



The High Cost of Heart Failure for the Medicare Population: An Actuarial Cost Analysis

Prepared by

Kathryn Fitch, RN, MEd
Principal and Healthcare Management Consultant

Pamela M. Pelizzari, MPH
Healthcare Management Consultant

Bruce Pyenson, FSA, MAAA
Principal and Consulting Actuary

Commissioned by Novartis Pharmaceuticals Corporation

February 2015

TABLE OF CONTENTS

EXECUTIVE SUMMARY	1
BACKGROUND	3
CLAIMS DATA ANALYSIS FINDINGS	6
Demographic characteristics	6
Cost and utilization metrics	11
Part D analysis	22
CONSIDERATIONS FOR KEY STAKEHOLDERS	23
APPENDIX A: PRIMER ON HEART FAILURE	25
APPENDIX B: KEY DATA SOURCES	27
APPENDIX C: METHODOLOGY	28
REFERENCES	32

EXECUTIVE SUMMARY

Heart Failure (HF) is a significant concern in the US population with its high prevalence, morbidity, mortality and medical cost, especially among Medicare beneficiaries. HF prevalence increases with age and HF incidence approaches 10 in 1000 in the over-65 population.¹ Researchers predict that HF cases in the U.S. will increase from 5.1 million in 2012 to over 8 million by 2030 with the aging of the population and people living longer.² Approximately 50% of HF patients die within 5 years of diagnosis,³ and for those with a HF hospital admission, 22% die within 1 year.⁴ In 2012, the total direct medical cost for HF was estimated at \$20.9 billion, and this is expected to increase to \$53.1 billion by 2030 with the majority of these costs related to hospitalization of HF patients.²

Prominent efforts to improve the care and reduce the cost of HF patients have been implemented over the past several years (see background section).^{5, 6, 7, 8,9, 10} Despite these efforts, the prevalence of HF is rising and only small improvements in survival have been realized. The high prevalence, cost and mortality of the HF population combined with lack of novel therapies and limited improvement in medical management highlights the need for increased focus on HF among the Medicare population.

This paper summarizes actual Medicare paid claims to quantify the burden of HF. We analyzed the HF population using the Medicare 5% sample and quantified cost drivers that present opportunity for better management. Our findings highlight the significant cost and utilization contribution that HF population has for Medicare. Specifically, in the Medicare FFS population, the following metrics were identified for the HF population:

Demographic Characteristics and Mortality

- Prevalence of HF in the Medicare population is 11% but HF beneficiaries contribute 34% of the total Medicare spend
- HF patients contribute 39% of total annual Medicare FFS deaths
- HF beneficiaries have a mortality rate of 22%, compared with only 6% in the total Medicare FFS population and 4% in the non HF Medicare FFS population

Admissions and Readmissions

- HF patients contribute 42% of total Medicare FFS admissions^a - HF beneficiaries have an admission rate of 1264 per 1000 members per year, compared with only 333 per 1000 members per year in the total Medicare FFS population and 218 per 1000 NH Medicare FFS beneficiaries
- HF patients contribute 55% of total Medicare FFS readmissions - HF beneficiaries have an all-cause readmission rate of 28%, compared with only 21% in the total Medicare FFS population and 16% in the non HF Medicare FFS population
- HF patients contribute 49% of total Medicare FFS SNF admissions - HF beneficiaries have a SNF admission rate of 356 per 1000 members per year, compared with only 79 per 1000 members per year in the total Medicare FFS population and 45 per 1000 non HF Medicare FFS population

Medicare Expenditures Per Member Per Month

- HF patients have 3x the average \$PMPM costs compared to the total Medicare FFS population: \$3,482 PMPM compared to \$1,072 PMPM; and 4x the average \$PMPM costs compared to the non HF Medicare FFS population: \$3,482 PMPM compared to \$791 PMPM^b
- Medicare Part D spending on HF Medicare beneficiaries is approximately twice the amount of an average Medicare beneficiary:
 - Among non-low income beneficiaries, the allowed Medicare Part D PMPM for an HF beneficiary is \$411, compared to only \$189 for the average beneficiary.

^a Includes medical, surgical, psych and substance abuse admissions – excludes acute rehab, maternity and SNF

^b Costs trended to 2014

- Among low income beneficiaries, with incomes below 150% of the federal poverty level, the allowed Medicare Part D PMPM for an HF beneficiary is \$622 compared to only \$377 for the average beneficiary.^c

There is a lack of recent claim based Medicare studies quantifying the burden of HF. We hope this report establishes baseline metrics of interest for payers and providers to direct improvements in the management of Medicare HF beneficiaries.

This report was commissioned by Novartis Pharmaceuticals Corporation. The findings reflect the research of the authors; Milliman does not endorse any product or organization. If this report is reproduced, we ask that it be reproduced in its entirety, as pieces taken out of context can be misleading. As with any economic or actuarial analysis, it is not possible to capture all factors that may be significant. Because we present national average data based on the 2012 Medicare 5% sample data, the findings should be interpreted carefully before they are applied to any particular situation. Findings for particular populations and for different time periods will vary from these findings.

^c Please see the description of our methodology in Appendix C for information on the population used in the Part D analysis.

BACKGROUND

This section provides a summary of published data on the burden of HF in the U.S. for the Medicare population.

Prevalence and Incidence of HF

The clinical and cost burden of heart failure (HF) in the United States is substantial and is projected to grow as more people age into Medicare and life expectancy increases. Based on data collected by the National Health and Nutrition Examination Survey (NHANES), the American Heart Association estimates that 5.7 million Americans are currently living with HF and there are approximately 870,000 incident cases of HF each year.¹ HF incidence approaches 10 per 1000 population after age 65 and prevalence increases with age.¹ By examining current HF prevalence along with US Census estimates of population growth, researchers predict that HF prevalence will increase approximately 46% in the next 15 years, resulting in over 8 million American adults with HF by 2030.²

Mortality in the HF Population

HF is associated with high mortality – large population-based studies have found that approximately 50% of HF patients die within 5 years of diagnosis³, and for those with a HF hospital admission, 22% die within 1 year.⁴ In the Medicare population, the risk-adjusted 1-year mortality rate has declined from 31.7% in 1999 to 29.6% in 2008, yet still remains high.¹¹ One in 9 US deaths has HF mentioned on the death certificate.¹ The risk-standardized 1-year mortality rates in HF patients show substantial variation across states, with a range from 29.1% in Maine to 35.2% in Arizona in 2008.¹¹ While there may be differences in populations across states that explain some of this mortality differential, the large variation suggests opportunity for improved patient management.

Medical Costs for the HF Population

HF patients generate substantial costs associated with exacerbations and treatments. In 2012, the total direct medical cost for HF was \$20.9 billion, and this is expected to increase to \$53.1 billion in 2030 (representing a 2.5 fold increase). The majority of these costs are related to hospitalization.² HF is the most common discharge diagnosis among patients older than 65 years and the primary cause of readmission within 60 days. The number of hospital discharges for HF were nearly unchanged from 2000 (1,008,000) to 2010 (1,023,000).¹ The percentage of HF patients that experience a hospitalization within the last 6 months of life has remained steadily high, at approximately 80% of HF patients for years 2000 through 2007.¹²

End of life costs for HF patients are substantial, and have increased in recent years. In the Medicare population, total medical expenditures on HF patients in the last 6 months of life increased from \$28,766 in 2000 to \$36,216 in 2007.¹² This increase in Medicare expenditures was despite an increase in both hospice utilization (from 19% to 38% of patients) and the duration of hospice care (from 37 to 44 days) over the same 2000 to 2007 study period.¹²

Current Status of HF Treatment

Clinical guidelines for the prevention and treatment of HF, most recently published in 2013, include a comprehensive approach to HF care including pharmacologic intervention, non-pharmacologic interventions (lifestyle recommendations and treatment of comorbidities), cardiac device therapy, care of the HF patient during hospitalization as well as care coordination and palliative care recommendations.⁵ The current standard, angiotensin-converting-enzyme (ACE) inhibitor therapy, was established almost 25 years ago.¹³ The introduction of cardiac devices in 2001 including left ventricular assist devices (LVAD), implantable cardiac defibrillator (ICD) and cardiac resynchronization therapy (biventricular pacemakers) have reduced the mortality rate for a target population of HF patients but are not indicated for the majority of end stage HF patients.¹³

HF Related Quality Performance Reporting Initiatives

Given the substantial burden of disease that HF represents, payers, professional organizations, and trade organizations are working to develop relevant performance measures surrounding HF patients and their treatment.

In 2005, the Centers for Medicare and Medicaid Services (CMS) published their first set of 10 core process measures on the Hospital Compare website, which included HF-related measures. This data was expanded in 2008 to include hospital 30-day mortality for HF and again expanded in 2010 to include 30-day readmission measures for HF.¹⁴ Hospital Compare currently allows visitors to the site to compare hospitals based on both outcome measures (30-day readmission and mortality rates) and process measures (whether HF patients were given discharge instructions, an evaluation of their left ventricular systolic function, or an ACE inhibitor or ARB for left ventricular systolic dysfunction).⁹

CMS' Physician Quality Reporting System (PQRS), which uses a combination of incentive payments and payment adjustments to encourage physicians and other healthcare professionals to report quality information, also incorporates HF-related measures.¹⁵ As of 2014, these measures were mainly centered around effective clinical care (including whether patients received left ventricular ejection fraction and left ventricular function testing, and whether they were treated for corresponding dysfunction) but also included patient-centered care measures such as whether HF patients completed patient-reported functional status assessments.⁸

In addition to CMS, a consortium of the American College of Cardiology Foundation (ACCF), the American Heart Association (AHA), and the American Medical Association's Physician Consortium for Performance Improvement (AMA-PCPI) published a 2011 recommended set of HF performance measures for both inpatient and outpatient settings, which included all of the PQRS measures mentioned above, as well as additional measures such as whether patients received self-care education, a symptom and activity assessment, counseling about ICD implantation when appropriate, and post discharge appointments in the event they were admitted to an inpatient facility.⁶

HF Disease Management Initiatives

Because of the significant clinical and cost burden of HF, payers and providers have implemented disease management programs, but these have had mixed results. Medicare Advantage (MA) plans have provided disease management programs for HF members for many years but the success of these programs has been limited.^{16,17} CMS launched The Medicare Health Support Pilot Program in 2005 to test the effectiveness of the commercial disease-management model with HF as one of the primary diseases to target. There was little success in slowing growth rates in either hospital admissions or emergency room visits, with only one of the eight participating companies slowing the hospitalization growth rate.¹⁸

Payment Model Initiatives Relevant to HF

Recent payment models aimed at improving HF management are having some success. In October of 2012, CMS initiated the Hospital Readmissions Reduction Program, under which hospitals are financially penalized for excess readmissions, with HF one of the three applicable conditions that CMS included in the first round.¹⁰ In the first year of the Hospital Readmissions Reduction Program, over 2,200 hospitals experienced aggregate penalties of approximately \$280 million in Medicare payments, and CMS estimates that the second year of the program will bring penalties of approximately \$227 million distributed across 2,225 hospitals.¹⁹ In each of these years, approximately 30% of hospitals received no penalty.¹⁹ The Medicare Payment Advisory Committee (MedPAC) reported in June 2013 that the conditions affected by the Hospital Readmissions Reduction Program experienced a larger decrease in readmission rates from 2009 to 2011 than the all-cause readmission rates, which MedPAC stated could be indicative of the successful impact of the program.²⁰

CMS also introduced the Hospital Value-Based Purchasing (VBP) Program in October of 2012.²¹ Under the VBP program, hospitals receive payments for achievement or improvement on a set of measures drawn from CMS' existing Hospital Inpatient Quality Reporting (IQR) program. A Total Performance Score is calculated for each

hospital, and they receive a payment based on this score.²² Another metric of the VBP Program that is relevant for HF is the Medicare Spending per Beneficiary (MSPB) measurement which compares the median Medicare spending per beneficiary ratio across all hospitals during the performance period.²¹ The spending includes all spending in the three days prior to and 30 days following all admissions combined with the spending during all admissions. Since HF is a significant portion of hospital's Medicare admissions, hospitals have an incentive to efficiently manage care and complications for HF patients.

