MILLIMAN REPORT

Analysis of Medical and Pharmacy Cost Burden of Hypertension and Atrial Fibrillation

Commissioned by: AliveCor

December 14, 2022

Juliet M. Spector, FSA, MAAA
Principal and Consulting Actuary

Pepper Huang
Senior Actuarial Analyst

71 S. Wacker Drive
31st Floor
Chicago, IL 60606
USA
Tel +1 312 726 0677

milliman.com

Milliman


Milliman

Table of Contents

I. BACKGROUND

AliveCor commissioned Milliman to conduct an analysis to quantify the medical and pharmacy footprint of individuals with hypertension and atrial fibrillation, as well as the medical and pharmacy cost for those individuals developing higher cardiac risk profiles over a 6- to 12-month study period, including more severe cardiovascular conditions and acute cardiovascular events.

Hypertension occurs when blood pressure is higher than normal. Blood pressure can damage the heart and cause health problems if it remains elevated for a long time.[1] Nearly 1 in 2 adults in the U.S. has hypertension (~116 million).[2] "Atrial fibrillation (AFib) is the most common type of treated heart arrhythmia. When a person has AFib, the beating in the upper chambers of the heart is irregular, and blood does not flow as well as it should to the lower chambers of the heart. AFib may happen in brief episodes, or it may be a permanent condition.[3]" AFib affects an estimated 2.2 million adults in the U.S. alone and is projected to grow over time.

Even though the needs for cardiac care are growing, the U.S. faces a shortage of cardiologists as the population ages and the burden of heart disease grows.[4] The market for solutions that can improve access to healthcare services related to cardiovascular conditions is growing. For example, software is available that allows users to record their own electrocardiogram (ECG), including direct-to-consumer personal devices and enterprise solutions that offer comprehensive benefits like data monitoring of ECG and blood pressure, live feedback, lifestyle coaching, and medication management. These types of interventions are designed to drive improved health outcomes and reduce the cost of cardiovascular care for people with cardiovascular conditions, including hypertension and AFib.

The study described in this report focuses on the cost of healthcare claims for commercially insured and Medicare Advantage (MA) members that is associated with hypertension and AFib, as well as select comorbidities among individuals who have hypertension or AFib. It illustrates the potential for savings resulting from interventions that may improve care management for these conditions by presenting a framework for estimating savings that may result from lower treatment costs for hypertension, AFib, and select comorbidities. This paper is not an analysis of AliveCor's solution or savings ("effectiveness") associated with AliveCor, but rather a generic look at potential savings from improved outcomes.

[1] Retrieved August 24, 2022, Facts About Hypertension | cdc.gov
[2] Retrieved August 24, 2022, Estimated Hypertension Prevalence, Treatment, and Control Among U.S. Adults | Million Hearts® (hhs.gov)
[3] Retrieved August 24, 2022, Atrial Fibrillation | cdc.gov
[4] Retrieved August 24, 2022, Cardiology workforce: a shortage, not a surplus - PubMed (nih.gov)

II. EXECUTIVE SUMMARY

To model potential savings from interventions to improve cardiovascular care and health outcomes, such as the use of comprehensive cardiac monitoring solutions, we analyzed health insurance claims for commercially insured and MA members who have either hypertension or AFib. The study period began with the member's first observed claim for hypertension or AFib in 2017. We tracked their spending and claims over a 2-year period. During the period, we evaluated their medical claims to determine if the patients had experienced an acute cardiovascular episode (such as a heart attack) or been newly diagnosed with a more severe cardiovascular condition (which increases the risk of an acute cardiovascular episode). We stratified patients into risk categories based on their severity of cardiovascular disease (see Figure 7 for definitions of cardiovascular conditions, acute cardiovascular episodes, and corresponding risk categories). We then identified the cost differences between patients who developed more severe cardiovascular conditions or experienced an acute cardiovascular episode during the study period and those who did not. Finally, using the observed costs differences for these groups of patients, we modelled the potential reduction in healthcare spending that could result from avoiding a portion of the new conditions or episodes. In addition, based on the prevalence and cost of cardiac care and comorbidities observed in the population of members with hypertension or AFib without an increase in risk during the study period, we modelled the potential cost savings from improvements in the efficiency of cardiovascular care and more effective management of comorbidities (this was not intended to look at the effectiveness of any specific solution but the economics of improved efficiency in general).

Using 2016 to 2019 data from Milliman's proprietary research database, we identified 2.7 million individuals with hypertension (ICD-10 CM I10, I52, I58, I59) and 94,000 people with AFib (ICD-10 CM I480, I481, I4811, I482, I4820, I4821, I4891), respectively, with at least one claim in 2017 (including both newly diagnosed and prevalent condition patients) and who did not have a higher risk cardiovascular condition or acute cardiovascular episode in 2016. We then analyzed claims data for the hypertension and AFib populations from 2017 to 2019 and trended costs to 2022.

The following key findings were identified:

- The cost of commercially insured members 6 to 12 months following the first identification of a hypertension diagnosis in the study period was between $1,548 to $163,768 per patient per year (PPPY) and $2,502 to $202,795 PPPY for those with an AFib diagnosis. MA members were less expensive, ranging from $2,384 to $74,705 for members with a hypertension diagnosis and $4,039 to $90,077 for members with an AFib diagnosis.

- 4% of commercially insured members and 11.9% of MA members with a hypertension diagnosis and 14.2% of commercially insured members and 28.0% of MA members with an AFib diagnosis were newly diagnosed with a higher risk cardiovascular condition or experienced an acute cardiovascular episode within 6 to 12 months after their hypertension or AFib diagnosis was first identified during the study period. The cost of these patients was substantially higher than individuals who did not develop an incident cardiovascular condition or experience an acute cardiovascular episode.

- Using best estimates and a varying intervention success rate in reducing impactable costs by 5% to 90%, we modelled per patient per month (PPPM) savings ranging from $20 to $407 that could potentially be realized by managing and maintaining patients with hypertension or AFib at the same risk level as their current cardiovascular disease state. We did not consider any reversion to the mean that may occur over time.

- While validating whether savings could be achievable by an intervention was outside the scope of this analysis, we reviewed the breakdown of spending by cost category to understand where reductions in utilization would be needed to achieve significant savings.

- We examined select comorbidities in patients with hypertension and AFib, identified specifically because interventions to improve hypertension and AFib management have the potential to improve these comorbidities. Due to uncertainty about the occurrence and magnitude of an impact of hypertension and AFib care management on the cost of select comorbidities, we modelled scenarios with (Figure 8 Column 5) and without (Figure 8 Column 4) cost reductions for comorbidity care. We applied these cost reductions to both patients who developed more severe cardiovascular conditions or experienced an acute cardiovascular episode and those who did not.

- For a given employer or Medicare Advantage plan, results of hypertension or AFib interventions may vary based on the underlying demographic and other characteristics of their employees or MA plan members. For example, differences in age or sex distribution will result in varying condition prevalence and the cost of disease conditions, as shown in Figures 2a and 2b. In addition, specific interventions may have different rates of success, including falling outside the range of success rates we modelled.

III. RESULTS

Using 2016 to 2019 data from Milliman's proprietary research database, we identified 2,246,931 commercially insured individuals and 433,253 MA members with hypertension in 2017 who did not have a more severe cardiovascular condition or experience an acute cardiovascular episode in 2016. We also identified 116,781 commercial lives and 94,047 MA members with AFib in 2017 who did not have a more severe cardiovascular condition or experience an acute cardiovascular episode in 2016. See Figure 7 for a mapping of cardiovascular conditions and associated risk level (i.e., severity). Of the members we identified, we analyzed each condition's prevalence and the cost of medical and pharmacy claims. For the purposes of this analysis, we excluded patients with chronic kidney disease and patients who were pregnant during the study period.

