Home Health Study and Report

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EXECUTIVE SUMMARY

The average case-mix weight of Medicare home health patients has increased steadily since the adoption of the home health prospective payment system (PPS) in 2000. Under the PPS, case-mix assignment is based on patient assessments completed by home health agencies. Thus, the extent to which case-mix increases reflect real changes in patient characteristics versus nominal case-mix changes attributable to changes in coding practices has been questioned. Measuring the proportion of total case-mix change that is due to nominal versus real factors has important implications for determining home health payment rates that are accurate and reasonable.

Abt Associates has produced a series of reports for CMS on home health case-mix change to assist CMS in adjusting home health payments over time (e.g., Abt Associates, 2009; 2010). However, a number of criticisms have been raised with the Abt methodology (Lewin Report, 2010; Dobson Report, 2010; DHHS, 2010). The purpose of this report is threefold: 1) to review the Abt methodology for analyzing case-mix change; 2) to assist CMS in responding to some of the major criticisms levied against this approach; and 3) discuss potential refinements to the Abt approach.

As a brief overview, the Abt (2010) approach relies on data from 2000 and 2008 to estimate a regression-based, predictive model of individual case-mix weights based on measures of patients' demographic characteristics, clinical status, inpatient history, and Medicare Part A expenditures in the time period leading up to their home health episodes. The regression coefficient estimates for these models are applied to episodes from 2007, allowing estimation of how much of the change in observed case-mix was predicted by changes in patient characteristics. Unpredicted (or nominal) change—the portion of case-mix change that cannot be explained by changes in patient characteristics—is assumed to reflect differences over time in agency coding practices. Abt estimated that nearly 90% of the case-mix change between 2000 and 2008 was attributable to nominal growth.

Using both the Abt data and methodology and additional data, we examined four important criticisms (*in italics*) of the Abt model.

- *Comment: A large number of home health patients do not have prior post-acute use, suggesting that the Abt model, which relies on case-mix from prior hospitalizations, will not work well to this population.* In order to address this criticism, we re-ran the Abt model for patients with varying prior inpatient and post-acute care use. Our results suggest that case-mix change is similar in the Abt model regardless of whether the patient had a prior inpatient stay or post-acute care use over the prior 14 or 120 days.

- *Comment: CMS should use the Abt methodology to adjust payments on an agency-by-agency basis.* We are wary of adjusting payments at the agency level due to the concern of small sample size at many agencies. Moreover, when we re-ran the Abt model by ownership type (non-profit, government, for-profit), agency type (facility-based, freestanding), region of the country (north, south, Midwest, west), agency size (large vs. small; based on number of initial episodes) and agency focus (post-acute versus community-dwelling), the results suggest that—although there is some variation—a

consistent percentage of the growth in case-mix is nominal growth. As such, these results do not provide much support for adjusting payments by classes of agencies.

- *Comment: The prior health care use variables included in the Abt model are less relevant for patients with more than one home health episode.* In order to examine this issue, we compared the results of the Abt model within the initial episode versus the full model results. The results indicated very similar findings, suggesting that the model is relatively stable across home health episodes.

- *Comment: An analysis using the Medical Expenditures Panel Survey (MEPS) data found that the entire Medicare population has become less healthy over the period 2000-2007, which is inconsistent with the Abt finding of relatively little real case-mix change for the home health population.* This comment implies unmeasured patient characteristics related to care needs may be underlying the Abt results. In order to address this concern, we examined case-mix change in the MEPS data, but we focused our analyses on self-reported health measures (to avoid any bias related to payment) and examined the Medicare home health population specifically. Our results do not support the conclusion that the health status of Medicare beneficiaries receiving home health services significantly deteriorated over the 2000 through 2008 period.

Based on these analyses, we conclude that the Abt methodology generally fares well in the context of these major criticisms. Nevertheless, because the Abt approach relies on a cross-sectional regression-based analysis, we believe CMS should continue to consider whether unmeasured real case-mix may bias the analyses generated using this approach.

Towards this end, the Abt model currently relies on the hospital-based All Patient Refined Diagnosis Related Group (APR DRG) measures to capture case-mix. These measures may not apply very well to home health patients. As such, we suggest that CMS evaluate the CMS hierarchical condition categories (CMS-HCC) score as a potential complement to the APR DRG measures. Given their reliance on a more complete claims history (hospital, physician, non-physician), we posit that the addition of the CMS-HCC scores may better account for changes in the case-mix of Medicare home health patients than the APR DRG scores alone.

INTRODUCTION AND OVERVIEW

Prior to the Balanced Budget Act (BBA) of 1997, home health agencies (HHAs) were paid by Medicare on the basis of their costs, up to pre-established per-visit limits. The 1997 BBA changed Medicare home health eligibility and coverage rules and reformed the payment methodology by instituting a prospective payment system (PPS) for home health care reimbursement. Implemented on October 1, 2000, Medicare pays HHAs a set payment rate for each 60-day episode of care.

Medicare HHA payments are adjusted according to the patient's clinical and functional severity, the episode's timing in a sequence of episodes and the use of therapy during the 60-day episode. Patient characteristics are determined using the Outcome and Assessment Information Set (OASIS), a patient assessment instrument. Payments are also adjusted for differences in local prices. For the purposes of case-mix adjustment, Medicare beneficiaries are grouped into home health resource utilization groups (HHRGs) based on their clinical and functional status, and according to the episode timing and therapy visits used. In January 2008, the 80-group HHRG system was replaced by a 153-group system. Each HHRG has an associated case-mix weight, which determines how much the payment for the specific episode is adjusted from the standardized base payment established for the current payment year.