Medicare's voluntary BPCI initiative, a payment model pilot program which aims to financially incentivize improved quality and coordination of care at a lower cost to Medicare, was launched in early 2013 and offers a HF episode of care. Under BPCI, providers can financially benefit from managing patients more effectively in the period of time during and following an inpatient admission for HF (defined as MS-DRGs 291, 292, and 293).²³ While no results are yet available on BPCI's success in improving quality or controlling costs, the HF episode of care is popular among program participants, with 128 organizations choosing HF who have already gone live as of mid-2014 and over 6000 organizations considering the HF bundle for a 2015 start.²⁴

Medicare's voluntary MSSP has approximately 340 organizations enrolled as of May 2014 with approximately 4.9 million Medicare lives in the U.S. attributed to these MSSP accountable care organizations (ACOs).²⁵ A key target for MSSP ACOs is the HF population since they contribute significant cost and have high admission and readmission rates. Three of the ACO quality metrics that determine if savings will be shared with an organization, are HF related. These include ambulatory sensitive admissions: HF (ACO-10), beta blocker therapy for left ventricular dysfunction (ACO-31) and all cause unplanned admissions for patients with HF (ACO-37).^{26,27}

Taken collectively, these efforts represent a significant investment in ensuring the delivery of high quality care for HF patients. Despite these efforts, the prevalence of HF is rising, and only small improvements in survival have been realized.¹¹ The following analysis quantifies the high medical utilization and cost associated with HF in the Medicare fee-for-service (FFS) population in an effort to highlight potential savings opportunities that could be realized by payers, providers, and other interested stakeholders.

CLAIMS DATA ANALYSIS FINDINGS

This section provides population-level statistics for patients with HF. A description of the methodology used to identify the study population and calculate various metrics can be found in Appendix C.

DEMOGRAPHIC CHARACTERISTICS

Using the Medicare 5% sample data for 2012 and 2011, we identified all HF Medicare FFS beneficiaries using the algorithm described in Appendix C. Table 1 provides comparisons of the number of members, prevalence, average age, and mortality rate between the HF population and the non-HF population, stratified across Medicare eligibility status.

Table 1: Key Demographic Characteristics Heart Failure Population (HF) vs. Nationwide Medicare FFS Population Excluding Heart Failure (non-HF)									
Status	Total beneficiaries in sample	Beneficiaries with HF	Distribution by eligibility status (non-HF)	Distribution by eligibility status (HF)	Prevalence of HF	Average Age (non-HF)	Average Age (HF)	Mortality Rate (non-HF)	Mortality Rate (HF)
Aged / Dual Eligible	127,748	20,593	8.2%	12.8%	16%	75.0	77.8	3.5%	13.8%
Aged / not Dual Eligible	1,038,085	104,622	71.7%	65.2%	10%	75.3	80.2	3.9%	22.0%
Disabled	229,957	13,085	16.7%	8.2%	6%	49.7	54.9	1.8%	10.0%
ESRD	17,061	7,307	0.8%	4.6%	43%	59.4	66.9	11.5%	29.4%
Institutionalized (Non-ESRD)	49,084	14,783	2.6%	9.2%	30%	79.2	82.7	21.9%	34.7%
Total	1,461,935	160,390	100.0%	100.0%	11%	71.0	77.5	4.1%	21.5%

Source: Milliman Analysis of Medicare 5% Sample 2011-2012 (2012 index year, 2011 look back year)

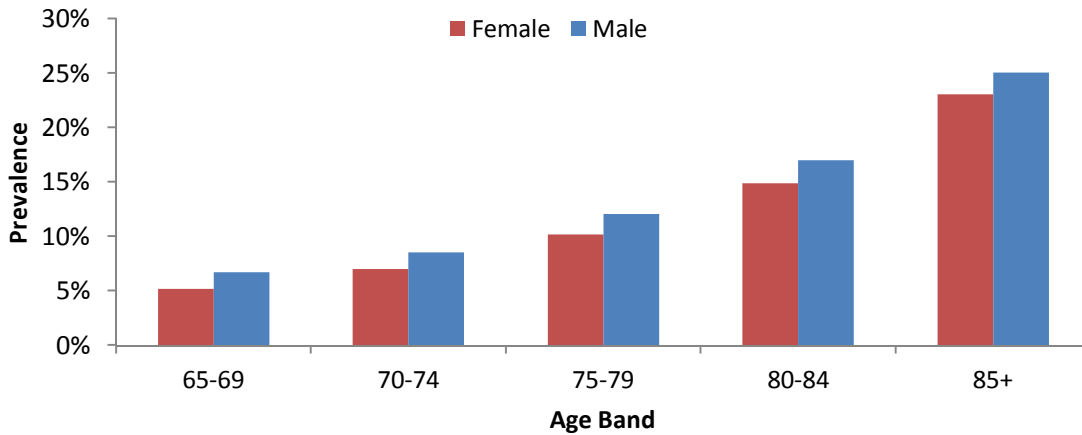
Table 1: Key Points

- HF prevalence in the Medicare FFS population is 11%, and varies by eligibility category, with 43% prevalence in the ESRD eligibility category as compared to only 10% prevalence in the aged / not dual eligible category.
- 9% of the Medicare HF population is institutionalized versus less than 3% of the non-HF population.
- Medicare beneficiaries with HF have a mortality rate 5x that of non-HF beneficiaries.
- Medicare HF beneficiaries are, on average, about 6 years older than beneficiaries without HF.

Prevalence

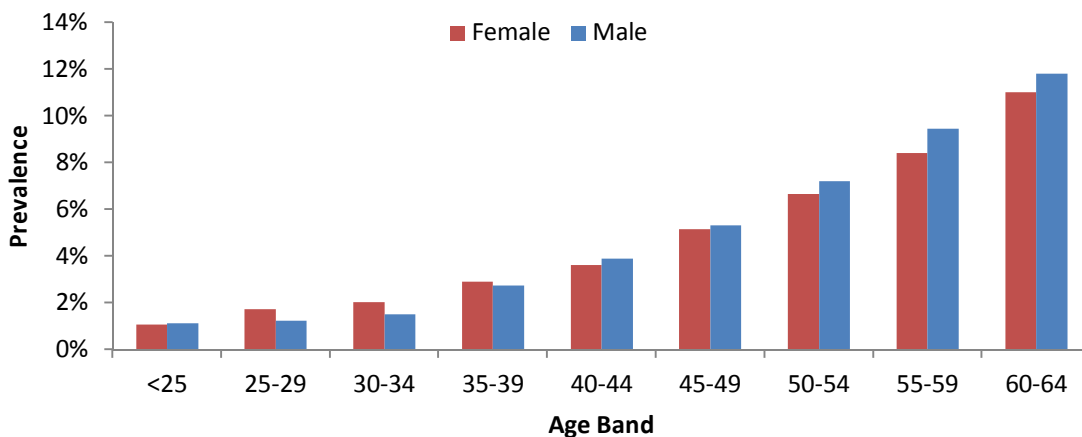
Graph 1 and 2 present the prevalence of HF by age gender. We split the 65+ from the <65 year old HF cohort.

Graph 1: Medicare Prevalence of Heart Failure by Age Band (Ages 65+, 89% of HF population)



Source: Milliman Analysis of Medicare 5% Sample 2011-2012 (2012 index year, 2011 look back year)

Graph 2: Medicare Prevalence of Heart Failure by Age Band (Ages 0-64, 11% of HF population)



Source: Milliman Analysis of Medicare 5% Sample 2011-2012 (2012 index year, 2011 look back year)

Graphs 1 and 2: Key Points

- HF prevalence increases steadily with age.
- HF is more prevalent in men than women in age bands 40+.
- 11% of the Medicare HF population is under 65 years of age while 17% of the total Medicare population is under age 65.

Risk Scoring

The Medicare population includes diverse risks, which are not uniform across the Medicare population. CMS developed several eligibility categories (e.g., dual eligibles) and these reflect an individual’s socio-economic status, which is a major factor in the risk level of an individual. Other important socio-economic characteristics can be found in Medicare data, such as residence in a nursing home.

To better quantify risks (and to reimburse Medicare Advantage carriers under that program), CMS developed a diagnosis-based risk scoring methodology known as the hierarchical condition categories; the score reflects a forecast of that individual’s Medicare expenses in the next year. Separate scores are available for future medical spending (HCC) and pharmacy spending (HCCR_X). Every beneficiary in the sample (nationwide as well as HF-only) was assigned an HCC and an HCCR_X score based on each beneficiary’s diagnosis codes. Table 2 provides the HCC and HCCR_X comparison by eligibility status.

Table 2: HCC Comparison Heart Failure Population (HF) vs. Nationwide Medicare FFS Population Excluding Heart Failure (non-HF)				
Status	Average HCC (non-HF)	Average HCC (HF)	Average HCCR _X (non-HF)	Average HCCR _X (HF)
Aged / Dual Eligible	1.31	2.47	1.05	1.40
Aged / not Dual Eligible	0.92	2.15	0.85	1.20
Disabled	0.96	2.33	1.15	1.55
ESRD			1.52	1.80
Institutionalized (Non-ESRD)	2.07	2.86	1.62	1.68
Total	0.99	2.30	0.94	1.33

Source: Milliman Analysis of Medicare 5% Sample 2011-2012 (2012 index year, 2011 look back year)
NOTE: Because of the nature of ESRD beneficiaries, they are not assigned an HCC.