The results of spend for patients with hypertension and AFib are shown in Figure 1. Further detail for patient cohorts, including those diagnosed with an incident cardiovascular condition or experiencing an acute cardiovascular episode, are included in the exhibits.

Figure 1. Medical and Pharmacy Cost for Hypertension and Atrial Fibrillation Cohorts in Commercial and Medicare Advantage Markets Using 2017 to 2019 Utilization Data, Costs Trended to 2022

Cohort	Risk Level	% in each Cohort 6 to 12 Months after Identification	Total PPPY	Total PPPM
Hypertension				
Hypertension; no additional claims[1]	<3	37.3%	$1,548	$129
Remains in hypertension	3	58.6%	$11,973	$998
Secondary Hypertension	3	0.1%	$19,522	$1,627
Incident cardiovascular condition	4	3.7%	$28,794	$2,400
Acute cardiovascular episode	5	0.3%	$163,768	$13,647
AFib				
AFib; no additional claims[1]	<4	29.8%	$2,502	$208
Remains in AFib	4	55.6%	$29,687	$2,474
Incident cardiovascular condition	4	13.0%	$41,607	$3,467
Acute cardiovascular episode	5	1.2%	$202,795	$16,900
Medicare Advantage Market				
Hypertension				
Hypertension; no additional claims[1]	<3	22.0%	$2,384	$199
Remains in hypertension	3	65.8%	$8,823	$735
Secondary Hypertension	3	0.1%	$12,673	$1,056
Incident cardiovascular condition	4	11.0%	$16,467	$1,372
Acute cardiovascular episode	5	0.9%	$74,705	$6,225
AFib				
AFib; no additional claims[1]	<4	13.1%	$4,039	$337
Remains in AFib	4	57.8%	$16,623	$1,385
Incident cardiovascular condition	4	25.1%	$23,153	$1,929
Acute cardiovascular episode	5	2.9%	$90,077	$7,506

[1]No additional claims means that there were no claims after the initial identification.

Rates of hypertension and AFib vary by geography, race[5], age, and sex. A given payer or employer will need to adjust for this in their own analysis. Figures 2a and 2b show the data from Figure 1 broken out by key age bands and sex:

Figure 2a. Hypertension - variation by Age and Sex

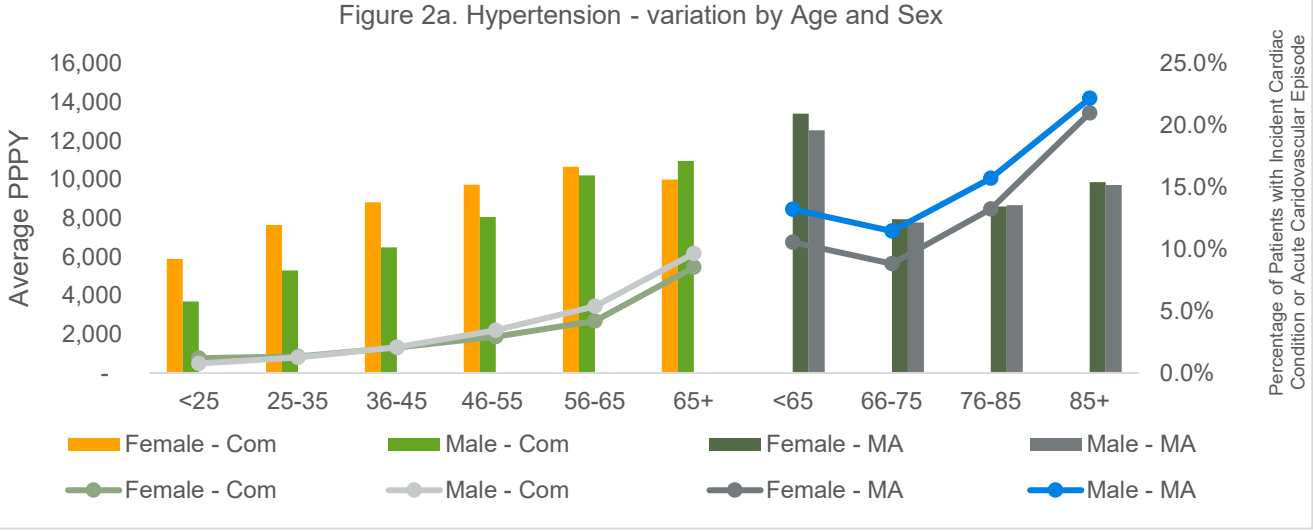
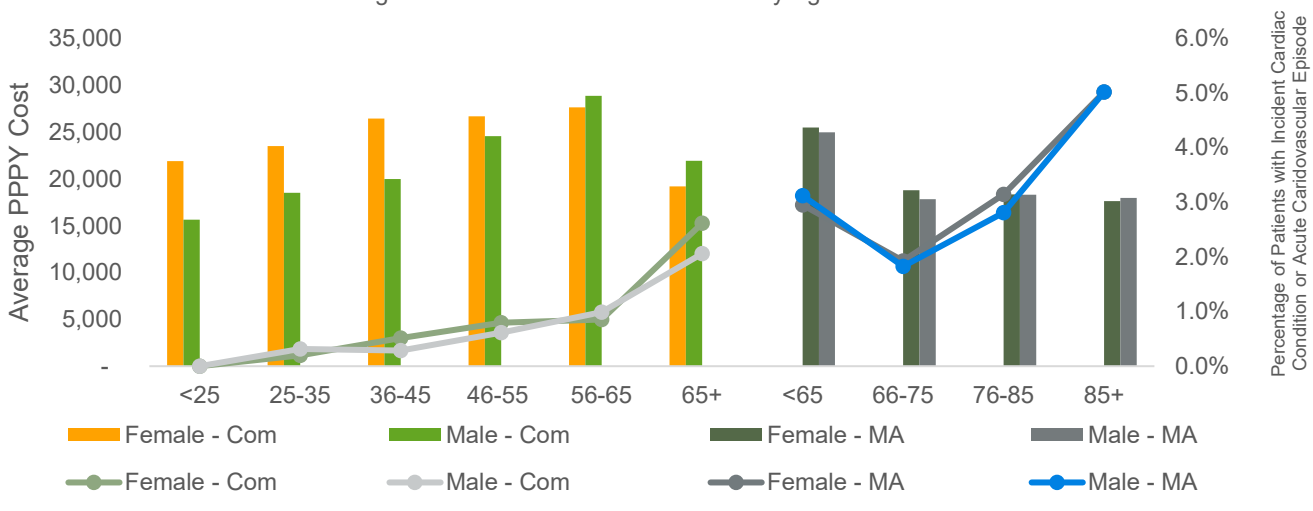


Figure 2b. Atrial Fibrillation - variation by Age and Sex



For a given employer or MA plan, results of a hypertension or AFib care management intervention may vary by the underlying makeup of their employees or MA plan members.

Once we looked at the underlying costs in the data in Figure 1 and some of the potential variation-related demographic drivers in Figures 2a and 2b, we then modelled the potential for savings if an individual who would have developed a higher risk cardiovascular condition or experienced an acute cardiovascular episode instead remained in their baseline hypertension or baseline AFib severity status.

- We show results of potential savings using the underlying age, sex, and geographic makeup of our nationwide data set.

