained

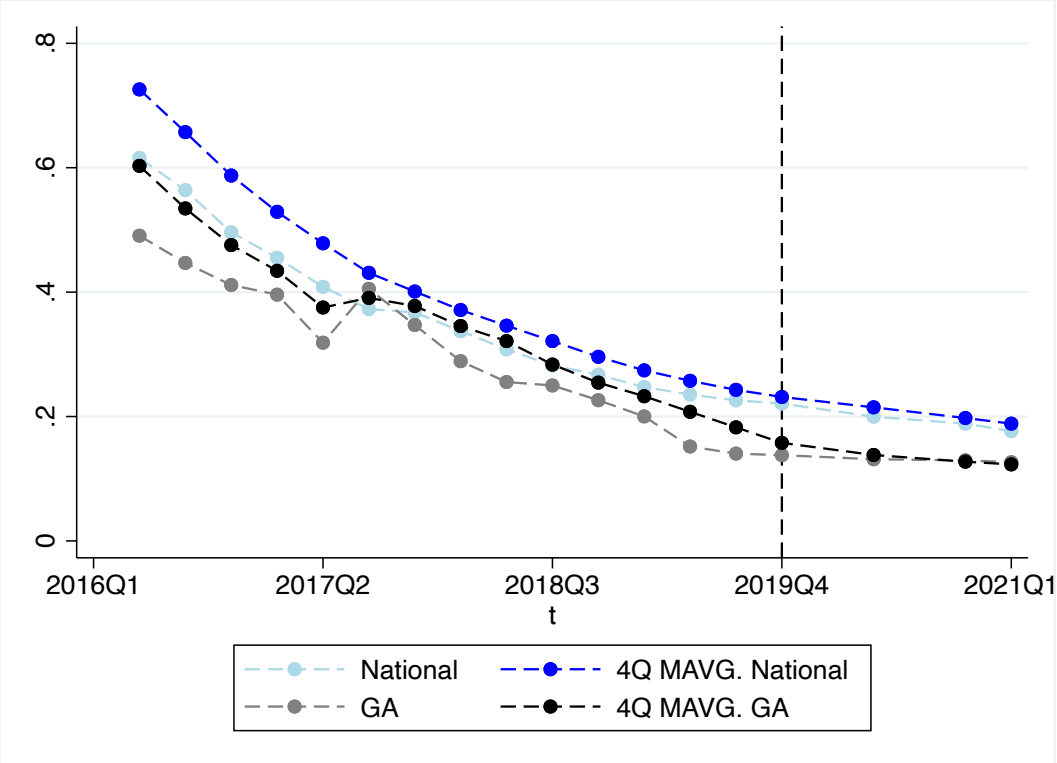


Figure A8: Quarterly and Four Quarter Moving Average Plots of MDS-Based Measure 410-Percentage of long-stay residents experiencing one or more falls with major injury

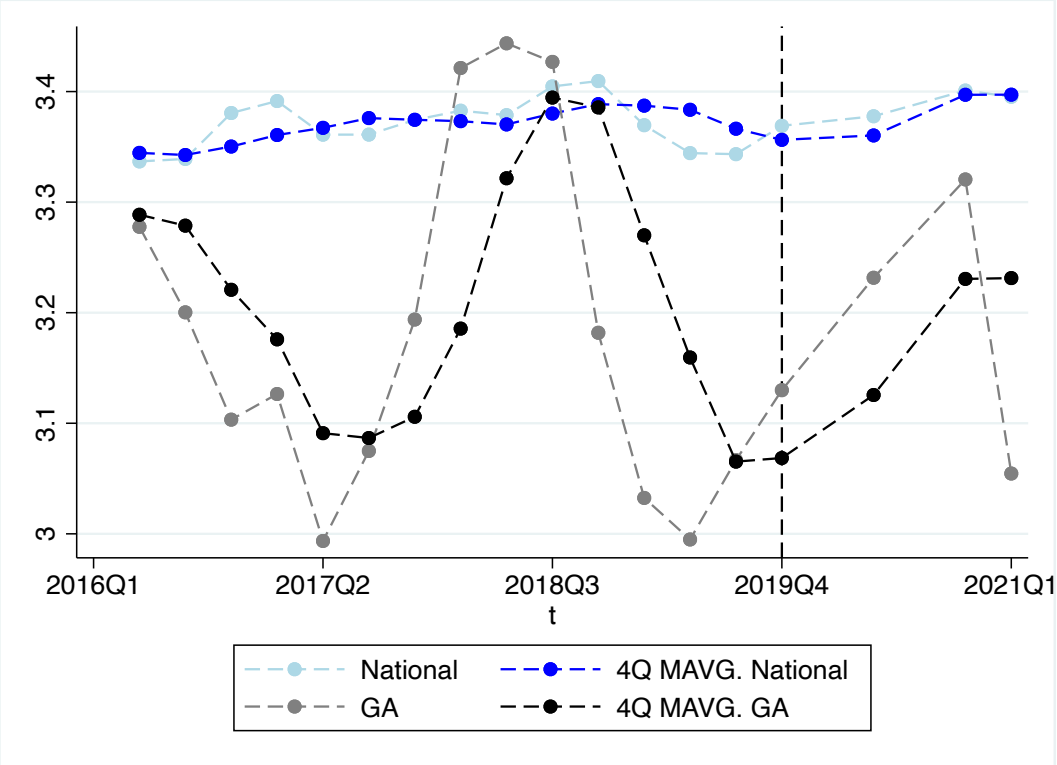


Figure A9 Quarterly and Four Quarter Moving Average Plots of MDS-Based Measure 415-Percentage of long-stay residents assessed and appropriately given the pneumococcal vaccine

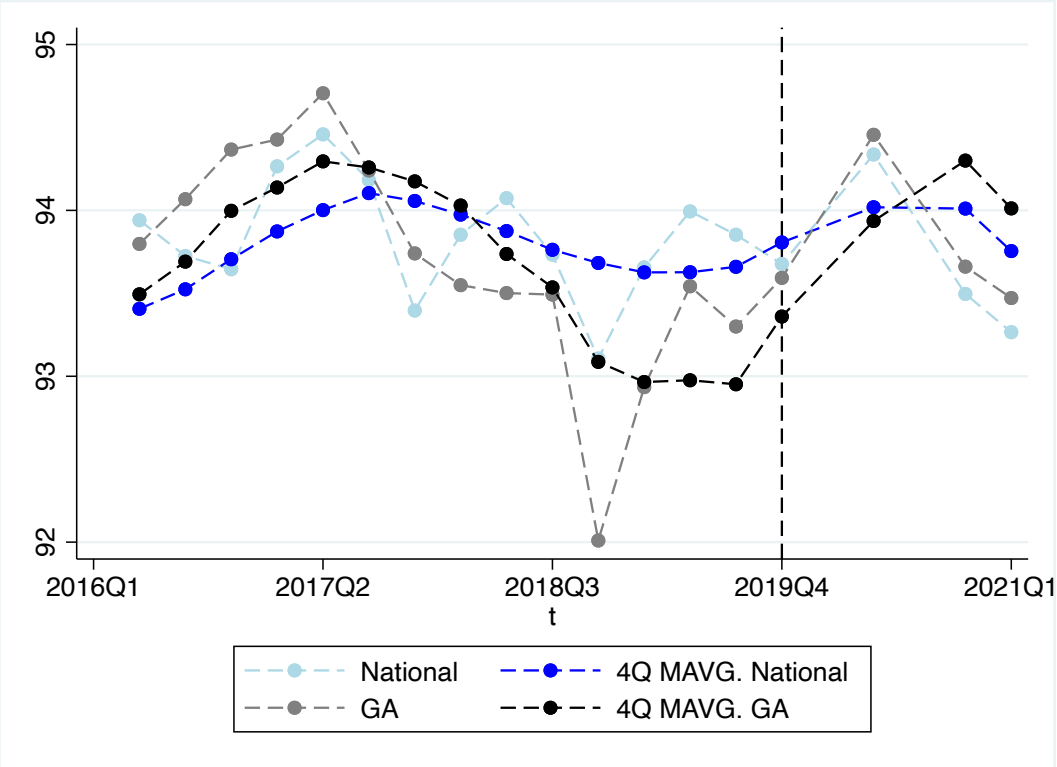


Figure A10: Quarterly and Four Quarter Moving Average Plots of MDS-Based Measure 419-Percentage of long-stay residents who received an antipsychotic medication

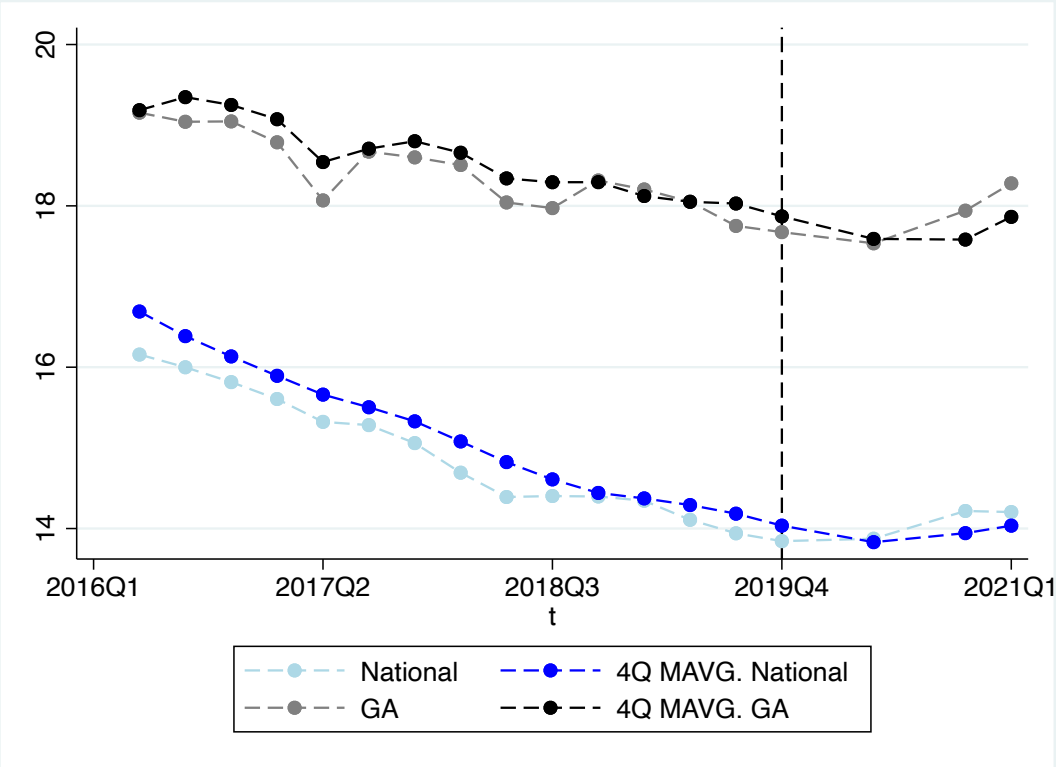


Figure A11: Quarterly and Four Quarter Moving Average Plots of MDS-Based Measure 451-Percentage of long-stay residents whose ability to move independently worsened