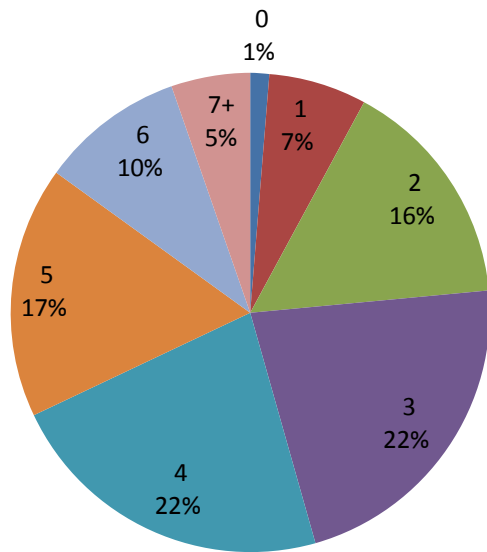
Table 2: Key Points

- In all eligibility categories, the HCC and HCCR_X scores are substantially higher in the HF population compared to the non-HF population.

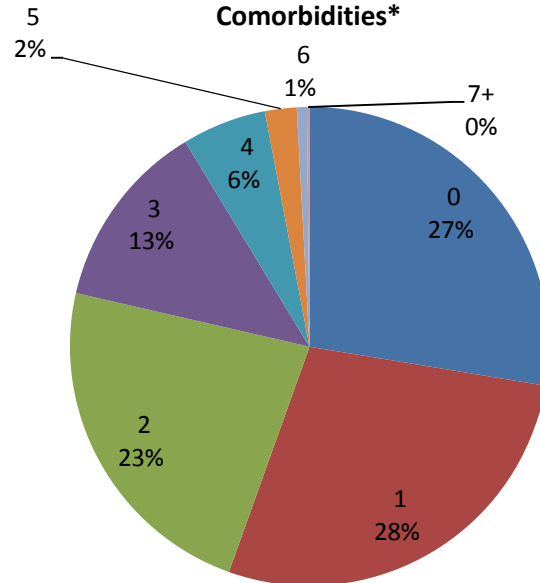
Comorbidities

We examined the presence of both cardiac and non-cardiac comorbidities in our HF sample. We considered the following comorbidities: arrhythmias, hypertension, atherosclerosis: coronary artery disease, atherosclerosis: cerebral artery disease, atherosclerosis: peripheral vascular disease, diabetes, chronic obstructive pulmonary disease, chronic kidney disease, serious mental illness and anemia. Graph 3 and 4 provide the distribution of HF and non-HF Medicare FFS beneficiaries by their number of comorbidities.

Graph 3: HF Population: Breakdown of Percentage of Population Having 0 to 7+ Concurrent Comorbidities*



Graph 4: Non-HF Population: Breakdown of Percentage of Population Having 0 to 7+ Concurrent Comorbidities*



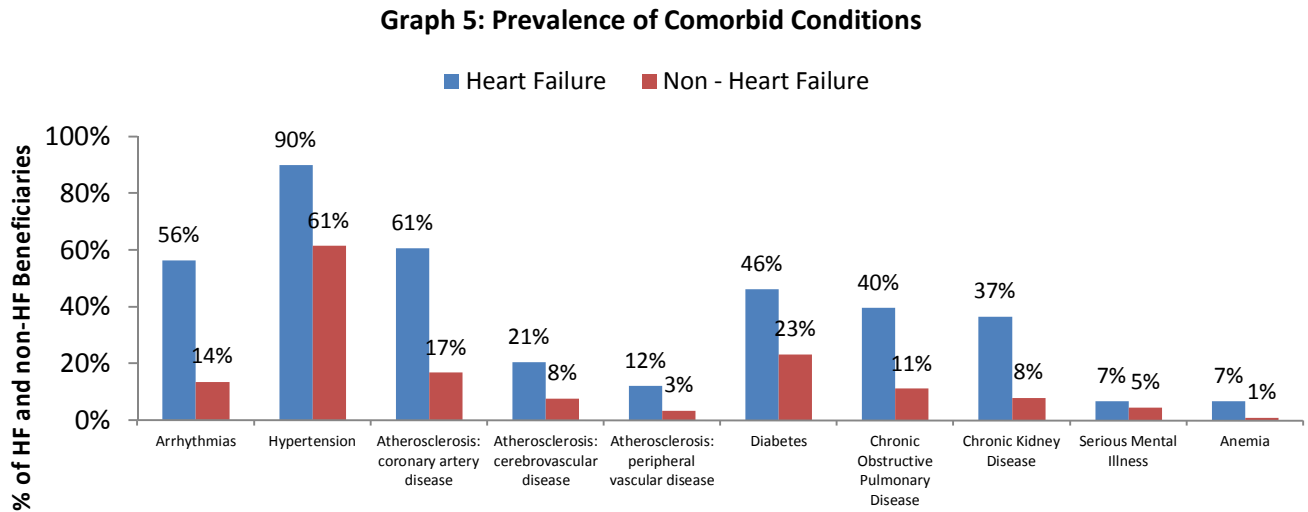
Source: Milliman Analysis of Medicare 5% Sample 2011-2012 (2012 index year, 2011 look back year)

**arrhythmias, hypertension, atherosclerosis: coronary artery disease, atherosclerosis: cerebral artery disease, atherosclerosis: peripheral vascular disease, diabetes, chronic obstructive pulmonary disease, chronic kidney disease, serious mental illness and anemia.*

Graph 3 and 4: Key Points

- 76% of the HF population and only 21% of non-HF population have 3 or more of the comorbidities we considered.
- 54% of HF population and only 9% of non-HF population have 4 or more of the comorbidities we considered.

Graph 5 provides the prevalence of comorbidities for Medicare HF and non-HF beneficiaries.



Source: Milliman Analysis of Medicare 5% Sample 2011-2012 (2012 index year, 2011 look back year)

Graph 5: Key Points

- The prevalence of comorbidities in the Medicare HF population is substantially higher than the rate for the non-HF population for all of the comorbidities analyzed.

COST AND UTILIZATION METRICS

In this section, we examine cost and utilization categories within the HF population and compare these patients to the non-HF population. An explanation of our methodology can be found in Appendix C. Table 3 provides a medical cost comparison of Medicare HF and non-HF beneficiaries by eligibility status.

Table 3: Cost Comparison Heart Failure Population (HF) vs. Nationwide Medicare FFS Population Excluding Heart Failure (non-HF)								
Status	Allowed \$PMPM (non-HF)	Allowed \$PMPM (HF)	Patient cost sharing (non-HF)	Patient cost sharing (HF)	Percent of Medicare members (non-HF)	Percent of Medicare spend (non-HF)	Percent of Medicare members (HF)	Percent of Medicare spend (HF)
Aged / Dual Eligible	\$794	\$2,996	\$119	\$337	7.3%	5.4%	1.4%	3.8%
Aged / not Dual Eligible	\$709	\$3,020	\$110	\$336	63.9%	42.7%	7.2%	19.1%
Disabled	\$761	\$3,327	\$117	\$368	14.8%	10.6%	0.9%	2.7%
ESRD	\$5,411	\$10,171	\$867	\$1,345	0.7%	3.3%	0.5%	4.4%
Institutionalized (Non-ESRD)	\$2,033	\$4,393	\$332	\$657	2.4%	4.2%	1.0%	3.8%
Total	\$791	\$3,482	\$123	\$412	89.0%	66.2%	11.0%	33.9%

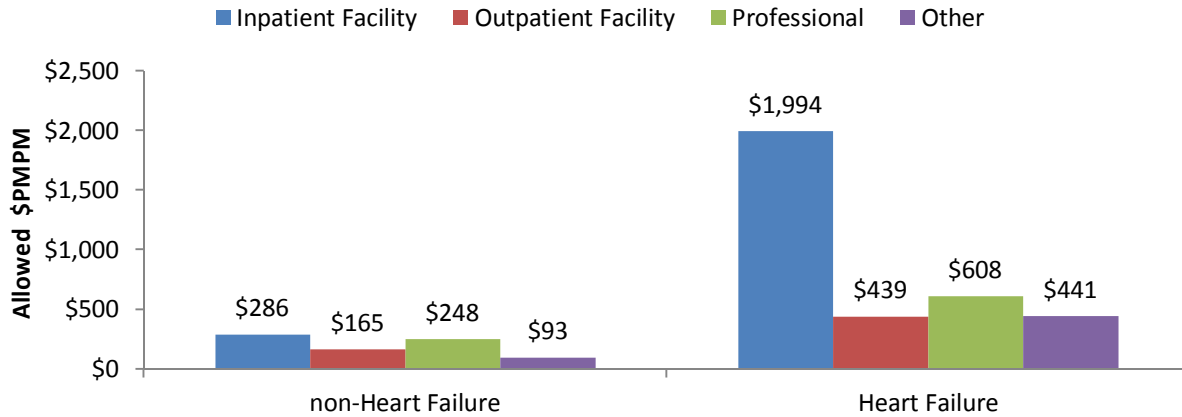
*Source: Milliman Analysis of Medicare 5% Sample 2011-2012 (2012 index year, 2011 look back year)
Allowed costs include patient cost sharing. Costs have been trended to 2014.*

Table 3: Key Points

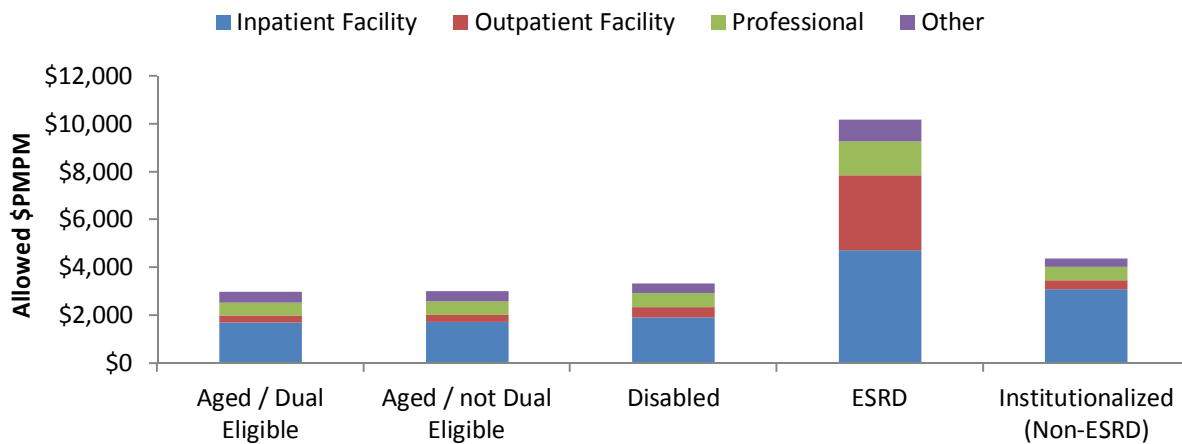
- The prevalence of HF in the Medicare population is 11% but HF beneficiaries contribute 34% to the total Medicare spend.
- The allowed per member per month (PMPM) medical costs are approximately twice as high for the HF ESRD and Institutionalized populations and approximately four times as high for the other HF eligibility category populations compared to the non-HF population, including the largest category, aged/not-dual eligible.

