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## CARDIOVASCULAR DISEASE PROFILE IN NORTH SUMATERA, INDONESIA: CHARACTERISTICS AND CHALLENGES

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### Abstract

#### Background

Cardiovascular disease (CVD) is the leading cause of mortality worldwide and put a significant amount of burden in health expenditure. It was expected its incidences and mortalities would continue to grow in the coming years as a growing prevalence of cardiovascular risk factors. Indonesia is the fifth rank of CVDs death in the world, but the data regarding its characteristic is still limited. The aim of this study was to figure out the epidemiological data of CVD in cardiac center of Haji Adam Malik Hospital Medan, Indonesia.

#### Methods

This was an observational study conducted at cardiac center of Haji Adam Malik Hospitals throughout 2015 to 2020. All patients from inpatient, outpatient, catheterization laboratory, and emergency visits were included. Data were analyzed based on gender, age, ethnicity and diagnosis. International Classification of the Diseases-10 (ICD-10) was used for diagnosis stratification [coronary artery disease (CAD), congestive heart failure (CHF), hypertensive heart disease (HHD), valvular heart disease (VHD), congenital heart disease (CHD), and arrhythmia].

#### Results

Between 2015 - 2020, there were 11.997 inpatients, 129.486 outpatients and 6.217 catheterization laboratory procedures. Moreover, a total of 14.311 visits in emergency room between 2016 and 2020 were found. There was a trend of more hospitalization between 2015 and 2019 with the highest (2.327 visits) occurred in 2019, but a significant drop was found in 2020. The highest outpatient visits occurred in 2017 (30.668). The oldest mean age of inpatients and outpatients were found respectively in 2015 and 2016 (55,03 and 56,39). Both inpatients and outpatients were predominated by CAD throughout observation periods. Batakese and male gender were the most common in this cohort. The highest visits in emergency room (4.432) and highest volume of procedures (1.341) in catheterization laboratory were recorded in 2019.

#### Conclusion

CAD is the most prevalent of CVD in cardiac center of Haji Adam Malik Hospital Medan. Prevention and control of cardiovascular risk factors must be included in strategies to reduce incidence and burden of CVD.

### Introduction

Cardiovascular disease (CVD) still remains the leading cause of mortality in persons over 50 years old worldwide [1, 2]. Mortalities by CVDs occur mainly due to coronary artery disease, stroke, rheumatic heart disease (RHD), and myocardial infarction (MI) [2]. Globally, it is expected that 17.9 million persons died from various heart diseases and most of them occur in low to middle income countries [3]. Prevalence cases of total CVD almost doubled in number in the last 30 years from 271 million in 1990 to 523 million in 2019. The increasing number of cardiovascular prevalent also followed by the increasing number of CVD deaths from 12.1 million in 1990 to 18,6 million in 2019 [4]. By looking at this number, it raised our concerns to look at the data in our cardiac center.

CVDs also put a significant amount of burden in health expenditure. The financial burden of coronary artery disease stems from hospitalizations, treatments, revascularization procedures, clinic visits, emergency visits, and prescribed drug treatments [5]. A report from European Society of Cardiology (ESC) in 2019, stated that CVDs took up 19% of their total healthcare expenditure in selected high-income European countries. This, number excluded when the patients had other comorbidities, which was common in CVDs. As example, the cost of care



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for patients with type 2 diabetes and CVD was 112% higher than diabetes alone. This data showed, that CVDs not only an issue about health, but also a challenge for the economic and financial systems [6].

It was expected that the number of CVDs incidences and mortalities would continue to grow in the coming years. This was consistent with the growing prevalence of obesity, hypertension, diabetes, metabolic syndrome, and a steep rise in global population aging in the past two decades [5, 7]. The worsening of cardiovascular health around the world, the most notably in developing countries, reflects the global changes of behavior and lifestyle. The westernization of dietary habits, sedentary lifestyle, increased childhood obesity, and increased tobacco consumption. In addition, the decline in infectious disease and improved childhood nutrition have contributed to the aging populations in many low and middle income countries, resulting in an increasing number of individuals who survive to the age at which risk factors they accrued throughout childhood and early adulthood manifest as chronic diseases, include CVDs [6].

Indonesia, which has one of the largest populations in the world, contributed as one of the top ranked of CVDs death in the world. Indonesia ranked number 5 as the country with the highest CVDs deaths after China, India, Russia, and the United States of America. Among various heart disease, coronary artery disease contributed as the leading cause of CVD deaths, followed by stroke, hypertensive heart disease (HHD), cardiomyopathy and myocarditis, atrial fibrillation (AF), and RHD [4]. In 2018 *riset kesehatan dasar* (RISKESDAS), a health research institution, published a data showing that a total prevalence of heart diseases in Indonesia was 1.5% and the highest prevalence was in the group of people above 75 years old [7].

