The Case for Medicare Investment in DME

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It turns out Benjamin Franklin was absolutely right: an ounce of prevention is worth a pound of cure. Paying for DME for beneficiaries saves Medicare much more than the actual payments it makes for the equipment. DME dramatically reduces the impact of injuries and other serious medical conditions that would result if the DME was not provided. This reduces the amount Medicare would otherwise have to pay to treat those conditions.

Summary. Over the past twenty-plus years, The Centers for Medicare & Medicaid Services (CMS) of the U.S. Department of Health & Human Services (HHS) have treated payments for durable medical equipment as a cost burden to be watched over and continually reduced or eliminated. These payments, which comprise 1.4% of overall Medicare spending[1], have been periodically driven downward. Currently, the CMS are working to implement a "competitive bidding" program for DMEPOS (Durable Medical Equipment; Prosthetics, Orthotics; and Supplies) that is projected by CMS to reduce spending on DME by an additional 32%[2].

Rather than simply assume that Medicare spending on DME is a cost burden, this study considered both costs of and benefits (i.e., cost avoidance) derived from providing DME to Medicare beneficiaries. Looking at three major categories of DME [mobility equipment, oxygen [O_2] and continuous positive airway pressure [CPAP], the study identified cost avoidance that results from providing equipment and compared that savings to the direct cost of providing the equipment. While focusing on costs borne directly by Medicare, the study also considered spending by Medicare beneficiaries and their private insurers where Medicare spending provides a direct cost savings to the overall U.S. healthcare system.

Falls are the leading cause of nonfatal medically attended injuries in the United States and injuries caused by falls are more prevalent among adults aged 65 years and over.[3] When Medicare pays for the mobility DME to Medicare beneficiaries, falls are reduced and significant net spending savings are realized. *Fall avoidance* leads directly to cost *avoidance*. When a fall is avoided, direct Medicare spending for emergency room visits, hospital stays, ambulance transport, rehabilitation and long term care is avoided. The study shows that:

- **For every dollar that Medicare currently spends providing mobility DME, Medicare actually avoids spending an additional $10.73 (i.e., a 1073% rate of return) over a five-year equipment life period for fall-related emergency room visits, hospital stays, ambulance transport, rehabilitation and long term care that would result without that equipment**.

- **The breakeven period based on the first year's return alone is 5.4 months, which suggests that Medicare can self-fund the cost of additional investments in mobility DME during year one of any program out of the direct cost savings from providing the equipment.**

- **Every dollar that Medicare now spends providing mobility DME results in an additional minimum cost savings to Medicare beneficiaries and their private insurers over five years of $3.49, for a total five-year cost avoidance savings of $14.22.**

- **Beyond these direct costs, studies have shown that additional indirect or economic costs (the value of lost wages and labor productivity) for the 65 and older category add another 20% to the total cost of falls.**

COPD is the 4th leading cause of death in the United States. Supplemental oxygen therapy is used to treat individuals who have difficulty breathing as a result of COPD. When Medicare pays for supplemental oxygen therapy, the cost of treating medical complications created by COPD drops dramatically and significant net spending savings are realized. The study shows that:

- **For every dollar that Medicare pays to provide supplemental oxygen therapy, Medicare avoids spending between $5.79 and $6.07 (i.e., a rate of return of 600%) for treatment of COPD-caused medical complications in that year that would result if the oxygen therapy was not provided**.[4]

- **The breakeven period for this return, since all of return is realized in the first year, is 2.1 months, which suggests that Medicare can self-fund the cost of additional payments for supplemental oxygen therapy during year one of any program out of the direct cost savings from providing oxygen therapy to those who medically qualify.**

- **Every dollar that Medicare now pays to provide supplemental oxygen therapy results in an additional minimum cost savings to Medicare beneficiaries and their private insurers in the first year of $0.79 - $0.82, for a total cost one-year avoidance savings of between $6.58 and $6.89.**

Obstructive Sleep Apnea (OSA) occurs in 70% of men over 65 and 56% of women over 65.[5] OSA is also a contributing factor in coronary artery disease, congestive heart failure, atrial fibrillation, stroke and other serious medical conditions. Continuous positive airway pressure (CPAP) therapy is used to treat individuals who have breathing interruptions and sleep disruptions as a result of OSA. CPAP therapy also results in a significant decrease in medical costs related to treatment of coronary artery disease, congestive heart failure, atrial fibrillation and stroke. When Medicare pays for CPAP therapy, the cost of treating medical complications created by OSA in these conditions drops dramatically and significant net spending savings are realized. The study shows that:

- **For every dollar that Medicare pays to provide CPAP therapy, Medicare avoids spending a minimum of $6.21 (i.e., a rate of return of 621%) for treatment of OSA-caused medical complications in that year that would result if the CPAP therapy was not provided**.
- **The breakeven period for this return is 1.9 months, which suggests that Medicare can self-fund the cost of additional payments for CPAP therapy during year one of any program out of the direct cost savings from providing CPAP therapy to those who medically qualify.**
- **Every dollar that Medicare now pays to provide CPAP therapy results in an additional minimum cost savings to Medicare beneficiaries and their private insurers in the first year of $1.27, for a total annual cost avoidance savings of $7.49.**

Introduction. The CMS have historically been pressured to cut the cost of providing durable medical equipment (DME) to Medicare beneficiaries. The Government Accountability Office (GAO) and HHS's Office of Inspector General (OIG) have regularly applied pressure on CMS for decades to manage reimbursements and lower overall costs. When GAO recommends a cost reduction initiative, it typically promotes the cost savings that will be realized by Medicare beneficiaries, rationalizing that their 20% co-pays will be reduced as part of the initiative.[6] With the continual focus on the **cost** of providing essential DME to those in need and at risk in the Medicare population, the value of providing DME and the cost **benefit** that results is typically overlooked, ignored or not adequately considered.
This study analyzed three areas of DME that constitute a significant portion of Medicare spending in this overall category – mobility equipment (e.g., wheelchairs, walkers and power chairs); oxygen [O_2] therapy; and continuous positive airway pressure [CPAP] therapy. For each area, a model was developed to analyze annual Medicare spending and to project the annual spending savings benefit that results from providing equipment and supplies. This savings also applies to any future investments to provide more DME equipment to those Medicare beneficiaries at risk in the analyzed areas.

Mobility Equipment

Overview. When a Medicare beneficiary falls, a resulting chain of events is triggered. This chain can include numerous links which are both (a) medical treatment events and (b) Medicare spending events. Approximately one-third of all Medicare beneficiaries fall at least once each year, and at least 10% of those falls result in serious injuries requiring treatment by a doctor, clinic or emergency room [ER]. ER visits for Medicare beneficiary falls are quickly approaching 2,000,000 annually. Medicare pays for these treatments.

Over 20% of those who visit the ER for a fall are admitted for a hospital stay. After a set deductible, Medicare pays for these stays. The average stay for a Medicare fall patient is 5.1 days, at a Medicare cost of over $25,000. A significant portion of those patients are transported to the ER/hospital by a Medicare-funded ambulance. Medicare pays 80%. Almost half (45.5%) of these fall patients also see a doctor or visit a clinic before going to the ER, see their personal doctor while in the ER or once admitted, or see a doctor or go to a clinic to address their fall injuries in lieu of an ER visit. Medicare pays 80%.