Graph 6 and 7 show the cost contribution of inpatient facility, outpatient facility and professional services to total medical spend for HF versus non-HF beneficiaries.

Graph 6: Allowed \$PMPM by Major Service Category*



Graph 7: Allowed \$PMPM by Major Service Category by Eligibility Status for HF Population*



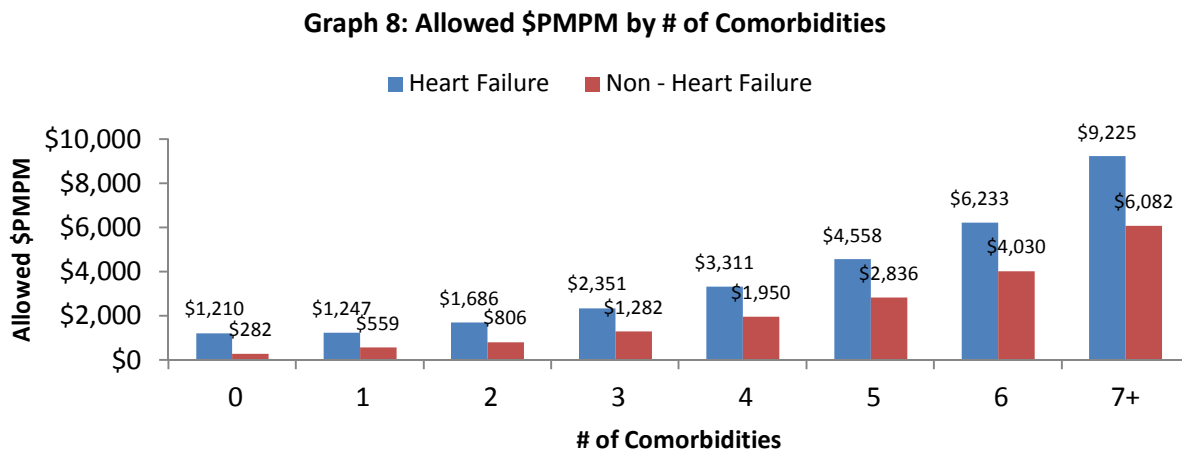
*Source for Graphs 6 and 7: Milliman Analysis of Medicare 5% Sample 2011-2012 (2012 index year, 2011 look back year)
 Inpatient facility includes medical, surgical, psych, substance abuse, acute rehab, SNF and maternity. Outpatient Facility includes all services delivered in an outpatient facility including ER, ambulatory surgery, radiology, lab, pathology, PT/OT/ST, dialysis etc. Professional includes all professional claims associated with both inpatient and outpatient services including office visits. Other includes home care, DME, ambulance etc. Allowed cost includes patient cost sharing. Costs have been trended to 2014.

Graph 6 and 7: Key Points

- The HF population has higher medical costs in each of the service categories shown compared to the non-HF population.
- Inpatient facility costs contribute 57% to the total HF population spend and 36% to the total non-HF population spend.

- The allowed \$PMPM for inpatient facility cost is almost 7 times as high in the HF population compared to the non-HF population.
- For the institutionalized subpopulation, the inpatient facility costs contribute a larger portion to the total spend.
- When examining cost by eligibility status, the OP facility costs are much higher for the ESRD cohort compared to other HF cohorts, likely due to the inclusion of dialysis OP treatment costs in this service line.

Graph 8 provides the allowed medical costs PMPM for HF and non-HF beneficiaries by number of comorbidities.

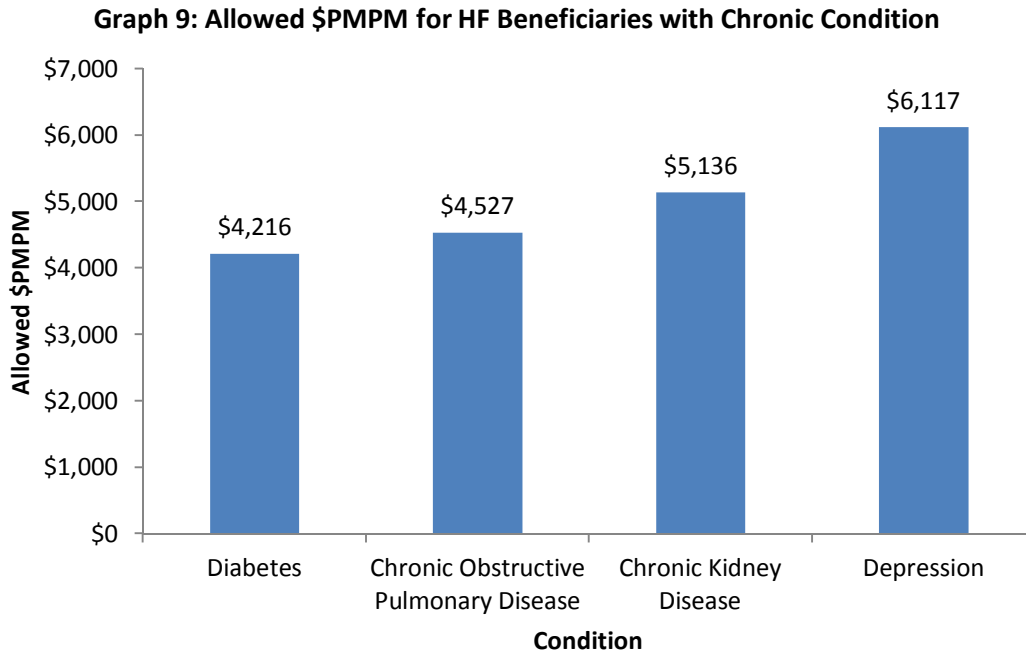


*Source: Milliman Analysis of Medicare 5% Sample 2011-2012 (2012 index year, 2011 look back year)
Allowed cost includes patient cost sharing. Costs have been trended to 2014.*

Graph 8: Key Points

- The average allowed PMPM medical costs increase with the number of prevalent comorbidities.
- Non-HF beneficiaries with the same number of comorbidities have significantly lower allowed medical costs compared to HF cohorts with the same number of comorbidities.

Graph 9 provides the allowed PMPM medical costs for HF beneficiaries who have 4 distinct comorbidities. The condition cohorts are not mutually exclusive. 84% of the cohort with depression had 4+ comorbidities while only 54% of the total HF population had 4+ comorbidities.



*Source: Milliman Analysis of Medicare 5% Sample 2011-2012 (2012 index year, 2011 look back year)
 Chronic condition cohorts are not mutually exclusive.
 Allowed cost includes patient cost sharing. Costs have been trended to 2014.*

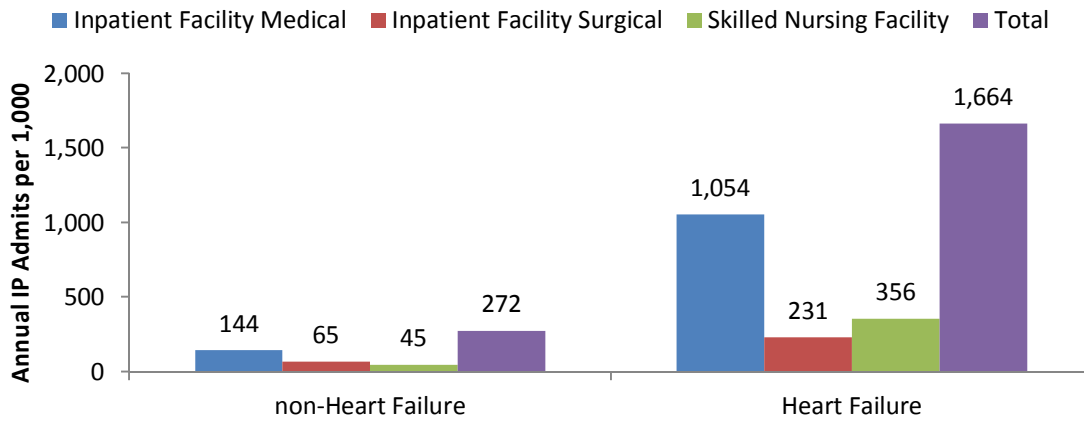
Graph 9: Key Points

- The type of chronic condition that HF patients exhibit, impacts the allowed PMPM medical costs.
- HF beneficiaries with depression had higher costs than beneficiaries with other chronic conditions.

Inpatient Admissions

Graph 10 compares inpatient (IP) admission rates between HF and non-HF beneficiaries by type of admission.

Graph 10: IP Admission Rates for HF and non HF Medicare Beneficiaries



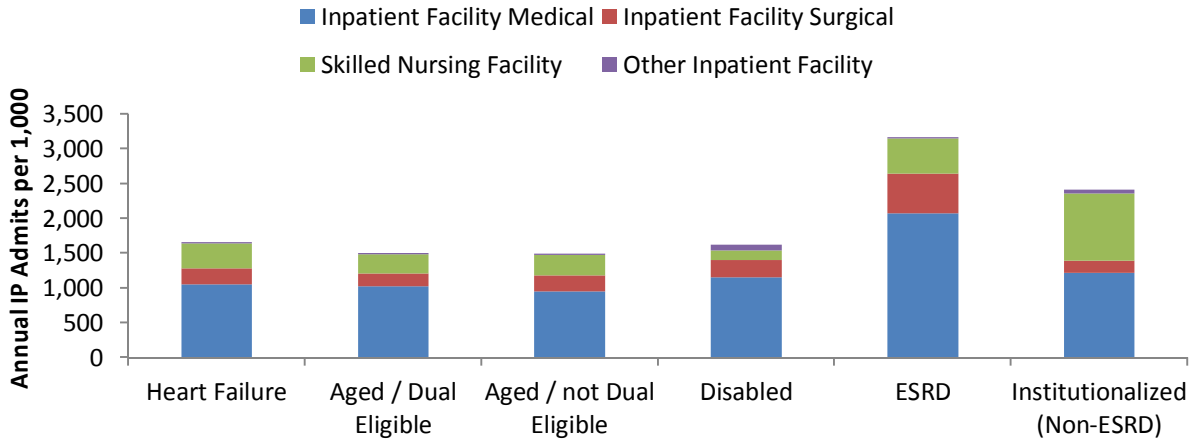
*Source: Milliman Analysis of Medicare 5% Sample 2011-2012 (2012 index year, 2011 look back year)
 "Other" admissions are included in total including psych, substance abuse, acute rehab and maternity.*

Graph 10: Key Points

- Inpatient admission rates for the HF population are 6x higher than inpatient admission rates in the non-HF population.
- Medical admissions make up 63% of total admissions for the HF population and 53% of total admissions for the non-HF population.
- SNF admission rates for the HF population are almost 8x as high as SNF admission rates in the non-HF population.

