Competitive Bidding - A Decade Focused on the Wrong Prize

The Case for Medicare Investment in DME in 2021

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Over the past decade of researching, analyzing and publishing studies on the efforts of CMS to control distribution of durable medical equipment (DME) through competitive bidding, one theme has remained constant and true: CMS spent a decade focused on the wrong prize.

They chose to reduce DME spending and attempted to eliminate the fraud they saw in the system. Their mission was to cut costs through the competitive bidding program and they did just that, generating some savings and reducing fraud and waste in the system. But at the same time, they totally missed the big opportunity, orders of magnitude larger -- the power of *investing* in DME. After ten years, the competitive bidding program amounted to little more chopping down a swath of trees in a massive forest of money.

And the side effects were painful. Fewer Medicare beneficiaries received the DME they really needed; the universe of suppliers who could promptly deliver and service DME to Medicare recipients shrunk; and through it all the cost of treating those who did not have the DME they needed skyrocketed. **CMS never saw the forest for the trees**. Over the decade, they learned little about the power and potential of investing in DME.

During the competitive bidding years, CMS focused solely on cutting down trees. They took a chain saw to DME prices, indiscriminately slashing prices in the names of fraud and overpricing. And while there was admittedly some of both, CMS chose to make deeper and deeper cuts across

the board, all in the name of squeezing every dollar they could out of the system, often without due regard to the needs of their Medicare beneficiaries or the realities of the DME marketplace.

On average, competitive bidding led to a 46% reduction in total spending on included items. This was comprised of an overall 36% reduction in DME prices (with reductions in some specific product categories approaching 50%) and another 10% reduction in overall spending achieved by reducing the share of beneficiaries receiving DME by 11%.[1]

At the same time, competitive bidding drove down the number of DME suppliers. Supplier locations operating during the decade of competitive bidding dropped somewhere between 29% and 40%, depending on the data source. Reductions were even more drastic in some of the individual DME categories, where the number of suppliers plummeted nearly 50%.[2, 3]

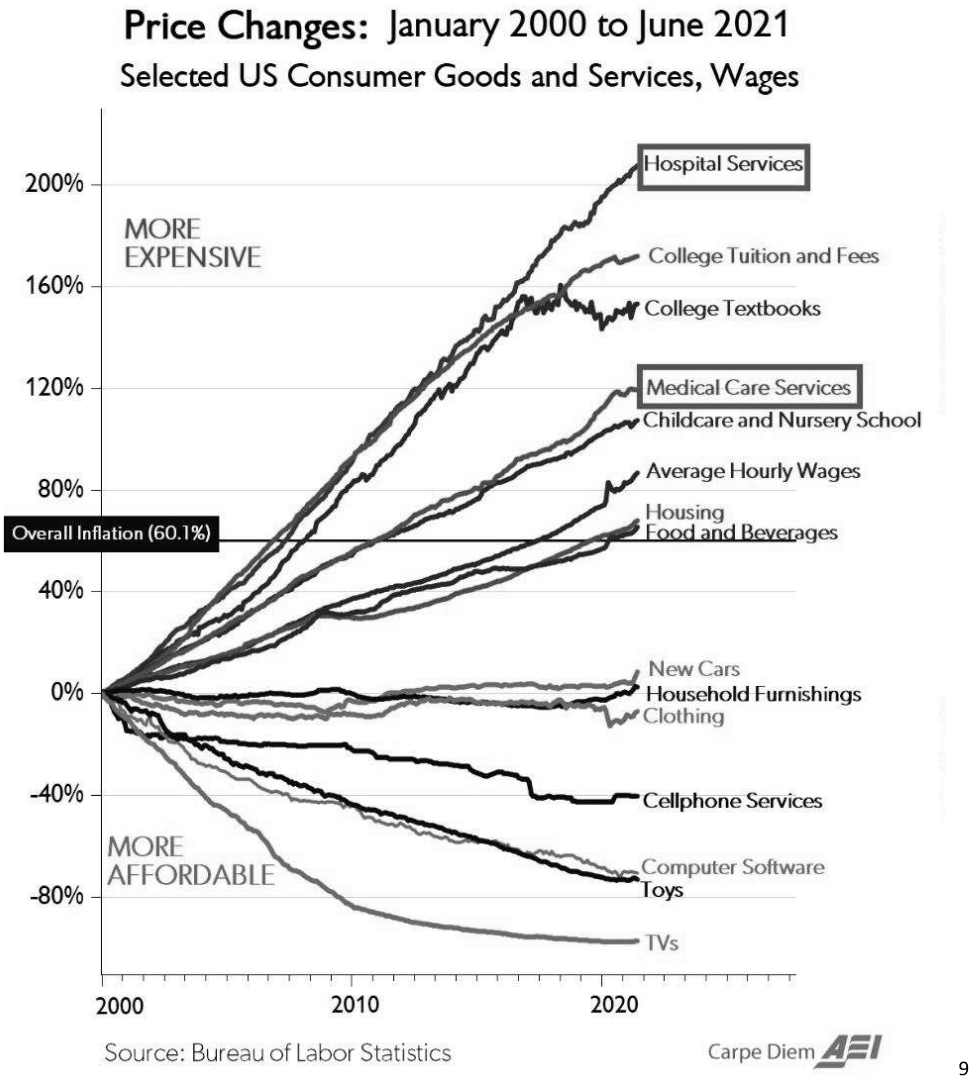
In our 2017 update, the lead recommendation was that the incoming administration direct CMS to end its focus on DME cost cutting and take immediate steps to drive down the massive payments it was making to treat the very problems that DME is designed to avoid. They did not follow that path and continued to pursue cost cutting. By the end of the decade, competitive bidding had effectively stalled out. The 2019 and 2021 rounds fizzled. The 2019 round was 'delayed'[4] as the program approached what may be its natural end – CMS was no longer able to squeeze any more cost out of the system. The 2021 round, characterized in the trade as a 'failed round'[5], was limited to only two product categories—off-the-shelf (OTS) back braces and OTS knee braces. In designing the round, CMS again cited fraud and overpricing as the basis for the round.[6]