Over half (55.6%) of those admitted to a hospital are discharged to a rehabilitation facility or skilled nursing facility for recovery and transported there by Medicare-funded ambulance. Medicare pays for twenty days of rehab. Approximately one in five Medicare beneficiaries hospitalized for a fall requires a stay in a nursing home/skilled nursing facility to recover from the fall injuries and be able to return home. After the first twenty days, Medicare pays for 80% of the next 80 days' stay. After 100 days, Medicare beneficiaries and their insurers pay. Every step along the path to recovery, Medicare pays, through Parts A and B. For 2011, Medicare will pay a projected $20.5 Billion.

Discussion. Numerous studies have been conducted over the years attempting to assess elements of the cost matrix of falls and to analyze attempts to reduce falls. To date, there is no single source document that comprehensively lays out the cost analysis of Medicare falls and the impact of DME on fall costs. To accomplish this, one must construct a model that incorporates information from a large number of disparate data points, studies, surveys and research that span over two decades.

All portions of the study incorporate data from a wide variety of sources. Our research focused on identifying the most reliable data available. In many cases, the most relevant data was not the most current. Commonly available Consumer Price Index [CPI] data (published by the Federal Reserve Bank of Minneapolis)[7] and Census Bureau population data and projections were employed to adjust data to a common year for analysis. When multiple data sources were available, the author used all available information and best analytical judgment to select the data source to be used. On a few occasions (e.g., percent of patients transported by ambulance), no identifiable data was uncovered. In these instances, the author has used estimates expected to conservatively understate outcomes. This approach is purposeful and is intended to obtain overall results that are supportable and conservative in nature and not skewed toward any particular conclusion.

The model described here does not attempt to incorporate every cost associated with Medicare beneficiary falls. Such a model would be an interesting exercise in frustration designed to quantify cost numbers to extreme levels not particularly useful in addressing the important issues – **do Medicare's payments for mobility DME make sense financially and what is the order of magnitude of any overall cost savings that results?**

The model includes key direct cost estimates for the major Medicare cost elements of the fall-triggered chain of events: emergency room visits; hospital admissions; ambulance service; doctor and clinic visits; rehabilitation following hospital discharge; and stays in long-term nursing facilities required to reacquire mobility and be able to go back home. For each element, it calculates the estimated annual Medicare payments based on available data on number of falls and the resulting use of facilities. After calculating the Medicare payments, the model also considers fall-related costs that will need to be paid for by co-pays, deductibles and non-covered expenses. These costs are typically borne directly by Medicare beneficiaries or by a secondary insurer. They are none the less real costs that add to the burden on the U.S. healthcare system and are costs that would be avoided simultaneously with any Medicare payment savings achieved.

The model, which is explained and described in greater detail in the *Mobility Equipment Model* section, calculates an annual Total Medicare Payments for Falls (MP_{Falls}). MP_{Falls} comprises the payments for ER visits and the cascading care spending that result, including Medicare spending on hospital admissions, doctor/clinic visits, ambulance trips, rehabilitation facility admissions and long term skilled nursing facility stays:

Total Medicare Payments for Falls (MP_{Falls})= Σ (Medicare ER Payments + Medicare Hospital Admission Payments + Medicare Ambulance Payments + Medicare Doctor/Clinic Visits + Medicare Rehab Payments + Medicare Long Term Care Payments); or

$$MP_{Falls} = \Sigma\ (E_{Falls}*P_E) + H_{Falls}*(P_H-D_H) + DC_{Falls}*P_{DC}*(1-CP) + ((A_{Falls}*P_A)+(A_{Falls}*M_A*P_M))*(1-CP) + (R_{Falls}*P_R*LOS_R) + (LT_{Falls}*P_{LT}*LOS_{LT}*(1-CP)$$

Dividing MP_{Falls} by the number of falls yields an average overall payment by Medicare for each Medicare patient fall. Based on available data estimating the number of falls avoided by providing DME mobility equipment and on a projected average useful life for the DME provided, the model calculates the Medicare Falls Payments Avoided ($MPAvoided_{Falls}$) over the equipment life:

$$MPAvoided_{Falls} = \sum_{n=1}^{n} (MP_{Falls}/F)*((DME*FPY*\%FR)*(1-FRF)^{n-1})$$

Comparing this number to the total cost of the equipment provided, a ratio of Medicare Payment Savings (MPS_{Falls}) per dollar invested in medical mobility equipment is derived:

$$MPS_{Falls}\ Ratio = MPAvoided_{Falls}/(DME*P_{DME})$$

Simply stated, this ratio shows the number of dollars saved by Medicare each time it invests $1 on providing mobility DME to Medicare beneficiaries.

Finally, a second ratio is calculated to project to the overall Healthcare System Payment Savings ($HSPS_{Falls}$) saved by every Medicare dollar invested in medical mobility equipment:

$$HSPS_{Falls}\ Ratio = (MPAvoided_{Falls} + Addbacks)/(DME*P_{DME})$$

This ratio adds back the co-pays, deductibles and the long term cost for recovery in skilled nursing facilities that is not paid for by Medicare (i.e., the cost of stays past day 100 for those Medicare patients who require an extended stay in a skilled nursing facility to recover from the fall injuries and be able to return home). These are all real, direct costs paid by Medicare beneficiaries and their insurers.

Mobility Equipment Model. The model to calculate the Total Medicare Falls Payments (MP_{Falls}) for mobility equipment consists of six elements, identified in the model equation:

$$MP_{Falls} = \Sigma\ \underset{①}{(E_{Falls}*P_E)} + \underset{②}{H_{Falls}*(P_H-D_H)} + \underset{③}{DC_{Falls}*P_{DC}*(1-CP)} + \underset{④}{((A_{Falls}*P_A)+(A_{Falls}*M_A*P_M))*(1-CP)} + \underset{⑤}{(R_{Falls}*P_R*LOS_R)} + \underset{⑥}{(LT_{Falls}*P_{LT}*LOS_{LT}*(1-CP)}$$

① This element calculates Medicare-funded emergency room payments. E_{Falls} represents the number of fall-related Medicare emergency room visits projected for 2011.[8] P_E represents the average emergency room charge paid by Medicare.[9]

② This element calculates Medicare payments for hospital stays. H_{Falls} represents the number of Medicare fall-caused hospital stays projected for 2011.[10] (P_H-D_H) represents the average Medicare payment for a typical stay for a 65+ fall patient less the Medicare deductible.[11,12]

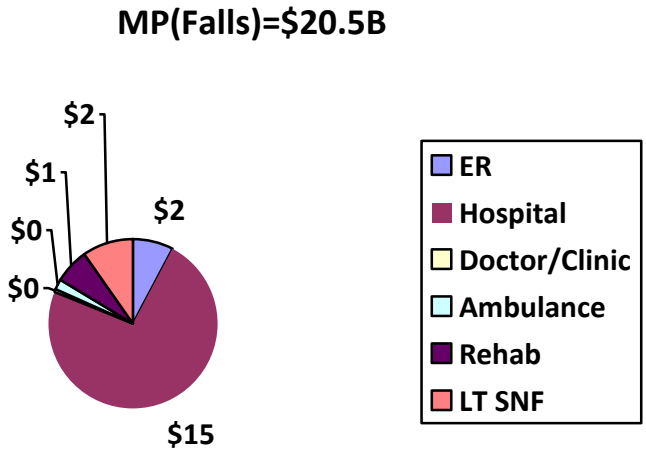
③ This element calculates Medicare payments for doctor/clinic fall-caused visits. DC_{Falls} represents the number of Medicare fall-caused doctor and clinic visits, calculated by multiplying E_{Falls} by the percent of Medicare fall patients who visit a doctor after a fall injury.[13] P_{DC} represents the average Medicare payment for a doctor visit[14], which is used as the surrogate for both doctor and clinic visits. CP represents the 20% copay cost for doctor/clinic visits.