### Methods

This was an observational study from patients who came to visit cardiac center of Haji Adam Malik Hospitals throughout 2015 to 2020. The data were collected from all the patients who came to our center from emergency visits, outpatients, inpatients, and from catheterization laboratory. We analyzed the data based on their sex, ethnicity, age, and diagnosis. We classified the diagnosis based on International Classification of the Diseases-10 (ICD-10) into six different groups: coronary artery disease (CAD), congestive heart failure (CHF), hypertensive heart disease (HHD), valvular heart disease (VHD), congenital heart disease (CHD), and arrhythmia.

### Results

#### Characteristic of inpatients

Between 2015 and 2020, a total of 11,997 patients were admitted to our cardiology ward, there was a trend of more hospitalization between 2015 and 2019, however a significant drop was found towards the end of our observation period. Moreover, 72% of hospitalized patients were Batakese and male gender was more prevalent. On the first two years, patients mean age was more than 50 years old, however in the following years the mean age was below 50 years old; this finding was consistent with more congenital heart disease diagnosis hospitalized during this period.

CAD was consistently the most common diagnosis throughout observation period. Moreover, heart failure was the second most prevalent diagnosis in 5 years, with significant increase was found during 2017 – 2019 period. Finally, diagnosis of valvular heart disease remained low.

Based on the data we collected from 2015 – 2020, men still dominated for hospitalized patients with heart diseases in Adam Malik hospital. The highest inpatients visit occurred in 2019 with 2,327 visits, men still dominated with 1,431 patients followed by women with 896 patients. In 2017, 2,297 patients were hospitalized with various heart diseases with 1,354 men and 943 women. In 2018, 2,169 patients was admitted to our cardiology ward with 1,334 men and 835 women. In 2016, 2,084 patients admitted to our cardiology ward with 1,409 men and 675 women. In 2015, 1,746 patients was hospitalized with 1,137 men and 609 women. In 2020, we took care of 1,374 patients with 845 men and 529 women (**Fig. 1**). From 2015 – 2020, a total of 11,997 patients were admitted to our cardiology ward with 72% of them was Batakese (**Fig. 2**). From total inpatients we admitted in 2015, the mean age was 55 years old followed by 53,47 years old in 2016, 43,67 years old in 2017, 45,13 years in 2018, 45,25 years old in 2019, and 47,84 years old in 2020 (**Fig 3**).



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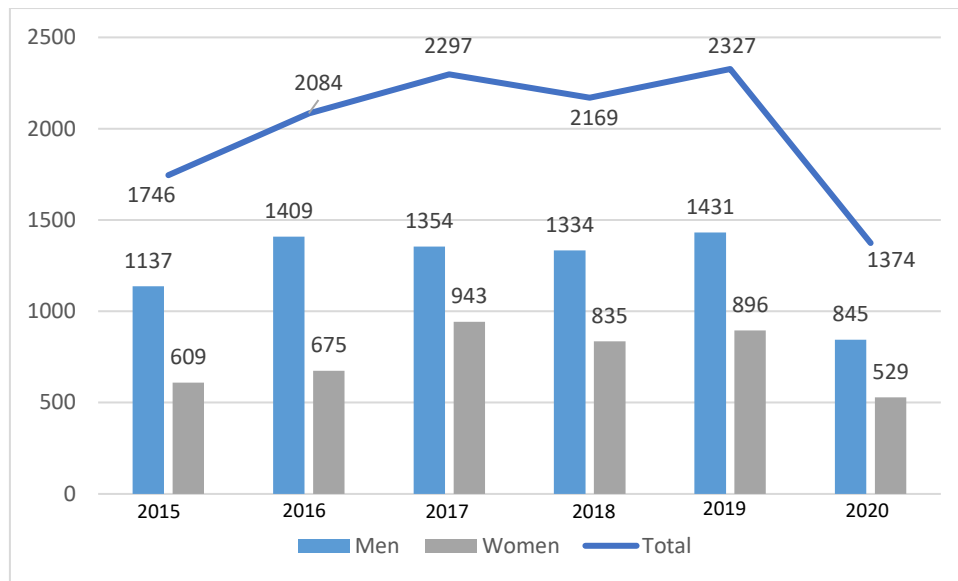