Throughout the decade, CMS failed to recognize the potential for DME to reduce treatment spending or to develop a plan to invest in needed DME, where a forest of financial savings stood waiting for harvest. That forest remains verdant today, having grown at a rate that dramatically outpaced inflation over the decade.

The forest of financial savings

Medicare beneficiaries who use (or conversely need but do not receive) DME are substantially less healthy and have substantially higher healthcare use than non-users. Medicare continues to suffer under the weight of the massive payments it now makes to treat the very problems that DME is designed to avoid.[7, 8]

The costs that CMS saved over a decade of focusing on the wrong prize pale in comparison. The real prize, reducing the cost of treating injuries and illnesses that befall Medicare beneficiaries who lack the critical DME they need to stay well, continues to be ignored by CMS. When DME is not provided, Medicare incurs substantial costs to treat the range of medical complications that result from not having the needed DME and those costs have continued to soar every year.



9

Hospital and medical care services that CMS pays for under Medicare Parts A, B and C are soaring

A well-crafted plan for appropriate distribution and use of DME would stem the cascade of costs that results from injuries, illnesses and other serious medical conditions that occur when the DME

is not provided, reducing the amount Medicare would otherwise have to pay to treat those conditions. Having the right DME when it is needed also means that patients can receive more care at home, which leads to better outcomes and significantly lower health care costs. [10, 11, 12]

Just How Big is the Forest of Financial Savings? …. $98 Billion Annually

As will be seen from the detailed discussions of the financial models for falls, oxygen therapy and CPAP therapy, the financial leverage and potential savings for properly investing in DME are significant. While all the savings cannot be realized instantaneously, we can attempt to estimate the magnitude of the size of the Forest that can be realized over time, if CMS makes a serious shift toward investing in DME.

For mobility DME, the ultimate goal is to eliminate all senior falls by providing the proper DME in advance of the need. With an estimate of over 6 million annual senior fall injuries that require treatment, at a cost to treat of over $8,500, we estimate that the annual savings potential for CMS is $46.2 Billion. This estimate is net of an estimated $2.5 Billion annual investment in equipment, proactive fall prevention, screening, education and training and assumes a fall reduction of over 90%, based on the best available study on the effectiveness of using the proper DME by beneficiaries (see detailed Falls discussion below for citations to the data assumptions referenced above). Medicare recipients and their insurers stand to save an additional $11.5 Billion. Over the five-year window we used for analyzing oxygen and CPAP therapy (see explanation below), the potential savings for CMS adds up to $231 Billion, with an additional $57.5 Billion for beneficiaries and insurers.