④ This element calculates Medicare payments for ambulance services and associated mileage. A_{Falls} represents the number of ambulance trips initiated or required as a result of a fall.[15] P_A represents the average Medicare charge for an ambulance trip.[16] Medicare payment for ambulance mileage charges is calculated by multiplying A_{Falls} times the average ambulance Medicare per mile payment P_M[17] times the average number of miles for an ambulance trip M_A[18]. The 20% ambulance copay CP is then deducted.

⑤ This element calculates Medicare payments for patients discharged to rehabilitation centers after hospitalization. R_{Falls} represents the number of Medicare fall patients discharged to rehab facilities.[19] P_R represents the average Medicare payment per day[20] for a rehab stay and LOS_R represents the expected length of stay in the facility, which is assumed to be the 20-day limit imposed by Medicare.

⑥ This element calculates Medicare payments for stays in long-term care facilities to complete recovery. For a portion of patients who complete initial rehab, additional long-term treatment in a skilled nursing facility is mandated. LT_{Falls} represents the number of Medicare fall patients who are sent to long-term care for additional therapy and recovery.[21] P_{LT} represents the average daily Medicare payment for care.[22] LOS_{LT} represents the expected length of stay in the facility, which is assumed to be the 80-day limit imposed by Medicare. Patients discharged from long-term care have an average stay of 272 days.[23] CP represents the 20% long-term care copay.

For 2011, the Total Medicare Payments for Falls are projected to be $20.5 Billion.[24] This total comprises $1.6B in ER visit payments; $15.1B in Hospital payments; $101M in Doctor/clinic payments; $353M in Ambulance payments; $1.4B in Rehab payments; and $2.0B in Long-Term Skilled Nursing Facility payments.



Having calculated Total Medicare Payments for Falls, the model now determines the Medicare Falls Payments Avoided ($MPAvoided_{Falls}$) comprising two elements:

$$MPAvoided_{Falls} = \sum_{n=1}^{n} (MP_{Falls}/F)*((DME*FPY*\%FR)*(1-FRF)^{n-1})$$

① The Total Medicare Falls Payments per fall.

② The number of falls avoided by providing medical mobility equipment, calculated by multiplying the total number of wheelchairs, power chairs and walkers provided by Medicare (*DME*)[25] times the average number of falls per year (*FPY*)[26] times the percentage of fall reduction (*%FR*)[27] times a fall reduction factor (*1-FRF*)[28] that accounts for decreased utilization of equipment in years 2-n.

For 2011, it is projected that the 1.3 Million pieces of medical mobility equipment (wheelchairs; power chairs and walkers) paid for by Medicare will result in Medicare Falls Payments Avoided of $9.3 Billion during the five year useful life of the equipment, from 2011-2015. The yearly savings is projected as:

2011	$1.92 Billion
2012	$1.89 Billion
2013	$1.86 Billion
2014	$1.82 Billion
2015	$1.79 Billion
2011-15	$9.3 Billion

2011 savings alone translate to a 5.4 month payback period on the investment in medical mobility equipment, indicating that Medicare spending on medical mobility equipment can essentially be self-funded in Year 1. The breakeven period is calculated by dividing the first year's savings by the amount Medicare pays for the equipment (2.22) and then dividing that number into 12 (months in a year).

The ratio of Medicare Payment Savings (MPS_{Falls}) per dollar invested in medical mobility equipment is then calculated by dividing the value of Medicare Falls Payments Avoided ($MPAvoided_{Falls}$) over the five-year life of the equipment by the total Medicare cost of the equipment provided.

①

$$MPS_{Falls}\ Ratio = MPAvoided_{Falls} / (DME * P_{DME})$$

① That cost is calculated by multiplying the total number of pieces of medical mobility equipment provided by Medicare (*DME*) by the Medicare payments for that equipment P_{DME}.

For 2011, the projected Medicare spending for that equipment is $863 Million, yielding a *Medicare Payment Savings Ratio for Falls* of 10.73. **This represents a direct spending savings to Medicare over five years of $10.73 for every dollar that Medicare spends for medical mobility equipment.**

Finally, the ratio of overall Healthcare System Payment Savings ($HSPS_{Falls}$) per Medicare dollar paid for medical mobility equipment is calculated by dividing the value of Medicare Falls Payments Avoided ($MPAvoided_{Falls}$) plus Addbacks by the total Medicare cost of the equipment provided.

①

$$HSPS_{Falls}\ Ratio = (MPAvoided_{Falls} + Addbacks)/(DME * P_{DME})$$

① The value of Medicare Falls Spending Avoided ($MPAvoided_{Falls}$) plus Addbacks representing co-pays, deductibles and long-term care costs not covered by Medicare that are paid by Medicare beneficiaries and private insurers are all divided by the total Medicare cost of the equipment provided.

For 2011, the projected overall Healthcare System Payment Savings per Medicare dollar paid for medical mobility equipment is over the five-year equipment life is 14.22, an incremental 3.29 from the MPS_{Falls}. **This represents a direct cost savings to the overall U.S. healthcare system over five years of an additional $3.29, for a total five-year savings of $14.22 for every dollar that Medicare spends on medical mobility equipment.**

While this report focuses on direct spending to identify the potential cost avoidance for Medicare and the overall U.S. healthcare system, it is worth noting that analysts concerned with spending and cost savings will also look at indirect or economic costs (the value of lost wages and labor productivity) when attempting to assess the total costs of falls. The report most referenced in the literature on economic costs for falls suggests that economic costs add another 20% to the total cost of falls for the 65 and older age group.[29]

Oxygen Therapy

Overview. Chronic Obstructive Pulmonary Disease (COPD) is the 4th leading cause of death in the United States.[30] COPD refers to two chronic lung diseases, chronic bronchitis and emphysema. Only heart disease, cancer and stroke take more lives each year. COPD is projected to surpass stroke and take over the #3 position by 2020.[31] The direct cost of treating medical complications caused by COPD in the U.S. in 2010 was estimated at $29.5 Billion.[32] This includes costs for emergency room and hospital treatments, prescription drugs, doctor and clinic visits, and home health and nursing home care. Medicare payments comprise just under 60% of this total, approximately $17 Billion.[33]

Supplemental oxygen therapy helps individuals who have difficulty breathing as a result of COPD. Often quoted research estimates that providing supplemental oxygen therapy to COPD patients with chronic hypoxemia (low blood oxygen) reduces hospital stays by 43.5%.[34] Medicare pays for supplemental oxygen therapy for just over one million beneficiaries annually who suffer from COPD with chronic hypoxemia.[35] Taking into account the percentage of Medicare beneficiaries who receive both stationary and portable equipment to deliver oxygen therapy and the percentage who receive oxygen therapy beyond the initial 36-month payment period, Medicare pays on average approximately $133.49 per month overall to provide supplemental oxygen therapy to a beneficiary, for a total Medicare annual payment of $2.15 Billion.[36]

Discussion. The model described here does not attempt to incorporate every cost associated with treating Medicare beneficiaries for COPD. It does address the important issues – **do Medicare's payments for supplemental oxygen therapy make sense financially and what is the order of magnitude of any overall cost savings that results?**

The model includes key direct cost estimates for the major Medicare cost elements of treating COPD: emergency room visits; hospital admissions; ambulance service; doctor and clinic visits; prescription medicines; home care; and rehabilitation following hospital discharge. The model calculates the overall estimated payments by Medicare for treatment of COPD exacerbations. The model then calculates the cost impact of providing supplemental oxygen therapy. If a beneficiary is already receiving supplemental oxygen therapy, the model calculates the increased payments that Medicare would have had to make if the beneficiary was not. If a beneficiary is not receiving supplemental oxygen therapy, then the model calculates the decreased Medicare payments that would have resulted if the beneficiary was receiving supplemental oxygen therapy.