Figure 1. Inpatients characteristic based on sex

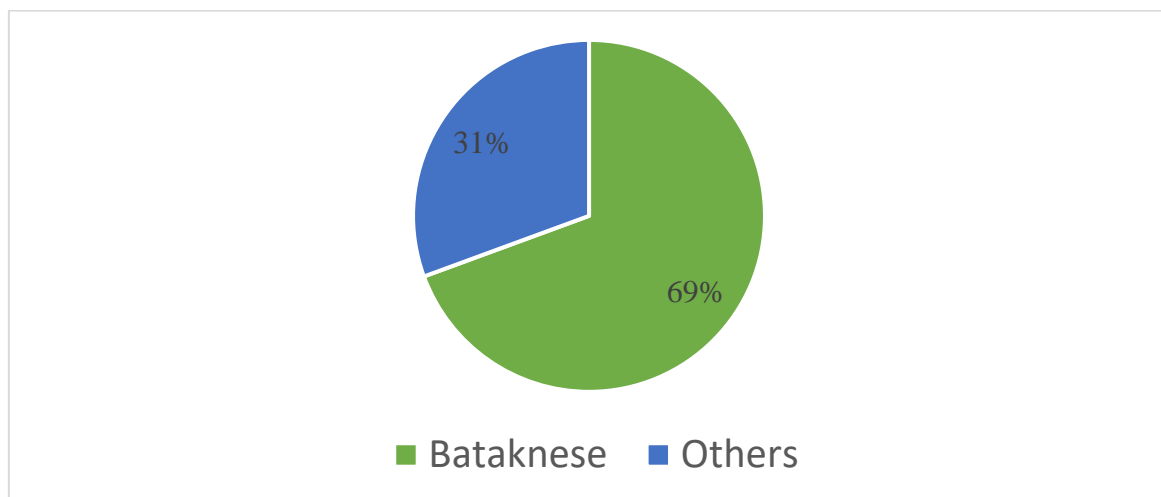


Figure 2. Inpatients characteristic based on ethnicity

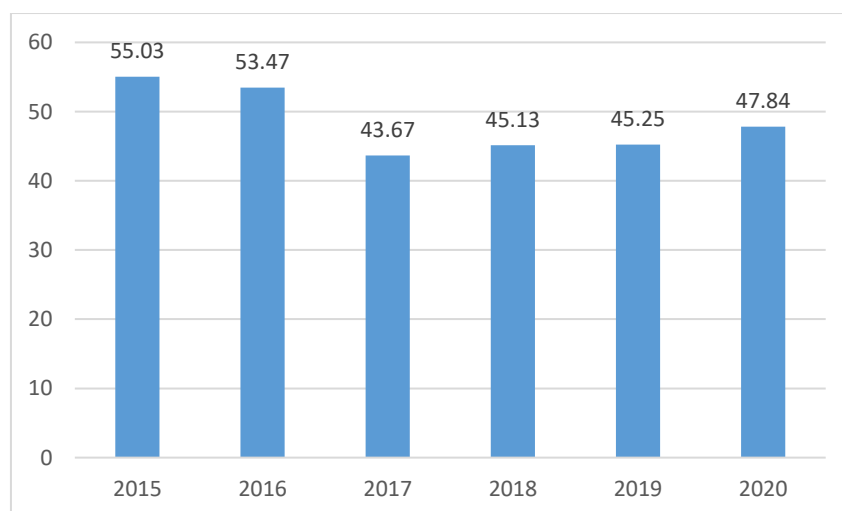


Figure 3. Inpatients characteristic based on mean age

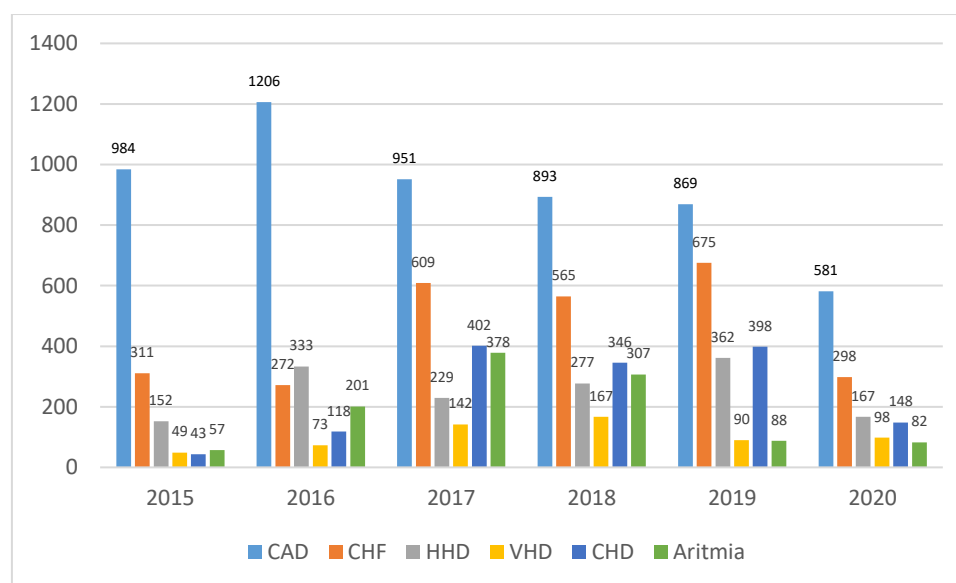


Figure 4. Inpatients characteristic based on diagnosis

Based on the diagnosis, we classified the patients into 6 subgroups: CAD, CHF, HHD, VHD, CHD, and arrhythmia. In 2015, from total 1746 patients, CAD still dominate for the most majority of patients who admitted to our center with 984 patients. This followed by CHF with 311 patients, HHD with 152 patients, arrhythmia with 57 patients, VHD with 49 patients, and CHD with 43 patients. In 2016, from total 2084 patients, 1206 patients with CAD, followed by HHD with 333 patients, CHF with 272 patients, arrhythmias with 201 patients, CHD with 118 patients, and VHD with 73 patients. In 2017, from total 2297 patients, 951 patients with CAD, followed by CHF with 609 patients, CHD with 402 patients, arrhythmias with 378 patients, HHD with 229 patients, and VHD with 142 patients. In 2018, from total 2169 patients, 893 patients with CAD, followed by CHF with 565 patients, CHD with 346 patients, arrhythmias with 307 patients, HHD with 277 patients, and VHD with 167 patients. In 2019, from total 2327 patients, 869 patients with CAD, followed by CHF with 675 patients, CHD