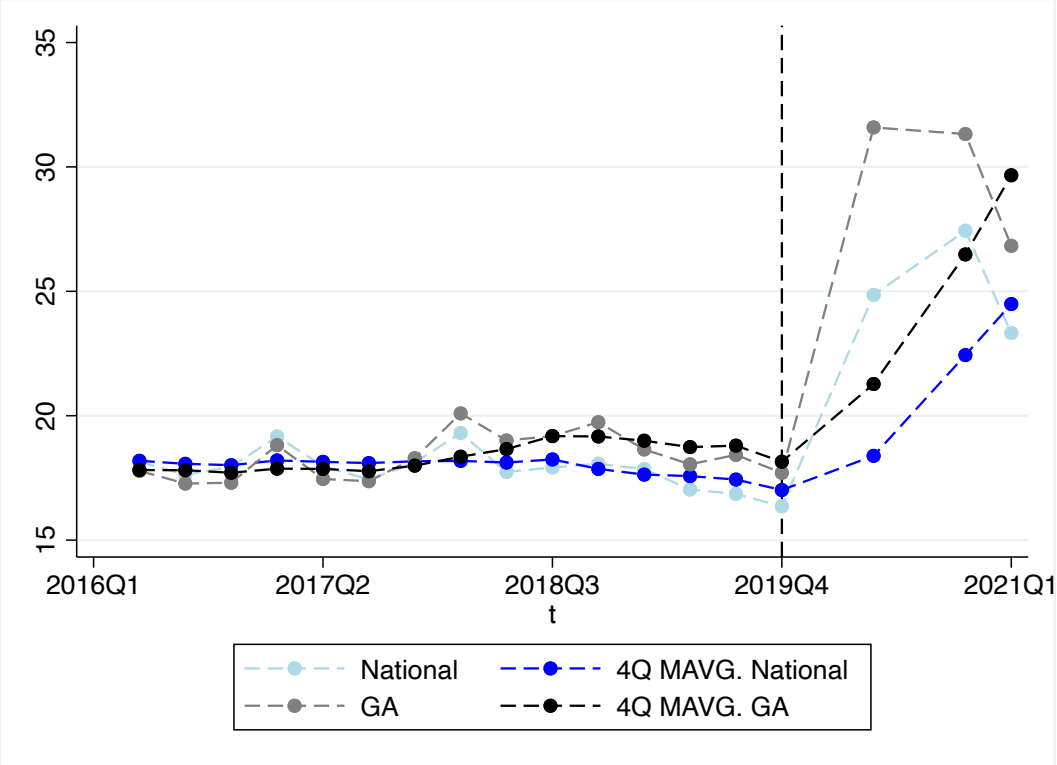


Figure A12: Quarterly and Four Quarter Moving Average Plots of MDS-Based Measure 452-Percentage of long-stay residents who received an antianxiety or hypnotic medication

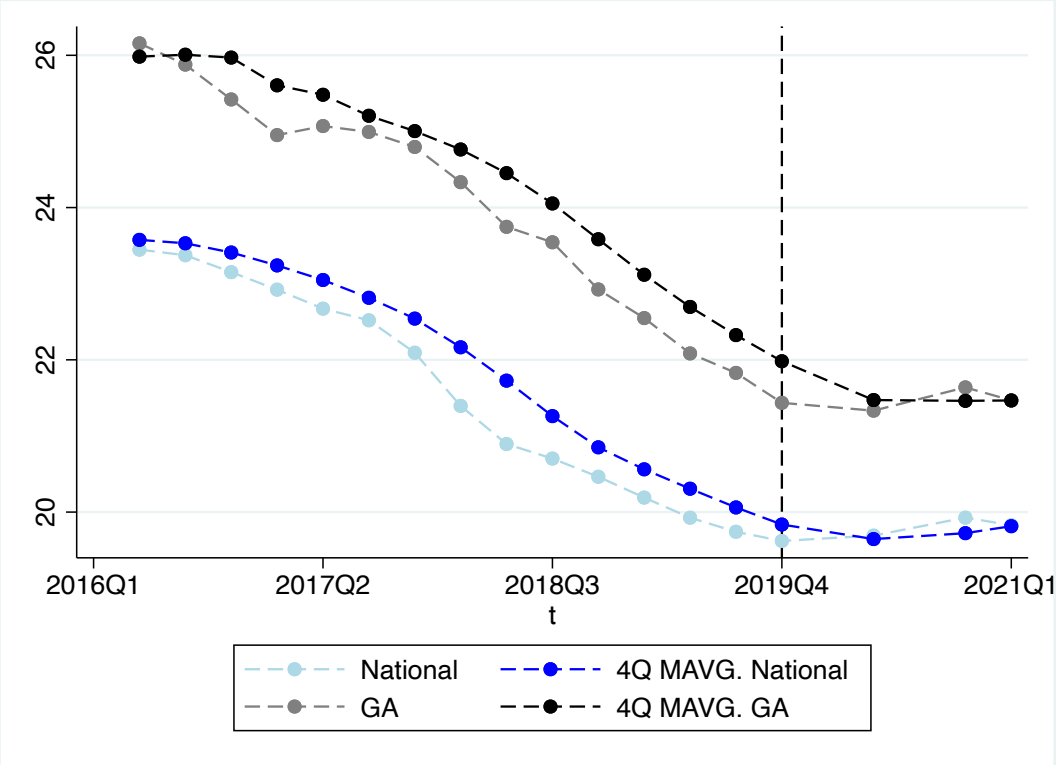


Figure A13: Quarterly and Four Quarter Moving Average Plots of MDS-Based Measure 453-Percentage of high risk long-stay residents with pressure ulcers

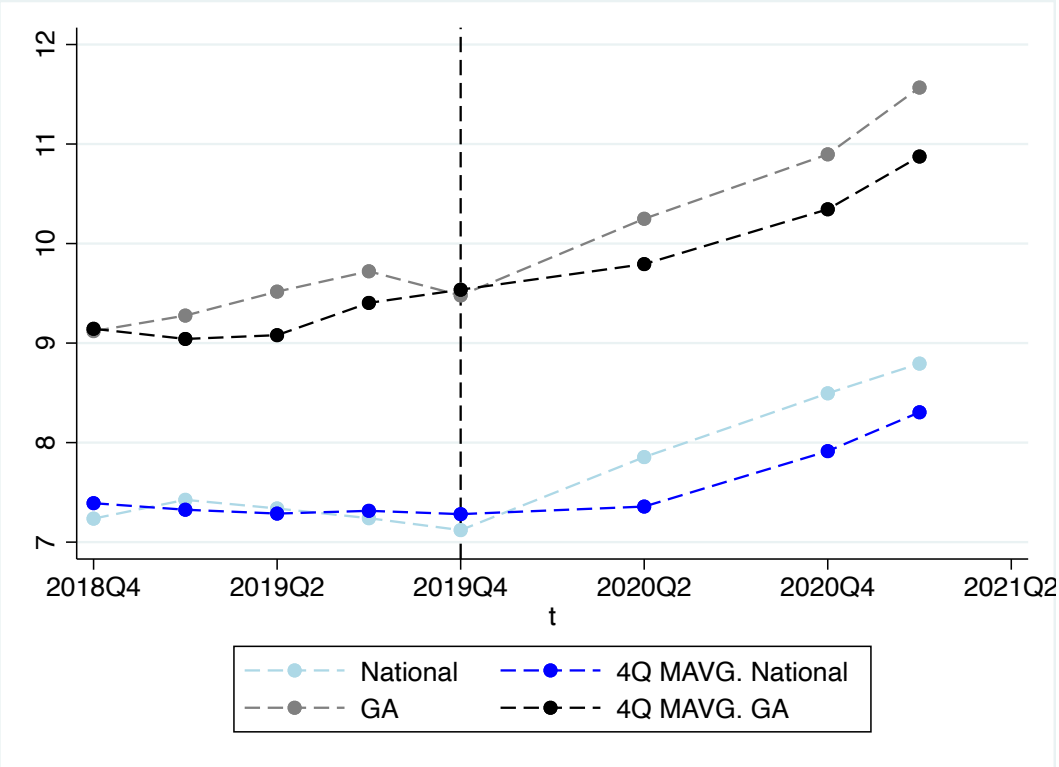


Figure A14: Quarterly and Four Quarter Moving Average Plots of MDS-Based Measure 454-Percentage of long-stay residents assessed and appropriately given the seasonal influenza vaccine