Graph 11 provides the annual IP admission rates for HF beneficiaries by eligibility status.

Graph 11: IP Admission Rates for HF Medicare Beneficiaries by Eligibility Status



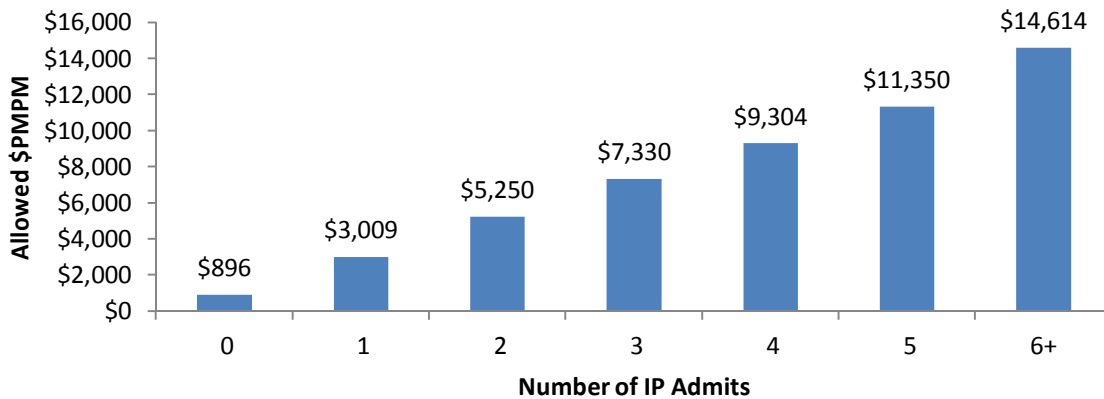
Source: Milliman Analysis of Medicare 5% Sample 2011-2012 (2012 index year, 2011 look back year)
Other IP admissions include psych, substance abuse, acute rehab and maternity.

Graph 11: Key Points

- The distribution of admission types varies by eligibility status in HF beneficiaries.
- The institutionalized HF population has the highest portion of SNF admits as a portion of total admits.

Graph 12 provides the allowed \$PMPM for HF beneficiaries by the number of IP admissions they have in a year.

Graph 12: Allowed \$PMPM by Number of IP Admits for HF Beneficiaries



Source: Milliman Analysis of Medicare 5% Sample 2011-2012 (2012 index year, 2011 look back year)
Allowed cost includes patient cost sharing. Costs have been trended to 2014.

Graph 12: Key Points

- The allowed PMPM medical costs for HF beneficiaries increases as the number of IP admissions increase.

Table 4 provides the distribution of HF and non-HF admissions for the HF population.

Table 4: IP Admission Distribution for HF Patients		
Type	Admit Count	Distribution
HF admissions (MS-DRG 291, 292, 293)	22,450	11%
Other admissions	180,758	89%
Total	203,208	100%

Source: Milliman Analysis of Medicare 5% Sample 2011-2012 (2012 index year, 2011 look back year)

Table 4: Key Points

- 11% of total admissions for the HF population were for one of the three HF MS-DRGs (291, 292, and 293).

Table 5 provides a distribution of HF population admissions by major diagnostic category. Admissions for HF specific DRGs 291, 292, 293 are attributed to the MDC category “diseases and disorders of the circulatory system” and other admissions in this MDC category may be HF related. In addition, admissions in the second major category, “diseases and disorders of the respiratory system: may include HF related admissions.

Table 5: Admit Distribution by Major Diagnostic Category for HF Patients	
Major Diagnostic Category	Distribution
Diseases and Disorders of the Circulatory System	31.04%
Diseases and Disorders of the Respiratory System	18.19%
Diseases and Disorders of the Digestive System	8.04%
Diseases and Disorders of the Kidney and Urinary Tract	7.84%
Infectious and Parasitic Diseases, Systemic or Unspecified Sites	6.97%
Diseases and Disorders of the Musculoskeletal System and Connective Tissue	6.42%
Diseases and Disorders of the Nervous System	5.66%
Endocrine, Nutritional and Metabolic Diseases and Disorders	3.48%
Diseases and Disorders of the Skin, Subcutaneous Tissue and Breast	2.54%
Diseases and Disorders of the Hepatobiliary System and Pancreas	1.81%
Diseases and Disorders of the Blood, Blood Forming Organs, Immunological Disorders	1.61%
Other	6.40%

Source: Milliman Analysis of Medicare 5% Sample 2011-2012 (2012 index year, 2011 look back year)

Table 5: Key Points

- Nearly 1/3 of all admissions for HF patients fell into the ‘diseases and disorders of the circulatory system’ category which includes the HF DRGs 291, 292, 293.
- The second most frequent admission type for the HF population was in the ‘disease and disorders of the respiratory system’.

Table 6 provides the distribution of HF beneficiaries by their number of annual admissions.

Table 6	HF Population having any admission(s)	
IP Admission Count per HF Beneficiary	Count of Medicare Beneficiaries	% of HF Population
1	45,968	29%
2	24,763	15%
3	12,376	8%
4	6,271	4%
5	3,301	2%
6+	3,912	2%
Total	96,591	60%

Source: Milliman Analysis of Medicare 5% Sample 2011-2012 (2012 index year, 2011 look back year)

Table 6: Key Points

- 60% of HF beneficiaries have one or more admissions while 31% have 2 or more admissions.

Table 7 provides the readmission rates for HF patients including readmissions after HF admissions.

Table 7: Overall Readmission Rates for HF Patients		
Type	Rate for HF Population	Rate for non-HF Population
All-cause readmissions following all-cause admissions	28%	16%
All-cause readmissions following HF admissions	31%	
HF readmissions following HF admissions	10%	

*Source: Milliman Analysis of Medicare 5% Sample 2011-2012 (2012 index year, 2011 look back year)
HF admissions include DRGs 291, 292, 293.*

Table 7: Key Points

- The all cause readmission rate is 28% in the HF population versus 16% in the non-HF population.
- The rate of all cause readmission following HF admissions is 31%.

Table 8 provides the average cost of an IP admission by type and the contribution to total medical allowed spend

Table 8: Cost of IP Admissions and Readmissions for HF Beneficiaries*					
Type of Admission for HF Beneficiary	Average Allowed Cost/ Admission	Allowed \$PMPM for HF Population	% of Total HF Spend	% of Total Medicare Spend	% of Total Medicare Admissions
All admissions	\$14,969	\$1,716	49.3%	16.7%	41.8%
All-cause readmissions following all-cause admissions	\$17,576	\$571	16.4%	5.6%	11.8%
All-cause readmissions following HF admissions	\$15,667	\$61	1.8%	0.6%	1.4%

Source: Milliman Analysis of Medicare 5% Sample 2011-2012 (2012 index year, 2011 look back year)

*IP Admissions do not include SNF, maternity or acute rehab admissions.

The allowed cost per admission includes all covered services that occur during an inpatient admission (including but not limited to professional and facility services) as well as patient cost sharing. Costs have been trended to 2014.

Table 8: Key Points

- IP admissions contribute 49.3 % to the total HF spend.

Mortality and End of Life Care

Table 9 compares the mortality rates between HF and non-HF beneficiaries by eligibility status.

Table 9: Mortality Rate Comparison Heart Failure Population (HF) vs. Nationwide Medicare FFS Population Excluding Heart Failure (non-HF)		
Status	Mortality Rate (non-HF)	Mortality Rate (HF)
Aged / Dual Eligible	3.5%	13.8%
Aged / not Dual Eligible	3.9%	22.0%
Disabled	1.8%	10.0%
ESRD	11.5%	29.4%
Institutionalized (Non-ESRD)	21.9%	34.7%
Total	4.1%	21.5%

Source: Milliman Analysis of Medicare 5% Sample 2011-2012 (2012 index year, 2011 look back year)

Table 9: Key Points

- The mortality rate for the HF population is 5x the rate of the non-HF population.
- For the HF population, mortality is highest among the institutionalized population at 34.7%.

Table 10 provides the distribution of site of death for those HF beneficiaries that die in a given year.

Table 10: Place of Death Among HF Beneficiaries that Died in 2012			
Place of Death	Deaths	Percent	Allowed Cost of Last Admit
Hospital	10,561	31%	\$25,016
SNF	2,620	8%	
Other with hospice	11,358	33%	
Other without hospice	9,957	29%	
Total	34,496	100%	

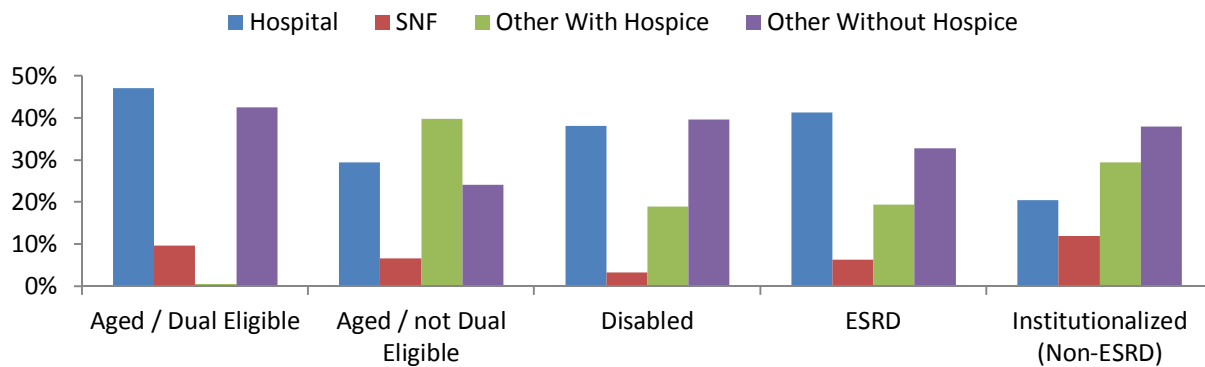
*Source: Milliman Analysis of Medicare 5% Sample 2011-2012 (2012 index year, 2011 look back year)
 Place of death determined by death within 1 day of discharge
 "Other" category includes non-IP hospital or non-SNF facilities, emergency departments, and home
 Allowed cost includes patient cost sharing. Costs have been trended to 2014.*

Table 10: Key Points

- 31% of HF beneficiaries that died in 2012 died in a hospital, while 8% died in a skilled nursing facility. This compares to only 17% of non-HF beneficiaries that died in 2012, dying in a hospital.