Over the 2000 through 2008 period, the average case-mix weight of Medicare home health patients has increased by 19.40% (Abt Associates, 2010). Given that case-mix assignment is based on patient assessments completed by home health agencies, the extent to which these increases reflect real case-mix change that is associated with true changes in patient characteristics versus nominal case-mix changes attributable to changes in coding practices has been questioned. Measuring the proportion of total case-mix change that is due to nominal versus real factors has important implications for establishing home health payment rates that are accurate and reasonable.

Abt Associates has produced a series of reports for CMS on home health case-mix change (e.g., Abt Associates 2009; Abt Associates 2010). However, a number of issues have been raised with the Abt approach (Lewin Report, 2010; Dobson Report, 2010; DHHS, 2010). The purpose of this report is threefold: 1) to review the Abt methodology for analyzing case-mix change; 2) to assist CMS in responding to some of the major criticisms levied against this approach; and 3) discuss potential refinements to the Abt approach.

DESCRIPTION AND REPLICATION OF THE ABT MODEL

Abt Model

Our analyses used the same approach employed by Abt Associates (2010) in its most recent report for CMS (hereafter referred to as the "Abt model"). The basic goal of the Abt model is to decompose HHA case-mix change into two sources: "real" change that can be accounted for by changes in patient characteristics, and "nominal" change that cannot be explained by these factors. The Abt model is described in detail in the earlier reports, so we present a brief description here.

First, the Abt regression model is run separately on the 2000 data (which represent HHA case-mix in the period prior to the introduction of the HHA PPS) and the 2008 data. The model regresses the HHA PPS case-mix weight for each HHA episode on a series of patient demographics, clinical status, inpatient and Medicare Part A expenditure histories. Second, the coefficient estimates from these two models are employed to separately predict the case-mix level in 2007 (means from the 2007 data are used in these calculations). Third, these results are used to calculate the real case-mix change for both 2000-2007 and 2007-2008. Fourth, the 2008 real case-mix is calculated by multiplying the ratio of actual 2008 case-mix (using the 153-HHRG system) to predicted 2007 153-HHRG case-mix by the predicted case-mix using the earlier 80-HHRG system. (This step is necessary to take into account the shift in the number of HHRGs between 2007 and 2008.)

Fifth, the percentage of total case-mix change between 2000 and 2008 estimated as real is calculated, as the ratio between the predicted change in real-case mix since 2000 to the total case-mix change during that time period ("Ratio 1"). Sixth, the actual case-mix percentage increase for 2000-2008 is calculated as the ratio between the 2008 average case-mix to the 2000 average case-mix ("Ratio 2"). Finally, the key estimate of the model – the nominal case-mix percentage increase from 2000 to 2008 – is calculated. This is done by multiplying the quantity (Ratio 1 minus one) by the quantity (one minus Ratio 2).

Tables 1, 2 and 3 below re-present the key tables (also numbered 1, 2 and 3) in the July 21, 2010 Abt report. To make the calculations concrete, we step through each row of the three tables below.

Table 1 describes the portion of the change in case-mix between 2000 and 2007 that is estimated as nominal. The calculations rely on three quantities: the average case-mix in 2000, C_{00} (1.0959), average case-mix in 2007, C_{07} (1.2606), and the predicted case-mix in 2007 using the year 2000 coefficient estimates from the Abt model, $\hat{C}_{07}^{00}$ (1.1152). The key quantities from this table are the number of percentage points of the total percentage change in case-mix estimated as real, R_{07}^{00} and nominal, N_{07}^{00} ,respectively. These quantities can be expressed using the three estimates above:

$$R_{07}^{00} = \frac{\hat{C}_{07}^{00} - C_{00}}{C_{07} - C_{00}} \cdot \frac{C_{07} - C_{00}}{C_{00}} = \frac{\hat{C}_{07}^{00} - C_{00}}{C_{00}}$$

$$N_{07}^{00} = \left[1 - \left(\frac{\hat{C}_{07}^{00} - C_{00}}{C_{07} - C_{00}}\right)\right] \cdot \frac{C_{07} - C_{00}}{C_{00}} = \frac{C_{07} - \hat{C}_{07}^{00}}{C_{00}}$$

Although the total change in case-mix during this period was 0.1647 (1.2606 minus 1.0959), or 15.03% in relative terms (0.1647 divided by 1.0959), the predicted change was only 0.0193 (1.1152 minus 1.0959). This result implies that a relatively small amount, 11.70%, of the observed case-mix change was real (0.0193 divided by 0.1647), and that 88.30% of the change was nominal. This finding, in turn, implies that of the 15.03 percentage point change in observed

case-mix, 1.76 percentage points were real (0.1179 times 0.1503) and 13.27 percentage points were nominal (the quantity 0.8830 times .1503).