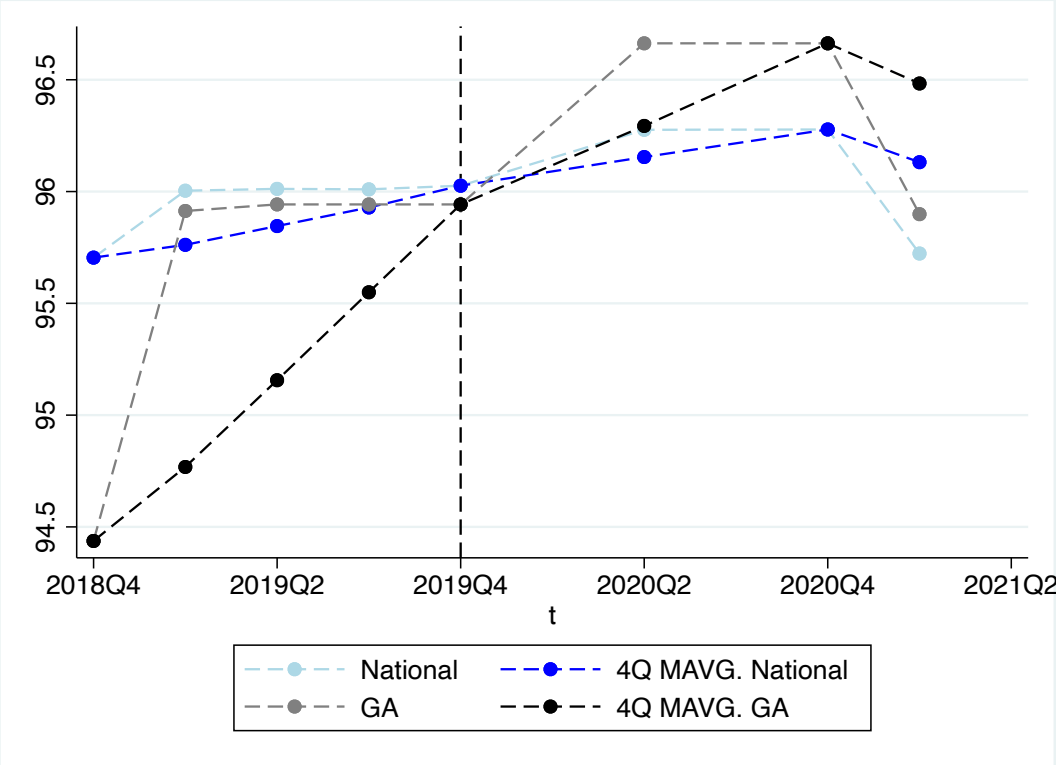


Figure A15: Quarterly and Four Quarter Moving Average Plots of MDS-Based Measure 430-Percentage of short-stay residents assessed and appropriately given the pneumococcal vaccine

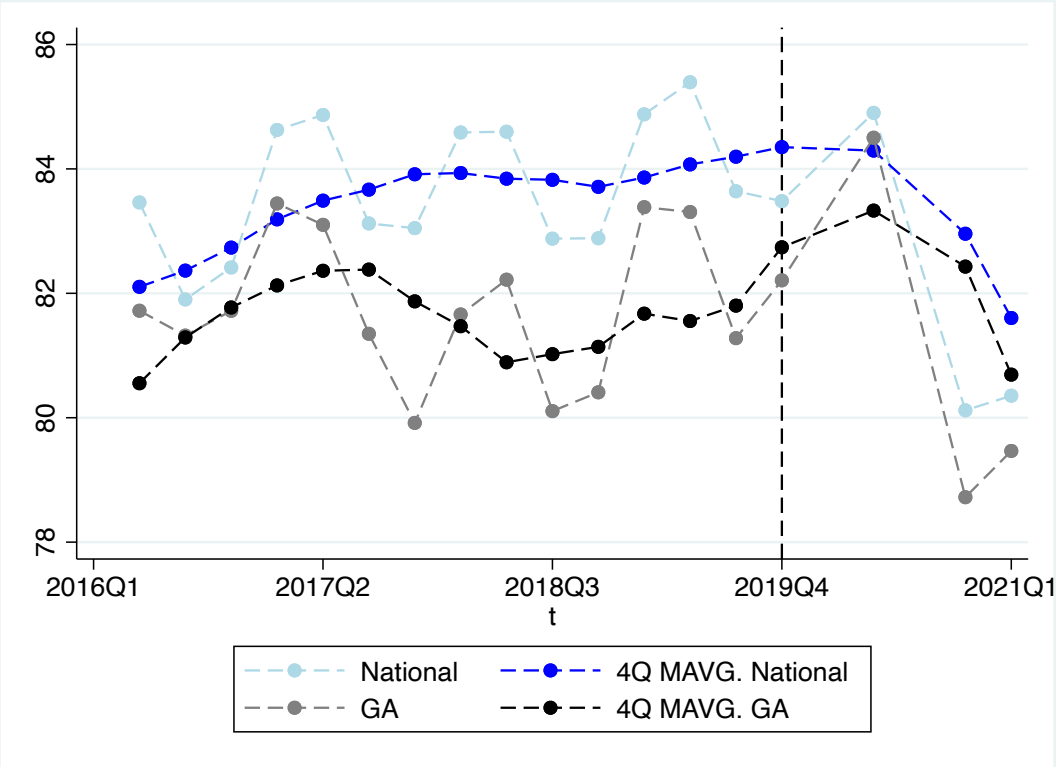


Figure A16: Quarterly and Four Quarter Moving Average Plots of MDS-Based Measure 434-Percentage of short-stay residents who newly received an antipsychotic medication

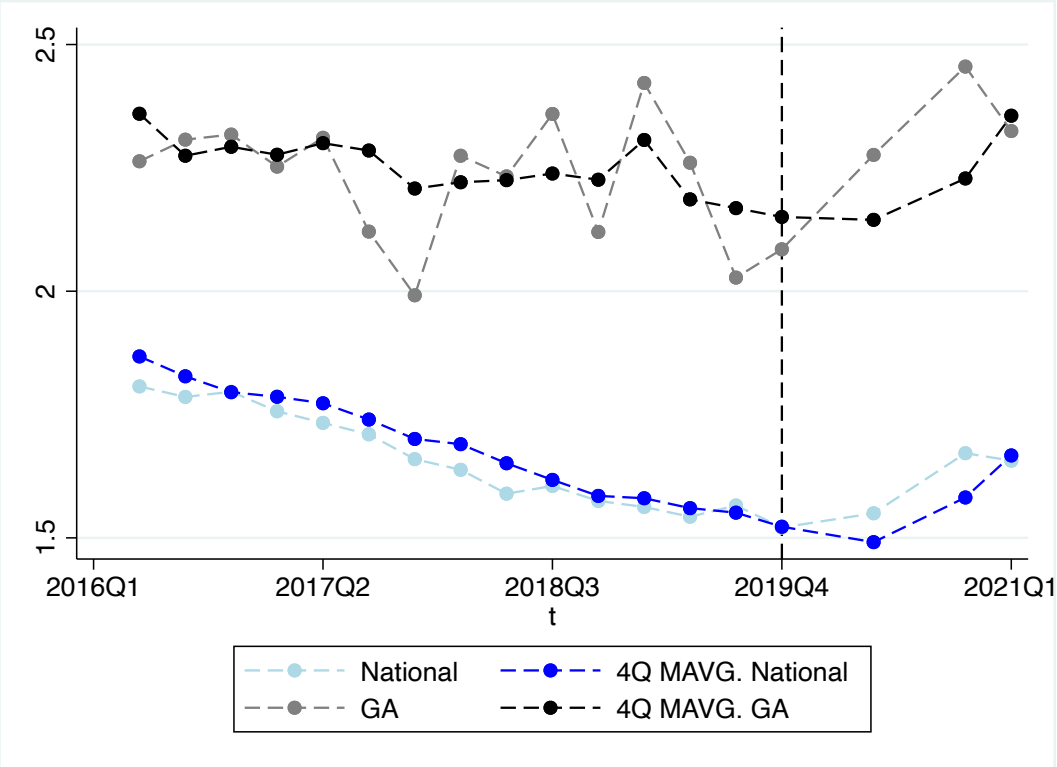


Figure A17: Quarterly and Four Quarter Moving Average Plots of MDS-Based Measure 471-Percentage of short-stay residents who made improvements in function

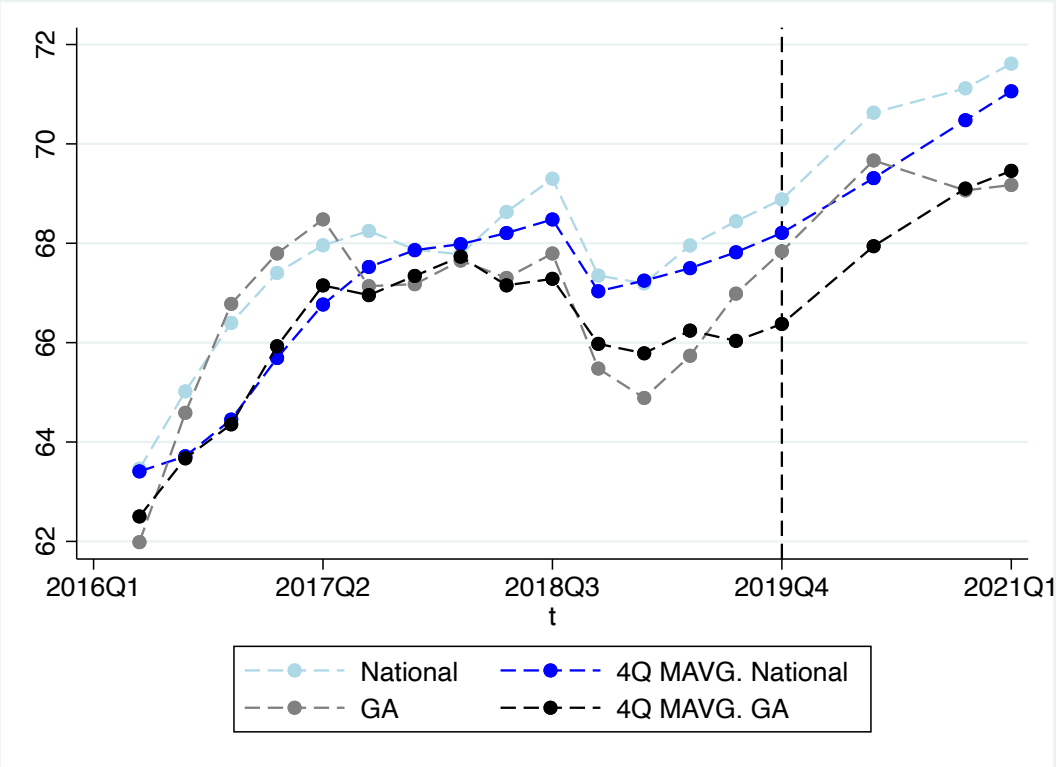
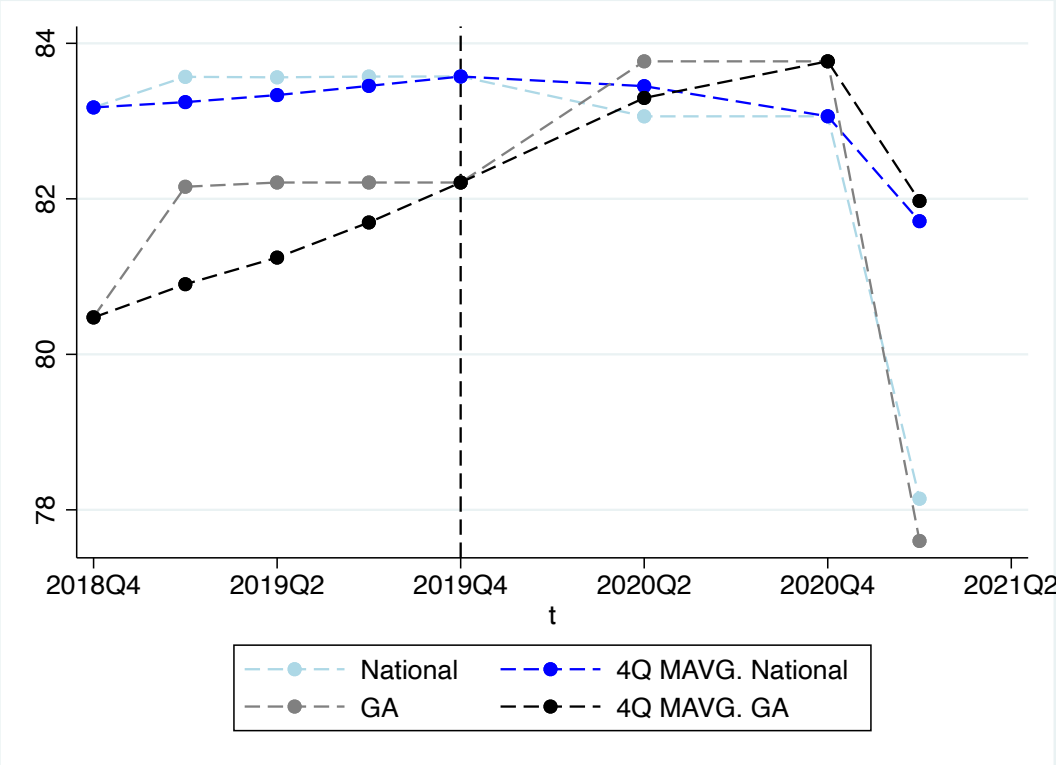