For supplemental oxygen therapy, the goal is to identify and treat Medicare beneficiaries with undiagnosed COPD. Best estimates are that 50% of Medicare beneficiaries with COPD are undiagnosed.[13] This amounts to approximately 800,000 undiagnosed Medicare beneficiaries with COPD, at a cost to treat of over $14,400 (see detailed Home Oxygen Therapy discussion below). We estimate that the savings potential for CMS is $2.1 Billion annually. This estimate is net of an estimated $191.5 Million annual investment in equipment, screening, identifying, educating and providing oxygen equipment to newly diagnosed beneficiaries. Medicare recipients and their insurers stand to save an additional $523 Million annually. Savings numbers in this category are significantly lower than the other two, largely due to the smaller number of beneficiaries in the target, undiagnosed group and our estimate that CMS cannot achieve all of the potential savings in Year 1 (we spread out the total potential savings in this category over five years). Over the five-year window, the potential savings for CMS adds up to $10.5 Billion, with an additional $2.6 Billion for beneficiaries and insurers.

For CPAP therapy, the goal is to identify and treat Medicare beneficiaries with undiagnosed OSA. Best estimates are that 80% of Medicare beneficiaries with OSA are undiagnosed. This amounts to approximately 10.6 million undiagnosed Medicare beneficiaries with OSA, at a cost to treat of

over $25,500 (see detailed CPAP Therapy discussion below for citations to the data assumptions referenced above). We estimate that the savings potential for CMS is $30.3 Billion annually. This estimate is net of an estimated $5.2 Billion annual investment in equipment, screening, identifying, educating and providing CPAP equipment to newly diagnosed beneficiaries. Medicare recipients and their insurers stand to save an additional $7.6 Billion. In our estimation, CMS cannot achieve all of the potential savings in Year 1, so we spread out the total potential savings in this category over a five-year period. Over that five-year window, the potential savings for CMS adds up to $151.3 Billion, with an additional $37.8 Billion for beneficiaries and insurers.

Investing in DME alone is not sufficient to achieve the savings projected above. In each of the three estimates, we included significant funds for CMS to invest in screening, identification and education programs to help providers find beneficiaries in need before the massive treatment costs start to accrue. While it is difficult to project how much it will cost CMS to develop a set of tools and promotional materials for such programs, we arbitrarily selected amounts that matched the proposed investments in the DME itself. Investment at that level is certainly a good starting point for CMS to meaningfully commit to refocusing on investing rather than continuing down the cost cutting path they have followed for the past decade.

Combining categories, CMS can aspire to $78.6 Billion in annual savings, representing 8.6% of its 2020 gross spending.[14] Beneficiaries and insurers can target an additional $19.6 Billion in annual savings. *All told, the cumulative potential savings for CMS, beneficiaries and insurers over the five-year investment period totals $491 Billion.*

Size of the Forest of Financial Savings ~ $98 Billion Annually

When CMS Invests …	CMS can potentially annually save …	Beneficiaries/Insurers can potentially annually save …
in mobility DME … 	$ 46.2 Billion	$ 11.5 Billion
in O_2 therapy … 	$ 2.1 Billion	$ 0.5 Billion
in CPAP therapy … 	$ 30.3 Billion	$ 7.6 Billion
	$ 78.6 Billion	$ 19.6 Billion

In our work over the last ten years, we focused on three product categories of DME that are used by many beneficiaries and comprise a significant portion of overall Medicare DME spending. – mobility equipment (e.g., wheelchairs, walkers and power chairs) to avoid falls; oxygen [O_2] therapy equipment to counter symptoms of COPD; and continuous positive airway pressure [CPAP] equipment to treat sleep apnea.

Falls have been the leading cause of fatal and nonfatal injuries among U.S. adults aged 65 years and over throughout the past decade.[15] When Medicare invests in mobility DME for Medicare beneficiaries, falls are reduced and the cascade of costs that result from treating those falls are eliminated. Fall avoidance leads directly to cost avoidance in the form of reduced Medicare and beneficiary spending.