Table 1: Summary of Real and Nominal Case-mix Change Estimates: 2000 - 2007

Measure	Value
Average case-mix: 2000 (IPS period)	1.0959
Actual case-mix: 2007	1.2606
Total change in case-mix	0.1647
Total percentage change	15.03%
Predicted case-mix (2007 using 2000 model coefficients)	1.1152
Estimated real (predicted) change in case-mix	0.0193
Percent of total change estimated as real	11.70%
Percent of total change estimated as nominal	88.30%
Percentage points (of total percentage change) estimated as real	1.76%
Percentage points (of total percentage change) estimated as nominal	13.27%

Table 2 summarizes the changes in case-mix between 2007 and 2008. Once again, the calculations here depend on three quantities: the average case-mix in 2007, C_{07} (1.2552), average case-mix in 2008, C_{08} (1.3085), and the predicted case-mix in 2007 using the year 2008 coefficient estimates from the Abt model, $\hat{C}_{07}^{08}$ (1.3060). (Because of the introduction of the 153-HHRG system in 2008, the 2007 average case-mix estimate in this table differs slightly from the one in Table 1.) The key quantities from this table are the number of percentage points of the total percentage change in case-mix estimated as real, R_{07}^{08}, and nominal, N_{07}^{08}, respectively. Employing the methods employed in the Abt report (specifically, using the average case-mix from 2008 as the denominator when calculating the relative change), these quantities can be expressed using the three estimates above:

$$R_{07}^{08} = \frac{C_{08} - \hat{C}_{07}^{08}}{C_{08} - C_{07}} \cdot \frac{C_{08} - C_{07}}{C_{08}} = \frac{C_{08} - \hat{C}_{07}^{08}}{C_{08}}$$

$$N_{07}^{08} = \left[1 - \left(\frac{C_{08} - \hat{C}_{07}^{08}}{C_{08} - C_{07}}\right)\right] \cdot \frac{C_{08} - C_{07}}{C_{08}} = \frac{\hat{C}_{07}^{08} - C_{07}}{C_{08}}$$

The total case-mix change was 0.0533 (1.3085 minus 1.2552), or 4.07% in relative terms (0.0533 divided by 1.3085). The real change in case-mix was 0.0025 (the 2008 average case-mix, 1.3085, minus the 2007 predicted case-mix, 1.3060). This implies that 4.69% of the overall case-mix change was real, and that 95.31% was nominal. Of the 4.07 percentage point change in total case-mix, the results indicate that 0.19 percentage points were real and 3.88 percentage points were nominal.

(It is important to note that we used the same approach as the Abt report in the decomposition, calculating the percentage change as the difference between 2007 and 2008 average case-mix divided by 2008 case-mix. If we had instead used 2007 case-mix in the denominator, we would have calculated a 4.25% change, of which 0.20 percentage points were real and 4.05 percentage points were nominal. Importantly, this alternate approach did not affect the final payment reduction parameter.)

Table 2: Summary of Real and Nominal Case-mix Change Estimates: 2007 - 2008

Measure	Value
Average case-mix: 2007	1.2552
Average case-mix: 2008	1.3085
Total change in case-mix	0.0533
Total percentage change	4.07%
Predicted case-mix (2007 using 2008 model coefficients)	1.3060
Estimated real (predicted) change in case-mix	0.0025
Percent of total change estimated as real	4.69%
Percent of total change estimated as nominal	95.31%
Percentage points (of total percentage change) estimated as real	0.18%
Percentage points (of total percentage change) estimated as nominal	3.88%

Table 3 combines the results from tables 1 and 2 to calculate the total nominal case-mix change between 2000 and 2008. The results in this table rely on four quantities: : the average case-mix in 2000, C_{00} (1.0959, from Table 1), average case-mix in 2008, C_{08} (1.3085, from Table 2), the predicted case-mix in 2007 using the year 2000 coefficient estimates from the Abt model, $\hat{C}_{07}^{00}$ (1.1152, from Table 1), and the predicted case-mix in 2007 using the year 2008 coefficient estimates from the Abt model, $\hat{C}_{07}^{08}$ (1.306, from Table 2). The key quantity of interest from this table is the number of percentage points of the total percentage change in case-mix estimated as nominal, N_{00}^{08}. This quantity can be expressed using the four estimates above:

$$N_{00}^{08} = \left(1 - \frac{\hat{C}_{07}^{00} \frac{C_{08}}{C_{00}} - C_{00}}{\hat{C}_{07}^{08}} \right) \cdot \frac{C_{08} - C_{00}}{C_{00}} = \frac{C_{08}}{C_{00}} \cdot \left(1 - \frac{\hat{C}_{07}^{00}}{\hat{C}_{07}^{08}} \right)$$

The actual change over this period was 0.2126 in absolute terms (1.3085 minus 1.0959), or 19.40% in percentage terms (0.2126 divided by 1.0959). The real case-mix for 2008 is calculated by multiplying the real case-mix estimate for 2007 by the ratio of the actual case-mix in 2008 to the predicted case-mix for 2007 (i.e., 1.306 times the ratio 1.3085/1.1152). This implies an absolute change in real case-mix from 2000-2008 of 0.0214 (1.1173 minus 1.0959), or 1.95% in relative terms (0.0214 divided by 1.0959). This in turn implies that only 10.07% of the total case-mix change from 2000 to 2008 was real (0.0214 divided by 0.2126). Of the 19.40

percentage point change in actual case-mix from 2000 to 2008, 17.45 percentage points were due to nominal case-mix change (the quantity 1.3085 divided by 1.0959, times the quantity 1 minus the ratio of 1.1152 to 1.3060).