Figure A18: Quarterly and Four Quarter Moving Average Plots of MDS-Based Measure 472-Percentage of short-stay residents who were assessed and appropriately given the seasonal influenza vaccine



Appendix Table A2: Summary of Coefficients Estimates from Multivariate Regressions for Quality Measure 551: Risk-Adjusted Number of hospitalizations per 1000 long-stay resident days Using National Data

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Measure	ln(rating)	Decile		ln(rating)	Decile		ln(rating)	Decile		ln(rating)	Decile	
Code		Not 1st	10th		Not 1st	10th		Not 1st	10th		Not 1st	10th
MRS401	0.003***	0.002***	0.002***	0.003***	0.002***	0.002***	0.003***	0.002***	0.002***	0.003***	0.001*	0.002**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)
MRS404	0.003***	0.001***	0.002***	0.004***	0.002**	0.002***	0.003***	0.001**	0.002***	0.004***	0.001	0.003***
	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
MRS405	0.000**	0.000	0.000	0.000	0.000	0.000	0.000***	0.000	0.000	0.001**	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
MRS406	0.006***	0.003**	0.003***	0.006***	0.003**	0.003**	0.006***	0.003**	0.004***	0.004***	0.004**	0.003
	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)
MRS407	0.006***	0.003***	0.004***	0.008***	0.004***	0.005***	0.006***	0.004***	0.003***	0.009***	0.006***	0.005***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
MRS408	-0.000	-0.000	0.000	-0.000	-0.001*	-0.000	-0.000	0.000	0.000	-0.001*	-0.001	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)
MRS409	-0.000	-0.003	-0.003	0.001	-0.004	-0.001	-0.001	-0.003	-0.003	0.001	-0.003	0.000
	(0.002)	(0.002)	(0.003)	(0.004)	(0.004)	(0.006)	(0.002)	(0.002)	(0.003)	(0.004)	(0.005)	(0.007)
MRS410	0.007***	0.006***	0.004***	0.008***	0.007***	0.004***	0.007***	0.005***	0.004***	0.008***	0.006***	0.005***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
MRS419	0.001**	0.001*	0.001*	0.000	0.000	0.001	0.001*	0.001	0.000	0.000	0.000	0.001
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)
MRS451	0.000	-0.000	0.000	0.000	-0.000	0.001	-0.000	-0.000	0.000	0.000	0.000	0.001
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)
MRS452	0.000	0.000	-0.000	0.001**	0.001	0.000	0.000	0.000	-0.000	0.001	0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)
MRS453				0.003***	0.002***	0.002***				0.004***	0.003***	0.002**
				(0.001)	(0.001)	(0.001)				(0.001)	(0.001)	(0.001)
MRS415	0.000	0.000	0.000	0.001**	0.000	0.000	-0.000	0.000	-0.000	0.001**	0.001	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
MRS454				-0.000	-0.000	0.000				-0.001	-0.001	0.000
				(0.000)	(0.000)	(0.000)				(0.000)	(0.000)	(0.000)
MRS471	0.000	-0.000	0.000	-0.000	-0.000**	-0.000	0.000	-0.000	0.000	-0.000	-0.000*	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Including 453 and 454:	No	No	No	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes
Including 2020Q1+:	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No
N	104274	104273	104273	69181	69180	69180	92975	92974	92974	57883	57882	57882

Notes: Each column reports the coefficient estimates and statistical significance for separate regressions which contain each MDS measure, nursing home fixed effects, quarter fixed effects, and with nursing home clustered robust standard errors. * P-value < 0.10, ** P-value < 0.05,*** P-value < 0.01.

Appendix Table A3: Summary of Coefficients Estimates from Multivariate Regressions for Quality Measure 552: Risk-Adjusted Number of outpatient emergency department visits per 1000 long-stay resident days Using National Data

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Measure	ln(rating)	Decile		ln(rating)	Decile		ln(rating)	Decile		ln(rating)	Decile	
Code		Not 1st	10th		Not 1st	10th		Not 1st	10th		Not 1st	10th
MRS401	0.001***	0.001***	0.001**	0.002***	0.002***	0.001**	0.001***	0.001	0.001	0.002***	0.001**	0.001*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)
MRS404	0.002***	0.001*	0.002***	0.003***	0.002**	0.002***	0.002***	0.001	0.002***	0.003***	0.001*	0.002***
	(0.000)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
MRS405	-0.000	-0.000	-0.000	-0.000	0.000	-0.000	-0.000	0.000	-0.000	-0.000	0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
MRS406	0.003***	0.001	0.001	0.003***	0.001	0.001	0.002**	0.001	0.001	0.002*	0.002	0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)
MRS407	0.004***	0.000	0.005***	0.005***	0.001	0.006***	0.003***	-0.000	0.004***	0.005***	0.001	0.006***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
MRS408	-0.000	0.000	-0.001	-0.000	0.000	-0.001	-0.001**	-0.000	-0.001*	-0.001**	-0.000	-0.001*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)
MRS409	0.001	-0.003	0.001	-0.000	-0.006	0.003	-0.001	0.001	-0.003	-0.002	-0.001	-0.002
	(0.002)	(0.003)	(0.004)	(0.003)	(0.004)	(0.005)	(0.002)	(0.004)	(0.004)	(0.004)	(0.005)	(0.006)
MRS410	0.006***	0.004***	0.004***	0.008***	0.006***	0.005***	0.005***	0.003***	0.004***	0.008***	0.004***	0.005***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
MRS419	0.001**	0.000	0.000	0.001**	0.000	0.000	0.001**	0.000	0.000	0.001***	0.001	0.001
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.000)	(0.000)	(0.001)	(0.000)	(0.001)	(0.001)
MRS451	0.001***	-0.000	0.000	0.001*	-0.001	0.000	0.001**	-0.000	0.000	0.000	-0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)
MRS452	0.001**	0.000	0.001**	0.001***	0.000	0.001	0.001**	-0.000	0.001*	0.001**	0.000	0.001
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)
MRS453				0.002***	0.001**	0.001*				0.002***	0.001	0.001
				(0.000)	(0.001)	(0.001)				(0.001)	(0.001)	(0.001)
MRS415	0.001***	0.000	0.000	0.001***	0.000	0.000	0.000**	0.000	0.000	0.001***	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
MRS454				0.000	0.000	-0.000				-0.000	-0.000	-0.001
				(0.000)	(0.000)	(0.000)				(0.000)	(0.000)	(0.000)
MRS471	0.000	0.000**	0.000	0.000	0.000*	-0.000	0.000	0.000*	0.000	0.000	0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Including MRS 453 and 454:	No	No	No	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes
Including 2020Q1+:	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No
N	80829	80828	80828	69181	69180	69180	69530	69530	69530	57883	57883	57883

Notes: Each column reports the coefficient estimates and statistical significance for separate regressions which contain each MDS measure, nursing home fixed effects, quarter fixed effects, and with nursing home clustered robust standard errors. * P-value < 0.10, ** P-value < 0.05,*** P-value < 0.01.

Appendix Table A4: Summary of Coefficients Estimates from Multivariate Regressions for Total Weighted All Cycle Health Survey Score Using National Data