Graph 13 provides the distribution of site of death for HF beneficiaries that die in a given year.

Graph 13: Place of Death Distribution by Eligibility Status for HF Beneficiaries That Die in a Given Year



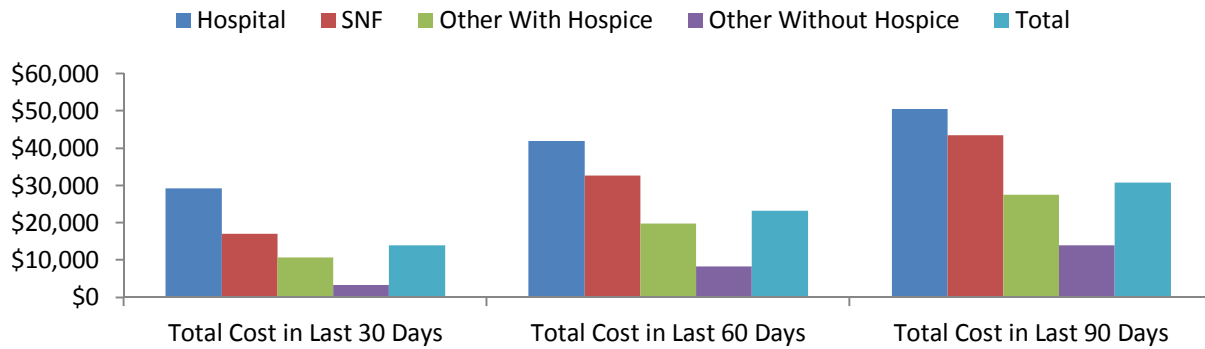
*Source: Milliman Analysis of Medicare 5% Sample 2011-2012 (2012 index year, 2011 look back year)
 Place of death determined by death within 1 day of discharge.
 "Other" category includes home, non-SNF facilities and emergency departments*

Graph 13: Key Points

- The aged dual eligible population has the highest rate of dying in a hospital.
- The aged non-dual eligible population has the highest rate of dying with "other with hospice" ("other" setting is most often home).

Graph 14 provides the average cost per HF member by the site of death in the 30, 60 and 90 days prior to death.

Graph 14: Average Allowed Cost per HF Member by Site of Death 30/60/90 Days Prior to Death



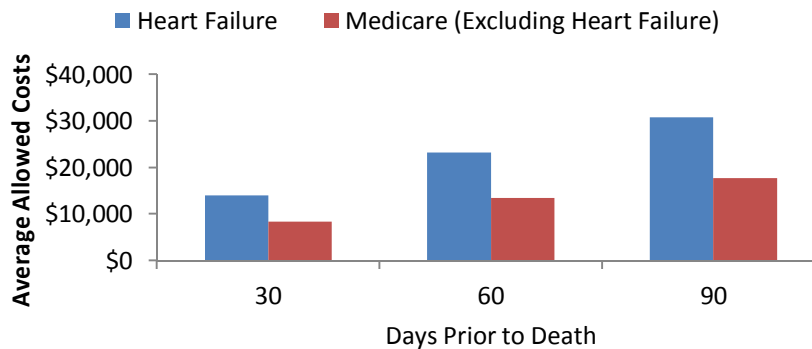
*Source: Milliman Analysis of Medicare 5% Sample 2011-2012 (2012 index year, 2011 look back year)
Place of death determined by death within 1 day of discharge. "Other" category includes home, non-SNF facilities and emergency departments. Allowed cost includes patient cost sharing. Costs have been trended to 2014.*

Graph 14: Key Points

- Costs in the last 90 days of life are highest for those dying in a hospital.
- Costs in the last 90 days of life are lower for those dying outside of a SNF or IP hospital.

Graph 15 provides the average cost in the 30, 60 and 90 days prior to death for the HF compared to the non-HF population.

Graph 15: Average Allowed Cost 30/60/90 Days Prior to Death per HF and Non HF Beneficiary



*Source: Milliman Analysis of Medicare 5% Sample 2011-2012 (2012 index year, 2011 look back year)
Allowed cost includes patient cost sharing. Costs have been trended to 2014.*

Graph 15: Key Points

- Costs in the last 90 days of life are approximately 70% higher for HF beneficiaries compared to non-HF beneficiaries.

PART D ANALYSIS

We analyzed pharmacy spending for HF patients and compared the cost to the typical Part D member using the Medicare Expenditure Panel Survey (MEPS) database for years 2010 through 2012, trended to 2014. Note that the beneficiaries included in this data source are not the same as those included in the Medicare 5% sample. While both are statistically-representative datasets, they do not represent the same individuals. Further explanation of both our data sources and methodology (including trends used) can be found in Appendices B and C.

We calculated the allowed pharmacy costs (the total cost at point of sale before rebates) for members enrolled in standalone Prescription Drug Plans (PDPs) separately for low income (LI) and non-LI members because the funding mechanism for these two populations are different. LI members face minimal cost sharing and have, on average, higher HCCRx scores than NLI members. Table 11 provides the comparison of Part D spend for HF and non-HF beneficiaries.

Table 11: Comparison of 2014 Part D Spending Members with Heart Failure (HF) vs. Average Members Prescription Drug Plan (PDP) National Averages			
Status	2012 PDP Enrollment (Millions)	Allowed \$PMPM (Average Member)	Allowed \$PMPM (HF Member)
Non Low Income	14.3	\$189	\$411
Low Income*	8.3	\$377	\$622

**Low income members are those with incomes below 150% of the federal poverty level (FPL). These members are automatically enrolled in Part D if they do not enroll voluntarily.*

Key Points: Table 11

- LI members either with or without HF have significantly higher pharmacy utilization than NLI members.
- NLI members with HF were approximately 115% more costly than the average NLI member in terms of pharmacy spending.
- LI members with HF showed less of a disparity, as they were only 65% more costly than the average LI member in terms of pharmacy spending.

CONSIDERATIONS FOR KEY STAKEHOLDERS

Findings from our claims data analyses support earlier findings that the HF population has a high mortality rate and generates a large proportion of total Medicare spending. Considering that the Medicare HF population contribute 34% of the total Medicare spend, 42% of the total Medicare admissions and 55% of the total Medicare readmissions, payers and providers alike should focus care management efforts on the HF population.

Medicare Advantage Plans

While this analysis focused on Medicare fee-for-service beneficiaries, we highlight implications for Medicare Advantage (MA) plans' Star ratings, which can have significant financial consequences. Star ratings by CMS are based on performance of MA plans on specific quality measures and several measures are relevant to HF patients.²⁸ By focusing on the HF population, MA plans can simultaneously target several performance measures that may impact their Star rating. Considering HF patients contribute 55% of the all cause readmissions for the total Medicare population, measure C22, *Plan All-Cause Readmissions* can be impacted by focusing on HF patients. With the high prevalence of diabetes in the HF population, the diabetes measures C14-C17 can be impacted by focusing on HF patients as well.²⁸

Medicare MSSP and Pioneer Program Participants

Medicare's voluntary Pioneer ACO Model and the Medicare Shared Savings Program (MSSP) allow physician groups, hospitals and other health care providers to share financial savings for their attributed population's health care costs.⁷ Since the HF population drives a significant portion of the total Medicare population's cost, a focus on reducing admissions and readmissions, as well as end of life costs, in the HF population can significantly impact an ACO's ability to hit their target benchmark and share in savings. Additionally, ACOs can only achieve financial savings if they meet the CMS ACO quality performance standards and three of these measures are HF related. These include ambulatory sensitive admissions: HF (ACO-10), beta blocker therapy for left ventricular dysfunction (ACO-31) and all cause unplanned admissions for patients with HF (ACO-37).^{26,27}

Medicare Bundled Payment for Care Improvement Participants

Medicare's voluntary BPCI initiative presents an opportunity for providers to earn supplemental Medicare payments if they reduce aggregate expenditures on certain episodes of care, including HF episodes. The episodes of care include 30, 60 or 90 days of post discharge costs. For organizations that select HF bundles, it will be essential to focus on readmissions after HF admissions as well as post acute utilization of SNF stays. BPCI participants could generate substantial savings given the high post acute care costs incurred after HF discharges.

Hospitals

The Medicare Hospital Readmission Reduction program administers financial penalties for higher than threshold all cause readmissions after HF admissions. We identified a 31% all cause readmission rate after HF admissions, suggesting there is an opportunity to lower that rate with more aggressive management of discharge transition of care.

Hospitals should also be incentivized to focus on HF patients to avoid financial penalties associated with the MSPB hospital payment penalty. If a hospital's risk adjusted per-capita spending for all annual hospital episodes (the 3 days prior to admission, admission and 30 days post admission costs) exceeds an established benchmark, the hospital will incur a financial penalty. Focusing on more efficient management of the care in the 30 days after HF patient's discharges, will impact performance on the MSPB measurement.

Provider Workforce

With the projected growth in the HF population, provider workforce demands should be evaluated. There will likely be a need for more physicians specializing in HF care and more training for primary care physicians, nurse practitioners, hospice care givers and pharmacists.

Our analysis highlights the cost burden that the HF population contributes to Medicare costs and the need for more efficient management. The mainstays of therapy, ACE inhibitors and ARBs, were introduced almost 25 years ago. The introduction of cardiac devices in 2001 including LVADs, ICDs, and cardiac resynchronization therapy (biventricular pacemakers) have reduced mortality for a target group of HF patients, but are not indicated for the majority of late stage HF patients. Disease management efforts have had mixed results as have the quality performance efforts and P4P programs. ACA-related payment reform efforts are in early stages and outcomes will be watched carefully. Although HF is gaining significant attention by provider and payer stakeholders, continued efforts to improve management of HF patients are needed.

APPENDIX A: PRIMER ON HEART FAILURE

HF is defined as the clinical syndrome resulting from impairment of the heart’s ability to fill with blood or to pump blood. Clinically, patients develop shortness of breath and fatigue. Fluid retention may develop, but it is not universal. Because some patients do not have symptoms or signs of fluid overload, the term “heart failure” is now preferred over “congestive heart failure.” The abbreviation, CHF, which is still commonly used, now refers to chronic HF. The diagnosis of HF is largely based on symptoms and the findings from physician examination, and there is no specific diagnostic test for HF.⁵

HF may be caused by conditions affecting any part of the heart, such as the covering (pericardium), lining (endocardium), or heart valves. However, the most common conditions underlying the development of HF, which are hypertension, previous myocardial infarction, and diabetes, ultimately affect the heart muscle (myocardium). Other causes of HF include substances that are directly toxic to heart muscle, such as some chemotherapy medications, alcohol, and cocaine. HF may also occur as a consequence of other diseases, such as thyroid disorders. Aggressive treatment of risk factors for coronary artery disease (hyperlipidemia, hypertension) reduces the risk of developing HF, as well.⁵

Left ventricular ejection fraction (EF) refers to the percentage of blood in the left ventricle that is pumped out with each heartbeat, and EF is usually measured noninvasively by echocardiography. Measurement of EF allows classification of patients with HF into those with preserved EF and those with reduced EF. That classification is important because of differences in prognosis and response to treatment.²⁹ Additionally, EF level has been used as an entry criterion for clinical trials of HF treatment.