Table 3: Estimate of Total Nominal Case-mix Change: 2000-2008

Measure	Value
Actual case-mix	
2000 (IPS period)	1.0959
2008	1.3085
Total change: 2000 – 2008	0.2126
Percent change: 2000 – 2008	19.40%
Real (predicted) case-mix	
2007 (change relative to 2000)	1.1152
2008 (change relative to 2000)	1.1173
Change in real (predicted) case-mix	0.0214
Percent change in real case-mix: 2000-2008	1.95%
Percent of total case-mix change estimated as real	10.07%
Nominal case-mix percentage point increase	17.45%

Extensions to the Abt Model

The results presented above are from our own replication of the Abt model. We were able to exactly replicate the results from the original report, using episode-level files of HHA data from 2000, 2007 and 2008.

In addition to replicating the results from the earlier report, we also extended it in a number of ways to address criticisms that have been made of the Abt model. The results from these extensions are presented below. In the interest of space, we present a summary of these results in Table 4. Only the bottom-row figures presented in each of the Table 1-Table 3 – the estimates of the percentage point change estimated as nominal for the periods 2000-2007, 2007-2008 and 2000-2008, respectively – are presented.

For each of these model extensions, we stayed as close to the original Abt regression model as possible. For some of the extensions, we had to exclude certain covariates. For example, one of our extensions restricted attention to episodes that had no inpatient hospital stay in the 14 days prior to the start of the HHA episode. Because the original Abt model includes a covariate that measures the number of inpatient hospital days in the 14 days prior to the episode, that covariate falls out of the regression model for this extension.

Although the Table 4 results are discussed in more detail in the next section, the 2000-2008 results (final column) are robust when compared to the original Abt model results. Once again, the Abt model suggests that 17.45 percentage points (of the 19.40 percentage point change in total case-mix over the period 2000 through 2008) were due to nominal case-mix. The smallest percentage point change across all the sub-categories is 13.90 (inpatient rehabilitation

facility/skilled nursing facility/long-term care hospital use in prior 14 days), and the largest is 21.16 (inpatient hospital use in prior 14 days). Although the estimates from 2000-2007 (first column, Table 4) and 2007-2008 (middle column, Table 4) are somewhat smaller for certain sub-groups (e.g., non-profit agencies; hospital-based agencies; northeast region), the bottom line estimates (final column, Table 4) still suggest a large percentage point increase in nominal case-mix growth over the full period.

Table 4: Estimate of Total Nominal Case-mix Change: 2000-2008

Model	Table 1	Table 2	Table 3
Original Abt Analyses	13.27%	4.05%	17.45%
Abt Model: Using Median IH length-of-stay	15.60%	1.60%	17.38%
Abt Model: Using 75th Percentile IH length-of-stay	12.69%	4.67%	17.47%
IH/IRF/SNF/LTCH use in the prior 14/15-120 days			
IH use in prior 14 days	13.22%	2.71%	21.16%
IH use in prior 15-120 days	10.39%	2.96%	16.81%
No IH use in prior 14 days	13.08%	4.63%	15.85%
No IH use in prior 15-120 days	15.43%	4.82%	18.19%
IRF/SNF/LTCH use in prior 14 days	7.59%	2.27%	13.90%
IRF/SNF/LTCH use in prior 15-120 days	7.64%	2.47%	14.11%
No IRF/SNF/LTCH use in prior 14 days	14.79%	4.49%	18.51%
No IRF/SNF/LTCH use in prior 15-120 days	14.81%	4.49%	18.33%
IH/IRF/SNF/LTCH use in prior 14 days	11.68%	2.55%	18.97%
IH/IRF/SNF/LTCH use in prior 15-120 days	10.25%	2.94%	16.74%
No IH/IRF/SNF/LTCH use in prior 14 days	14.80%	5.29%	16.95%
No IH/IRF/SNF/LTCH use in prior 15-120 days	15.68%	4.89%	18.29%
HHA characteristics			
Non-profit	7.45%	1.16%	14.49%
For-profit	15.55%	5.47%	18.63%
Government-owned	10.30%	0.17%	15.22%
Hospital- or SNF-based	7.79%	0.88%	14.17%
Free-standing	14.11%	4.68%	17.86%
West	16.05%	1.93%	17.51%
Midwest	10.57%	2.46%	16.76%
South	14.96%	5.98%	18.01%
Northeast	7.67%	0.84%	14.81%
Large HHA	11.43%	4.80%	17.21%
Small HHA	14.97%	3.30%	17.53%
Urban	13.14%	3.99%	17.75%
Rural	13.21%	4.36%	15.36%
Post-acute-focused HHA	10.15%	1.82%	16.80%
Community-focused HHA	16.86%	6.53%	18.72%
First HHA Episodes Only	13.62%	3.07%	19.06%

Note: HHA = home health agency; IH = Inpatient hospitalization; IRF = inpatient rehabilitation facility; SNF = skilled nursing facility: LTCH = long-term care hospital

RESPONSE TO CRITICISMS OF THE ABT METHODOLOGY

Criticism: "Only 39 percent of the home health episodes were preceded by an inpatient or post acute care setting" (p. 5, Lewin Report, 2010).

We investigated whether nominal case-mix growth occurred for both patients with and without prior inpatient/post acute care use. We re-ran the Abt model conditional on the prior hospital and post-care care use measures present on the Abt data file. Specifically, we defined prior inpatient/post acute care use in six different ways: any hospital use over past 14 days (yes/no); any post-acute use (defined as care received in an inpatient rehabilitation facility, skilled nursing facility or long-term care hospital) over prior 14 days (yes/no); any hospital use over past 15-120 days (yes/no); any post-acute use over past 15-120 days (yes/no); any hospital or post-acute care use in the preceding 14 days (yes/no); and any hospital or post-acute care use in the preceding 15-120 days (yes/no).