[5] Racial disparities in healthcare: Cardiovascular conditions (milliman.com)

- We assume those who opt out would not receive the intervention, and therefore, their utilization and costs would be not impacted by the analysis.
- We assume only claims with a cardiovascular diagnosis code (Figure 8 Column 4) and / or select comorbidity claims (Figure 8 Column 5) would have the opportunity to be reduced. For example, with the cardiovascular and / or comorbidity, among commercial members who started with hypertension and developed an incident cardiovascular condition or experienced an acute cardiovascular episode within the following 6 to 12 months, only 67.6% of their medical and pharmacy claims would be impactable. This would subsequently reduce the total impactable PPPY from $28,794 to $19,477 (the sum of PPPY for claims with cardiovascular conditions and select comorbidity diagnoses; Figure 8).
- Please note, in this example, the cost of services for this member is higher than the cost of services for a member who remained in hypertension, $11,973, which accounts for the fact that those individuals who ended up with a higher cardiovascular risk level were probably sicker than those that remained in hypertension or AFib.
- For those members who remained in hypertension and AFib without an increase in cardiovascular risk level, we looked at their costs segmented by major cost category, displayed in Figure 5. It will ultimately be up to those that develop the intervention to determine which categories they can achieve savings.
- Of those costs that are impactable, we then assume only a portion would be successfully reduced by the intervention. We call this the success rate.
- We vary the success rate from 5% to 90% to show the range of potential results of a successful intervention. Success rates could be outside of the range shown.
- We modelled scenarios with (Figure 8 Column 5) and without (Figure 8 Column 4) cost reductions for select comorbidity claims. We assumed that intervention would reduce costs for select comorbidity claims for both patients who remain in the same risk level and those that move to a higher risk level. The select comorbidity claims that are impactable by intervention are the same for all risk levels.
- These scenarios were not intended to look at the effectiveness of any specific solution but the economics of improved efficiency in general.

Figure 3. Estimated Sensitivity of Savings Patient per Month (PPPM) from Intervention for Hypertension and Atrial Fibrillation Patients 2017 to 2019 Utilization Data, Costs Trended to 2022

	Probability of a Successful Intervention					
	5%	*15%*	*35%*	*50%*	*70%*	*90%*
Commercial with select comorbidity savings	$23	$68	$158	$226	$316	$407
Commercial without select comorbidity savings	$20	$59	$137	$195	$273	$351
Medicare Advantage with select comorbidity savings	$22	$65	$152	$217	$304	$391
Medicare Advantage without select comorbidity savings	$19	$57	$133	$190	$267	$343

Figures 4a and 4b show an example of how the values in Figure 3 were calculated. In this example, we see approximately $158 PPPM savings for the commercial population and $152 PPPM savings for the MA population, based on the illustrative assumption that 35% of the interventions were successful. The success of hypertension and AFib care management interventions is unknown and likely to vary across types of interventions, populations participating in the intervention, etc.

Figure 4a. Estimated Savings per Patient per Month (PPPM) from Cardiac Intervention for Hypertension and AFib Patients 2017 to 2019 Utilization Data, Costs Trended to 2022; Illustrative (35% Success Rate)

Commercial Market

Hypertension	Risk Level	% in Each Cohort 6-12 Months After Identification (Col 1)	% in Each Cohort After Success Rate (Col 2)	Baseline[3] (Col 3)	Claims with Cardio-vascular or Select Comorbidity Diagnosis (Col 4)	Remains in Baseline Risk Level (Col 5 = Col 3 - Col 7)	New Baseline Cardio-vascular Claims (Col 6)	PPPM Difference (Col 7 = (Col 4 - Col 6) *Success rate
Hypertension; no additional claims[1]	<3	37.3%		$129	$49	$112	-	$17
Remains in hypertension	3	58.6%		$998	$521	$815	-	$182
Hypertension Baseline	**3**	**95.9%**	**97.3%**	**$660**	**$337**	**$542**	**-**	**$118**
Secondary Hypertension	3'	0.1%	0.1%	$1,627	$659	$1,518	$337	$109
Incident cardiovascular condition[2]	4	3.7%	2.4%	$2,400	$1,623	$1,950	$337	$450
Acute cardiovascular episode[2]	5	0.3%	0.2%	$13,647	$12,045	$9,550	$337	$4,098
Total Hypertension		**99.9%**	**99.9%**	**$763**	**$419**	**$621**		**$142**
AFib								
AFib; no additional claims[1]	<4	29.8%		$208	$110	$170	-	$38
Remains in AFib	4	55.6%		$2,474	$1,771	$1,854	-	$620
AFib Baseline	**4**	**85.4%**	**90.3%**	**$1,684**	**$1,192**	**$1,267**	**-**	**$417**
Incident cardiovascular condition[2]	4'	13.0%	8.5%	$3,476	$2,627	$2,965	$1,192	$502
Acute cardiovascular episode[2]	5	1.2%	0.8%	$16,900	$14,980	$12,074	$1,192	$4,826
Total AFib		**99.6%**	**99.6%**	**$2,100**	**$1,545**	**$1,496**		**$481**
Total Hypertension and AFib				**$826**	**$473**	**$663**		**$158**

[1]No additional claims means that there were no claims after the initial identification.
[2]We assume patients are sicker and those in risk level 4 and 5 do not revert back to Baseline.
[3]Source of assumption is Figure 1. Final Column.
[4]Source of assumption is Figure 8 Column 5. For the without comorbidities assumption, we used Figure 8, Column 4.

Figure 4b. Estimated Savings per Patient per Month (PPPM) from Cardiac Intervention for Hypertension and AFib Patients 2017 to 2019 Utilization Data, Costs Trended to 2022; Illustrative (35% Success Rate)

Medicare Advantage Market

Hypertension	Risk Level	% in Each Cohort 6-12 Months After Identification (Col 1)	% in Each Cohort After Success Rate (Col 2)	Baseline[3] (Col 3)	Claims with Cardiovascular or Select Comorbidity Diagnosis (Col 4)	Remains in Baseline Risk Level (Col 5 = Col 3 - Col 7)	New Baseline Cardio-vascular Claims (Col 6)	PPPM Difference (Col 7 = (Col 4 - Col 6) *success rate
Hypertension; no additional claims[1]	<3	22.0%		$199	$71	$174	-	$25
Remains in hypertension	3	65.8%		$735	$345	$615	-	$121
Hypertension Baseline	**3**	**87.8%**	**92.0%**	**$601**	**$276**	**$504**	**-**	**$97**
Secondary Hypertension	3'	0.1%	0.1%	$1,056	$405	$1,011	$276	$45
Incident cardiovascular condition[2]	4	11.0%	7.1%	$1,372	$836	$1,176	$276	$196
Acute cardiovascular episode[2]	5	0.9%	0.6%	$6,225	$5,262	$4,480	$276	$1,745
Total Hypertension		**99.8%**	**99.8%**	**$737**	**$383**	**$615**		**$122**
AFib								
AFib; no additional claims[1]	<4	13.1%		$337	$201	$266	-	$70
Remains in AFib	4	57.8%		$1,385	$884	$1,076	-	$309
AFib Baseline	**4**	**70.8%**	**80.6%**	**$1,192**	**$758**	**$926**	**-**	**$265**
Incident cardiovascular condition[2]	4'	25.1%	16.3%	$1,929	$1,326	$1,730	$758	$199
Acute cardiovascular episode[2]	5	2.9%	1.9%	$7,506	$6,477	$5,505	$758	$2,002
Total AFib		**98.8%**	**98.8%**	**$1,565**	**$1,071**	**$1,147**		**$300**
Total Hypertension and AFib				**$875**	**$498**	**$703**		**$152**

[1]No additional claims means that there were no claims after the initial identification.
[2]We assume patients are sicker and those in risk level 4 and 5 do not revert back to Baseline.
[3]Source of assumption is Figure 1. Final Column.
[4]Source of assumption is Figure 8 Column 5. For the without comorbidities assumption, we used Figure 8, Column 4.

For those members that remained in hypertension and AFib at the baseline risk level, we examined their cost by service category to identify the categories that would likely be drivers of savings with improved care management. In Figures 4a and 4b, we show savings PPPM of $118 (Hypertension Commercial), $417 (AFib Commercial), $97 (Hypertension MA), and $265 (Hypertension Commercial). We assumed those would come from ED / Observation, Specialist, and Cardiovascular Care. Figure 5 will help those creating the intervention to understand which categories need to be reduced to achieve necessary savings.