The model also considers supplemental oxygen therapy costs that will need to be paid for by co-pays, deductibles and non-covered expenses. These costs are typically borne by directly by Medicare beneficiaries or by a secondary insurer. They are none the less real costs that add to the burden on the U.S. healthcare system and are costs that would be avoided simultaneously with any Medicare cost savings achieved.

The model, which is explained and described in greater detail in the *Supplemental Oxygen Therapy Model* section, calculates annual Total Medicare Payments for COPD Treatment (MP_{COPD}). MP_{COPD}

comprises the payments for ER visits, hospital admissions, doctor/clinic visits, ambulance trips, prescription medications, rehabilitation facility admissions and homecare:

Total Medicare Payments for COPD Treatment (MP_{COPD}*) = Σ (Medicare Hospital/ER Payments + Medicare Ambulance Payments + Medicare Doctor/Clinic Visits + Medicare Prescription Medication Payments +Medicare Rehab Payments + Medicare Homecare Payments); or*

$$MP_{COPD} = \Sigma\ (\underline{ER}_{COPD} + \underline{HOSP}_{COPD}) + \underline{DOC}_{COPD} + \underline{((A_{COPD}*P_A)+(A_{COPD}*M_A*P_M))*(1\text{-}CP)} + PM_{COPD} + \underline{(R_{COPD}*P_R*LOS_R)} + \underline{HC}_{COPD}$$

The model looks at the number of Medicare beneficiaries who are annually admitted to a hospital for COPD exacerbations, i.e., the Medicare population that generates the bulk of annual Medicare expenditures. To create a range of savings to Medicare payments ratios, the model assumes two cases, (1) that all hospital admissions are beneficiaries who are not receiving oxygen therapy at the time of admission; and (2) that all admissions are beneficiaries who are receiving oxygen therapy at the time of admission. This brackets the range of possible scenarios and while neither extreme correct, the actual case will lie somewhere in between.

For Case 1, the incremental cost of COPD treatment for beneficiaries not receiving supplemental oxygen therapy is calculated and compared to the cost of providing those beneficiaries with oxygen therapy, creating a Medicare Payment Savings ratio (MPS_{COPD}):

$$MPS_{COPD}\ Ratio\ (Case\ 1) = MPIncremental_{COPD}/MPIncremental_{O2}$$

For Case 2, the total payments that were avoided by providing the beneficiaries with COPD treatment is calculated and compared to current cost of providing oxygen therapy, creating a second Medicare Payment Savings ratio (MPS_{COPD}):

$$MPS_{COPD}\ Ratio\ (Case\ 2) = MPAvoided_{COPD}/MPCurrent_{O2}$$

Simply stated, these ratios show the number of dollars saved by Medicare each time it pays $1 to provide supplemental oxygen therapy to Medicare recipients.

Finally, a second ratio is calculated to project to the overall Healthcare System Payment Savings ($HSPS_{COPD}$) saved by every Medicare dollar paid to provide supplemental oxygen therapy:

$$HSPS_{COPD}\ Ratio = MPS_{COPD}\ Ratio + Addbacks\ Ratio$$

This ratio adds back the co-pays and deductibles that are direct costs paid by Medicare beneficiaries and their insurers.

Supplemental Oxygen Therapy Model. The model to calculate the Total Medicare Payments for COPD Treatment (MP_{COPD}) consists of six elements, identified in the model equation:

$$MP_{COPD} = \Sigma\ (\underset{①}{ER_{COPD}} + \underset{①}{HOSP_{COPD}}) + \underset{②}{DC_{COPD}} + \underset{③}{((A_{COPD}*P_A)+(A_{COPD}*M_A*P_M))*(1-CP)} + \underset{④}{PM_{COPD}} + \underset{⑤}{(R_{COPD}*P_R*LOS_R)} + \underset{⑥}{HC_{COPD}}$$

① This element calculates Medicare-funded COPD-related emergency room and hospital payments.

② This element calculates Medicare payments for doctor/clinic COPD-related visits.

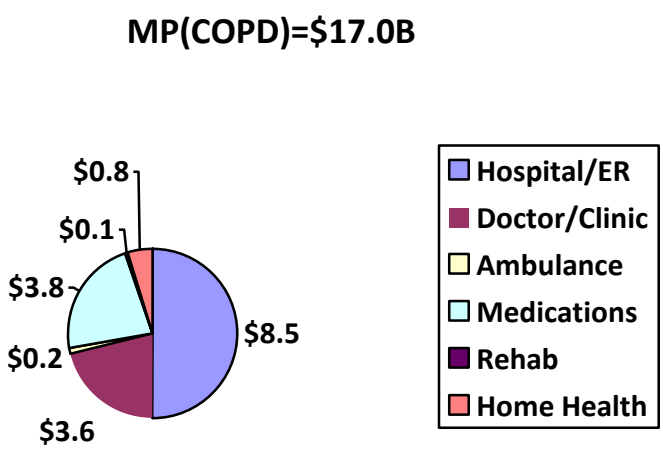
③ This element calculates Medicare payments for ambulance services and associated mileage. A_{COPD} represents the number of COPD-related ambulance trips.[37] P_A represents the average Medicare charge for an ambulance trip.[38] Medicare payment for ambulance mileage charges is calculated by multiplying A_{COPD} times the average ambulance Medicare per mile payment P_M[39] times the average number of miles for an ambulance trip M_A[40]. The 20% ambulance copay CP is then deducted.

④ This element calculates Medicare payments prescription medicines for COPD treatment.

⑤ This element calculates Medicare payments for patients discharged to rehabilitation centers after hospitalization. R_{COPD} represents the number of Medicare COPD patients discharged to rehab facilities.[41] P_R represents the average Medicare payment per day[42] for a rehab stay and LOS_R represents the expected length of stay in the facility, which is assumed to be the 20-day limit imposed by Medicare.

⑥ This element calculates Medicare payments for COPD-related homecare.

For 2010, the Total Medicare Payments for COPD are projected to be $17.0 Billion. This total comprises $8.5B in Hospital/ER payments; $3.6B in Doctor/clinic payments; $165M in Ambulance payments; $92M in Rehab payments; $3.8B in prescription medicine payments; and $842M in Home Care payments.



Having calculated Total Medicare Payments for COPD, the model now determines a range of 'Savings to Medicare payments' ratios. The model assumes the two cases referenced above: (1) that all hospital admissions are beneficiaries who are not receiving oxygen therapy at the time of admission; and (2) that all admissions are beneficiaries who are receiving oxygen therapy at the time of admission.