Across all twelve models, our estimates of nominal case-mix growth were very similar to those in the original Abt report (see Table 4). Compared with the original estimate of 17.45 percent from Table 3, all of the results are within four percentage points of this amount. The estimate for the model run on patients with an inpatient hospital stay in the preceding 14 days was the largest (21.16 percent), while the estimate for the model run on patients with a post-acute stay in the preceding 14 days was the smallest (13.90 percent). Using the broadest definition of any acute care or post-acute care stay in the prior 15-120 days, the estimates for those with and without such a stay are 16.74 percent and 18.29 percent, respectively. Each of these estimates represents a difference in magnitude of less than one percentage point compared with the original estimate. The results from these extensions suggest that the Abt model is robust regardless of whether there was a preceding inpatient or post-acute stay. (The estimates here represent percent increases attributable to nominal case mix growth, given the base value (in 2000) relevant to each subgroup.)

We also conducted analyses to investigate the sensitivity of the Abt results to varying assumptions regarding the inpatient hospital length-of-stay prior to the home health episode. As noted above, the Abt model generates predictions using the mean values for the different covariates. The average home health patient had 1.56 days of inpatient hospital care over the prior 14 day period and 3.29 days over the prior 15-120 day period. In order to assess the sensitivity of the Abt model to varying length-of-stay, we substituted these mean values with the median values (0 days over prior 14 days; 0 days over prior 15-120 days) and the 75th percentile values (2 days over prior 14 days; 4 days over prior 15-120 days). As exhibited in Table 4, the results using the median or 75th percentile values for length-of-stay are quite similar to the main Abt results.

Criticism: "Commenters stated that all of the HHAs are being penalized for the corrupt actions of a few HHAs…Commenters stated that nominal case-mix change reductions should be limited to certain types of agencies (for example, those with high average case-mix index [CMI] or large weight increases or for-profit providers) or that CMS should implement different payment reductions by state or geographical region, suggesting that their region has a lower nominal case-mix change than the national average" (p. 70376, DHHS, 2010).

The commenter suggests that CMS could implement different payment adjustments by agency or type of agency (e.g., ownership category). In attempting to make case-mix adjustments on an agency-by-agency basis, an important consideration would be sample size. Although some larger agencies are in operation, many agencies are quite small and the application of the Abt methodology to a relatively small number of patients would not be very robust.

In considering the adjustment of payments by type of agency, we re-ran the Abt model based on ownership type (non-profit, for-profit, government-owned), agency type (hospital- or SNF-based, freestanding), region of the country (north, south, Midwest, west) and agency size (large vs. small). We defined the agency size indicator by calculating each HHA's number of initial episodes. Those HHAs with episodes greater than or equal to the median in 2007, 225 episodes, were classified as large agencies. We also examined the urban-rural status of the agency's county location, and whether the agency had a particular focus on post-acute vs. community patients. We defined the post-acute agency indicator by calculating each agency's percentage of HHA episodes in 2007 with an inpatient hospital stay in the preceding 14 days. Those agencies whose percentage of post-acute episodes was greater than or equal to the weighted median in 2007, 27%, were classified as post-acute-focused agencies.

It is important to note for both the ownership and facility-based/freestanding extensions described above, we departed from the coding of these variables in the original Abt model. In the original model, there are nine covariates that represent both the ownership and facility-based status of each agency: free-standing non-profit; free-standing for-profit, free-standing government-owned; facility-based non-profit; facility-based for-profit; facility-based government-owned; other non-profit; other for-profit; other government-owned. "Other" here appears to refer to agencies whose facility-based/freestanding status could not be ascertained from the CMS Provider of Services file, the source Abt used to code these variables. We instead used the Medicare cost reports to code agency ownership type and facility-based/freestanding status; agencies found in the HHA cost reports are freestanding, while those found in the hospital or SNF cost reports are facility-based.

Across all these different categories (ownership, agency type, region, agency size, agency focus), nominal case-mix growth was present. For-profit agencies had the highest figure across all of these subgroups, at 18.63%; hospital- or SNF-based agencies had the lowest figure, at 14.17%. As expected, nominal case-mix growth was larger for some sub-groups (e.g., for-profit and freestanding HHAs), but it was still present among other agency types (e.g., non-profit/government and facility-based HHAs). Given the large degree of nominal case-mix growth present in each category, we assert that the potential gains from differentially adjusting payments across sub-groups of agencies are minimal relative to the administrative and political costs of making these adjustments.

Criticism: "Acute care hospital APR-DRGs and other prior use variables are less and less relevant for patients with more than one home health episode" (p. iii, Dobson report, 2010).

To address this criticism, we re-ran the Abt model using only the first home health episode for each patient. The idea here is that the first episode should be the cleanest "test" of the Abt model. Once again, results based on this first episode in Table 4 were very similar to the overall Abt results compared with the original estimate of 17.45 percentage points from Table 3; the result from this analysis is 19.06 percentage points. This suggests that the model is relatively stable across home health episodes. Put alternatively, the inclusion of the later episodes does not dramatically alter the primary finding of significant nominal case-mix growth.

Criticism: "One commenter stated that a recent study that used data from a nationally representative survey (the Medical Expenditures Panel Survey—MEPS) found a change in real case-mix between 2000 and 2007" (p.70378, DHHS, 2010).