For every dollar that Medicare spends proactively providing mobility DME, Medicare can avoid spending an additional $39.24 to pay for fall-related emergency room visits, doctor visits, hospital stays, ambulance transport, rehabilitation and long-term care. Medicare investments in DME can also generate an additional cost savings to Medicare beneficiaries and their private insurers, who typically bear the burden of the ~20% copay that Medicare doesn't cover, of $9.89.

Beyond these direct costs, falls are responsible for additional indirect or economic costs (e.g., the value of lost wages and labor productivity) for Americans 65 and older, adding another 35% to the total cost of falls.[16]

COPD is the 4th leading cause of disease-based death in the United States, behind only heart disease, cancer and COVID-19. 85% of all COPD deaths occur among those age 65 years or older.[17]

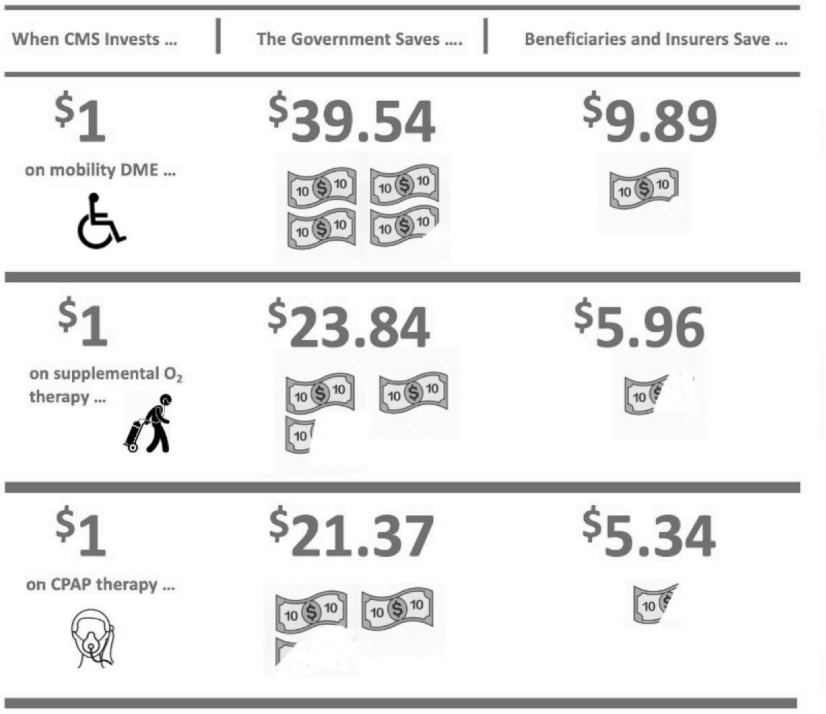
Supplemental oxygen therapy is used to treat individuals who have difficulty breathing because of COPD. When Medicare proactively invests in providing supplemental oxygen therapy, the cost of treating the gamut of medical complications that typically befall beneficiaries with COPD drops dramatically. For every dollar that Medicare invests, Medicare can avoid spending approximately $23.84 in treatment costs. In addition, Medicare investment in supplemental oxygen therapy can also result in copay cost savings to Medicare beneficiaries and their private insurers of $5.96.

Indirect or economic costs can add an additional 11% to the total cost of COPD.[18]

Obstructive Sleep Apnea (OSA) leads to life-threatening breathing interruptions and sleep disruptions in up to 70% of men over 65 and up to 56% of women over 65.[19] OSA has been associated with comorbidities including hypertension, atrial fibrillation and other arrhythmias, heart failure, coronary artery disease, stroke, pulmonary hypertension, metabolic syndrome, diabetes and cardiovascular mortality.[20] Continuous positive airway pressure (CPAP) therapy is a critical tool used to treat individuals who have OSA and significantly reduce comorbidity medical costs. When Medicare pays for CPAP therapy, the cost of treating medical complications created by OSA drops dramatically. For every dollar that Medicare invests in providing CPAP therapy,

Medicare can avoid spending $21.37 for treatment of OSA and OSA-caused medical complications. Every dollar that Medicare invests in providing CPAP therapy can also generate a cost savings to Medicare beneficiaries and their private insurers of $5.34.