Figure 5. PPPY and PPPM for Those Remaining in Baseline Risk Level

	PPPY				PPPM			
	Commercial		Medicare Advantage		Commercial		Medicare Advantage	
	Hypertension	AFib	Hypertension	AFib	Hypertension	AFib	Hypertension	AFib
Inpatient	$2,611	$7,215	1,744	3,447	217.58	601.28	145.35	287.26
OP Surgery	2,317	6,797	1,241	2,977	193.08	566.43	103.44	248.07
Pharmacy	2,070	3,739	2,166	3,683	172.49	311.60	180.46	306.88
ED / Observation / Urgent Care / Ambulance	975	3,374	394	688	81.25	281.15	32.81	57.36
Specialist	426	1,001	373	644	35.51	83.38	31.12	53.67
PCP	404	919	472	1,006	33.68	76.57	39.35	83.86
Preventive	551	1,130	375	615	45.88	94.17	31.21	51.21
Pathology and Radiology	1,098	2,450	589	942	91.53	204.15	49.06	78.47
Cardiovascular	156	316	82	122	13.01	26.34	6.86	10.18
Psych	70	124	56	79	5.85	10.37	4.63	6.59
Cancer	404	867	301	579	33.66	72.28	25.09	48.24
Other	891	1,729	1,030	1,841	74.22	144.06	85.85	153.43
Total	**$11,973**	**$29,661**	**$8,823**	**$16,623**	**$997.73**	**$2,471.77**	**$735.24**	**$1,385.23**

IV. METHODOLOGY AND ASSUMPTIONS

DATA SOURCES

Our study was based on Milliman's *Consolidated Health Cost Guidelines Sources Database (CHSD)*. The Milliman *CHSD* contains proprietary historical claims experience from Milliman's *Health Cost Guidelines*™ *(HCG)* data contributors. The database contains annual enrollment and paid medical and pharmacy claims for a sample of over 70 million commercially insured individuals and 2.8 million MA members covered by the benefit plans of large employers, health plans, and governmental and public organizations nationwide. We used data for calendar years 2016 through 2019.

MEMBER IDENTIFICATION

Members with cardiovascular conditions and acute cardiovascular episodes were identified based on the Agency for Healthcare Research and Quality (AHRQ) Clinical Classification system (CCSR V2021.2) and relevant ICD-10-CM codes.

We included the following members in the analysis:

- The member's employer group or data contributor must be present in data for all four years: 2016, 2017, 2018, and 2019.
- Unless the member has an acute cardiovascular episode, they must be enrolled for at least two consecutive years. We maintained members in the study population who had an acute cardiovascular episode regardless of how long they were enrolled after identification of hypertension or AFib because we did not want to exclude members who may have died.
- A member is required to have a diagnosis of hypertension or AFib in 2017 without evidence of a more severe cardiovascular condition or an acute cardiovascular episode during 2016. This increases the likelihood that members of the hypertension and AFib study populations had not previously been diagnosed with a more severe cardiovascular condition or experienced an acute cardiovascular episode. We follow this subset of members through two years after hypertension or AFib identification and identify newly diagnosed cardiovascular conditions and acute cardiovascular episodes.
- Members with pregnancy or chronic kidney disease were excluded using relevant ICD-10-CM diagnosis codes to avoid studying members with substantial confounding costs not associated with hypertension or AFib.
- Neither the hypertension nor AFib study populations were limited by age.

Figures 6a and 6b show a waterfall chart of the hypertension and AFib patients meeting our inclusion criteria for the analysis.

Figure 6a. Hypertension Study Waterfall

			Commercial Members		Medicare Advantage	
Timeframe	**Risk Level**	**Description**	**Members**	**%**	**Members**	**%**
		Enrolled members	71,536,513		2,791,031	
Pre-Study		Members with hypertension diagnosis during study year that did not have a more severe cardiovascular condition in prior year	8,964,154		1,810,535	
		Continuously enrolled from 2016 to 2019	2,692,157		687,297	
		Exclude members with chronic kidney disease or pregnancy	2,246,931		433,253	
0 Months	**3**	**Starting Study Population**	**2,246,931**	**100.0%**	**433,253**	**100.0%**
6 to 12 months after identification		Patients still alive	2,245,681	99.9%	432,301	99.8%
	<3	Hypertension; no additional claims	838,060	37.3%	95,463	22.0%
	3	Remains in hypertension	1,315,974	58.6%	284,939	65.8%
	3	Secondary Hypertension	2,214	0.1%	351	0.1%
	4	Incident cardiovascular condition	82,882	3.7%	47,610	11.0%
	5	Acute cardiovascular episode	6,551	0.3%	3,938	0.9%
1 to 2 years after identification		Patients still alive	2,243,343	99.8%	430,427	99.3%
	<3	No additional claims	416,907	18.6%	33,899	7.8%
	3	Remains in hypertension	1,649,087	73.4%	303,845	70.1%
	3	Secondary Hypertension	2,348	0.1%	325	0.1%
	4	Incident cardiovascular condition	163,525	7.3%	85,415	19.7%
	5	Acute cardiovascular episode	11,476	0.5%	6,943	1.6%

Figure 6b. AFib Study Waterfall

			Commercial Members		Medicare Advantage	
Timeframe	**Risk Level**		**Members**	**%**	**Members**	**%**
		Enrolled members	71,536,513		2,791,031	
Pre-Study		Members with AFib diagnosis during study year that did not have a more severe cardiovascular condition in prior year	494,374		342,825	
		Continuously enrolled from 2016 to 2019	132,365		100,518	
		Exclude members with chronic kidney disease or pregnancy	116,781		94,047	
0 Months	**4**	**Starting Study Population**	**116,781**	**100.0%**	**94,047**	**100.0%**
6 to 12 months after identification		Patients still alive	116,310	99.6%	92,936	98.8%
	<4	AFib, no additional claims	34,747	29.8%	12,302	13.1%
	4	Remains in AFib	64,940	55.6%	54,327	57.8%
	4	Incident cardiovascular condition	15,229	13.0%	23,565	25.1%
	5	Acute cardiovascular episode	1,394	1.2%	2,742	2.9%
1 to 2 years after identification		Patients still alive	115,562	99.0%	91,354	97.1%
	<4	AFib, no additional claims	21,108	18.1%	5,712	4.9%
	4	Remains in AFib	74,985	64.2%	56,639	48.5%
	4	Incident cardiovascular condition	17,701	15.2%	25,406	21.8%
	5	Acute cardiovascular episode	1,768	1.5%	3,597	3.1%

CLAIMS STRATIFICATION

For members identified with hypertension or AFib, we followed their claims for two years to see whether they developed a more severe cardiovascular condition or had a cardiac acute episode following the start of the study period. Diagnosis codes are mapped to a Clinical Classification System Refined (CCSR) category which is in turned mapped to a risk level. Members who incurred claims in multiple CCS categories were mapped to the condition with the highest risk level. Figure 7 shows the mapping of CCSR to cardiovascular risk levels. In the initial analysis, we also looked at risk categories 1 (family history) and risk level 2 (pre-hypertension), but we did not include those results in this paper.