For Case 1, the incremental cost of oxygen therapy for beneficiaries not receiving supplemental oxygen therapy is calculated and compared to the cost of providing those beneficiaries with oxygen therapy, creating a Medicare Payment Savings ratio (MPS_{COPD}):

MPS_{COPD} *Ratio (Case 1)* $= MPIncremental_{COPD}/MPIncremental_{O2} = 5.79$

For Case 2, the total payments that were avoided by providing the beneficiaries with supplemental oxygen therapy is calculated and compared to current cost of providing oxygen therapy, creating a second Medicare Payment Savings ratio (MPS_{COPD}):

MPS_{COPD} *Ratio (Case 2)* $= MPAvoided_{COPD}/MPCurrent_{O2} = 6.07$

Simply stated, these ratios show the number of dollars saved by Medicare annually each time it pays $1 to provide supplemental oxygen therapy to Medicare beneficiaries. **This represents an annual direct spending savings to Medicare of between $5.79 and $6.07 for every dollar that Medicare pays for supplemental oxygen therapy.**

Finally, a second ratio is calculated to project to the overall Healthcare System Payment Savings ($HSPS_{COPD}$) saved by every Medicare dollar paid for supplemental oxygen therapy:

$HSPS_{COPD}$ *Ratio* $= MPS_{COPD}$ *Ratio + Addbacks Ratio = 6.58 (Case 1)-6.89 (Case 2)*

This ratio adds back the co-pays and deductibles that are direct costs paid by Medicare beneficiaries and their insurers. **This represents an annual direct cost savings to the overall U.S. healthcare system of an additional $0.79 – $0.82, for a total savings of between $6.58 and $6.89 for every dollar that Medicare pays for supplemental oxygen therapy.**

These savings translate to a 2.1 month payback period on the payments for supplemental oxygen therapy, indicating that Medicare spending on oxygen therapy can essentially be self-funded in Year 1. The breakeven period is calculated by dividing the annual savings by the amount Medicare pays for the equipment (5.79) and then dividing that number into 12 (months in a year).

While this report focuses on direct spending to identify the potential cost avoidance for Medicare and the overall U.S. healthcare system, it is worth noting that analysts concerned with spending and cost savings will also look at indirect or economic costs (the value of lost wages and labor productivity) when attempting to assess the total costs of COPD. The report most referenced in the literature on economic costs for COPD suggests that economic costs for the entire U.S. population add another 69% to the total cost of COPD.[43]

CPAP Therapy

Overview. Since Obstructive Sleep Apnea (OSA) was first defined just over forty years ago, there has been a substantial increase in the healthcare costs related to diagnosis and treatment of breathing disorders during sleep. Unlike many other conditions, emergency room visits and hospital admissions and other significant medical cost events are typically not attributed directly to OSA. In fact, over 85% of patients with clinically significant and treatable OSA may not yet have been diagnosed. The referral populations of OSA patients may represent the 'tip of the iceberg' of OSA prevalence and the understanding of the true cost of OSA.[44]

OSA is, however, a contributing factor to major, serious medical conditions including coronary artery disease, congestive heart failure, atrial fibrillation and stroke.[45] Coronary artery disease, congestive heart failure, atrial fibrillation and stroke patients who also have OSA incur dramatically higher medical costs, including costs for emergency room and hospital treatments, doctor and clinic visits, prescription drugs and home health and nursing home care.[46] Medicare pays an estimated $41 Billion annually to treat these medical conditions alone.[47] Medicare payments due to medical complications of OSA for these conditions are estimated to be $10.8 Billion.[48]

Medicare pays for CPAP therapy for just over six hundred thousand beneficiaries annually who suffer from OSA.[49] Total Medicare annual payment for CPAP therapy is estimated to be $536 Million.[50]

Discussion. The model described here does not attempt to incorporate every cost associated with treating Medicare beneficiaries for OSA. It does address the important issues – **do Medicare's payments for supplemental CPAP therapy make sense financially and what is the order of magnitude of any overall cost savings that results?**

The model includes key direct Medicare payment estimates of treating conditions that involve OSA as a contributing factor: emergency room visits; hospital admissions; ambulance service; doctor and clinic visits; prescription medicines; home care; and rehabilitation following hospital discharge. The model calculates the overall estimated payments by Medicare for treatment of OSA exacerbations of these conditions. While OSA certainly contributes to other significant medical conditions including hypertension, obesity and Type 2 Diabetes[51], this report focuses on the four conditions referenced above, where data sources for spending and payments are reasonably available.

The model then calculates the cost impact of providing CPAP therapy. Since the literature strongly suggests that there is an extremely high percentage of individuals in the United States with undiagnosed OSA[52], the model assumes for the purposes of calculating cost savings and payback periods that those being treated for the four medical conditions to which OSA is a significant contributor are not already on CPAP therapy. This is a conservative assumption that results in the minimum projected savings numbers.

The model also considers CPAP therapy costs that will need to be paid for by co-pays, deductibles and non-covered expenses. These costs are typically borne by directly by Medicare beneficiaries or by a secondary insurer. They are none the less real costs that add to the burden on the U.S. healthcare system and are costs that would be avoided simultaneously with any Medicare cost savings achieved.

The model, which is explained and described in greater detail in the *CPAP Therapy Model* section, calculates annual the Total Medicare Payments for OSA related Treatment (MP_{OSA}). MP_{OSA} comprises the payments for hospital admissions, adjusted by a comorbidity factor for OSA for each condition, a multiplier factor for other Medicare medical payment estimates for ER visits, doctor/clinic visits, ambulance trips, prescription medications, rehabilitation facility admissions and homecare, a cost savings factor and a CPAP compliance factor:

Total Medicare Payments for OSA related Treatment (MP_{OSA}*) = Σ (Medicare Hospital Payments for each of the measured conditions* Comorbidity factor*Multiplier factor for that condition for other related medical payments* Cost Savings Factor* CPAP Compliance Factor); or*

$MP_{OSA} = \Sigma (HOSP_{\text{OSA related conditions}} * Comorbidity\ Factor_{OSA} * Multiplying\ factor_{OSA} * Coast\ Savings\ Factor_{OSA} * CPAP\ Compliance\ Factor)$

The model looks at the number of Medicare beneficiaries who are annually admitted to a hospital for the four conditions, i.e., the Medicare population that generates the bulk of annual Medicare expenditures where OSA is a significant contributing factor. To determine Medicare payments for this population, the model adjusts hospital billings to Medicare by a Medicare payments factor[53]. To create a minimum savings estimate to Medicare payments ratio, the model assumes that all hospital admissions are beneficiaries who are not receiving CPAP therapy at the time of admission. While this is certainly not the case, it is a reasonable approximation that yields a low-end, conservative result.

The incremental cost of treating the OSA-related exacerbations for beneficiaries not already receiving therapy is calculated and compared to the cost of providing those beneficiaries with CPAP therapy, creating a Medicare Payment Savings ratio (MPS_{OSA}):

$MPS_{OSA}\ Ratio = MP_{OSA}/MPIncremental_{CPAP}$, where $MPIncremental_{CPAP}$ is calculated by applying the current Medicare average annual payment to provide CPAP equipment to the population hospitalized for the four conditions.

Simply stated, this ratio shows the number of dollars saved by Medicare each time it pays $1 to provide CPAP therapy to Medicare recipients.

Finally, a second ratio is calculated to project to the overall Healthcare System Payment Savings ($HSPS_{OSA}$) saved by every Medicare dollar paid to provide CPAP therapy:

$HSPS_{OSA}\ Ratio = MPS_{OSA}\ Ratio + Addbacks\ Ratio$

This ratio adds back the co-pays and deductibles that are direct costs paid by Medicare beneficiaries and their insurers. It also includes a small, direct cost for automobile accidents attributable to OSA.