Indirect or economic costs can add an additional 25% to the total cost of OSA.[21]



A Note on the Study

This study and the earlier versions[22] show that the massive payments that Medicare makes for ER visits, hospital stays, visits to physicians, medicines, outpatient treatment, extended care and other treatment payments have increased over the competitive bidding era, while DME spending has dropped dramatically due in large part to competitive bidding. Each update of the study reflected growing cuts in payments forced on beneficiaries and providers by CMS, along with a substantial increase in the value and leverage of potential DME investment savings. The power of one dollar spent to provide DME to those who need it has dramatically risen over the decade of competitive bidding.

FALLS

Your heart beats around 35 million times each year, just under once every second. Each time it beats, an American adult aged 65 years or older falls[23], meaning that one in four older Americans fall each year. One quarter of those falls (8.4 million per year) results in an injury, making falls the leading cause of injury among senior adults.[24]

Every 11 seconds, one of those falls is serious enough to require a trip to an emergency room.[25] Even more lead to a visit to a doctor's office or a clinic.[26] Over 30% of the ER visits lead to a hospital admission.[27] And it doesn't end there. After the hospital stay, most senior patients are discharged to a rehabilitation or skilled nursing facility to recover. All of the costs that are rung up after a fall put a huge financial burden on Medicare, which ends up paying the bulk (~80%) of all the costs incurred to treat fall-related beneficiary injuries.

In earlier studies, we used fairly complex models to calculate the savings that can be realized by Medicare investment in DME, with a goal to simplify the models whenever possible. Studies and data that have published since the last study have made it possible for us to greatly simplify the models while simultaneously significantly improving the accuracy of the estimates of savings from investment in DME.

DME has, for the most part, been a highly reactive product. By reactive, we mean that DME has been given to and used by people who had a need arising from an injury or illness that had already befallen them. Giving DME to people prospectively, with the expectation or prediction that they will need it in the future to avoid injury or illness, has been the exception to the rule. And this is where CMS has missed the boat. Historically, they have created a mindset and an environment where DME is not provided to beneficiaries until after the injury or illness. With competitive bidding approaching its natural end, the time is ideal for CMS to change its mindset and create programs focused on accurately predicting and getting the correct DME to beneficiaries in advance of their need, to avoid the significant costs now being spent to repair injuries and treat illnesses.

In 2020, CMS spent $616 Million on mobility DME for Medicare beneficiaries.[28] To determine the average cost to proactively provide mobility DME to Medicare beneficiaries, we looked at the amount CMS pays for that DME when provided after a fall injury. We estimated that between 73-82% of Medicare beneficiaries who suffer a fall injury are treated in a physician's office, a clinic or an emergency room.[29] This equates to spending an average of $89.64 on DME for each beneficiary treated for a fall injury. In addition, each fall victim incurs at least one doctor visit, at a cost we estimated at $110.43 for a Level-4 visit.[30] This brings the average cost to provide DME

after a fall injury to $200.07, which serves as a reasonable proxy for the proactive cost of providing mobility DME.

To determine the cost that Medicare pays for each fall injury, we started with two different estimates of CMS overall spending on fall injuries from 2018 and 2019 publications.[31] We deducted the amount actually spent on DME to identify the Medicare spending for treatment of fall injuries. We then divided that amount by the number of fall injuries to calculate a cost per injury to treat falls. The first estimate was $52 Billion in 2020, which required no adjustments.[32] The second estimate was inflated to 2020 dollars[33], adjusted for increases in Medicare beneficiary population and for the impact of Medicare Advantage enrollment.[34] That resulted in an estimate of total CMS spending on fall injuries of $54.3 Billion in 2020 dollars. These estimates yielded a cost to treat the average Medicare beneficiary fall injury of between $8,355.13 and $8,731.46. Estimates were then adjusted for effectiveness of using the proper DME by beneficiaries, based on a decade of historical effectiveness of providing DME to those in need.[35]

Thus, for every dollar CMS invests in proactively providing DME to Medicare beneficiaries who need it, CMS will avoid between $38.67 - $40.41 in payments to treat fall injuries. We chose the average of the models, $39.54. Taking into account the copays and deductibles paid by Medicare beneficiaries and their private insurers, the healthcare system can on average avoid $49.43 in payments to treat fall injuries.