with 398 patients, HHD with 362 patients, and VHD with 90 patients, and arrhythmias with 88 patients. In 2020, from total 1374 patients, 581 patients with CAD, followed by CHF with 298 patients, CHD with 148 patients, arrhythmias with 82 patients, HHD with 167 patients, and VHD with 98 patients (Fig. 4).

#### Characteristic of outpatients

Based on the data we collected between 2015 and 2020, men still dominated for outpatient visits with heart diseases in Adam Malik hospital. The highest outpatient visits occurred in 2017 with 30.668 visits, men still dominated with 18.850 patients followed by women with 11.818 patients. In 2018, 25.669 patients visited or clinic with various heart diseases with 15.742 men and 9.927 women. In 2016, 23.800 patients came to our cardiology clinic with 14.468 men and 9.332 women. In 2019, 18.432 patients visited to our clinic with 12.349 men and 6.083 women, followed by 2015 with 18.296 patients visited our clinic and 11.501 of them were men and 6.795 were women. In 2020, we recorded a total of 12.621 visits to our clinic with 9.201 men and 3.420 women. (Fig. 5) From 2015 – 2020, a total of 129.486 patients came to our clinic and 69% of them were Batakese (Fig. 6). From total outpatient visits in 2015, the mean age was 55 years, 56,39 years old in 2016, 56,35 years in 2017, 52,37 years in 2018, 51,19 years old in 2019, and 50,15 years old in 2020. (Fig 7)