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Measure	ln(rating)	Decile		ln(rating)	Decile		ln(rating)	Decile		ln(rating)	Decile	
Code		Not 1st	10th		Not 1st	10th		Not 1st	10th		Not 1st	10th
MRS401	0.004***	0.000	0.001**	0.004	-0.000	0.002	0.004***	0.000	0.001**	0.006	-0.000	0.002
	(0.001)	(0.000)	(0.000)	(0.004)	(0.002)	(0.002)	(0.001)	(0.000)	(0.001)	(0.006)	(0.003)	(0.004)
MRS404	0.005***	0.001*	0.001**	0.004	0.000	-0.000	0.005***	0.001*	0.002***	0.007	0.001	0.001
	(0.002)	(0.001)	(0.001)	(0.006)	(0.002)	(0.004)	(0.002)	(0.001)	(0.001)	(0.010)	(0.004)	(0.006)
MRS405	-0.001	0.000	-0.000	-0.000	-0.000	-0.001	-0.000	0.000	-0.000	-0.000	0.000	-0.001
	(0.000)	(0.000)	(0.000)	(0.002)	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)	(0.003)	(0.001)	(0.002)
MRS406	0.010***	0.001	0.002	0.002	-0.001	0.001	0.010***	0.001	0.002	0.002	-0.001	0.000
	(0.003)	(0.001)	(0.001)	(0.011)	(0.004)	(0.006)	(0.003)	(0.001)	(0.001)	(0.018)	(0.008)	(0.010)
MRS407	-0.000	-0.001	0.000	-0.005	-0.001	-0.000	-0.001	-0.001	0.000	-0.006	0.001	0.001
	(0.002)	(0.001)	(0.001)	(0.009)	(0.005)	(0.005)	(0.002)	(0.001)	(0.001)	(0.015)	(0.008)	(0.008)
MRS408	0.000	-0.000	0.000	0.000	-0.000	-0.000	-0.000	-0.000	0.000	0.002	-0.001	0.002
	(0.001)	(0.000)	(0.000)	(0.002)	(0.001)	(0.002)	(0.001)	(0.000)	(0.000)	(0.005)	(0.003)	(0.004)
MRS409	-0.001	0.000	-0.001	-0.059	-0.006	-0.021	0.002	0.000	0.000	-0.011	-0.004	-0.022
	(0.007)	(0.002)	(0.003)	(0.068)	(0.015)	(0.029)	(0.006)	(0.002)	(0.003)	(0.047)	(0.019)	(0.045)
MRS410	0.003	0.001	0.001	0.003	0.001	-0.000	0.003	0.001	0.001	0.001	-0.004	0.000
	(0.002)	(0.001)	(0.001)	(0.009)	(0.004)	(0.004)	(0.002)	(0.001)	(0.001)	(0.014)	(0.006)	(0.008)
MRS419	0.005***	0.000	0.001*	0.002	0.000	0.001	0.004***	0.000	0.001	0.003	-0.000	0.000
	(0.001)	(0.000)	(0.000)	(0.004)	(0.002)	(0.003)	(0.001)	(0.000)	(0.000)	(0.008)	(0.003)	(0.006)
MRS451	0.001	-0.000	0.000	-0.002	0.001	-0.001	0.001	-0.000	0.000	-0.002	-0.000	0.000
	(0.001)	(0.000)	(0.000)	(0.003)	(0.001)	(0.002)	(0.001)	(0.000)	(0.000)	(0.006)	(0.002)	(0.004)
MRS452	0.002	0.000	-0.000	0.001	-0.000	0.001	0.002	0.000	-0.000	0.002	-0.000	0.001
	(0.001)	(0.000)	(0.000)	(0.004)	(0.002)	(0.002)	(0.001)	(0.000)	(0.000)	(0.007)	(0.003)	(0.004)
MRS453				0.004	-0.000	0.002				0.004	-0.000	-0.000
				(0.005)	(0.002)	(0.003)				(0.009)	(0.004)	(0.006)
MRS415	0.004***	0.000	0.001***	0.004*	0.000	0.000	0.004***	0.000	0.001***	0.004	0.001	0.000
	(0.001)	(0.000)	(0.000)	(0.002)	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)	(0.004)	(0.001)	(0.002)
MRS454				-0.001	-0.000	-0.001				-0.002	-0.001	-0.001
				(0.003)	(0.001)	(0.002)				(0.005)	(0.001)	(0.003)
MRS471	0.002***	0.000**	0.001***	0.000	0.000	0.001	0.002***	0.000**	0.001***	-0.000	0.000	0.001
	(0.000)	(0.000)	(0.000)	(0.002)	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)	(0.003)	(0.001)	(0.002)
Including MRS 453 and 454:	No	No	No	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes
Including 2020Q1+:	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No
N	43063	42797	42797	15804	15688	15688	41629	41375	41375	14370	14266	14266

Notes: Each column reports the coefficient estimates and statistical significance for separate regressions which contain each MDS measure, nursing home fixed effects, quarter fixed effects, and with nursing home clustered robust standard errors. * P-value < 0.10, ** P-value < 0.05,*** P-value < 0.01.

Appendix Table A5: Summary of Coefficients Estimates from Multivariate Regressions for Quality Measure 551: Risk-Adjusted Number of hospitalizations per 1000 long-stay resident days Using National Data

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Measure	ln(rating)	Decile		ln(rating)	Decile		ln(rating)	Decile		ln(rating)	Decile	
Code		Not 1st	10th		Not 1st	10th		Not 1st	10th		Not 1st	10th
MRS401	0.003***	0.002***	0.002***	0.003***	0.002***	0.002***	0.003***	0.002***	0.002***	0.003***	0.001*	0.002**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)
MRS404	0.003***	0.001***	0.002***	0.004***	0.002**	0.002***	0.003***	0.001**	0.002***	0.004***	0.001	0.003***
	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
MRS405	0.000**	0.000	0.000	0.000	0.000	0.000	0.000***	0.000	0.000	0.001**	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
MRS406	0.006***	0.003**	0.003***	0.006***	0.003**	0.003**	0.006***	0.003**	0.004***	0.004***	0.004**	0.003
	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)
MRS407	0.006***	0.003***	0.004***	0.008***	0.004***	0.005***	0.006***	0.004***	0.003***	0.009***	0.006***	0.005***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
MRS410	0.007***	0.006***	0.004***	0.008***	0.007***	0.004***	0.007***	0.005***	0.004***	0.008***	0.006***	0.005***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
MRS419	0.001**	0.001*	0.001*	0.000	0.000	0.001	0.001*	0.001	0.000	0.000	-0.000	0.001
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)
MRS451	0.000	-0.000	0.000	0.000	-0.000	0.001	-0.000	-0.000	0.000	0.000	0.000	0.001
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)
MRS452	0.000	0.000	-0.000	0.001**	0.001	0.000	0.000	0.000	-0.000	0.001	0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)
MRS453				0.003***	0.002***	0.002***				0.004***	0.003***	0.002**
				(0.001)	(0.001)	(0.001)				(0.001)	(0.001)	(0.001)
MRS415	0.000	0.000	0.000	0.000**	0.000	0.000	-0.000	0.000	-0.000	0.000*	0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Including MRS 453 and 454:	No	No	No	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes
Including 2020Q1+:	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No
N	104274	104273	104273	69181	69180	69180	92975	92974	92974	57883	57882	57882

Notes: Each column reports the coefficient estimates and statistical significance for separate regressions which contain each MDS measure, nursing home fixed effects, quarter fixed effects, and with nursing home clustered robust standard errors. * P-value < 0.10, ** P-value < 0.05,*** P-value < 0.01.

Appendix Table A6: Summary of Coefficients Estimates from Multivariate Regressions for Quality Measure 552: Risk-Adjusted Number of outpatient emergency department visits per 1000 long-stay resident days Using National Data

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Measure	ln(rating)	Decile		ln(rating)	Decile		ln(rating)	Decile		ln(rating)	Decile	
Code		Not 1st	10th		Not 1st	10th		Not 1st	10th		Not 1st	10th
MRS401	0.001***	0.001***	0.001**	0.002***	0.002***	0.001**	0.001***	0.001	0.001	0.002***	0.001**	0.001*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)
MRS404	0.002***	0.001*	0.002***	0.003***	0.002**	0.002***	0.002***	0.001	0.002***	0.003***	0.001*	0.002***
	(0.000)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
MRS405	-0.000	-0.000	-0.000	-0.000	0.000	-0.000	-0.000	0.000	-0.000	-0.000	0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
MRS406	0.003***	0.001	0.001	0.003***	0.001	0.001	0.002**	0.001	0.001	0.002*	0.002	0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)
MRS407	0.004***	0.000	0.005***	0.005***	0.001	0.006***	0.003***	-0.000	0.004***	0.005***	0.001	0.006***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
MRS410	0.006***	0.004***	0.004***	0.008***	0.006***	0.005***	0.005***	0.003***	0.004***	0.008***	0.004***	0.005***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
MRS419	0.001**	0.000	0.000	0.001**	0.000	0.000	0.001**	0.000	0.000	0.001***	0.001	0.001
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.000)	(0.000)	(0.001)	(0.000)	(0.001)	(0.001)
MRS451	0.001***	-0.000	0.000	0.001**	-0.001	0.000	0.001**	-0.000	0.000	0.000	-0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)
MRS452	0.001**	0.000	0.001**	0.001***	0.000	0.001	0.001**	-0.000	0.001	0.001**	0.000	0.001
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)
MRS453				0.002***	0.001**	0.001				0.002***	0.001	0.001
				(0.000)	(0.001)	(0.001)				(0.001)	(0.001)	(0.001)
MRS415	0.001***	0.000	0.000	0.001***	0.000	0.000	0.000**	0.000	0.000	0.001***	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Including MRS 453 and 454:	No	No	No	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes
Including 2020Q1+:	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No
N	80829	80828	80828	69181	69180	69180	69530	69530	69530	57883	57883	57883

Notes: Each column reports the coefficient estimates and statistical significance for separate regressions which contain each MDS measure, nursing home fixed effects, quarter fixed effects, and with nursing home clustered robust standard errors. * P-value < 0.10, ** P-value < 0.05,*** P-value < 0.01.

Appendix Table A7: Summary of Coefficients Estimates from Multivariate Regressions for Total Weighted All Cycle Health Survey Score Using National Data