This public comment refers to Partha Deb's (2010) report entitled "Trends in Case-Mix in the Medicare Population," which found significant increases in severity of illness in the Medicare population's health status over the 2000-2007 period. Deb used importance weights constructed by summing total expenditures across medical provider visits, outpatient visits, emergency room visits, prescribed medicines and home health care visits and regressing the expenditures against diagnosis related groups. Thus, if in the latter year (2007), more diagnoses were related to higher expenditures than in the earlier year (2000), the case mix index increases. However, given that there might be large increases in diagnoses related to expenditures, for example, on pharmaceuticals, it does not necessarily mean that an increase in case mix is related to actual increases in impairment that would affect the home health setting. Self-reported measures of health, pain and limitations in activities of daily living are more likely to be directly related to increased need for the intensity of home health services.

Thus, our analyses extend the Deb analysis in two important ways. First, we examined two measures of perceived health status from the Medical Expenditures Panel Survey (MEPS) in 2000 and 2008. Perceived health status has been shown to be highly correlated with actual health (McHorney, Ware, Raczek, 1993; Ware and Sherbourne, 1992). We also examined a measure of whether the respondent required assistance with activities of daily living (ADLs). Second, because trends in overall health do not necessarily correspond to trends among users of home health care (home health users constitute less than 10 percent of the fee-for-service enrolled Medicare population), we examined the three health status measures across a range of populations using the MEPS 2000 & 2008 Full Year Consolidated Data Files, Home Health Event Files, and Inpatient Event Files. Specifically, four populations are considered in both years:

- The full MEPS sample in both years.
- All Medicare beneficiaries, defined as all respondents ever having Medicare in a given year.
- All home health patients, defined as having at least one home health provider day in a given year. This population is further subdivided into community and post-acute entrants.

  - Home health community entrants are defined as having at least one home health provider day in a given year but with no inpatient stay during the preceding or same month[1] as the month of home health.
  - Post-acute home health patients are defined as respondents having at least one home health provider day in a given year and having an inpatient stay during the same month as the home health stay or the preceding month.

- Home health Medicare beneficiaries, defined as all respondents with any Medicare home health charges. Like the full home health population, the analysis further splits this population into community and post-acute entrants.

Table 5 presents the sample size for each subpopulation in both 2000 and 2008. Although we assert that examining changes for the home health population is an important extension of the earlier Deb analyses, we acknowledge that a tradeoff with this approach is that the sample sizes become quite small when we examine health status for the home health sub-population.

Table 5. Subpopulation Sample Sizes

Subpopulation	2000	2008
Full MEPS Sample	25,096	33,066
Medicare Beneficiaries	3,371	4,144
Home Health	451	645
Home Health: Community Entrants	*267*	*398*
Home Health: Post-Acute	*184*	*247*
Medicare Home Health	174	289
Medicare Home Health: Community Entrants	*99*	*191*
Medicare Home Health: Post-Acute	*75*	*98*

Source: MEPS, 2000 and 2008.

The team reviewed three variables related to health status from the MEPS:

- Respondents indicating perceived health status of “poor” or “fair”, as opposed to those indicating health status as "good”, “very good”, or “excellent".

- Respondents indicating if pain limited normal work outside or in the home in the past four weeks "extremely” or “quite a bit", as opposed to those indicating health status as "moderately”, “a little bit”, or “not at all".

- Respondents with a positive screen for ADL help, a variable that signifies whether the person receives help or supervision with personal care such as bathing, dressing, or

1 Note that MEPS records receipt of home health event at the month level only, limiting consideration to months rather than the actual date of home health admission.

getting around the house because of an impairment or a physical or mental health problem. We acknowledge that this measure may be less appropriate for capturing health status at high levels of severity of illness, but in conjunction with the other two measures, we believe it provides additional insight into the health status of the home health population.

In all cases, responses such as "refused", "don't know", or "not ascertained" were omitted from the analysis. Weighted survey responses are presented below. As MEPS is a nationally representative survey, the team was able to utilize pre-constructed survey weights to present nationally representative changes in the three health status variables. The percent of home health care beneficiaries experiencing "extreme' or "quite a bit" of work-limiting pain significantly decreased from 2000 to 2008. Because the sample sizes are small and standard errors are large, although differences appear between the post-acute and community admitted home health episodes, these differences are not significant at the .05 level and the p-value is also presented.

In addition to the mean, standard error, and sample size, the following tables report the 95 percent confidence interval for each sample. This can be used to ascertain the precision of the estimate being presented. A small range between the two numbers of the confidence interval represents a greater likelihood that the reported mean is close to the actual mean. The smaller that range, the more precise the estimate is likely to be. For example, the first row of Table 6, below includes the full MEPS sample in 2000 and 2008. In 2000 a reported 9.8 percent of all respondents indicated a perceived health status of "poor" or "fair." This percentage has a 95 percent confidence interval ranging from 9.2 percent to 10.5 percent, which means that the actual percentage has a 95 percent likelihood of falling between these two values. Because the confidence interval is fairly narrow (9.2 and 10.5 are close together), the reported value of 9.8 percent is quite likely to be very close to the true value. However, as the sample size decreases, as in the last row of the table, the confidence interval is quite large, suggesting less precision in the estimate.

Significance tests show little significant difference in the perceived health status of MEPS respondents in each subpopulation across the two periods (see Table 6). Although only significant at the .10 level, improvement was found in this measure among the post-acute entrants between 2000 and 2008. For community entrants, although we observed a decline in self-reported health status, this difference was not significant.