The American College of Cardiology Foundation/American Heart Association (ACCF/AHA) has produced a classification of the stages of HF. This staging system may be helpful in understanding the development and progression of HF.³⁰

ACCF/AHA Stage	Description
A	At high risk for HF, without structural heart disease or symptoms of HF
B	Evidence of structural heart disease, but no symptoms or signs of HF
C	Structural heart disease, and previous or current symptoms of HF
D	HF requiring specialized interventions.

The New York Heart Association (NYHA) functional classification focuses on patient symptoms and has gained widespread acceptance by clinicians as a way of describing functional status.³⁰

NYHA Classification	Description
I	No symptoms of HF with ordinary physical activity
II	Symptoms of HF with ordinary physical activity
III	Symptoms of HF with less than ordinary physical activity
IV	Symptoms of HF at rest or with any physical activity

ACCF/AHA guidelines for the management of HF were most recently published in 2013. A summary of guideline-recommended care follows:⁵

- **Diagnosis:** The guidelines recommend 2-dimensional echocardiogram with Doppler as part of the initial evaluation of HF, for the assessment of ventricular function, including the measurement of EF.
- **Pharmacologic treatment:** Guideline-directed medical therapy (GDMT) for HF with reduced EF focuses on the use of vasodilating medications (ACE inhibitors, ARBs, and, for selected populations, the combination of hydralazine and isosorbide dinitrate), and beta blockers. Diuretics should be used to treat fluid retention. Aldosterone receptor antagonists are recommended for many patients.

GDMT for HF with preserved EF emphasizes the need for control of both systolic and diastolic blood pressure. Diuretics should be used to treat fluid retention. The use of ACE inhibitors, ARBs, and beta blockers to treat hypertension is described as reasonable, as there is less evidence of efficacy, as compared with their use for HF with reduced EF.

- Device therapies: Device therapies include cardiac resynchronization therapy (CRT) and ICD. These treatments are recommended in specific clinical circumstances and are generally not suggested in patients whose frailty and/or comorbid conditions limit life expectancy to less than a year.
- Mechanical cardiac support: Use of LVADs and cardiac transplantation are suggested on a very selective basis only for patients with ACCF/AHA Stage D HF despite GDMT and device management.

Other treatments that are commonly used for HF patients include treatment of symptomatic coronary artery disease with medical treatment or revascularization, either percutaneous coronary intervention (PCI) or coronary artery bypass graft surgery (CABG). Patients with aortic valve disease may require surgical or transcatheter valve replacement. For patients with functional mitral insufficiency, transcatheter mitral valve repair or mitral valve surgery is of uncertain benefit.⁵

Other medical conditions commonly occur in patients with HF. The most common of these are atrial fibrillation, anemia, and depression. The presence of atrial fibrillation increases the risk for HF; conversely, the presence of HF makes atrial fibrillation more likely. Additionally, rapid ventricular response to atrial fibrillation may induce or worsen HF symptoms, and worsening HF may induce rapid ventricular response in atrial fibrillation. Treatment of coexisting atrial fibrillation and HF focuses on anticoagulation to prevent stroke or other thromboembolic complications and symptom control. Anemia occurs in approximately 25-40% of patients with HF and is associated with reduced exercise capacity and an increased risk for hospitalization. Mortality risk is approximately doubled for HF patients with anemia compared with those without anemia. Unfortunately, there is no evidence-based specific treatment for anemia in patients with HF. Depression commonly occurs in patients with HF and it is associated with worse cardiac outcomes and higher utilization of healthcare services compared with patients without depression. Again, there is no guideline recommendation for specific interventions.⁵

Recommendations for palliative care for HF include the suggestion that formal palliative care consultation be part of evaluation prior to cardiac transplantation and other advanced HF treatment. General principles of palliative care are applicable to HF, including a focus on patient preferences, symptom control, health-related quality of life, alleviation of psychosocial distress, and caregiver support. Hospice care may be appropriate for some patients.⁵

APPENDIX B: KEY DATA SOURCES

Medicare 5% Sample. This Limited Data Set contains all Medicare FFS paid claims generated by a statistically-balanced sample of Medicare FFS beneficiaries. Information includes diagnosis codes, procedure codes, and diagnosis-related group (DRG) codes, along with site of service information as well as beneficiary age, eligibility status and an indicator for HMO enrollment. We used Medicare 5% beneficiary sample data in 2011-2012.

Milliman's 2014 65+ Health Cost Guidelines (HCGs). The HCGs provide a flexible but consistent basis for the determination of health claim costs and premium rates for a wide variety of health plans. The HCGs are developed as a result of Milliman's continuing research on healthcare costs. First developed in 1954, the HCGs have been updated and expanded annually since that time. The HCGs are continually monitored as they are used in measuring the experience or evaluating the rates of health plans, and as they are compared to other data sources. The HCGs were developed to be representative of the age and sex distribution for the Medicare FFS population. The Standard Demographics were developed using data from the Medicare 5% sample and publicly available Medicare demographic population data.

Medicare Expenditure Panel Survey (MEPS) 2010-2012. For the Part D cost calculation, we relied on membership and total pharmacy cost information for members with 12 months of Medicare eligibility with some form of Pharmacy Coverage from the MEPS 2010, 2011 and 2012 datasets. MEPS is a large-scale survey of individuals, families, medical providers, and employers in the United States. During multiple rounds of household interviews, MEPS collects detailed information including demographic characteristics, health status, utilization and allowed costs of medical services (including pharmacy), sources of payments, health insurance coverage and income.

APPENDIX C: METHODOLOGY

1. Identification of study population

We used the Medicare 5% sample 2012 data as an index year to identify HF beneficiaries. The following beneficiaries were excluded from the denominator population:

- Beneficiaries without eligibility in all months of 2011 and at least one month in 2012
- Beneficiaries without Part A and Part B eligibility during the study period
- Beneficiaries enrolled in an HMO for any portion of the study period

HF patients were identified as individuals with at least one outpatient, non-acute inpatient, acute inpatient or emergency department claim coded with a HF ICD-9 code in any position of the claim. The claim types queried for HF identification were required to have one of the codes below:

Claim type	CPT code	Revenue codes
Outpatient	99201-99205, 99211-99215, 99217-99220, 99241-99245, 99341-99345, 99347-99350, 99384-99387, 99394-99397, 99401-99404, 99411, 99412, 99420, 99429, 99455, 99456	051x, 0520-0523, 0526-0529, 057x-059x, 082x-085x, 088x, 0982, 0983
Non-acute inpatient	99034-99310, 99315, 99316, 99318, 99324-99328, 99334-99337	0118, 0128, 0138, 0148, 0158, 019x, 0524, 0525, 055x, 066x
Acute inpatient	99221-99223, 99231-99233, 99238, 99239, 99251, 99255, 99291	010x, 0110-0114, 0119, 0120-0124, 0129, 0130-0134, 0139, 0140-0144, 0149, 0150-0154, 0159, 016x, 020x, 021x, 072x, 080x, 0987
Emergency department	99281-99285	045x, 0981

List of HF ICD-9 diagnosis codes for HF patient identification:

ICD-9 Dx Code	Code Description
398.91	Rheumatic heart failure (congestive)
402.01	Malignant hypertension, with heart failure
402.11	Benign hypertension, with heart failure
402.91	Unspecified hypertension, with heart failure
404.01	Hypertensive heart and chronic kidney disease, malignant, with heart failure and with chronic kidney disease stage I through stage IV, or unspecified
404.03	Hypertensive heart and chronic kidney disease, malignant, with heart failure and with chronic kidney disease stage V
404.11	Hypertensive heart and chronic kidney disease, benign, with heart failure and with chronic kidney disease stage I through stage IV, or unspecified
404.13	Hypertensive heart and chronic kidney disease, benign, with heart failure and with chronic kidney disease stage V
404.91	Hypertensive heart and chronic kidney disease, unspecified, with heart failure and with chronic kidney disease stage I through stage IV or unspecified
404.93	Hypertensive heart and chronic kidney disease, unspecified, with heart failure and with chronic

	kidney disease stage V
428.0	Congestive heart failure, unspecified
428.1	Left heart failure
428.20	Systolic heart failure, unspecified
428.21	Systolic heart failure, acute
428.22	Systolic heart failure, chronic
428.23	Systolic heart failure, acute on chronic
428.30	Diastolic heart failure, unspecified
428.31	Diastolic heart failure, acute
428.32	Diastolic heart failure, chronic
428.33	Diastolic heart failure, acute on chronic
428.40	Combined systolic and diastolic heart failure, unspecified
428.41	Combined systolic and diastolic heart failure, acute
428.42	Combined systolic and diastolic heart failure, chronic
428.43	Combined systolic and diastolic heart failure, acute on chronic
428.9	Heart failure, unspecified

2. Descriptive claim data analyses and metrics of interest

The HF cohort was stratified into the following categories for reporting based on each beneficiary's eligibility file:

- Aged / dual eligible
- Non-Institutionalized, Non-Medicaid (NINM) Aged
- Disabled
- ESRD
- Institutionalized (living in a nursing home)

Prevalence of comorbidities was defined if beneficiaries had one outpatient, non-acute outpatient, acute inpatient or emergency department claim coded with the specified condition ICD-9 code in any position of the claim.

Cardiac Comorbidities	ICD-9 Diagnosis Codes
Arrhythmias	427.0-427.9
Hypertension	401.0-401.9; 402.0-402.9; 404.00-405.99
Atherosclerosis: coronary artery disease	414.00-414.9
Atherosclerosis: cerebrovascular disease	433.00-437.9
Atherosclerosis: peripheral vascular disease	440.0-440.9

Non-Cardiac Comorbidities	ICD-9 Diagnosis Codes
Diabetes	250.xx, 357.2x, 362.0x, 366.41
Chronic Obstructive Pulmonary Disease	491.xx, 492.xx; 496.xx, 493.2
Chronic Kidney Disease	585.1-585.9
Serious Mental Illness (schizophrenia; major depression; bipolar disease)	295.00-295.95; 296.00-296.99
Anemia	285.29

3. Cost Metrics

All cost metrics were trended from 2012 to 2014 using a two year trend rate of 2.6%.³¹

4. Utilization Metrics

Methodology to Measure Acute Hospital Readmissions

To calculate HF-related and all-cause 30-day admission rates, we used a modified version of the methodology developed by the federal Agency for Healthcare Research and Quality (AHRQ) for its Healthcare Cost and Utilization Project (HCUP).