CPAP Therapy Model. The model to calculate the Total Medicare Payments for OSA related Treatment (MP_{OSA}) based on available data is identified in the model equation:

$MP_{OSA} = \Sigma (HOSP_{OSA\ related\ conditions} * Comorbidity\ Factor_{OSA} * Multiplying\ factor_{OSA} * Coast\ Savings\ Factor_{OSA} * CPAP\ Compliance\ Factor)$

For the four major medical conditions evaluated in this analysis, the payments and multiplying factors are:

	Medicare Hospital Pmts.	Comorbidity	Total Medicare Pmt. Factor	Cost Saving Factor	CPAP Compliance	Projected Medicare Pmts. Savings
CAD	$10,108,410,000	0.305	2.22	0.6	0.7	$2,874,649,853
CHF	$9,588,150,000	0.25	2.22	0.6	0.7	$2,234,997,765
Stroke	$5,226,780,000	0.6	2.22	0.5	0.7	$2,436,724,836
A Fib	$15,700,000,000[54]	0.49	1.00	0.6	0.7	$3,231,060,000

For 2010, the Total Medicare Payments for OSA related direct costs are projected to be $10.8 Billion.

Having calculated Total Medicare Payments for OSA related costs, the model now determines the minimum projected 'Savings to Medicare payments' ratio. The model assumes that all hospital admissions are beneficiaries who are not receiving CPAP therapy at the time of admission, as discussed above.

$MPIncremental_{CPAP} = MP_{CPAP}/M\ Recipients_{CPAP} * Population\ Treated\ for\ Conditions$[55]

$MPS_{OSA}\ Ratio = MPIncremental_{OSA}/MPIncremental_{CPAP} = 6.21$

Simply stated, this ratio shows the number of dollars saved by Medicare annually each time it pays $1 to provide CPAP therapy to Medicare beneficiaries. **This represents an annual direct spending savings to Medicare of $6.21 for every dollar that Medicare pays for CPAP therapy.**

Finally, a second ratio is calculated to project to the overall Healthcare System Payment Savings ($HSPS_{OSA}$) saved by every Medicare dollar paid for CPAP therapy:

$HSPS_{OSA}\ Ratio = MPS_{OSA}\ Ratio + Addbacks\ Ratio = 7.49$

This ratio adds back the co-pays and deductibles that are direct costs paid by Medicare beneficiaries and their insurers and a calculated cost savings for vehicular accidents that that are OSA caused[56]. **This represents an annual direct cost savings to the overall U.S. healthcare system of an additional $1.27, for a total savings of $7.49 for every dollar that Medicare pays for CPAP therapy.**

These savings translate to a 1.9 month payback period on the payments for CPAP therapy, indicating that Medicare spending on CPAP therapy can essentially be self-funded in Year 1. The breakeven period is calculated by dividing the annual savings by the amount Medicare pays for the equipment (6.21) and then dividing that number into 12 (months in a year).

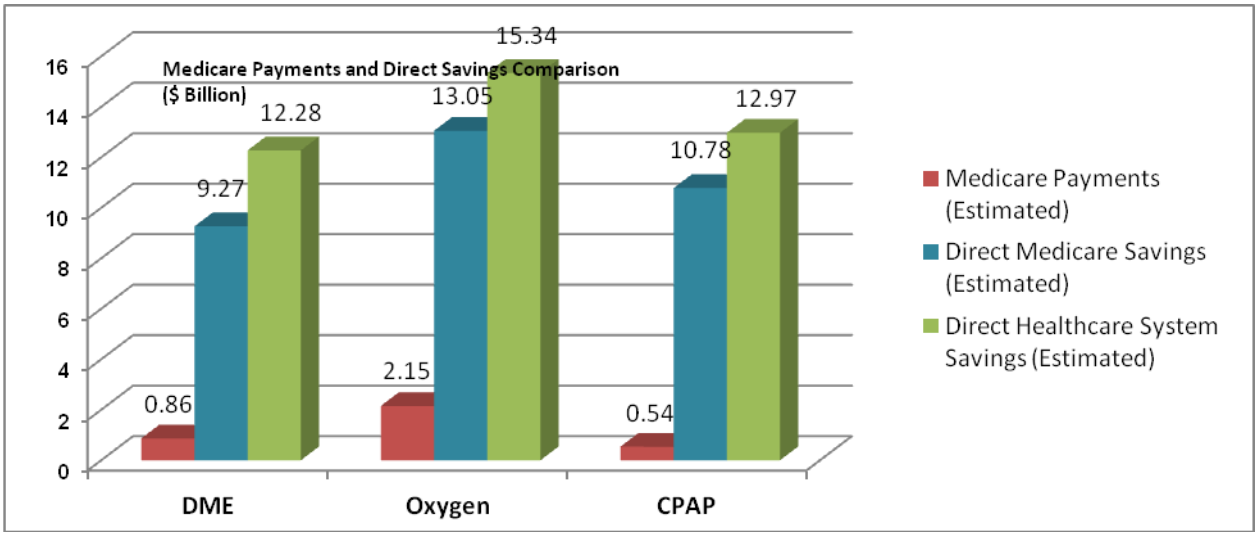
While this report focuses on direct spending to identify the potential cost avoidance for Medicare and the overall U.S. healthcare system, it is worth noting that analysts concerned with spending and cost savings will also look at indirect or economic costs (the value of lost wages and labor productivity) when attempting to assess the total OSA related costs. The literature on economic costs for OSA suggests that economic costs for the entire U.S. population add another 50-65% to the total cost of OSA.[57]

Conclusion

Medicare achieves significant direct cost savings by providing Mobility Equipment, Supplemental Oxygen Therapy and CPAP Therapy to Medicare beneficiaries. The cost of treating COPD, OSA complications related to several major medical conditions and the injuries resulting from falls is orders of magnitude greater than the payments made by Medicare to provide that equipment and therapy.

For every dollar Medicare pays for:	**It avoids paying:**
Mobility Equipment	**$10.73 for treating falls that would result**
Supplemental Oxygen Therapy	**$5.79 and $6.07 for treatment of COPD-caused medical complications**
CPAP Therapy	**$6.21 in treatment of OSA related complications in connection with coronary artery disease, congestive heart failure, atrial fibrillation and stroke**

In addition, Medicare directly saves its beneficiaries and their secondary insurers additional dollars that would otherwise have to be spent on these treatments and indirectly saves significant amounts in economic costs that would otherwise be incurred. Direct savings estimates are shown in the following graph for each of the three categories considered in this analysis:



[1]2009 CMS National Health Expenditures Tables, Table 2. http://www.cms.gov/NationalHealthExpendData/downloads/tables.pdf

[2] CMS website, referenced in June 9, 2011. https://www.cms.gov/FFSProvPartProg/EmailArchive/itemdetail.asp?filterType=none&filterByDID=-99&sortByDID=1&sortOrder=descending&itemID=CMS1244473&intNumPerPage=10

[3] *CDC Advance Data from Vital and Health Statistics*, Number 392, September 21, 2007. http://www.cdc.gov/nchs/data/ad/ad392.pdf

[4] This study did not examine the appropriateness of home oxygen therapy for the Medicare beneficiaries who received it. That analysis could result in identification of additional cost savings that should be addressed separately.

[5] *State of the Art, Epidemiology of Obstructive Sleep Apnea, A Population Health Perspective*, American Journal of Respiratory and Critical Care Medicine, Vol. 165, pp. 1220-1221. http://ajrccm.atsjournals.org/cgi/reprint/165/9/1217

[6] See, e.g., *Medicare Home Oxygen – Refining Payment Methodology Has Potential to Lower Program and Beneficiary Spending*, GAO 11-56, January 2011, second paragraph. http://www.gao.gov/new.items/d1156.pdf.