A significant decrease was found in the proportion of the Medicare home health population that indicated that pain limited their normal work outside or in the home over the prior few weeks either "extremely" or "quite a bit" from 2000 to 2008 (see Table 7).

No significant differences were found in any of the populations in the proportion of individuals that had a positive screen for needing help with ADLs from 2000 to 2008 (see Table 8).

Table 6. Respondents indicating perceived health status of "poor" or "fair"

Subpopulation	2000: N	2000: % (SE)	2000: CI	2008: N	2008: % (SE)	2008: CI	P Value (Significant at .05 level denoted by star)
Full MEPS Sample	275,332,494	9.8% (0.003)	[9.2%,10.5%]	300,451,632	10.7% (0.003)	[10.2%, 11.2%]	0.033*
Medicare Beneficiaries	37,499,774	27.5% (0.011)	[25.4%, 29.7%]	43,274,592	26.3% (0.009)	[24.5%. 28.1%]	0.386
Home Health	4,639,198	51.5% (0.026)	[46.4%, 56.6%]	5,999,858	51.7% (0.022)	[47.4%, 56.0%]	0.952
Home Health: Post-Acute	1,944,159	58.8% (0.043)	[50.2%, 67.4%]	2,381,384	54.7% (0.038)	[47.1%, 62.4%]	0.478
Home Health: Community Entrants	2,695,040	46.2% (0.033)	[39.6%, 52.9%]	3,618,473	49.7% (0.0457)	[40.6%, 58.9%]	0.540
Medicare Home Health	1,836,513	61.1% (0.036)	[53.9%, 68.4%]	3,001,392	58.8% (0.024)	[54.0%, 63.5%]	0.581
Medicare Home Health: Post-Acute	867,560	61.0% (0.060)	[48.1%, 73.9%]	1,173,449	43.7% (0.070)	[28.2%, 59.2%]	0.064
Medicare Home Health: Community	968,953	61.3% (0.068)	[47.2%, 75.3%]	1,827,944	68.4% (0.042)	[59.6%, 77.2%]	0.371

Source: MEPS, 2000 and 2008
Note: Strata with a single sampling unit are treated as certainty units and do not contribute to the standard error.

Table 7. Respondents indicating pain limited normal work outside or in the home in the past four weeks "extremely" or "quite a bit"

Subpopulation	2000: N	2000: % (SE)	2000: CI	2008: N	2008: % (SE)	2008: CI	P Value (Significant at .05 level denoted by star)
Full MEPS Sample	184,880,436	10.3% (0.003)	[9.7%, 11%]	211,858,874	10.9% (0.003)	[10.3%, 11.41%]	0.224
Medicare Beneficiaries	34,553,777	23.6% (0.009)	[21.8%, 25.3%]	41,165,864	22.7% (0.009)	[21%, 24.41%]	0.481
Home Health	3,986,524	49.0% (0.028)	[43.5%, 54.5%]	5,312,454	45.2% (0.022)	[40.8%, 49.63%]	0.285
Home Health: Post-Acute	1,802,475	48.7% (0.054)	[37.6%, 59.7%]	2,357,707	46.3% (0.052)	[35.8%, 56.8%]	0.753
Home Health: Community Entrants	2,184,049	49.3% (0.047)	[39.9%, 58.7%]	2,954,746	44.4% (0.037)	[36.9%, 51.8%]	0.407
Medicare Home Health	1,760,458	56.6% (0.044)	[47.6%, 65.6%]	3,020,606	45.4% (0.031)	[39.1%, 51.61%]	0.039*
Medicare Home Health: Post-Acute	820,400	54.4% (0.106)	[31.5%, 77.2%]	1,229,062	45.4% (0.058)	[32.6%, 58.3%]	0.462
Medicare Home Health: Community	940,058	58.5% (0.074)	[43.1%, 73.9%]	1,791,544	45.3% (0.069)	[31.1%, 59.6%]	0.192

Source: MEPS, 2000 and 2008.
Note: Strata with a single sampling unit are treated as certainty units and do not contribute to the standard error.

Table 8. Respondents with a positive screen for ADL help

Subpopulation	2000: N	2000: % (SE)	2000: CI	2008: N	2008: % (SE)	2008: CI	P Value (Significant at .05 level denoted by star)
Full MEPS Sample	275,498,017	1.4% (0.001)	[1.2%, 1.6%]	299,413,089	1.5% (0.001)	[1.3%, 1.7%]	0.291
Medicare Beneficiaries	37,635,061	6.7% (0.006)	[5.6%, 7.8%]	43,358,834	7.5% (0.005)	[6.4%, 8.6%]	0.304
Home Health	4,712,417	32.4% (0.027)	[27%, 37.9%]	5,995,858	34.3% (0.023)	[29.7%, 38.9%]	0.601
Home Health: Post-Acute	1,955,650	27.3% (0.031)	[21%, 33.6%]	2,381,384	30.1% (0.039)	[22%, 38.2%]	0.586
Home Health: Community Entrants	2,756,767	36.0% (0.047)	[26.6%, 45.5%]	3,614,474	37.1% (0.046)	[27.8%, 46.5%]	0.876
Medicare Home Health	1,864,938	37.5% (0.039)	[29.6%, 45.4%]	3,001,392	36.0% (0.028)	[30.3%, 41.7%]	0.751
Medicare Home Health: Post-Acute	867,560	15.9% (0.065)	[18.9%, 29.8%]	1,173,449	19.4% (0.044)	[9.8%, 29.1%]	0.649
Medicare Home Health: Community Entrants	997,378	56.4% (0.087)	[38.3%, 74.4%]	1,827,944	46.6% (0.054)	[35.5%, 57.7%]	0.342

Source: MEPS, 2000 and 2008.
Note: Strata with a single sampling unit are treated as certainty units and do not contribute to the standard error.