For the following readmission rates, every admission was counted as a separate index admission (the starting point for follow-up to check for readmissions) and as such, a single patient may contribute multiple index admissions and readmissions to these metrics.

We included all discharges in 2012 and followed 30 days out (or in the case of December discharges, days remaining until December 31st) for a readmission. We use December 2011 discharges and follow 30 days into January 2012 to determine which January 2012 admissions would be considered readmissions.

- 30-day readmission rate, all-cause, defined as follows:

$$\frac{\text{\# of IP admissions with at least one IP discharge occurring within the prior 30 days}}{\text{total \# of IP discharges}}$$

- 30-day readmission rate following HF admissions, defined as follows:

$$\frac{\text{\# of IP admissions with at least one IP discharge for HF occurring within the prior 30 days}}{\text{total \# of HF IP discharges}}$$

- HF-related 30-day readmission rate following HF admissions, defined as follows:

$$\frac{\text{\# of IP admissions for HF with at least one IP discharge for HF occurring within the prior 30 days}}{\text{total \# of HF IP discharges}}$$

We reported readmissions separately that followed HF discharges. HF DRGs are noted below.

MS-DRG	MS-DRG Description
291	Heart failure and shock, with major complication/comorbidity (MCC)
292	Heart failure and shock, with complication/comorbidity (CC)
293	Heart failure and shock, without CC/MCC

Methodology to identify hospice utilization

To be classified as a beneficiary who was on hospice, there had to be at least one hospice claim within 180 days of the death date. To analyze the length of time spent in hospice, the time elapsed between the hospice claim furthest from the death date and within 365 days of the death date was identified. If the number of days was greater than 180 days, it was considered to be 180 days for analytic purposes.

5. Medicare Part D Analysis

We relied on membership and total pharmacy cost information for members with 12 months of Medicare eligibility with some form of Pharmacy Coverage from the MEPS 2010, 2011 and 2012 datasets. MEPS is a large-scale survey of individuals, families, medical providers, and employers in the United States. During multiple rounds of household interviews, MEPS collects detailed information including demographic characteristics, health status, utilization and

allowed costs of medical services (including pharmacy), sources of payments, health insurance coverage and income.

We segmented these populations further into Non-Low Income and Low Income. HF was identified using the MEPS Condition Files which listed each reported condition for each survey respondent. We then calibrated the total cost for each population to reported 2013 MedPAC Reports. MedPAC is a nonpartisan agency that advises the U.S. Congress on issues pertinent to the Medicare program. We used both the June 2014 DataBook “Health Care Spending and the Medicare Program” and the March 2014 “Report to the Congress: Medicare Payment Policy”. We then trended claims costs forward to 2014 using a 2% trend rate for 2013 and a 4% trend rate for 2014.

REFERENCES

1. Mozaffarian D, Benjamin EJ, Go AS, et al. Heart disease and stroke statistics-2015 update: a report from the American Heart Association. *Circulation*. Jan 27 2015;131(4):e29-e322.
2. Heidenreich PA, Albert NM, Allen LA, et al. Forecasting the impact of heart failure in the United States: a policy statement from the American Heart Association. *Circulation. Heart failure*. May 2013;6(3):606-619.
3. Roger VL, Weston SA, Redfield MM, et al. Trends in heart failure incidence and survival in a community-based population. *JAMA*. 2004;292(3):344-350.
4. Loefer LR, Rosamond WD, Chang PP, Folsom AR, Chambless LE. Heart Failure Incidence and Survival (from the Atherosclerosis Risk in Communities Study). *American Journal of Cardiology*. 101(7):1016-1022.
5. Yancy CW, Jessup M, Bozkurt B, et al. 2013 ACCF/AHA guideline for the management of heart failure: a report of the American College of Cardiology Foundation/American Heart Association Task Force on practice guidelines. *Circulation*. Oct 15 2013;128(16):e240-327.
6. Bonow RO, Ganiats TG, Beam CT, et al. ACCF/AHA/AMA-PCPI 2011 Performance Measures for Adults With Heart Failure: A Report of the American College of Cardiology Foundation/American Heart Association Task Force on Performance Measures and the American Medical Association-Physician Consortium for Performance Improvement. *Journal of the American College of Cardiology*. 2012;59(20):1812-1832.
7. Centers for Medicare and Medicaid Services. Accountable Care Organizations (ACO). 2013; <http://www.cms.gov/Medicare/Medicare-Fee-for-Service-Payment/ACO/index.html>, 2014.
8. Centers for Medicare and Medicaid Services. 2014 Physician Quality Reporting System (PQRS) Measures List. Baltimore, MD 2014.
9. Centers for Medicare and Medicaid Services. Measures displayed on Hospital Compare. 2014; <http://www.medicare.gov/hospitalcompare/Data/Measures-Displayed.html>. Accessed November 4, 2014.
10. Centers for Medicare and Medicaid Services. Readmissions reduction program. 2014; CMS Policy Document. Available at: <http://www.cms.gov/Medicare/Medicare-Fee-for-Service-Payment/AcuteInpatientPPS/Readmissions-Reduction-Program.html>. Accessed 25 October 2014.
11. Chen J, Normand ST, Wang Y, Krumholz HM. National and regional trends in heart failure hospitalization and mortality rates for medicare beneficiaries, 1998-2008. *JAMA*. 2011;306(15):1669-1678.
12. Unroe KT, Greiner MA, Hernandez AF, et al. Resource use in the last 6 months of life among medicare beneficiaries with heart failure, 2000-2007. *Archives of Internal Medicine*. Feb 14 2011;171(3):196-203.
13. Sacks CA, Jarcho JA, Curfman GD. Paradigm shifts in heart-failure therapy--a timeline. *The New England Journal of Medicine*. Sep 11 2014;371(11):989-991.
14. Centers for Medicare and Medicaid Services. Hospital Compare. 2014; <http://www.cms.gov/Medicare/Quality-Initiatives-Patient-Assessment-Instruments/HospitalQualityInits/HospitalCompare.html>. Accessed October 31, 2014.
15. Centers for Medicare and Medicaid Services. 2014 Physician Quality Reporting System (PQRS): Implementation Guide. Baltimore, MD 2014.
16. Green LH. *Evaluation of Care and Disease Management Under Medicare Advantage Contract*. Washington DC: L&M Policy Research, 2009.
17. Sidorov J. Reduced Health Care Costs Associated With Disease Management for Chronic Heart Failure: A Study Using Three Methods to Examine the Financial Impact of a Heart Failure Disease Management Program Among Medicare Advantage Enrollees. *Journal of Cardiac Failure*. 2006;12(8):594-600.
18. McCall N, Cromwell J. Results of the Medicare Health Support Disease-Management Pilot Program. *New England Journal of Medicine*. 2011;365(18):1704-1712.
19. James J. Health Policy Brief: Medicare Hospital Readmissions Reduction Program. *Health Affairs*. November 12, 2013.
20. Medicare Payment Advisory Commission. *Report to Congress: Medicare and the Health Care Delivery System*. Washington, DC: MedPAC; June 14, 2013.

21. Centers for Medicare and Medicaid Services. 42 CFR Parts 412, 413, 424, et al. Medicare Program; Hospital Inpatient Prospective Payment Systems for Acute Care Hospitals and Long-Term Care Hospital Prospective Payment System and Fiscal Year 2013 Rates; Hospitals' Resident Caps for Graduate Medical Education Payment Purposes; Quality Reporting Requirements for Specific Providers and for Ambulatory Surgical Centers; Final Rule. In: Centers for Medicare and Medicaid Services, ed. Vol CMS-1588-F: Department of Health and Human Services; 2012:494.
22. Centers for Medicare and Medicaid Services. Open Door Forum: Hospital Value-Based Purchasing Fiscal Year 2013 Overview. In: Department of Health and Human Services, ed. Baltimore, MD, 2011.
23. Centers for Medicare and Medicaid Services. Bundled Payments for Care Improvement (BPCI) Initiative: General Information. 2014; <http://innovation.cms.gov/initiatives/bundled-payments/>. Accessed 25 October 2014.
24. Centers for Medicare and Medicaid Services. BPCI Initiative filtered view. 2014; <https://data.cms.gov/dataset/BPCI-Initiative-Filtered-View/e5a5-c768>. Accessed 25 October 2014.
25. Centers for Medicare and Medicaid Services. Fast Facts - All Medicare Shared Savings Program ACOs. 2014; <https://www.cms.gov/Medicare/Medicare-Fee-for-Service-Payment/sharesavingsprogram/Downloads/All-Starts-MSSP-ACO.pdf>. Accessed October 25, 2014.
26. Centers for Medicare and Medicaid Services. Medicare Program; Revisions to Payment Policies Under the Physician Fee Schedule, Clinical Laboratory Fee Schedule, Access to Identifiable Data for the Center for Medicare and Medicaid Innovation Models & Other Revisions to Part B for CY 2015; Final Rule. In: Department of Health and Human Services, ed. Vol 42 CFR Parts 403, 405, 410, et al. Baltimore, MD, 2014.
27. Centers for Medicare and Medicaid Services. Medicare Shared Savings Program Quality Measure Benchmarks for the 2014 and 2015 Reporting Years. 2014; <http://www.cms.gov/Medicare/Medicare-Fee-for-service-Payment/sharesavingsprogram/Downloads/MSSP-QM-Benchmarks.pdf>. Accessed October 25, 2014.
28. Centers for Medicare and Medicaid Services. *Medicare 2015 Part C & D Star Rating Technical Notes*. Baltimore, MD, 2014.
29. Meyer T, Shih J, Aurigemma G. Heart failure with preserved ejection fraction (diastolic dysfunction). *Annals of Internal Medicine*. Jan 1 2013;158(1):ITC5-1-ITC5-15; quiz ITC5-16.
30. Hunt SA, Abraham WT, Chin MH, et al. 2009 focused update incorporated into the ACC/AHA 2005 Guidelines for the Diagnosis and Management of Heart Failure in Adults: a report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines: developed in collaboration with the International Society for Heart and Lung Transplantation. *Circulation*. Apr 14 2009;119(14):e391-479.
31. Coyle R. Early Preview - CY2016 Medicare Advantage Ratebook Growth Rates. In: Office of the Actuary, ed. Baltimore, MD: Centers for Medicare and Medicaid Services; 2014.