Figure 7. Definition of Cardiovascular Conditions and Acute Cardiovascular Episodes, and Corresponding Risk Categories

CCSR	CCSR Description	Cardiovascular Risk Level	Hypertension Category	AFib Category
3CIR007	Essential hypertension	3	Remain in Hypertension	N/A
3CIR008	Hypertension with complications and secondary hypertension (ICD10-CM: I52, I58, I59)	3	Hypertension with Complications	N/A
4CIR017	Cardiac dysrhythmias	4	Cardiovascular Condition	Remain in AFib
4CIR019	Heart failure	4	Cardiovascular Condition	Cardiovascular Condition
4CIR008	Hypertension with complications and secondary hypertension – ((ICD-10 H35031, H35032, H35033, I110, I119)	4	Cardiovascular Condition	Cardiovascular Condition
4CIR005	Myocarditis and cardiomyopathy	4	Cardiovascular Condition	Cardiovascular Condition
4CIR015	Other and ill-defined heart disease	4	Cardiovascular Condition	Cardiovascular Condition
4CIR026	Peripheral and visceral vascular disease	4	Cardiovascular Condition	Cardiovascular Condition
4CIR014	Pulmonary heart disease	4	Cardiovascular Condition	Cardiovascular Condition
4CIR011	Coronary atherosclerosis and other heart disease	4	Cardiovascular Condition	Cardiovascular Condition
5CIR009	Acute myocardial infarction	5	Acute Cardiovascular Episode	Acute Cardiovascular Episode
5CIR021	Acute hemorrhagic cerebrovascular disease	5	Acute Cardiovascular Episode	Acute Cardiovascular Episode
5CIR018	Cardiac arrest and ventricular fibrillation	5	Acute Cardiovascular Episode	Acute Cardiovascular Episode
5CIR020	Cerebral infarction	5	Acute Cardiovascular Episode	Acute Cardiovascular Episode
5CIR019	End Stage Heart failure	5	Acute Cardiovascular Episode	Acute Cardiovascular Episode
5CIR008	Hypertension with complications and secondary hypertension (ICD-10 CM, I161, I169)	5	Acute Cardiovascular Episode	Acute Cardiovascular Episode
5CIR025	Sequela of cerebral infarction and other cerebrovascular disease	5	Acute Cardiovascular Episode	Acute Cardiovascular Episode
5CIR022	Sequela of hemorrhagic cerebrovascular disease	5	Acute Cardiovascular Episode	Acute Cardiovascular Episode
5CIR010	Complications of acute myocardial infarction	5	Acute Cardiovascular Episode	Acute Cardiovascular Episode

Cardiovascular risk / severity is determined for CCSR categories by considering the level of injury and cost of treating the initial diagnoses assigned to each category, as well as any sequelae related to not treating or under-treating the diagnoses. Sequelae following an acute cardiovascular episode (myocardial infarction, stroke, etc.), are grouped with the acute episode to fully capture the episode's cost. Diagnoses prevalence and cost analyses were performed after 6 to 12 months and two years from the start of the study period for a given patient, during which we assigned the cardiovascular risk level and CCSR category to each member based on their medical claims. Risk levels were assigned based on diagnosis codes reported in all position on medical claim for risk levels 3 and 4 and only on inpatient claims for risk level 5 (acute episode). For each of the periods we tracked the member count, calculated the prevalence percentages, and calculated the cumulative allowed cost per patient.

ILLUSTRATIVE SAVINGS CALCULATION

For the illustrative savings calculation, we assumed there are two ways in which these populations can achieve savings:

1. Avoiding developing a new higher risk cardiovascular condition or experience an acute cardiovascular episode. We assumed the savings would be the cardiovascular and comorbidity-related costs of the higher risk disease state. Cardiovascular claims were assigned based on the same diagnosis codes used to assign hypertension, AFib, cardiac conditions, and acute cardiac episodes. Select comorbidity related costs are specified using the ICD-10 CM codes shown in the Appendix. We looked at all 15 positions on the claim. There were some claims that had only cardiovascular diagnosis codes. There were some claims that had both cardiovascular and comorbidity diagnosis codes, and there were some claims that had only comorbidity

diagnosis codes. We looked at those that had cardiovascular and / or comorbidity diagnosis codes and accounted for overlap to avoid double counting savings. See Figure 8 for more detail.

2. For those who remain in their baseline disease state, we calculated savings across the entire PPPM (See Col 7, Figures 4a and 4b).

This illustration was not intended to look at the effectiveness of any specific solution but the economics of improved efficiency in general.

ENGAGEMENT RATE AND SUCCESS RATE ASSUMPTIONS

For illustrative purposes only, we assumed that a percentage of those in the hypertension and AFib populations would opt out of receiving a care management intervention. Therefore, we based the analysis only on the remaining percentage that would be expected to engage (i.e., engagement rate). Given those that were expected to engage were the only one receiving the interventions and costs, this was not a relevant assumption to the analysis. We used best estimates and a varying success rate (i.e., probability of intervention success) from 5% to 90% to determine the range of potential savings. It is possible that savings would be outside the range chosen.

CARDIOVASCULAR CLAIMS AND COMORBIDITY CLAIMS OVERLAP

Figure 8 shows the percentage of claims with cardiovascular diagnosis codes in any position on the claim, as well as claims with select comorbidity diagnosis codes alone and together with cardiovascular diagnosis codes.

Figure 8. Estimated Savings Patient per Year (PPPY) from Intervention for Hypertension and Atrial Fibrillation Patients 2017 to 2019 Utilization Data, Costs Trended to 2022

	Cumulative Allowed Cost per Patient* (Col 1)	Claims with Cardio-vascular Diagnosis Codes on any position (Col 2)	Non-Cardio-vascular Claims with Co-Morbidity Diagnosis Code (Col 3)	% of Claims with Cardio-vascular Diagnosis Code (Col 4)	% of Claims with Cardio-vascular or Comorbidity Diagnosis Code (Col 5)	All Claims with Comorbidity Diagnosis Codes (Col 6)	% of Claims with Comorbidity Diagnosis Codes (Col 7)
Commercial Market							
Hypertension	$7,929	$3,318	$734	42%	51%	$2,020	25%
Hypertension; no additional claims[1]	$1,548	$181	$406	12%	38%	$583	38%
Remains in hypertension	$11,973	$5,311	$942	44%	52%	$2,933	24%
Secondary Hypertension	$19,522	$5,831	$1,957	30%	40%	$3,489	18%
Incident cardiovascular condition	$28,794	$18,103	$1,373	63%	68%	$7,812	27%
Acute cardiovascular episode	$163,768	$142,361	$2,181	87%	88%	$42,081	26%
Afib	$23,047	$15,686	$898	68%	72%	$6,704	29%
AFib; no additional claims[1]	$2,502	$920	$396	37%	53%	$1,298	52%
Remains in AFib	$29,687	$20,171	$1,079	68%	72%	$8,574	29%
Incident cardiovascular condition	$41,607	$30,248	$1,276	73%	76%	$11,064	27%
Acute cardiovascular episode	$202,795	$178,418	$1,339	88%	89%	$42,769	21%
Medicare Advantage Market							
Hypertension	$7,212	$2,604	$707	36%	46%	$1,587	22%
Hypertension; no additional claims[1]	$2,384	$254	$595	11%	36%	$839	35%
Remains in hypertension	$8,823	$3,391	$744	38%	47%	$1,837	21%
Secondary Hypertension	$12,673	$3,471	$1,386	27%	38%	$2,219	18%
9Incident cardiovascular condition	$16,467	$9,063	$969	55%	61%	$3,647	22%
Acute cardiovascular episode	$74,705	$62,002	$1,138	83%	85%	$14,257	19%
Afib	$16,612	$10,119	$759	61%	65%	$4,168	25%
AFib; no additional claims[1]	$4,039	$1,751	$666	43%	60%	$2,395	59%
Remains in AFib	$16,623	$9,911	$696	60%	64%	$4,088	25%
Incident cardiovascular condition	$23,153	$14,966	$951	65%	69%	$5,277	23%
Acute cardiovascular episode	$90,077	$76,786	$940	85%	86%	$15,281	17%

V. CAVEATS AND LIMITATIONS

Guidelines issued by the American Academy of Actuaries require actuaries to include their professional qualifications in actuarial communications. I, Juliet Spector, Principal and Consulting Actuary for Milliman, Inc., am a member of the American Academy of Actuaries, and I meet the Qualification Standards of the American Academy of Actuaries to render the actuarial analysis contained herein.