HOME OXYGEN THERAPY

COPD takes a significant annual toll on America's annual healthcare budget. It is the fourth leading cause of mortality and the second leading cause of disability in the United States.[36] In

2020, $49 Billion were spent treating COPD, that number having grown by more than 50% over the past decade.[37] Medicare bore a significant portion of that burden.

COPD is a life-threatening respiratory condition. The term COPD includes two main conditions—emphysema and chronic bronchitis. In emphysema, the walls between many of the air sacs are damaged. As a result, the air sacs lose their shape and become floppy. This damage also can destroy the walls of the air sacs, leading to fewer and larger air sacs instead of many tiny ones. If this happens, the amount of gas exchange in the lungs is reduced. In chronic bronchitis, the lining of the airways stays constantly irritated and inflamed, and this causes the lining to swell. Lots of thick mucus forms in the airways, making it hard to breathe. Most people who have COPD have both emphysema and chronic bronchitis.[38]

COPD is a chronic condition with a long period of disability that typically get progressively worse over time. COPD patients also suffer from a broad range of comorbidities that contribute to the problem, including hypertension; allergies; respiratory infections; arthritis; high cholesterol; anxiety and panic disorders; GERD and pneumonia.[39] As such, it will continue to burden the healthcare system into the foreseeable future. In the coming two decades, COPD is expected to cost the U.S. healthcare system an additional $800 Billion in direct medical costs and an additional $100 Billion in COPD-attributable indirect absenteeism costs.[40]

Supplemental oxygen therapy is the cornerstone mode of treatment in patients with severe COPD.[41] Oxygen therapy is particularly effective in slowing or preventing right-sided heart failure and minimizing COPD exacerbations[42], which lead to most COPD-related hospital stays.[43] Research estimates show that providing supplemental oxygen therapy to COPD patients with low blood oxygen reduces hospital stays by 45%.[44]

In 2020, CMS spent $584 Million on supplemental oxygen therapy equipment for Medicare beneficiaries.[45] Approximately 82% ($479 Million) went to beneficiaries suffering from COPD.[46] To determine the average cost to proactively provide supplemental oxygen therapy equipment to Medicare beneficiaries, we looked at the amount CMS pays for that equipment when provided after hospitalization or other diagnosis. Conservatively estimating that beneficiaries receive and use equipment for a full 12 months, we calculated the number of COPD beneficiaries using equipment in 2020.[47] Using this approach, we calculated the average cost to provide supplemental oxygen equipment, accessories and supplies to COPD beneficiaries to be $605.44, which serves as a reasonable proxy for the proactive cost of providing the equipment.

To model the cost saving of providing supplemental oxygen therapy to Medicare beneficiaries in need, we determined the average annual incremental cost of treating COPD patients with frequent exacerbations. A recent publication provided the most accurate breakdown of annual per capita health services payments comparing beneficiaries with and without frequent exacerbations.[48] Adjusted to 2020 dollars, those incremental costs averaged $14,333 per patient.[49]

Thus, for every dollar CMS invests in proactively providing supplemental oxygen therapy equipment to Medicare COPD beneficiaries who need it, CMS will avoid $23.84 in payments to treat beneficiaries with COPD. Considering the copays and deductibles paid by Medicare beneficiaries and their private insurers, the healthcare system can avoid $29.80 in payments to treat beneficiaries with COPD.

CPAP Therapy

Sleep apnea is a medical condition characterized by the repeated stopping and starting of breathing while asleep. By far the most common type of sleep apnea is obstructive sleep apnea. OSA occurs when a person's throat muscles intermittently relax to the point of collapse and block the person's airway during sleep.

OSA may be the single-most undiagnosed illness in existence. Around the world and in the United States, approximately 80% of all sleep apnea sufferers are undiagnosed.[50] Globally, over 100 million people suffer from sleep apnea.[51] This failure to identify such a significant clinical problem places a tremendous financial burden on healthcare systems around the world.