[7] http://www.minneapolisfed.org/.

[8] 2,200,000 ER visits for 65+ for 2009. *CDC Injury Prevention & Control: Home and Recreational Survey, Falls Among Older Adults: an Overview*. (http://www.cdc.gov/HomeandRecreationalSafety/Falls/adultfalls.html), adjusted to 2011 using U.S. population size.

[9] 2006 average cost of $651, adjusted to 2011 using CPI data. *ARHQ MEPS* Statistical Study #256, August 2009, reported at http://www.meps.ahrq.gov/mepsweb/data_files/publications/st256/stat256.pdf.

[10] 582,000 hospitalizations for 2009, adjusted to 2011 using U.S. population size. *CDC Injury Prevention & Control: Home and Recreational Survey, Falls Among Older Adults: an Overview*. (http://www.cdc.gov/HomeandRecreationalSafety/Falls/adultfalls.html).

[11] $22,065 average hospital stay cost for Medicare fall patient, 2004 adjusted to 2011 using CPI data. *Fall-related Hospitalizations among Elderly Medicare Beneficiaries,* Presentation by William Buczko, PhD, APHA Annual Meeting, November 2007, Abstract # 160280. (http://apha.confex.com/apha/135am/techprogram/paper_160280.htm).

[12] 5.1 day average stay for Medicare fall patient. *Fall-related Hospitalizations among Elderly Medicare Beneficiaries,* Presentation by William Buczko, PhD, APHA Annual Meeting, November 2007, Abstract # 160280. (http://apha.confex.com/apha/135am/techprogram/paper_160280.htm).

[13] 45.8%. National Health Interview Surveys (2001-2003), referenced in *CDC Advance Data from Vital and Health Statistics*, Number 392, September 21, 2007. (http://www.cdc.gov/nchs/data/ad/ad392.pdf).

[14] $65.30 in 2010, referenced in DecisionHealth Part B News, June 3, 2010. (http://pbn.decisionhealth.com/Blogs/Detail.aspx?id=81943).

[15] Calculated by assuming that approximately 50% of all patients arriving at the emergency room for a fall-caused visit arrive by ambulance and ambulances are used to transport patients discharged to rehab (55.6% of those hospitalized) to the facility.

[16] $305.38 in 2007, adjusted to 2011 using U.S. population size, for ALS ambulance service to hospitals. $163.24 in 2007, adjusted to 2011 using U.S. population size, for BLS ambulance service to rehab facilities. Based on the total number of to-hospital and to-rehab transports, the average billed to Medicare per transport is $229.54. *The Centers for Medicare and Medicaid Services, AMA's RBRVS Data Manager 2010*, referenced in *The Wall Street Journal*, October 27, 2010. (http://online.wsj.com/public/resources/documents/st_RUC102010_20101020.html).

[17] $5.90 for 2011. *CMS Ambulance Billing Guide*, October 2010. (http://www.medicarenhic.com/providers/pubs/Ambulance%20Billing%20Guide.pdf).

[18] National average was 9 miles in 2004. *GAO Report to Congressional Committees, Ambulance Providers – Costs and Expected Medicare Margins Vary Greatly*, May 2007. (http://www.medicarenhic.com/providers/pubs/Ambulance%20Billing%20Guide.pdf)

[19] 55.6% of hospitalized Medicare fall patients are discharged to rehab. *Fall-related Hospitalizations among Elderly Medicare Beneficiaries,* Presentation by William Buczko, PhD, APHA Annual Meeting, November 2007, Abstract # 160280. (http://apha.confex.com/apha/135am/techprogram/paper_160280.htm).

[20] $205.00 in 2010 adjusted to 2011 using CPI data. *Market Survey of Long-term Care Costs,* MetLife October 2010. (http://www.metlife.com/assets/cao/mmi/publications/studies/2010/mmi-2010-market-survey-long-term-care-costs.pdf).

[21] 24.1%. *ARHQ Statistical Brief #80* October 2009. (http://www.hcup-us.ahrq.gov/reports/statbriefs/sb80.pdf).

[22] $205.00 in 2010 adjusted to 2011 using CPI data. *Market Survey of Long-term Care Costs,* MetLife October 2010. (http://www.metlife.com/assets/cao/mmi/publications/studies/2010/mmi-2010-market-survey-long-term-care-costs.pdf).

[23] *Care Context,* The Alliance for Quality Nursing Home Care, September 2009. http://www.aqnhc.org/www/file/AQNHC_Care_Context_914%20Updated.pdf?phpMyAdmin=HzHnhISAGxbugH-niVxYkWiXQq0.

[24] This total calculated by the model is corroborated by the estimates in the often-cited research of Englander et al. in *Economic Dimensions of Slip and Fall Injuries*, *Journal of Forensic Science* 1996, 41(5).

[25] 1,027,259 units in 2009. Derived from Part B, National Summary Data File, HCPCS Codes E and K Durable Medical Equipment.

[26] Conservatively estimated at 1.1. Derived from information presented in *Preventing Falls: What Works*, Stevens and Sogolow, National Center for Injury Prevention and Control 2008 (http://www.cdc.gov/ncipc/preventingfalls/CDCCompendium_030508.pdf) and *UCLA Health Policy Research Brief, Older Californians at Risk for Avoidable Falls, May 2010.* (http://www.healthpolicy.ucla.edu/pubs/files/Avoidable_Falls_PB_0510.pdf).

[27] Estimate derived from *Age in Action*, Volume 26, Number 1, *Case Study: Impact of Providing Rehab Mobility Equipment to Those in Need*, B. Stelmack and B. Leitten 2011 (http://www.vcu.edu/vcoa/ageaction/agewinter11.pdf) and *Med J Aust.,* 6;164(9):530-2, *Preventing falls in the elderly at home: a community-based program* 1996. (http://www.ncbi.nlm.nih.gov/pubmed/8649287).

[28] Estimated by the author to decay at 5% per annum over the 5-year period of equipment use.

[29] *Economic Dimensions of Slip and Fall Injuries*, *Journal of Forensic Science* 1996, 41(5), Englander et al.

[30] National Heat Lung and Blood Institute, *Diseases and Conditions Index*, 2011. http://www.nhlbi.nih.gov/health/dci/Diseases/Copd/Copd_KeyPoints.html

[31] http://www.copd-international.com/library/statistics.htm.

[32] *Mortality & Morbidity: 2009 Chart Book on Cardiovascular, Lung and Blood Diseases,* National Institutes of Health 2009, p.17. http://www.nhlbi.nih.gov/resources/docs/2009_ChartBook.pdf.

[33] Calculated based on total cost of COPD care and historical Medicare proportion of payment. Hospital cost data derived from http://www.nhlbi.nih.gov/resources/docs/2009_ChartBook.pdf and Medicare proportion of payment calculated from data at http://www.ahrq.gov/news/nn/nn110105.htm.

[34] *Does long-term oxygen therapy reduce hospitalisation in hypoxaemic chronic obstructive pulmonary disease?*, European Respiratory Journal, 20: 38-42, 2002. http://erj.ersjournals.com/content/20/1/38.full.pdf+html.

[35] *Current Issues in Home Long Term Oxygen Therapy,* Lewarski, 2007. http://www.thoracic.org/chapters/thoracic-society-chapters/ca/current-news/resources/home-longterm-oxygen.pdf

[36] *Medicare Home Oxygen – Refining Payment Methodology Has Potential to Lower Program and Beneficiary Spending*, GAO, January 2011. http://www.gao.gov/new.items/d1156.pdf.