In performing our analysis, we relied on data from various contributors to our *Consolidated Health Cost Guidelines Sources Database (CHSD)*. We have not audited or verified this data and other information, but we have reviewed it for reasonableness. If the underlying data or information is inaccurate or incomplete, the results of our analysis may likewise be inaccurate or incomplete. In addition, we used 2016, 2017, 2018, and 2019 data. The results may differ when using more recent data.

The attached results are based on Milliman research and on our experience in working with employers and MA plans. Actual experience will vary from our estimates for many reasons, including differences in case-mix and severity, reimbursement levels, and the delivery of healthcare services, as well as other non-random and random factors. It is important that actual experience be monitored and that adjustments are made, as appropriate. Our estimates are not predictions of the future; they are estimates based on the assumptions. If the underlying data or other listings are inaccurate or incomplete, this analysis may also be inaccurate or incomplete. Emerging results should be carefully monitored with assumptions adjusted as appropriate. Our analysis is based on historical practice patterns and treatments which may change over time. Actual experience may vary from the estimates presented in this report for many reasons.

Other caveats around the methodology of this report:

- Our analysis presents overall averages by CCSR category; however, there may be significant variance underlying those averages. Additional review may be desirable and emerging results should be carefully monitored with assumptions adjusted as appropriate.
- Using a lookback period of only 12 months may not have identified all individuals with prior more severe cardiovascular conditions.
- The methodology does not address any potential reversion to the mean (e.g., shorter follow up (6 to 12 months) may be likely is picking up high costs around a new diagnosis or acute episode).
- If an intervention is successful, once patients have been using the intervention, baseline costs may be lower and additional savings may not be achievable.
- Patients who develop more severe cardiovascular disease are likely to be sicker than those who remain in their baseline status and accounting for their severity based on non-cardiovascular and comorbidity claims alone may not fully account for their ongoing severity if they do not develop more severe cardiac disease.
- The drivers of more severe cardiovascular disease may not be impacted by the intervention (e.g., diabetes).
- The results were not intended to look at the effectiveness of any specific solution but the economics of improved efficiency in general.

Milliman has developed certain models to estimate the values included in this report. The intent of the models is to develop reimbursement values. We have reviewed the models, including their inputs, calculations, and outputs for consistency, reasonableness, and appropriateness to the intended purpose and in compliance with generally accepted actuarial practice and relevant actuarial standards of practice (ASOP).

This engagement is subject to the terms specified in the Consulting Services Agreement between Milliman and AliveCor effective July 19, 2021.

Milliman does not intend to legally benefit any third-party recipient of its work product. Even though Milliman has consented to the release of its work product to a third party, any third-party recipient of this report should not rely upon Milliman's report, but should engage qualified professionals for advice appropriate to its own specific needs. The statements contained in the report are those of the authors and do not necessarily represent the views of Milliman or its other consultants.

APPENDIX A

Appendix A ICD 10 CM Code and Description for Co-Morbidities		
ICD-10-CM Code	**ICD-10-CM Code Description**	**Comorbidity Category**
E66	Overweight and Obesity	Obesity
E6601	Morbid (severe) obesity due to excess calories	Obesity
E6609	Other obesity due to excess calories	Obesity
E661	Drug-induced obesity	Obesity
E662	Morbid (severe) obesity with alveolar hypoventilation	Obesity
E663	Overweight	Obesity
E668	Other obesity	Obesity
E669	Obesity, unspecified	Obesity
F17200	Nicotine dependence, unspecified, uncomplicated	Tobacco use/abuse
G4730	Sleep apnea, unspecified	Sleep disorders
G4733	Obstructive sleep apnea (adult) (pediatric)	Sleep disorders
G479	Sleep disorder, unspecified	Sleep disorders
R457	State of emotional shock and stress, unspecified	Stress
Z733	Stress, not elsewhere classified	Stress
E8881	Metabolic syndrome	Metabolic syndrome
F320	Major depressive disorder, single episode, mild	Depression
F321	Major depressive disorder, single episode, moderate	Depression
F322	Major depressive disorder, single episode, severe w/o psych features	Depression
F323	Major depressive disorder, single episode, severe w psych features	Depression
F324	Major depressive disorder, single episode, in partial remission	Depression
F325	Major depressive disorder, single episode, in full remission	Depression
F328	Other depressive episodes	Depression
F3281	Premenstrual dysphoric disorder	Depression
F3289	Other specified depressive episodes	Depression
F329	Major depressive disorder, single episode, unspecified	Depression
F330	Major depressive disorder, recurrent, mild	Depression
F331	Major depressive disorder, recurrent, moderate	Depression
F332	Major depressive disorder, recurrent severe w/o psych features	Depression
F333	Major depressive disorder, recurrent, severe w psych symptoms	Depression
F3340	Major depressive disorder, recurrent, in remission, unspecified	Depression
F3341	Major depressive disorder, recurrent, in partial remission	Depression
F3342	Major depressive disorder, recurrent, in full remission	Depression
F338	Other recurrent depressive disorders	Depression
F339	Major depressive disorder, recurrent, unspecified	Depression
F430	Acute stress reaction	Stress
F4320	Adjustment disorder, unspecified	Adjustment Disorder
F4321	Adjustment disorder with depressed mood	Adjustment Disorder
F4322	Adjustment disorder with anxiety	Adjustment Disorder
F4323	Adjustment disorder with mixed anxiety and depressed mood	Adjustment Disorder
F4324	Adjustment disorder with disturbance of conduct	Adjustment Disorder
F4325	Adjustment disorder w mixed disturb of emotions and conduct	Adjustment Disorder
F4329	Adjustment disorder with other symptoms	Adjustment Disorder
F438	Other reactions to severe stress	Stress
F439	Reaction to severe stress, unspecified	Stress
Z6830	Body mass index (BMI) 30.0-30.9, adult	Obesity
Z6831	Body mass index (BMI) 31.0-31.9, adult	Obesity
Z6832	Body mass index (BMI) 32.0-32.9, adult	Obesity
Z6833	Body mass index (BMI) 33.0-33.9, adult	Obesity
Z6834	Body mass index (BMI) 34.0-34.9, adult	Obesity
Z6835	Body mass index (BMI) 35.0-35.9, adult	Obesity
Z6836	Body mass index (BMI) 36.0-36.9, adult	Obesity
Z6837	Body mass index (BMI) 37.0-37.9, adult	Obesity
Z6838	Body mass index (BMI) 38.0-38.9, adult	Obesity
Z6839	Body mass index (BMI) 39.0-39.9, adult	Obesity
Z6841	Body mass index (BMI) 40.0-44.9, adult	Obesity
Z6842	Body mass index (BMI) 45.0-49.9, adult	Obesity
Z6843	Body mass index (BMI) 50-59.9, adult	Obesity
Z6844	Body mass index (BMI) 60.0-69.9, adult	Obesity
Z6845	Body mass index (BMI) 70 or greater, adult	Obesity

EXHIBITS

Exhibit 1
Prevalence and Cost by AHA follow up Periods
Includes All Claims Incurred by Patient within Specified Time Periods
Commercial Market
Patients Continuously Enrolled through 2017-2019
2017-2019 Data, Costs Trended to 2022
Excludes Members with Pregnancy or Chronic Kidney Disease