Although the approach presented here deviates from the one used by Deb (2010), we assert that these methods are more appropriate for assessing whether there are increases in the severity of illness that would specifically indicate a need for more resources in the home health setting. In summary, the results do not support the conclusion that the health status of Medicare beneficiaries receiving home health services significantly deteriorated from 2000 to 2008. This result held even after beneficiaries were divided into subgroups of individuals admitted from the community and individuals admitted from an inpatient setting.[2] In fact, the results indicate that individuals coming from the inpatient setting into home health may be healthier overall in 2008 than they were in 2000. Additionally, overall Medicare beneficiaries in home health may have less pain in 2008 than in 2000.

SUMMARY AND RECOMMENDATIONS

Measuring the proportion of total home health care case-mix change that is due to nominal versus real factors has important implications for establishing accurate and reasonable payment rates. To date, CMS has relied on a methodology developed by Abt Associates to analyze case-mix change in order to set payment rates. In this report, we reviewed the Abt methodology and then examined several of the major criticisms levied against this approach. Based on our analyses, we conclude that the Abt methodology generally fares well in the context of these major criticisms.

Specifically, this report examined four potential criticisms of the Abt model. First, we examined the criticism that a large number of home health patients do not have prior post-acute use, suggesting that the Abt model, which relies on case-mix from prior hospitalizations, will not work well to this population. However, our results suggest that case-mix change is similar in the Abt model regardless of whether the patient had a prior inpatient stay or post-acute care use over the prior 14 or 15-120 days.

Second, we examined the criticism that the Abt model applies a uniform payment adjustment to all agencies. The commenter suggests that all "HHAs are being penalized for the corrupt actions of a few HHAs." This comment implies that CMS should use the Abt methodology to adjust payments on an agency-by-agency basis. We are wary of adjusting payments at the agency level due to the concern of small sample size at many agencies. Moreover, when we re-ran the Abt model by ownership type (non-profit, government, for-profit), agency type (facility-based, freestanding), region of the country (north, south, Midwest, west), agency size (large vs. small; based on number of initial episodes) and agency focus (post-acute versus community-dwelling), the results suggest that a consistent percentage of the growth in case-mix is nominal growth. As such, these results do not provide much support for adjusting payments by type of agency.

Third, the criticism was raised that the other prior health care use variables included in the Abt model are less relevant for patients with more than one home health episode. In order to examine this issue, we compared the results of the Abt model within the initial episode versus the full model results. The results indicated very similar findings, suggesting that the model is relatively stable across home health episodes.

[2] Because the sample sizes are small, caution should be made in concluding that no changes exist in the community-referred population.

Finally, a commenter raised the concern that an earlier analysis of the MEPS data has suggested that the Medicare population has become less healthy over the period 2000-2007. This result implies unmeasured case-mix may be underlying the Abt results. In order to address this concern, we also examined case-mix change in the MEPS data, but focused our analyses on self-reported health measures (to avoid any bias related to payment) and examined the Medicare home health population. Our results do not support the conclusion that the health status of Medicare beneficiaries receiving home health services significantly deteriorated from 2000 to 2008.

Given the consistency of the nominal case-mix changes across sub-groups and the MEPS data for the home health population, we conclude that the Abt model does an adequate job of capturing health severity for home health patients, including those from the community. Nevertheless, one of the key remaining criticisms of the Abt methodology is that the cross-sectional model does not account for some unmeasured change in the Medicare home health population. In order to address this issue, we recommend a potential refinement to the Abt model. The Abt model currently relies on the All Patient Refined Diagnosis Related Group (APR DRG) measures to risk-adjust the patients. Potential concerns with the APR-DRG approach include the long "look back" period (APR DRGs are collected from hospital stays up to four years prior), the small proportion of patients with no APR DRG data (roughly 10 percent of home health patients have no hospitalization over prior four years), and the idea that the hospital-based DRG system may not capture the risk of home health patients. We were able to analyze the first two concerns with the APR DRG system in this report, and we concluded that these are not major issues. However, the third concern—the APR DRGs may not capture home health case-mix very well—may still be relevant.

As such, we suggest that CMS evaluate the CMS hierarchical condition categories (CMS-HCC) score as a potential complement to the APR DRG categories. Implemented in 2004, the CMS-HCC model adjusts Medicare capitation payments to Medicare Advantage health care plans to account for the health expenditure risk of their enrollees. The model includes demographic information (age, sex, Medicaid dual eligibility, disability status) and a profile of major medical conditions obtained from Medicare diagnoses over the prior calendar year. HCCs are assigned using hospital (Part A) and physician (Part B) diagnoses from any of five sources: (1) hospital inpatient–principal diagnoses, (2) hospital inpatient–secondary diagnoses, (3) hospital outpatient, (4) physician, and (5) clinically-trained non-physician (e.g., psychologist, podiatrist). Given the HCCs' reliance on a more complete claims history (hospital, physician, non-physician), the inclusion of this score with the APR DRG categories may better account for the case-mix of Medicare home health patients as compared to the APR DRG measures alone.

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