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Measure	ln(rating)	Decile		ln(rating)	Decile		ln(rating)	Decile		ln(rating)	Decile	
Code		Not 1st	10th		Not 1st	10th		Not 1st	10th		Not 1st	10th
MRS401	0.003***	0.000	0.001*	0.004	-0.000	0.002	0.003***	0.000	0.001**	0.006	-0.000	0.002
	(0.001)	(0.000)	(0.001)	(0.004)	(0.002)	(0.002)	(0.001)	(0.000)	(0.001)	(0.006)	(0.003)	(0.003)
MRS404	0.005***	0.001**	0.002**	0.003	0.000	0.000	0.005***	0.001**	0.002***	0.006	0.001	0.003
	(0.002)	(0.001)	(0.001)	(0.006)	(0.002)	(0.004)	(0.002)	(0.001)	(0.001)	(0.010)	(0.004)	(0.006)
MRS405	-0.000	0.000	-0.000	-0.001	-0.000	-0.000	-0.000	0.000	0.000	-0.000	-0.000	-0.000
	(0.001)	(0.000)	(0.000)	(0.002)	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)	(0.003)	(0.001)	(0.002)
MRS406	0.010***	0.001	0.002*	0.002	-0.001	-0.002	0.010***	0.001	0.002*	0.002	0.000	-0.003
	(0.003)	(0.001)	(0.001)	(0.011)	(0.004)	(0.005)	(0.003)	(0.001)	(0.001)	(0.018)	(0.008)	(0.008)
MRS407	0.001	-0.001	0.000	-0.007	-0.002	-0.001	0.001	-0.001	0.000	-0.005	-0.000	-0.001
	(0.002)	(0.001)	(0.001)	(0.009)	(0.005)	(0.004)	(0.002)	(0.001)	(0.001)	(0.015)	(0.008)	(0.008)
MRS410	0.004*	0.001	0.000	0.003	0.001	0.001	0.004	0.001	-0.000	0.004	-0.004	0.002
	(0.002)	(0.001)	(0.001)	(0.009)	(0.004)	(0.004)	(0.002)	(0.001)	(0.001)	(0.014)	(0.007)	(0.008)
MRS419	0.005***	0.001	0.001**	0.003	0.000	0.001	0.005***	0.001	0.001	0.004	-0.000	-0.000
	(0.001)	(0.000)	(0.000)	(0.004)	(0.002)	(0.002)	(0.001)	(0.000)	(0.000)	(0.008)	(0.003)	(0.005)
MRS451	0.001	0.000	0.001	-0.001	0.001	-0.001	0.001	-0.000	0.000	-0.003	-0.000	-0.000
	(0.001)	(0.000)	(0.000)	(0.003)	(0.001)	(0.002)	(0.001)	(0.000)	(0.000)	(0.006)	(0.002)	(0.004)
MRS452	0.001	0.000	0.000	0.000	-0.000	0.000	0.001	0.000	0.000	0.000	-0.000	-0.001
	(0.001)	(0.000)	(0.000)	(0.004)	(0.002)	(0.002)	(0.001)	(0.000)	(0.000)	(0.007)	(0.003)	(0.004)
MRS453				0.001	-0.000	0.001				0.000	0.001	-0.003
				(0.005)	(0.002)	(0.003)				(0.009)	(0.003)	(0.005)
MRS415	0.004***	0.000	0.001***	0.005**	0.000	0.001	0.004***	0.000	0.001***	0.006	0.001	0.002
	(0.001)	(0.000)	(0.000)	(0.002)	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)	(0.004)	(0.001)	(0.002)
Including MRS 453 and 454:	No	No	No	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes
Including 2020Q1+:	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No
N	43063	42793	42793	15804	15679	15679	41629	41370	41370	14370	14256	14256

Notes: Each column reports the coefficient estimates and statistical significance for separate regressions which contain each MDS measure, nursing home fixed effects, quarter fixed effects, and with nursing home clustered robust standard errors. * P-value < 0.10, ** P-value < 0.05,*** P-value < 0.01.

Appendix Table A8: Summary of Coefficients Estimates from Multivariate Regressions for Quality Measure 551: Risk-Adjusted Number of hospitalizations per 1000 long-stay resident days Using Georgia Nursing Homes

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Measure	ln(rating)	Decile		ln(rating)	Decile		ln(rating)	Decile		ln(rating)	Decile	
Code		Not 1st	10th		Not 1st	10th		Not 1st	10th		Not 1st	10th
MRS401	0.002	0.001	0.001	0.005**	0.004*	0.002	0.001	0.000	0.000	0.004	0.003	0.001
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
MRS404	0.003	-0.001	0.006**	0.002	-0.000	0.003	0.003	-0.001	0.006**	0.002	0.000	0.004
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)	(0.003)	(0.003)
MRS405	-0.000	-0.000	-0.001*	0.000	0.000	-0.001	-0.000	-0.000	-0.001*	0.000	0.000	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
MRS406	0.008	0.004	-0.008	0.000	-0.004	-0.010*	0.009	0.006	-0.008	0.001	-0.002	-0.009
	(0.008)	(0.006)	(0.006)	(0.008)	(0.007)	(0.006)	(0.008)	(0.007)	(0.006)	(0.009)	(0.008)	(0.006)
MRS407	0.005	0.002	0.010**	0.005	0.002	0.009**	0.006	0.002	0.010**	0.006	0.003	0.009**
	(0.005)	(0.004)	(0.004)	(0.006)	(0.005)	(0.004)	(0.005)	(0.003)	(0.004)	(0.006)	(0.004)	(0.004)
MRS410	0.003	0.004	-0.002	0.007	0.007**	0.002	0.002	0.004	-0.004	0.007	0.008**	-0.001
	(0.004)	(0.003)	(0.005)	(0.005)	(0.004)	(0.005)	(0.005)	(0.003)	(0.005)	(0.005)	(0.004)	(0.005)
MRS415	0.000	0.001	-0.000	-0.001	0.000	-0.001	0.000	0.001*	-0.001	-0.001	0.001	-0.001**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)
MRS419	0.002	0.001	0.001	0.002	0.001	0.001	0.002	0.001	0.001	0.002	0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)
MRS451	-0.000	-0.001	0.002	-0.002	-0.003**	0.000	0.000	-0.001	0.002*	-0.002	-0.003***	0.001
	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)
MRS452	-0.000	-0.001	0.000	0.000	-0.001	0.000	0.000	-0.001	0.000	0.001	-0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
MRS453				0.008***	0.005***	0.005*				0.008***	0.005***	0.005
				(0.003)	(0.002)	(0.003)				(0.003)	(0.002)	(0.003)
Including MRS 453:	No	No	No	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes
Including 2020Q1+:	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No
N	2502	2502	2502	1646	1646	1646	2238	2238	2238	1382	1382	1382

Notes: Each column reports the coefficient estimates and statistical significance for separate regressions which contain each MDS measure, quarter fixed effects, and with nursing home clustered robust standard errors. * P-value < 0.10, ** P-value < 0.05,*** P-value < 0.01.

Appendix Table A9: Summary of Coefficients Estimates from Multivariate Regressions for Quality Measure 552 I53Risk-Adjusted Number of outpatient emergency department visits per 1000 long-stay resident days Using Georgia Nursing Homes

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Measure	ln(rating)	Decile		ln(rating)	Decile		ln(rating)	Decile		ln(rating)	Decile	
Code		Not 1st	10th		Not 1st	10th		Not 1st	10th		Not 1st	10th
MRS401	0.004*	-0.000	0.002	0.005**	0.001	0.002	0.004	-0.001	0.003	0.005*	-0.000	0.002
	(0.003)	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)	(0.003)	(0.003)	(0.002)
MRS404	0.001	-0.005*	0.001	0.001	-0.005*	0.001	0.000	-0.005*	0.001	0.000	-0.006*	0.002
	(0.003)	(0.003)	(0.003)	(0.004)	(0.003)	(0.003)	(0.004)	(0.003)	(0.003)	(0.004)	(0.003)	(0.004)
MRS405	-0.002**	-0.002***	-0.001	-0.002**	-0.002***	-0.001	-0.002*	-0.002***	-0.001	-0.002*	-0.002***	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
MRS406	0.007	-0.004	0.005	0.004	-0.005	0.005	0.007	-0.004	0.005	0.004	-0.006	0.005
	(0.010)	(0.008)	(0.009)	(0.010)	(0.008)	(0.009)	(0.011)	(0.009)	(0.010)	(0.011)	(0.009)	(0.010)
MRS407	0.006	-0.001	0.003	0.005	-0.002	0.003	0.007	0.000	0.005	0.007	0.000	0.004
	(0.006)	(0.007)	(0.004)	(0.006)	(0.007)	(0.004)	(0.006)	(0.007)	(0.005)	(0.007)	(0.007)	(0.005)
MRS410	0.004	-0.001	0.011*	0.006	-0.000	0.013*	0.004	-0.001	0.011	0.007	-0.000	0.012
	(0.006)	(0.004)	(0.007)	(0.007)	(0.005)	(0.007)	(0.007)	(0.005)	(0.008)	(0.007)	(0.005)	(0.008)
MRS415	-0.001	0.002***	-0.002***	-0.002*	0.001***	-0.002***	-0.001	0.002***	-0.002**	-0.002*	0.002***	-0.003***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
MRS419	0.003	0.000	0.003	0.003	-0.000	0.003*	0.003	0.001	0.003	0.003	0.000	0.004*
	(0.002)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
MRS451	-0.002	0.000	0.001	-0.002	-0.000	0.001	-0.002	0.001	0.001	-0.002	0.001	0.002
	(0.002)	(0.001)	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)	(0.001)	(0.002)
MRS452	0.001	-0.001	0.002	0.001	-0.000	0.002	0.001	-0.001	0.002	0.001	-0.001	0.002
	(0.002)	(0.001)	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)	(0.001)	(0.002)
MRS453				0.005*	0.004*	0.001				0.005*	0.004*	0.002
				(0.003)	(0.002)	(0.003)				(0.003)	(0.002)	(0.003)
Including MRS 453:	No	No	No	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes
Including 2020Q1+:	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No
N	1924	1924	1924	1646	1646	1646	1660	1660	1660	1382	1382	1382

Notes: Each column reports the coefficient estimates and statistical significance for separate regressions which contain each MDS measure, quarter fixed effects, and with nursing home clustered robust standard errors. * P-value < 0.10, ** P-value < 0.05,*** P-value < 0.01.

Appendix Table A10: Summary of Coefficients Estimates from Multivariate Regressions for Total Weighted All Cycle Health Survey Score Using Georgia Nursing Homes

	(1)	(2)	(3)	(4)	(5)	(6)
Measure	ln(rating)	Decile		ln(rating)	Decile	
Code		Not 1st	10th		Not 1st	10th
MRS401	0.004	-0.002	-0.000	0.004	-0.002	-0.000
	(0.010)	(0.004)	(0.002)	(0.010)	(0.004)	(0.002)
MRS404	0.024*	0.005	0.005	0.024*	0.005	0.005
	(0.013)	(0.005)	(0.003)	(0.013)	(0.005)	(0.003)
MRS405	0.004	0.001	0.001*	0.004	0.001	0.001*
	(0.003)	(0.001)	(0.001)	(0.003)	(0.001)	(0.001)
MRS406	0.000	0.006	-0.012*	0.000	0.006	-0.012*
	(0.035)	(0.013)	(0.007)	(0.035)	(0.013)	(0.007)
MRS407	-0.004	-0.002	0.002	-0.004	-0.002	0.002
	(0.016)	(0.007)	(0.003)	(0.016)	(0.007)	(0.003)
MRS410	-0.028	-0.009	-0.002	-0.028	-0.009	-0.002
	(0.023)	(0.009)	(0.004)	(0.023)	(0.009)	(0.004)
MRS415	0.019***	0.004***	0.002	0.019***	0.004***	0.002
	(0.005)	(0.001)	(0.001)	(0.005)	(0.001)	(0.001)
MRS419	0.016**	0.006**	0.001	0.016**	0.006**	0.001
	(0.007)	(0.003)	(0.001)	(0.007)	(0.003)	(0.001)
MRS451	0.009	0.001	0.000	0.009	0.001	0.000
	(0.008)	(0.003)	(0.002)	(0.008)	(0.003)	(0.002)
MRS452	-0.012*	-0.005**	0.001	-0.012*	-0.005**	0.001
	(0.007)	(0.003)	(0.001)	(0.007)	(0.003)	(0.001)
Including MRS 453:	No	No	No	No	No	No
Including 2020Q1+:	Yes	Yes	Yes	No	No	No
N	797	778	778	797	778	778

Notes: Each column reports the coefficient estimates and statistical significance for separate regressions which contain each MDS measure, quarter fixed effects, and with nursing home clustered robust standard errors. Regressions that included MRS 453 had too few observations (N=223) and were excluded. * P-value < 0.10, ** P-value < 0.05,*** P-value < 0.01.