Baseline Member Count (First Identification of Hypertension)
2,246,931

		Prevalence (%)[1]		Member Count		Allowed Cost Per Patient	
Risk Level	Risk Description	6 to 12 months after first identification	1 to 2 years after first identification	6 to 12 months after first identification	1 to 2 years after first identification	12 months after first identification (PMPY)	2 years after first identification (cumulative)
All	**Total Patients with Hypertension**	**99.9%**	**99.8%**	**2,245,681**	**2,243,343**	**$9,154**	**$17,958**
<= 3	**Total Hypertension**	**96.0%**	**92.1%**	**2,156,248**	**2,068,342**	**$7,929**	**$15,439**
3	No additional claims[2]	37.3%	18.6%	838,060	416,907	$1,548	$4,263
3	Essential hypertension	58.6%	73.4%	1,315,974	1,649,087	$11,973	$18,243
3	Secondary hypertension[3]	0.1%	0.1%	2,214	2,348	$19,522	$29,887
4	**Total Incident Cardiovascular Condition [4]**	**3.7%**	**7.3%**	**82,882**	**163,525**	**$28,794**	**$38,221**
4	Cardiac dysrhythmias (A-fib only)	0.4%	0.8%	9,686	18,820	$35,007	$47,945
4	Heart failure	0.2%	0.4%	4,556	9,005	$47,974	$61,972
4	Hypertension with complications	0.8%	1.5%	17,065	34,825	$17,043	$24,317
4	Myocarditis and cardiomyopathy	0.1%	0.2%	2,686	4,512	$29,956	$44,379
4	Other and ill-defined heart disease	0.1%	0.2%	2,459	5,365	$33,035	$37,838
4	Peripheral and visceral vascular disease	0.6%	1.2%	14,002	28,069	$24,139	$34,803
4	Pulmonary heart disease[7]	0.0%	0.0%	17	22	$22,040	$67,028
4	Coronary atherosclerosis and other heart disease	1.4%	2.8%	32,411	62,907	$32,026	$40,715
5	**Total Acute Cardiovascular Episode[5]**	**0.3%**	**0.5%**	**6,551**	**11,476**	**$163,768**	**$183,213**
5	Acute myocardial infarction	0.1%	0.2%	2,839	5,237	$148,507	$162,141
5	Acute hemorrhagic cerebrovascular disease	0.0%	0.0%	503	768	$321,662	$384,103
5	Cardiac arrest and ventricular fibrillation	0.0%	0.0%	401	662	$283,961	$299,327
5	Cerebral infarction	0.1%	0.1%	1,671	2,881	$123,038	$146,057
5	End stage heart failure[7]	0.0%	0.0%	2	7	$39,280	$161,627
5	Hypertensive emergency or crisis [6]	0.0%	0.0%	404	759	$86,624	$103,837
5	Complications of acute myocardial infarction[7]	0.0%	0.0%	2	1	$326,388	$724,098
5	Sequela of hemorrhagic cerebrovascular disease	0.0%	0.0%	85	122	$289,955	$375,839
5	Sequela of cerebral infarction and other cerebrovascular disease	0.0%	0.0%	644	1,039	$170,187	$204,970

[1] *Count over baseline diagnosis count.*

[2] *No additional claims means that there were no claims after the initial identification.*

[3] *ICD10-CM: I152, I158, I159.*

[4] *CCSR categories, V2021.2: CIR017, CIR019, CIR008 (ICD-10 H35031, H35032, H35033, I110, I119, I160), CIR005, CIR015, CIR026, CIR014, CIR011.*

[5] *CCSR categories, V2021.2: CIR008 (ICD-10 I161, I169, I674), CIR009, CIR010, CIR018, CIR019, CIR020, CIR021, CIR022, CIR025 happening on an inpatient event.*

[6] *ICD-10 CM, I161, I169, I674.*

[7] *These conditions have low sample size. Therefore we caution against interpreting these cost amounts.*

Exhibit 2
Prevalence and Cost by AHA follow up Periods
Includes All Claims Incurred by Patient within Specified Time Periods
Commercial Market
Patients Continuously Enrolled through 2017-2019
2017-2019 Data, Costs Trended to 2022
Excludes Members with Pregnancy or Chronic Kidney Disease

Baseline Member Count (First Identification of A-fib)
116,781

		Prevalence (%)[1]		Member Count		Allowed Cost Per Patient	
Risk Level	Risk Description	6 to 12 months after first identification	1 to 2 years after first identification	6 to 12 months after first identification	1 to 2 years after first identification	12 months after first identification (PMPY)	2 years after first identification (cumulative)
All	**Total Patients with A-fib**	**99.6%**	**99.0%**	**116,310**	**115,562**	**$25,201**	**$42,318**
<= 4	**Total A-fib**	**85.4%**	**82.3%**	**99,687**	**96,093**	**$23,047**	**$39,215**
4	No additional claims[2]	29.8%	18.1%	34,747	21,108	$2,502	$5,845
4	Cardiac dysrhythmias (A-fib only)	55.6%	64.2%	64,940	74,985	$29,687	$43,964
4	**Total Incident Cardiovascular Condition [3]**	**13.0%**	**15.2%**	**15,229**	**17,701**	**$41,607**	**$58,886**
4	Heart failure	2.5%	2.7%	2,876	3,181	$50,954	$77,757
4	Hypertension with complications[4]	1.0%	1.2%	1,224	1,407	$27,843	$42,886
4	Myocarditis and cardiomyopathy	1.9%	1.9%	2,178	2,202	$36,451	$57,789
4	Other and ill-defined heart disease	0.2%	0.3%	245	319	$36,663	$45,773
4	Peripheral and visceral vascular disease	1.3%	1.5%	1,477	1,705	$28,764	$43,743
4	Pulmonary heart disease[7]	0.0%	0.0%	4	9	$54,500	$34,520
4	Coronary atherosclerosis and other heart disease	6.2%	7.6%	7,225	8,878	$44,559	$58,336
5	**Total Acute Cardiovascular Episode[5]**	**1.2%**	**1.5%**	**1,394**	**1,768**	**$202,795**	**$242,069**
5	Acute myocardial infarction	0.3%	0.5%	404	542	$233,906	$255,658
5	Acute hemorrhagic cerebrovascular disease	0.1%	0.1%	109	137	$237,488	$309,246
5	Cardiac arrest and ventricular fibrillation	0.1%	0.1%	147	158	$354,024	$444,013
5	Cerebral infarction	0.4%	0.4%	414	521	$143,441	$179,854
5	End stage heart failure[7]	0.0%	0.0%	6	14	$128,848	$336,382
5	Hypertensive emergency or crisis [6]	0.0%	0.1%	46	63	$119,561	$144,210
5	Complications of acute myocardial infarction[7]	0.0%	0.0%	1	1	$30,674	$30,674
5	Sequela of hemorrhagic cerebrovascular disease[7]	0.0%	0.0%	20	30	$297,853	$298,244
5	Sequela of cerebral infarction and other cerebrovascular disease	0.2%	0.3%	247	302	$156,380	$200,048

[1] *Count over baseline diagnosis count.*

[2] *No additional claims means that there were no claims after the initial identification.*

[3] *CCSR categories, V2021.2: CIR017, CIR019, CIR008 (ICD-10 H35031, H35032, H35033, I110, I119, I160), CIR005, CIR015, CIR026, CIR014, CIR011.*

[4] *ICD10-CM: I152, I158, I159.*

[5] *CCSR categories, V2021.2: CIR008 (ICD-10 I161, I169, I674), CIR009, CIR010, CIR018, CIR019, CIR020, CIR021, CIR022, CIR025 happening on an inpatient event.*

[6] *ICD-10 CM, I161, I169, I674.*

[7] *These conditions have low sample size. Therefore we caution against interpreting these cost amounts.*

Exhibit 3
Prevalence and Cost by AHA follow up Periods
Includes All Claims Incurred by Patient within Specified Time Periods
Medicare Advantage Market
Patients Continuously Enrolled through 2017-2019
2017-2019 Data, Costs Trended to 2022
Excludes Members with Pregnancy or Chronic Kidney Disease