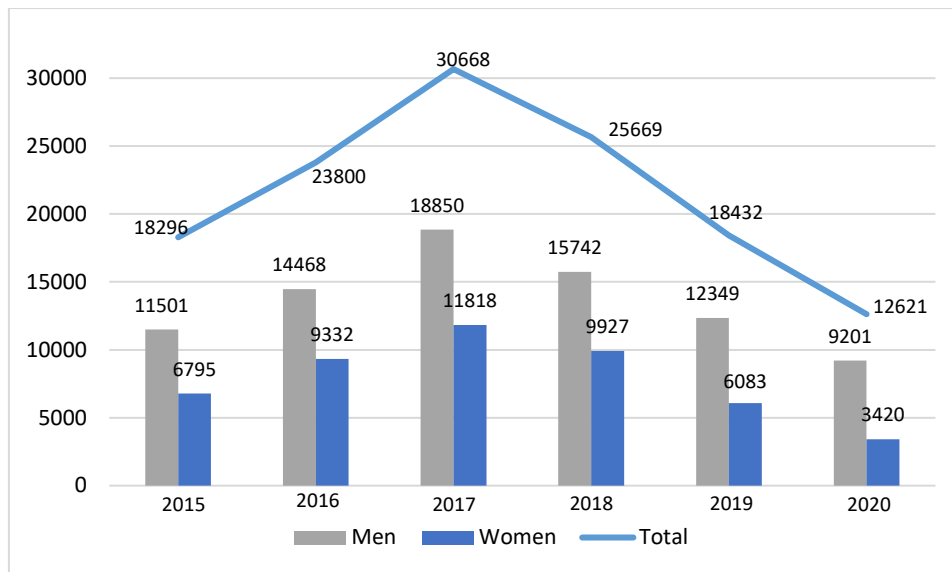


Figure 5. Outpatients characteristic based on sex

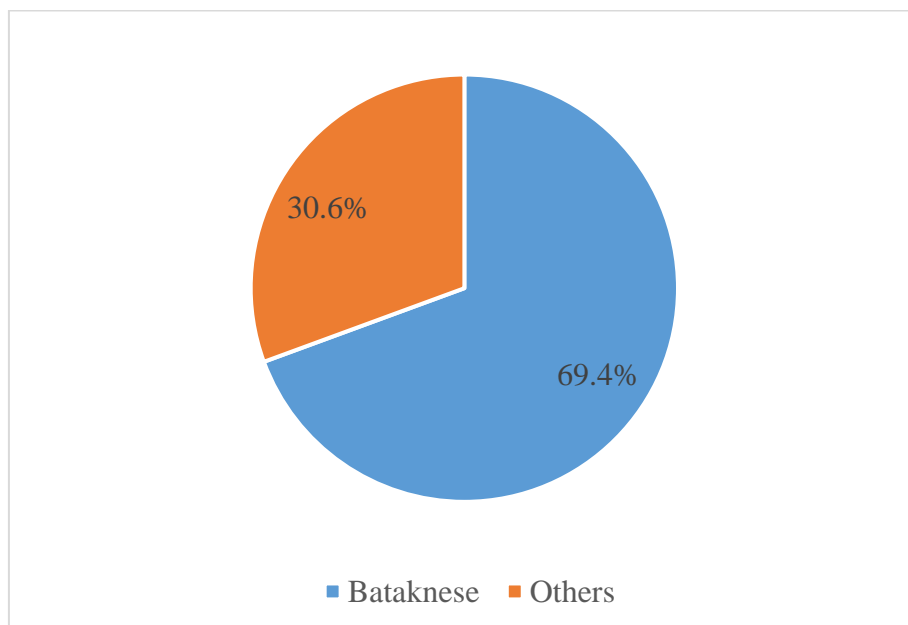


Figure 6. Outpatients characteristic based on ethnicity

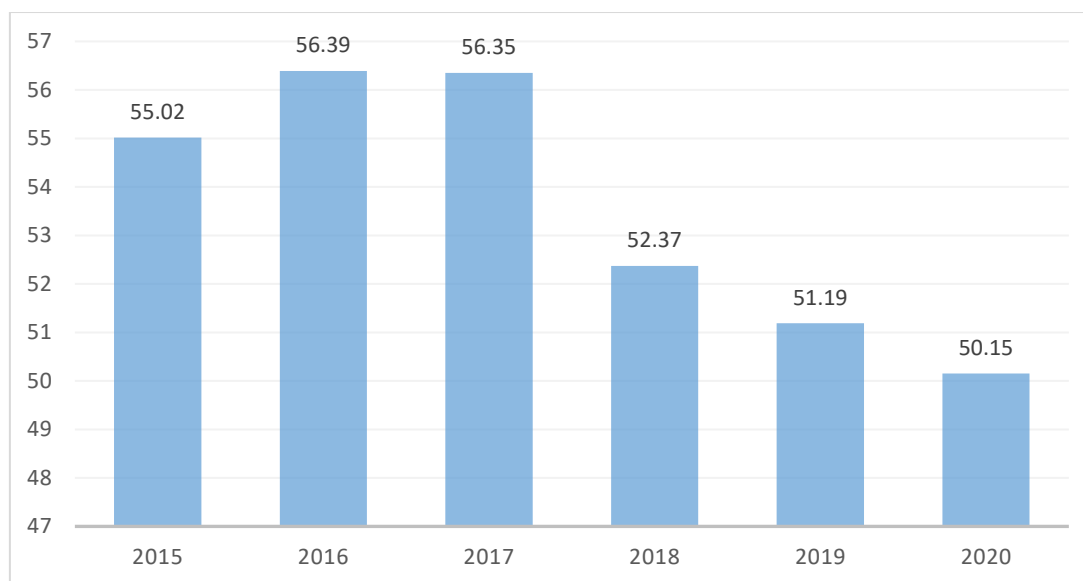


Figure 7. Outpatients characteristic based on mean age

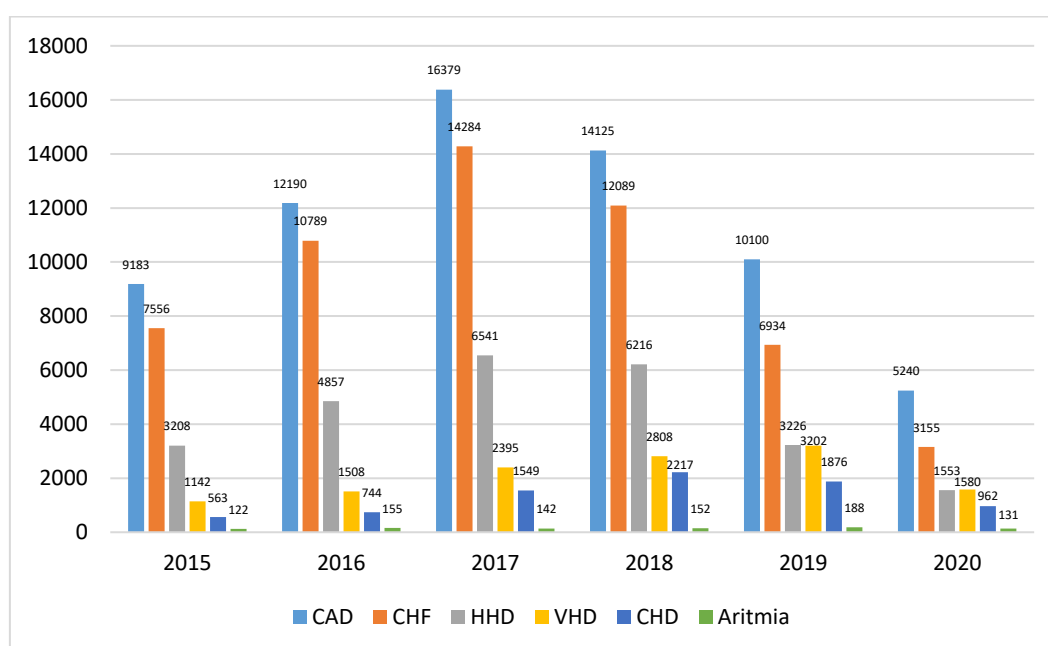


Figure 8. Outpatients characteristic based on diagnosis

Based on the diagnosis, we classified the patients into 6 subgroups, such as: CAD, CHF, HHD, VHD, CHD, and arrhythmia. In 2015, from total 18.296 patients, CAD still dominate for the most majority of patients who admitted to our center with 9.183 patients. This followed by CHF with 7.556 patients, HHD with 3.208 patients, VHD with 1.142 patients, CHD with 563 patients, and arrhythmia with 122 patients. In 2016, from total 23.800 patients, 12.190 patients with CAD, followed by CHF with 10.789 patients, HHD with 2.857 patients, VHD with 1.508 patients, CHD with 744 patients, and arrhythmia with 155 patients. In 2017, from total 30.668 patients, 16.379 patients with CAD, followed by CHF with 14.284 patients, HHD with 6.541 patients, VHD with 2.808 patients, CHD with 1.549 patients, and arrhythmia with 142 patients. In 2018, from total 25.669 patients, 14.125 patients with CAD, followed by CHF with 12.089 patients, HHD with 6.216 patients, VHD with 2.395 patients, CHD with 2.395 patients, and arrhythmia with 152 patients. In 2019, from total 16.985 patients, 10.100 patients with CAD, followed by CHF with 6.934 patients, HHD with 3.226 patients, VHD with 3.202 patients, CHD with 1.876 patients, and arrhythmia with 188 patients. In 2020, from total 12.621 patients, 5.240 patients with CAD, followed



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by CHF with 3.155 patients, VHD with 1.580 patients, HHD with 1553 patients, CHD with 962 patients, and arrhythmia with 131 patients. (Fig. 8)

### Characteristic of catheterization laboratory patients

From total of 6.217 patients who underwent different type of procedures in our catheterization laboratory from 2015 – 2020, the majority of the patients were men. From total 1.029 patients in 2015, 712 of them were men and 317 were women. From total 971 patients in 2016, 638 patients were men and 333 patients were women. In 2017, 1.153 patients underwent various procedures in our catheterization laboratory and 727 of them were men and 426 of them were women. From total 1.024 patients in 2018, 625 were men and 399 were women. The highest volume of procedures in our catheterization laboratory occurred in 2019 with 1341 cases, 870 of them were men and 471 of them were women. In 2020, from total 699 patients, 432 of them were men and 267 of them were women (Fig. 9).