Appendix Table A11: Summary of Coefficients Estimates from Multivariate Regressions for Quality Measure 551: Risk-Adjusted Number of hospitalizations per 1000 long-stay resident days Using Georgia Nursing Homes (Excluding Quarter Fixed Effects)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Measure	ln(rating)	Decile		ln(rating)	Decile		ln(rating)	Decile		ln(rating)	Decile	
Code		Not 1st	10th		Not 1st	10th		Not 1st	10th		Not 1st	10th
MRS401	0.002	0.001	0.001	0.005**	0.004*	0.002	0.001	0.000	0.000	0.004	0.003	0.001
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
MRS404	0.004	-0.000	0.006**	0.002	-0.000	0.003	0.004	-0.000	0.007**	0.002	0.000	0.004
	(0.003)	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)	(0.003)	(0.003)
MRS405	-0.000	-0.000	-0.001*	0.000	0.000	-0.001	-0.000	-0.000	-0.001*	0.000	0.000	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
MRS406	0.008	0.004	-0.009	-0.000	-0.003	-0.011*	0.009	0.005	-0.008	0.001	-0.002	-0.009
	(0.008)	(0.006)	(0.006)	(0.008)	(0.007)	(0.006)	(0.008)	(0.007)	(0.006)	(0.009)	(0.008)	(0.006)
MRS407	0.005	0.002	0.010**	0.005	0.002	0.009**	0.006	0.002	0.010**	0.006	0.003	0.009**
	(0.005)	(0.004)	(0.004)	(0.006)	(0.005)	(0.004)	(0.005)	(0.003)	(0.004)	(0.006)	(0.004)	(0.004)
MRS410	0.003	0.004	-0.002	0.007	0.007**	0.002	0.002	0.004	-0.004	0.007	0.008**	-0.001
	(0.004)	(0.003)	(0.005)	(0.005)	(0.004)	(0.005)	(0.005)	(0.003)	(0.005)	(0.005)	(0.004)	(0.005)
MRS415	0.000	0.001	-0.000	-0.001	0.000	-0.001	0.000	0.001*	-0.001	-0.001	0.001	-0.001**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)
MRS419	0.002	0.001	0.001	0.002	0.001	0.001	0.002	0.001	0.001	0.002	0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)
MRS451	-0.000	-0.001	0.002	-0.002	-0.003***	0.000	0.000	-0.001	0.002*	-0.002	-0.003***	0.001
	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)
MRS452	0.000	-0.001	0.000	0.000	-0.001	0.000	0.000	-0.001	0.000	0.001	-0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
MRS453				0.008***	0.005***	0.005*				0.008***	0.005***	0.005
				(0.003)	(0.002)	(0.003)				(0.003)	(0.002)	(0.003)
Including MRS 453:	No	No	No	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes
Including 2020Q1+:	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No
N	2502	2502	2502	1646	1646	1646	2238	2238	2238	1382	1382	1382

Notes: Each column reports the coefficient estimates and statistical significance for separate regressions which contain each MDS measure with nursing home clustered robust standard errors. * P-value < 0.10, ** P-value < 0.05,*** P-value < 0.01.

Appendix Table A12: Summary of Coefficients Estimates from Multivariate Regressions for Quality Measure 552: Risk-Adjusted Number of outpatient emergency department visits per 1000 long-stay resident days Using Georgia Nursing Homes (Excluding Quarter Fixed Effects)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Measure	ln(rating)	Decile		ln(rating)	Decile		ln(rating)	Decile		ln(rating)	Decile	
Code		Not 1st	10th		Not 1st	10th		Not 1st	10th		Not 1st	10th
MRS401	0.004*	-0.000	0.002	0.005**	0.001	0.002	0.004	-0.001	0.003	0.005*	-0.000	0.002
	(0.003)	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)	(0.003)	(0.003)	(0.002)
MRS404	0.001	-0.004*	0.001	0.000	-0.005*	0.001	0.001	-0.005*	0.002	0.000	-0.006*	0.002
	(0.003)	(0.003)	(0.003)	(0.004)	(0.003)	(0.003)	(0.004)	(0.003)	(0.003)	(0.004)	(0.003)	(0.004)
MRS405	-0.002*	-0.002***	-0.001	-0.002**	-0.002***	-0.001	-0.002*	-0.002***	-0.001	-0.002*	-0.002***	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
MRS406	0.008	-0.004	0.006	0.005	-0.005	0.007	0.007	-0.004	0.005	0.004	-0.006	0.005
	(0.010)	(0.008)	(0.009)	(0.010)	(0.008)	(0.009)	(0.011)	(0.009)	(0.010)	(0.011)	(0.009)	(0.010)
MRS407	0.006	-0.001	0.004	0.005	-0.001	0.003	0.007	0.001	0.005	0.007	0.000	0.005
	(0.006)	(0.007)	(0.004)	(0.006)	(0.007)	(0.004)	(0.006)	(0.007)	(0.005)	(0.007)	(0.007)	(0.005)
MRS410	0.004	-0.001	0.011*	0.006	-0.000	0.013*	0.004	-0.001	0.011	0.007	0.000	0.012
	(0.006)	(0.004)	(0.007)	(0.007)	(0.005)	(0.007)	(0.007)	(0.005)	(0.008)	(0.007)	(0.005)	(0.008)
MRS415	-0.001	0.002***	-0.002***	-0.002*	0.001***	-0.002***	-0.001	0.002***	-0.002***	-0.002*	0.002***	-0.003***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
MRS419	0.003	0.000	0.003	0.003	-0.000	0.003*	0.003	0.001	0.003	0.003	0.000	0.004*
	(0.002)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
MRS451	-0.002	0.000	0.000	-0.003	-0.000	0.001	-0.002	0.001	0.001	-0.002	0.001	0.002
	(0.002)	(0.001)	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)	(0.001)	(0.002)
MRS452	0.001	-0.000	0.002	0.001	-0.000	0.002	0.001	-0.001	0.002	0.001	-0.001	0.002
	(0.002)	(0.001)	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)	(0.001)	(0.002)
MRS453				0.005*	0.004*	0.001				0.005*	0.004*	0.002
				(0.003)	(0.002)	(0.003)				(0.003)	(0.002)	(0.003)
Including MRS 453:	No	No	No	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes
Including 2020Q1+:	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No
N	1924	1924	1924	1646	1646	1646	1660	1660	1660	1382	1382	1382

Notes: Each column reports the coefficient estimates and statistical significance for separate regressions which contain each MDS measure with nursing home clustered robust standard errors. * P-value < 0.10, ** P-value < 0.05,*** P-value < 0.01.

Appendix Table A13: Summary of Coefficients Estimates from Multivariate Regressions for Total Weighted All Cycle Health Survey Score Using Georgia Nursing Homes (Excluding Quarter Fixed Effects)

	(1)	(2)	(3)	(4)	(5)	(6)
Measure	ln(rating)	Decile		ln(rating)	Decile	
Code		Not 1st	10th		Not 1st	10th
MRS401	0.007	-0.001	0.000	0.007	-0.001	0.000
	(0.010)	(0.004)	(0.002)	(0.010)	(0.004)	(0.002)
MRS404	0.021*	0.003	0.005*	0.021*	0.003	0.005*
	(0.013)	(0.005)	(0.003)	(0.013)	(0.005)	(0.003)
MRS405	0.004	0.000	0.001	0.004	0.000	0.001
	(0.003)	(0.001)	(0.001)	(0.003)	(0.001)	(0.001)
MRS406	0.008	0.010	-0.012*	0.008	0.010	-0.012*
	(0.034)	(0.013)	(0.006)	(0.034)	(0.013)	(0.006)
MRS407	-0.004	-0.004	0.003	-0.004	-0.004	0.003
	(0.016)	(0.007)	(0.003)	(0.016)	(0.007)	(0.003)
MRS410	-0.029	-0.007	-0.001	-0.029	-0.007	-0.001
	(0.023)	(0.009)	(0.005)	(0.023)	(0.009)	(0.005)
MRS419	0.015**	0.005**	0.001	0.015**	0.005**	0.001
	(0.007)	(0.003)	(0.001)	(0.007)	(0.003)	(0.001)
MRS451	0.009	0.001	0.000	0.009	0.001	0.000
	(0.008)	(0.003)	(0.002)	(0.008)	(0.003)	(0.002)
MRS415	0.020***	0.004***	0.002	0.020***	0.004***	0.002
	(0.005)	(0.001)	(0.001)	(0.005)	(0.001)	(0.001)
MRS452	-0.012*	-0.006**	0.001	-0.012*	-0.006**	0.001
	(0.007)	(0.003)	(0.001)	(0.007)	(0.003)	(0.001)
Including MRS 453:	No	No	No	No	No	No
Including 2020Q1+:	Yes	Yes	Yes	No	No	No
N	797	778	778	797	778	778

Notes: Each column reports the coefficient estimates and statistical significance for separate regressions which contain each MDS measure with nursing home clustered robust standard errors. Regressions that included MRS 453 had too few observations (N=223) and were excluded. * P-value < 0.10, ** P-value < 0.05,*** P-value < 0.01.