Baseline Member Count (First Identification of Hypertension)
433,253

		Prevalence (%)[1]		Member Count		Allowed Cost Per Patient	
Risk Level	Risk Description	6 to 12 months after first identification	1 to 2 years after first identification	6 to 12 months after first identification	1 to 2 years after first identification	12 months after first identification (PMPY)	2 years after first identification (cumulative)
All	**Total Patients with Hypertension**	**99.8%**	**99.3%**	**432,301**	**430,427**	**$8,846**	**$18,230**
<= 3	**Total Hypertension**	**87.9%**	**78.0%**	**380,753**	**338,069**	**$7,212**	**$14,963**
3	No additional claims[2]	22.0%	7.8%	95,463	33,899	$2,384	$8,605
3	Essential hypertension	65.8%	70.1%	284,939	303,845	$8,823	$15,663
3	Secondary hypertension[3]	0.1%	0.1%	351	325	$12,673	$23,571
4	**Total Incident Cardiovascular Condition [4]**	**11.0%**	**19.7%**	**47,610**	**85,415**	**$16,467**	**$25,259**
4	Cardiac dysrhythmias (A-fib only)	1.7%	3.0%	7,182	12,789	$19,933	$30,286
4	Heart failure	0.8%	1.5%	3,575	6,350	$23,552	$37,166
4	Hypertension with complications	1.4%	2.6%	6,233	11,257	$12,242	$19,641
4	Myocarditis and cardiomyopathy	0.3%	0.4%	1,192	1,595	$14,932	$28,019
4	Other and ill-defined heart disease	0.3%	0.6%	1,298	2,777	$17,127	$22,412
4	Peripheral and visceral vascular disease	2.7%	5.2%	11,704	22,666	$13,135	$20,679
4	Pulmonary heart disease[7]	0.0%	0.0%	14	36	$15,303	$23,752
4	Coronary atherosclerosis and other heart disease	3.8%	6.5%	16,412	27,945	$17,447	$26,359
5	**Total Acute Cardiovascular Episode[5]**	**0.9%**	**1.6%**	**3,938**	**6,943**	**$74,705**	**$90,809**
5	Acute myocardial infarction	0.3%	0.6%	1,282	2,386	$71,946	$85,853
5	Acute hemorrhagic cerebrovascular disease	0.1%	0.1%	297	522	$98,264	$116,638
5	Cardiac arrest and ventricular fibrillation	0.1%	0.1%	218	353	$94,227	$118,907
5	Cerebral infarction	0.2%	0.4%	1,062	1,892	$63,062	$76,405
5	End stage heart failure[7]	0.0%	0.0%	8	2	$41,284	$309,580
5	Hypertensive emergency or crisis [6]	0.0%	0.1%	174	303	$48,627	$63,637
5	Complications of acute myocardial infarction[7]	0.0%	0.0%	1	2	$47,032	$76,013
5	Sequela of hemorrhagic cerebrovascular disease[7]	0.0%	0.0%	61	103	$132,708	$151,382
5	Sequela of cerebral infarction and other cerebrovascular disease	0.2%	0.3%	835	1,380	$81,823	$103,320

[1] *Count over baseline diagnosis count.*

[2] *No additional claims means that there were no claims after the initial identification.*

[3] *ICD10-CM: I152, I158, I159.*

[4] *CCSR categories, V2021.2: CIR017, CIR019, CIR008 (ICD-10 H35031, H35032, H35033, I110, I119, I160), CIR005, CIR015, CIR026, CIR014, CIR011.*

[5] *CCSR categories, V2021.2: CIR008 (ICD-10 I161, I169, I674), CIR009, CIR010, CIR018, CIR019, CIR020, CIR021, CIR022, CIR025 happening on an inpatient event.*

[6] *ICD-10 CM, I161, I169, I674.*

[7] *These conditions have low sample size. Therefore we caution against interpreting these cost amounts.*

Exhibit 4
Prevalence and Cost by AHA follow up Periods
Includes All Claims Incurred by Patient within Specified Time Periods
Medicare Advantage Market
Patients Continuously Enrolled through 2017-2019
2017-2019 Data, Costs Trended to 2022
Excludes Members with Pregnancy or Renal Insufficiency

Baseline Member Count (First Identification of A-fib)
94,047

		Prevalence (%)[1]		Member Count		Allowed Cost Per Patient	
Risk Level	Risk Description	6 to 12 months after first identification	1 to 2 years after first identification	6 to 12 months after first identification	1 to 2 years after first identification	12 months after first identification (PMPY)	2 years after first identification (cumulative)
All	**Total Patients with A-fib**	**98.8%**	**97.1%**	**92,936**	**91,354**	**$18,780**	**$34,731**
<= 4	**Total A-fib**	**70.8%**	**66.3%**	**66,629**	**62,351**	**$16,612**	**$31,314**
4	No additional claims[2]	13.1%	6.1%	12,302	5,712	$4,039	$11,315
4	Cardiac dysrhythmias (A-fib only)	57.8%	60.2%	54,327	56,639	$16,623	$29,937
	Total Incident Cardiovascular Condition [3]	**25.1%**	**27.0%**	**23,565**	**25,406**	**$23,153**	**$38,881**
4	Heart failure	4.3%	4.6%	4,019	4,368	$28,622	$49,180
4	Hypertension with complications[4]	1.3%	1.3%	1,239	1,266	$17,378	$32,488
4	Myocarditis and cardiomyopathy	1.4%	1.3%	1,310	1,219	$22,040	$39,462
4	Other and ill-defined heart disease	0.2%	0.2%	216	192	$17,734	$33,297
4	Peripheral and visceral vascular disease	2.8%	2.9%	2,666	2,726	$18,032	$31,772
4	Pulmonary heart disease[7]	0.0%	0.0%	6	7	$8,187	$38,719
4	Coronary atherosclerosis and other heart disease	15.0%	16.6%	14,109	15,628	$23,262	$37,783
5	**Total Acute Cardiovascular Episode[5]**	**2.9%**	**3.8%**	**2,742**	**3,597**	**$90,077**	**$118,037**
5	Acute myocardial infarction	0.9%	1.2%	839	1,093	$96,061	$124,214
5	Acute hemorrhagic cerebrovascular disease	0.3%	0.3%	239	291	$88,784	$122,884
5	Cardiac arrest and ventricular fibrillation	0.2%	0.3%	196	247	$129,533	$160,131
5	Cerebral infarction	0.8%	1.0%	765	952	$76,029	$103,803
5	End stage heart failure[7]	0.0%	0.0%	10	24	$91,124	$94,484
5	Hypertensive emergency or crisis [6,7]	0.1%	0.1%	77	111	$53,264	$75,304
5	Complications of acute myocardial infarction[7]	0.0%	0.0%	1	-	$123,632	
5	Sequela of hemorrhagic cerebrovascular disease[7]	0.0%	0.1%	35	53	$129,517	$149,467
5	Sequela of cerebral infarction and other cerebrovascular disease	0.6%	0.9%	580	826	$89,578	$116,383

[1] *Count over baseline diagnosis count.*

[2] *No additional claims means that there were no claims after the initial identification.*

[3] *CCSR categories, V2021.2: CIR017, CIR019, CIR008 (ICD-10 H35031, H35032, H35033, I110, I119, I160), CIR005, CIR015, CIR026, CIR014, CIR011.*

[4] *ICD10-CM: I152, I158, I159.*

[5] *CCSR categories, V2021.2: CIR008 (ICD-10 I161, I169, I674), CIR009, CIR010, CIR018, CIR019, CIR020, CIR021, CIR022, CIR025 happening on an inpatient event.*

[6] *ICD-10 CM, I161, I169, I674.*

[7] *These conditions have low sample size. Therefore we caution against interpreting these cost amounts.*

For more information about Milliman, please visit us at:

milliman.com

Milliman is among the world's largest providers of actuarial and related products and services. The firm has consulting practices in life insurance and financial services, property & casualty insurance, healthcare, and employee benefits. Founded in 1947, Milliman is an independent firm with offices in major cities around the globe.

milliman.com

CONTACT

Juliet M. Spector
juliet.spectort@milliman.com

Pepper Huang
pepper.huang@milliman.com