In 2020, CMS spent $1 Billion on CPAP equipment for Medicare beneficiaries.[52] To determine the average cost to proactively provide CPAP equipment to Medicare beneficiaries, we looked at the amount CMS pays for that equipment when provided after hospitalization or other diagnosis. We determined the number of CPAP beneficiaries using equipment and supplies and the number of sleep studies conducted in 2020. We calculated the average cost to provide CPAP diagnosis and equipment to beneficiaries at $1197.72, which serves as a reasonable proxy for the proactive cost of diagnosing OSA and providing CPAP equipment.

To model the cost saving of providing diagnosing OSA and providing CPAP equipment to Medicare beneficiaries in need, we determined the average annual incremental cost of treating OSA patients. A recent publication provided the most accurate breakdown of annual per capita health services payments for beneficiaries with untreated obstructive sleep apnea.[53] Adjusted to 2020 dollars, those incremental costs averaged $25,594 per patient.

Thus, for every dollar CMS invests in proactively providing CPAP therapy equipment to diagnosed Medicare OSA beneficiaries, CMS can avoid $21.37 in payments to treat beneficiaries with OSA. Considering the copays and deductibles paid by Medicare beneficiaries and their private insurers, the healthcare system can avoid $26.71 in payments to treat beneficiaries with OSA.

The Bottom Line

CMS has spent the last decade controlling distribution of durable medical equipment through competitive bidding. They have dramatically lowered DME prices and reduced fraud in the system, while simultaneously weakening the DME distribution network and restricting beneficiary access to needed equipment. The last two rounds of competitive bidding suggest that it may be reaching the end of its natural life, no longer able to continue driving overall prices down and useful, if at all, in only very specific applications.

Each time we have looked the impact of the program, we have seen DME prices drop and the cost of treating beneficiaries go up. The net effect is to increase the potential leverage of investments in needed DME. CMS can continue to use competitive bidding to try and squeeze more costs out of the DME system or it can take a different approach.

Falls, COPD and obstructive sleep apnea are major financial burdens on Medicare, burdens that grow annually as the Medicare population increases and hospital and medical care costs continue to skyrocket. Because it has so vigorously concentrated its efforts on equipment cost cutting, CMS has spent a decade focused on the wrong prize. CMS needs to refocus on cutting the massive costs it now spends treating the illnesses and injuries that result from beneficiaries not having

the right DME. And equipment spending alone is not the complete solution. CMS needs develop more aggressive and comprehensive screening, diagnosis and treatment tools and programs and increase awareness and adjust financial incentives for providers to use those programs to drive down spending on illness and injury.

The leverage of one dollar of DME investment had never been higher. Today, each dollar can create $39.54 in avoided spending on fall injuries; $23.84 in avoided spending on treating COPD; and $21.37 in avoided spending on treating OSA. On an individual basis, these savings are significant. Overall, they provide an opportunity for CMS to save billions.

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[33] All inflation adjustments in this study are made using data on actual and estimated annual growth in per capita Medicare spending for the period from 2014-2020 reported by the Henry J. Kaiser Family Foundation, Cubanski et al, *The Facts on Medicare Spending and Financing* (2019). https://www.kff.org/medicare/issue-brief/the-facts-on-medicare-spending-and-financing/

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[35] Effectiveness was calculated using data from the FREE Foundation, Roanoke Virginia. The Foundation has been tracking effectiveness of providing proper DME to those in need for the past decade. Their data show that having the proper DME results in a rate of ~92.6% reduction in fall injuries, ER visits and hospitalizations (5 year average, 2015-2019), https://660e17be-556a-4b0c-bc78-c415615483b5.filesusr.com/ugd/400e22_f28c068407934fb4a7c072205d73ec6f.pdf

[36] National Lung Health Education Program (2021). https://nlhep.org/?page_id=28

[37] CDC, *Chronic Obstructive Pulmonary Disease (COPD) – COPD Costs* (2020). **********.cdc.gov/copd/infographics/copd-costs.html

[38] National Heart, Lung and Blood Institute, *COPD*. https://www.nhlbi.nih.gov/health-topics/copd

[39] Statista, *Percentage of those diagnosed with chronic obstructive pulmonary disease (COPD) in the U.S. who experienced select other conditions as of 2019*, https://www.statista.com/statistics/863289/comorbidities-chronic-obstructive-pulmonary-disease-us/

[40] See Note 18.