Appendix Table A14: Summary of Coefficients Estimates from Multivariate Regressions for Quality Measure 551: Risk-Adjusted Number of hospitalizations per 1000 long-stay resident days Using Georgia Nursing Homes (Independent Evaluation of MDS Measures)

	(1)	(2)	(3)	(4)	(5)	(6)
Measure	ln(rating)	Decile		ln(rating)	Decile	
Code		Not 1st	10th		Not 1st	10th
MRS401	0.002	0.001	0.002	0.002	0.000	0.002
N	2502	2502	2502	2238	2238	2238
MRS404	0.004	-0.001	0.007**	0.004	-0.001	0.007**
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
N	2502	2502	2502	2238	2238	2238
MRS407	0.006	0.001	0.010**	0.006	0.002	0.010**
	(0.005)	(0.004)	(0.004)	(0.004)	(0.003)	(0.004)
N	2502	2502	2502	2238	2238	2238
MRS410	0.005	0.003	0.002	0.004	0.003	0.001
	(0.004)	(0.003)	(0.005)	(0.005)	(0.003)	(0.005)
N	2502	2502	2502	2238	2238	2238
MRS419	0.002*	0.001	0.001	0.002*	0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
N	2502	2502	2502	2238	2238	2238
MRS453	0.008***	0.005***	0.005*	0.008***	0.005***	0.005
	(0.003)	(0.002)	(0.003)	(0.003)	(0.002)	(0.003)
N	1646	1646	1646	1382	1382	1382
Including 2020Q1+:	Yes	Yes	Yes	No	No	No

Notes: Each row and column reports the coefficient estimates and statistical significance for separate regressions which contain each MDS measure, quarter fixed effects, and with nursing home clustered robust standard errors. * P-value < 0.10, ** P-value < 0.05,*** P-value < 0.01.

Appendix Table A15: Summary of Coefficients Estimates from Multivariate Regressions for Quality Measure 552 Risk-Adjusted Number of outpatient emergency department visits per 1000 long-stay resident days Using Georgia Nursing Homes: (Independent Evaluation of MDS Measures)

	(1)	(2)	(3)	(4)	(5)	(6)
Measure	ln(rating)	Decile		ln(rating)	Decile	
Code		Not 1st	10th		Not 1st	10th
MRS401	0.003	0.000	0.003*	0.003	0.000	0.003*
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
N	1924	1924	1924	1660	1660	1660
MRS404	0.002	-0.005*	0.004	0.002	-0.006*	0.004
	(0.003)	(0.003)	(0.003)	(0.004)	(0.003)	(0.004)
N	1924	1924	1924	1660	1660	1660
MRS407	0.006	-0.003	0.005	0.008	-0.002	0.007
	(0.006)	(0.008)	(0.004)	(0.006)	(0.007)	(0.005)
N	1924	1924	1924	1660	1660	1660
MRS410	0.011*	0.000	0.019***	0.011	0.000	0.019**
N	1924	1924	1924	1660	1660	1660
MRS419	0.005**	0.001	0.005**	0.004**	0.001	0.005**
N	1924	1924	1924	1660	1660	1660
MRS453	0.005*	0.004	0.001	0.005	0.004	0.001
	(0.003)	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)
N	1646	1646	1646	1382	1382	1382
Including 2020Q1+:	Yes	Yes	Yes	No	No	No

Notes: Each row and column reports the coefficient estimates and statistical significance for separate regressions which contain each MDS measure, quarter fixed effects, and with nursing home clustered robust standard errors. * P-value < 0.10, ** P-value < 0.05,*** P-value < 0.01.

Appendix Table A16: Summary of Coefficients Estimates from Multivariate Regressions for Total Weighted All Cycle Health Survey Score Using Georgia Nursing Homes (Independent Evaluation of MDS Measures)

	(1)	(2)	(3)	(4)	(5)	(6)
Measure	ln(rating)	Decile		ln(rating)	Decile	
Code		Not 1st	10th		Not 1st	10th
MRS401	0.026***	0.003	0.001	0.026***	0.003	0.001
	(0.008)	(0.003)	(0.002)	(0.008)	(0.003)	(0.002)
N	797	775	775	797	775	775
MRS404	0.031**	0.010**	0.005*	0.031**	0.010**	0.005*
	(0.013)	(0.005)	(0.003)	(0.013)	(0.005)	(0.003)
N	797	775	775	797	775	775
MRS407	-0.014	-0.002	-0.000	-0.014	-0.002	-0.000
	(0.016)	(0.006)	(0.003)	(0.016)	(0.006)	(0.003)
N	797	775	775	797	775	775
MRS410	-0.049**	-0.013	-0.000	-0.049**	-0.013	-0.000
	(0.022)	(0.009)	(0.004)	(0.022)	(0.009)	(0.004)
N	797	775	775	797	775	775
MRS419	0.010	0.003	0.001	0.010	0.003	0.001
	(0.007)	(0.003)	(0.001)	(0.007)	(0.003)	(0.001)
N	797	775	775	797	775	775
MRS453	0.030*	0.009	0.004	0.030*	0.009	0.004
	(0.018)	(0.007)	(0.005)	(0.018)	(0.007)	(0.005)
N	233	224	224	233	224	224
Including 2020Q1+:	Yes	Yes	Yes	No	No	No

Notes: Each row and column reports the coefficient estimates and statistical significance for separate regressions which contain each MDS measure, quarter fixed effects, and with nursing home clustered robust standard errors. * P-value < 0.10, ** P-value < 0.05,*** P-value < 0.01.

Appendix Table A17: Summary of Coefficients Estimates from Multivariate Regressions for Quality Measure 551: Risk-Adjusted Number of hospitalizations per 1000 long-stay resident days Using Georgia Nursing Homes (Independent Evaluation of MDS Measures Without Quarter Fixed Effects)

	(1)	(2)	(3)	(4)	(5)	(6)
Measure	ln(rating)	Decile		ln(rating)	Decile	
Code		Not 1st	10th		Not 1st	10th
MRS401	0.003	0.001	0.002	0.002	0.000	0.002
	(0.002)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)
N	2502	2502	2502	2238	2238	2238
MRS404	0.005*	-0.000	0.007**	0.005*	0.000	0.008**
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
N	2502	2502	2502	2238	2238	2238
MRS407	0.006	0.002	0.010**	0.007	0.002	0.010**
	(0.004)	(0.004)	(0.004)	(0.004)	(0.003)	(0.004)
N	2502	2502	2502	2238	2238	2238
MRS410	0.005	0.003	0.002	0.005	0.003	0.001
	(0.004)	(0.003)	(0.005)	(0.005)	(0.003)	(0.005)
N	2502	2502	2502	2238	2238	2238
MRS419	0.002*	0.001	0.002	0.002*	0.001	0.002
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
N	2502	2502	2502	2238	2238	2238
MRS453	0.008***	0.004***	0.005*	0.008***	0.005***	0.005
	(0.003)	(0.002)	(0.003)	(0.003)	(0.002)	(0.003)
N	1646	1646	1646	1382	1382	1382
Including 2020Q1+:	Yes	Yes	Yes	No	No	No

Notes: Each row and column reports the coefficient estimates and statistical significance for separate regressions which contain each MDS measure and with nursing home clustered robust standard errors. * P-value < 0.10, ** P-value < 0.05,*** P-value < 0.01.

Appendix Table A18: Summary of Coefficients Estimates from Multivariate Regressions for Quality Measure 552 Risk-Adjusted Number of outpatient emergency department visits per 1000 long-stay resident days Using Georgia Nursing Homes: (Independent Evaluation of MDS Measures Without Quarter Fixed Effects)

	(1)	(2)	(3)	(4)	(5)	(6)
Measure	ln(rating)	Decile		ln(rating)	Decile	
Code		Not 1st	10th		Not 1st	10th
MRS401	0.003	0.000	0.003	0.003	0.000	0.003*
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
N	1924	1924	1924	1660	1660	1660
MRS404	0.003	-0.005*	0.004	0.003	-0.006*	0.004
	(0.003)	(0.003)	(0.003)	(0.004)	(0.003)	(0.004)
N	1924	1924	1924	1660	1660	1660
MRS407	0.007	-0.003	0.006	0.008	-0.001	0.007
	(0.006)	(0.007)	(0.004)	(0.006)	(0.007)	(0.005)
N	1924	1924	1924	1660	1660	1660
MRS410	0.012*	0.001	0.019***	0.012*	0.001	0.019**
N	1924	1924	1924	1660	1660	1660
MRS419	0.005**	0.001	0.005**	0.004**	0.001	0.005**
N	1924	1924	1924	1660	1660	1660
MRS453	0.005	0.003	0.001	0.005	0.004	0.001
	(0.003)	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)
N	1646	1646	1646	1382	1382	1382
Including 2020Q1+:	Yes	Yes	Yes	No	No	No

Notes: Each row and column reports the coefficient estimates and statistical significance for separate regressions which contain each MDS measure and with nursing home clustered robust standard errors. * P-value < 0.10, ** P-value < 0.05,*** P-value < 0.01.

Appendix Table A19: Summary of Coefficients Estimates from Multivariate Regressions for Total Weighted All Cycle Health Survey Score Using Georgia Nursing Homes (Independent Evaluation of MDS Measures Without Quarter Fixed Effects)

	(1)	(2)	(3)	(4)	(5)	(6)
Measure	ln(rating)	Decile		ln(rating)	Decile	
Code		Not 1st	10th		Not 1st	10th
MRS401	0.028***	0.003	0.002	0.028***	0.003	0.002
	(0.008)	(0.003)	(0.002)	(0.008)	(0.003)	(0.002)
N	797	775	775	797	775	775
MRS404	0.025**	0.007	0.005*	0.025**	0.007	0.005*
	(0.013)	(0.004)	(0.003)	(0.013)	(0.004)	(0.003)
N	797	775	775	797	775	775
MRS407	-0.015	-0.004	0.000	-0.015	-0.004	0.000
	(0.016)	(0.006)	(0.003)	(0.016)	(0.006)	(0.003)
N	797	775	775	797	775	775
MRS410	-0.052**	-0.014*	-0.000	-0.052**	-0.014*	-0.000
	(0.022)	(0.008)	(0.004)	(0.022)	(0.008)	(0.004)
N	797	775	775	797	775	775
MRS419	0.009	0.002	0.001	0.009	0.002	0.001
	(0.007)	(0.003)	(0.001)	(0.007)	(0.003)	(0.001)
N	797	775	775	797	775	775
MRS453	0.033*	0.009	0.005	0.033*	0.009	0.005
	(0.017)	(0.007)	(0.005)	(0.017)	(0.007)	(0.005)
N	233	224	224	233	224	224
Including 2020Q1+:	Yes	Yes	Yes	No	No	No

Notes: Each row and column reports the coefficient estimates and statistical significance for separate regressions which contain each MDS measure and with nursing home clustered robust standard errors. * P-value < 0.10, ** P-value < 0.05,*** P-value < 0.01.