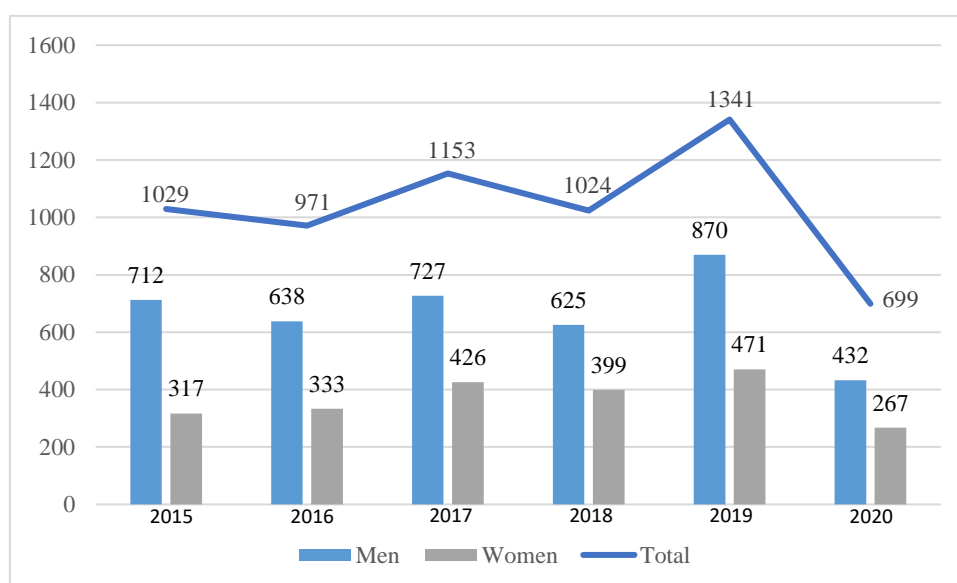


Figure 9. Characteristic of catheterization laboratory patients

### Characteristic of patients in emergency room

A total visits in our emergency room in 2016 – 2020 were 14.311. From total of 2031 visits in 2016, 1.333 of them were men and 698 were women. In 2017, we recorded a total visits of 2130 patients and 1.324 of them were men and 806 were women. From total of 2.546 visits in 2018, 1.677 of them were men and 869 were women. The highest visits were recorded in 2019 with 4.432 visits, with 2.889 men and 1.543 women. From total of 3.172 visits in 2020, 1.885 of them were men and 1.287 women (Fig.10).

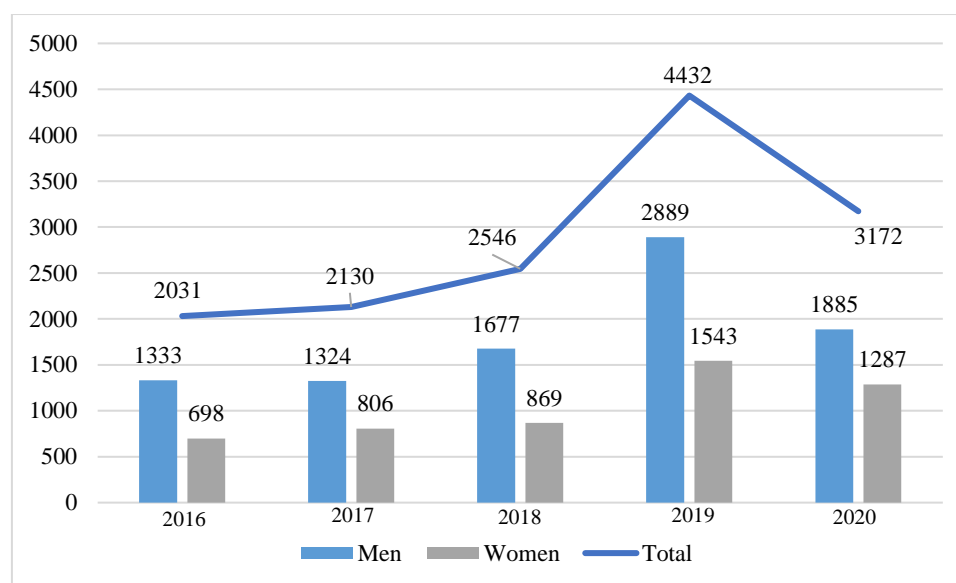


Figure 10. Characteristic of patients in emergency room

## Discussion

CVD often assumed as a problem for a wealthy and industrialized nations. In fact, CVD was the leading cause of deaths not only in developed country but also in low and middle income countries. CVD deaths accounted for nearly 30 percent of total deaths. The increased prevalence of risk factors for CVD in developing nations including tobacco use, unhealthy dietary changes, reduce physical activity, increasing blood lipids, and hypertension, reflects a global changes of behavior and lifestyle [7, 2]. By the year of 2030, the United nations (UN) through their Sustainable Development Goals (SDG) program aim to reduce the premature mortality from non-communicable disease by third. CVD (which include coronary artery disease and stroke) accounted as the most common non-communicable disease globally, and responsible for an estimated 17,8 million deaths in 2017, of which more than three quarters were in low income and middle-income countries. [9]

Our study showed that the total number of all visits, either emergency visits, inpatients, outpatients, or catheterization laboratory, in our hospital did not significantly increase over the years, except that there is a noticeable decrease in 2020 compare to the previous years. From our study also showed that men had a higher prevalence than women to have CVD. On average, women experience heart disease at older ages than men. The average age at onset of heart disease in the population aged 50 and over is 70 for men and 73 for women [10]. Age is an independent risk factor for CVD both in men and women, it is known that older women are more likely to have a complications related to heart disease. Generally speaking, before menopause, women are relatively protected from CVD, and then, after menopause, the risk of developing CVD increases significantly in women [11].