[41] Katsenos et al, *Long-Term Oxygen Therapy in COPD: Factors Affecting and Ways of Improving Patient Compliance*, *Pulmonary Medicine*, vol. 2011, Article ID 325362 (2011), **********.hindawi.com/journals/pm/2011/325362/

[42] COPD exacerbations, or flare-ups, occurs when COPD respiratory symptoms become much more severe. The most common signs and symptoms of an oncoming exacerbation are increased coughing, wheezing, or shortness of breath; changes in the color, thickness, or amount of mucus; feeling tired for more than one day; swelling of the legs or ankles; increased difficulty sleeping; and an increased need for oxygen, typically indicated by lower blood oxygen level readings. Extreme signs include severe shortness of breath or chest pain; blue color in lips or fingers; and confusion, disorientation, or difficulty speaking in full sentences. COPD Step By Step, *Understanding COPD Exacerbations* (2021). https://www.copd.com/copd-progression/copd-exacerbations/

[43] HealthLinkBC, *Oxygen Treatment for Chronic Obstructive Pulmonary Disease (COPD)* (2020). **********.healthlinkbc.ca/health-topics/ug2661

[44] Le et al, *PRS11 HEALTHCARE RESOURCE UTILIZATION AND COSTS IN OLDER COPD PATIENTS WITH AND WITHOUT FREQUENT EXACERBATIONS*, ISPOR Value in Health, VOLUME 23, SUPPLEMENT 1, S350, MAY 01, 2020. **********.valueinhealthjournal.com/article/S1098-3015(20)31524-2/fulltext#relatedArticles

The results of Le et al align with data from *Does long-term oxygen therapy reduce hospitalisation in hypoxaemic chronic obstructive pulmonary disease?*, European Respiratory Journal, 20: 38-42, 2002, *******erj.ersjournals.com/content/20/1/38.full.pdf+html and *Cost-Effectiveness of Homecare*, American Association of Homecare (2017), **********.aahomecare.org/news/post/cost-effectiveness-of-homecare, adjusted upward to account for higher reported outcomes in Chakravorty et al, *ISRN Pulmonology*. Volume 2011 (2011), Article ID 364989 **********.hindawi.com/journals/isrn/2011/364989/, as discussed in Leitten, How America Can Cut Waste, Save *Billions and Improve Healthcare* (2017), http://leitten.com/medicare-cost-studies/.

[45] Author's estimate based on compilation of oxygen therapy equipment, accessories and supplies-related HCPCS E and K code 2019 spending, adjusted for 2020 dollars.

[46] Nishi et al, *Oxygen Therapy Use in Older Adults with Chronic Obstructive Pulmonary Disease*, PLoS One. 2015; 10(3): e0120684. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4364693/

[47] Author's estimate of approximately 790,000 based on compilation of oxygen therapy equipment, accessories and supplies-related HCPCS E and K code 2019 spending, adjusted for 2020 dollars.

[48] Le et al, *PRS11 HEALTHCARE RESOURCE UTILIZATION AND COSTS IN OLDER COPD PATIENTS WITH AND WITHOUT FREQUENT EXACERBATIONS*, ISPOR Value in Health, VOLUME 23, SUPPLEMENT 1, S350, MAY 01, 2020. **********.valueinhealthjournal.com/article/S1098-3015(20)31524-2/fulltext#relatedArticles

[49] Id.

[50] Frost & Sullivan, *Hidden Health Crisis Costing America Billions* (2016). https://aasm.org/resources/pdf/sleep-apnea-patient-experience.pdf

[51] Wakefield, *9 Sleep Apnea Statistics You Should Know in 2021***,** (2021). https://www.cpap.com/blog/sleep-apnea-statistics/

[52] Author's estimate based on compilation of CPAP and sleep study-related HCPCS A, E and G code 2019 spending, adjusted for 2020 dollars.

[53] Wickwire et al, *Older adult US Medicare beneficiaries with untreated obstructive sleep apnea are heavier users of health care than matched control patients*, Journal of Clinical Sleep Medicine, Volume 16, Issue 1 (2020). ********jcsm.aasm.org/doi/full/10.5664/jcsm.8128