[37] Calculated by assuming that approximately 50% of all patients arriving at the emergency room for a fall-caused visit arrive by ambulance.

[38] $305.38 in 2007, adjusted to 2011 using U.S. population size, for ALS ambulance service to hospitals. *The Centers for Medicare and Medicaid Services, AMA's RBRVS Data Manager 2010*, referenced in *The Wall Street Journal*, October 27, 2010. (http://online.wsj.com/public/resources/documents/st_RUC102010_20101020.html).

[39] $5.90 for 2011. *CMS Ambulance Billing Guide*, October 2010. (http://www.medicarenhic.com/providers/pubs/Ambulance%20Billing%20Guide.pdf).

[40] National average was 9 miles in 2004. *GAO Report to Congressional Committees, Ambulance Providers – Costs and Expected Medicare Margins Vary Greatly*, May 2007. (http://www.medicarenhic.com/providers/pubs/Ambulance%20Billing%20Guide.pdf)

[41] 4.6% of hospitalized Medicare COPD patients are discharged to rehab. *Outcomes and health-related quality of life following hospitalization for an acute exacerbation of COPD,* Wang and Bourbeau, Respirology 10: 334-340, 2005. http://www.ubccriticalcaremedicine.ca/academic/jc_article/COPD%20Outcome(Jan-31-08).pdf.

[42] $205.00 in 2010 adjusted to 2011 using CPI data. *Market Survey of Long-term Care Costs,* MetLife October 2010. (http://www.metlife.com/assets/cao/mmi/publications/studies/2010/mmi-2010-market-survey-long-term-care-costs.pdf).

[43] *Mortality & Morbidity: 2009 Chart Book on Cardiovascular, Lung and Blood Diseases,* National Institutes of Health 2009, p.17. http://www.nhlbi.nih.gov/resources/docs/2009_ChartBook.pdf.

[44] *AHA/ACCF Scientific Statement, Sleep Apnea and Cardiovascular Disease*, 2008. http://circ.ahajournals.org/content/118/10/1080.full

[45] ResMed *Risk Reflections* presentation, slide 7, 2011 and references cited therein. http://www.rmia.org.au/LinkClick.aspx?fileticket=wMall8RykBU%3D&tabid=88&mid=621

[46] Based on several studies, the author estimates that 50-60% of Medicare payments to treat these conditions when OSA is involved is attributable to the complications caused by OSA. *Reduced Hospitalization with Cardiovascular and Pulmonary Disease in Obstructive Sleep Apnea Patients on Nasal CPAP Treatment,* Peker et al., *Sleep,* 202(8):645-653 *(*http://www.mysleepquest.com/sa_papers.lasso); *Cost Justification for Diagnosis* and Treatment of Obstructive *Sleep Apnea, SLEEP,* Vol. 23, No. 8, 2000 (http://www.novasom.com/clinical_library/cost_justification.pdf*); Obstructive Sleep Apnea (OSA) in Primary Care: Evidence-based Practice*, Pagel, *The Journal of the American Board of Family Medicine* 20 (4): 392-398, 2007, (http://www.jabfm.org/cgi/content/full/20/4/392); *Determinants affecting health-care utilization in obstructive sleep apnea syndrome patients,* Tarasiuk et al., *Chest* Sep;128(3):1310-4 2005 (http://www.ncbi.nlm.nih.gov/pubmed?term=16162723%20).

[47] Calculated by the author from data presented in *Medicare and Atrial Fibrillation/Consequences in Cost and Care*, Eisenhart et al., 2009 (http://www.afstat.com/docs/pdf/Avalere_Medicare_AFib_report.pdf); Statistical Brief # 107, *The National Hospital Bill: The Most Expensive Conditions by Payer, 2008*, p. 5, 2011 (http://www.hcup-us.ahrq.gov/reports/statbriefs/sb107.pdf); National Health Expenditure Data, National Health Expenditures by type of service and source of funds, CY 1960-2009 (https://www.cms.gov/NationalHealthExpendData/02_NationalHealthAccountsHistorical.asp#TopOfPage).

[48] Calculated by the author. Medicare hospital payments for each of the four conditions is adjusted for comorbidity of OSA, total Medicare medical payments for treatment of the condition, CPAP compliance and a payments savings factor.

[49] HME News, *State of the Industry 2009*. http://www.hmenews.com/upload/SR/HME_SOI_2009.pdf

[50] HME News, *State of the Industry 2009*. http://www.hmenews.com/upload/SR/HME_SOI_2009.pdf

[51] ResMed *Risk Reflections* presentation, slide 7, 2011 and references cited therein. http://www.rmia.org.au/LinkClick.aspx?fileticket=wMall8RykBU%3D&tabid=88&mid=621

[52] *AHA/ACCF Scientific Statement, Sleep Apnea and Cardiovascular Disease*, 2008. http://circ.ahajournals.org/content/118/10/1080.full

[53] Approximately 39%, calculated using the data in the references in footnote 47

[54] For atrial fibrillation, the $15,700,000,000 number represents the total Medicare payments for all treatments, including hospital and all other payments.

[55] 2008 Medicare CPAP payments was $535,497,424. HME News, *State of the Industry 2009*. http://www.hmenews.com/upload/SR/HME_SOI_2009.pdf; total number of Medicare CPAP recipients was 627,767. HME News, *State of the Industry 2009*. http://www.hmenews.com/upload/SR/HME_SOI_2009.pdf; total number of Medicare

recipients hospitalized for the four conditions studied was 2,033,200. Statistical Brief # 107, *The National Hospital Bill: The Most Expensive Conditions by Payer, 2008*, p. 5, 2011 (http://www.hcup-us.ahrq.gov/reports/statbriefs/sb107.pdf); *Heart Disease and Stroke Statistics- 2011 Update, Circulation* 123:e18-e209; (http://circ.ahajournals.org/content/123/4/e18.full.pdf); *Atrial Fibrillation Risk Questionnaire* (http://www.afstat.com/Docs/Pdf/AFibRiskFactorsQuestionaire.pdf)

[56] A significant number of motor vehicle accidents involving individuals over the age of 65 can be attributed to OSA. Based on data provided in *Sleep Disordered Breathing, Reducing Motor-Vehicle Collisions, Costs and Fatalities by Treating Obstructive Sleep Apnea Syndrome*, SLEEP 2004;27(3):453-8 (http://sleepapneakills.org/wp-content/uploads/2011/05/Reducing-Motor-Vehicle-collisions-and-fatalities-by-treating-OSA1998-1.pdf), *A Corporate Driven Sleep Apnea Detection And Treatment Program: Results and Challenges* (http://www.remmedical.com/occupational_health/Schneider_TB_Symposium_Paper.pdf) and *Injury Prevention & Control: Motor Vehicle Safety* (http://www.cdc.gov/Motorvehiclesafety/Older_Adult_Drivers/index.html), the author calculates that approximately $28 Million in direct medical and property damage costs and significantly higher indirect economic costs be attributed annually to OSA.

[57] *Mortality & Morbidity: 2009 Chart Book on Cardiovascular, Lung and Blood Diseases,* National Institutes of Health 2009, p.17. http://www.nhlbi.nih.gov/resources/docs/2009_ChartBook.pdf and *Costs of Diseases and Disabilities: Due to Environmental Contaminants: Washington State Case Study*, BE SAFE Campaign for Precautionary Action, Center for Health, Environment and Justice.