In our study we noticed that the average age of patients with heart diseases tend to decrease over the years. The increased prevalence of risk factors for CVD especially in developing nations shifted the average age of having heart disease towards younger adults. Hypertension was found to be the most common CVD risk factor, followed by obesity, and diabetes. [12] There is a high prevalence of uncontrolled hypertension among young adults. Up to 38% of hypertension goes undetected before age 40. Hypertension in young adults has been associated with adverse cardiovascular outcomes later in life, with many of these occurring before age 50. [13] The prevalence of DM in adolescent and young adults also increasing. Both type 1 and type 2 DM have been related to early vascular dysfunction, and share risk factor similar to those hypertension, dyslipidemia, microalbuminuria, inflammation, and hyperglycemia. [13] In addition to hypertension, DM, and obesity, the modifiable risk factors of unhealthy diets and insufficient physical activity are also played an important risk factors for CVD. In 2016, the prevalence of physical inactivity for adults aged above 18 years old was 27,5%. Women had higher levels of insufficient physical activity (31,7%) than men (23,4%). Over four out of five adolescents did not meet the criteria of WHO recommendations of doing at least one hour of physical activity [3]. In additional to unhealthy diets and physical inactivity, tobacco smoking is an important risk factor for CVD. Maharani et al, found that 26,6% and 9,6% of Indonesian adults age 40 years and older were current smokers and past smokers, respectively. [12] The most





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strongly associated risk factor for CAD in young adults is current tobacco use. A recent study of adults <45 years of age found an eightfold increase of acute myocardial infarction (AMI) for those who smoked >25 cigarettes/day compared with those who had never smoked. [14]

Out of all total visits in our cardiac center, CAD is the most common diagnosis from all heart diseases. CAD affects around 126 million individuals worldwide, which is approximately 1,72% of the world's population. Men were more common than women and the incidence typically started at the fourth decade. CAD remains the leading cause of death and premature mortality worldwide, with economic and urbanization having the greatest impact on disease development.[5] it should be noted that CHF also constitute as the major diagnosis in our cardiac center. It comes as no surprise that patients with heart failure has a high rate hospitalization and the need for routine visits to adjust the medication. This tendency is present despite of the increasing prevalence of heart failure, caused by aging of population and more effective treatment of myocardial infarction, resulting in survival of patients with left ventricular dysfunction.[10] CHD is one of the most common birth defects and there has been an increase in the prevalence of CHD over the past decade with improvement in CHD screening and pediatric care. In 2017, the incidence rate of CHD was 17,9/1000 worldwide, with 19,1/1000 for male and 16,6/1000 for female. Ventricular septal defect and atrial septal defect were the most common subtype of CHD with an incidence of 5,29/1000 and accounted for about 29,6% of all cases of CHD. [15] In our cardiac center, the prevalence of CHD tend to increase over the years. This is likely due to more cardiologist working at rural area. In addition, our cardiac center also did several less invasive procedures to treat CHD and improvement of survival rate of patients with CHD.

There is also a significant decrease of patients in 2020. As we all know, at the beginning of 2020, the world suffered a pandemic caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). The pandemic greatly impact the hospital visits in our center, and so did other center. In Northern Italy, the mean admission during the pandemic era was 13.3 admission per day. This rate was significantly lower than either the rate during earlier pandemic (total number of admissions, 899; 18.0 admissions per day) or the rate during the previous year (total number of admissions, 756; 18.9 admission per day). [16] Many studies have conducted to further investigate this phenomenon. First, the fear of contagion at the hospital may have discouraged access to emergency medical facilities. The number of total hospital visits continue to decline, despite the decreasing number of COVID-19 cases and the government started to loosen up quarantine measure, suggest that the physiological element may represent an important factor. A second hypothesis is linked that we could not exclude the possibility that the true reduction in the incidence of acute coronary syndrome as a potential beneficial result of low mental and physical stress during quarantine. Finally, the fact that most of the healthcare resources were allocated to manage the pandemic may have largely contributed to the reduction in cardiology admission. [17]

### Conclusion

This study shows CAD is the most prevalent of CVD in cardiac center of Haji Adam Malik Hospital Medan. Men had a higher prevalence than women to have CVD. Average age at onset of heart disease in the population aged 50. Total number of all visits in our hospital did not significantly increase over the years, except that there is a noticeable decrease in 2020, COVID-19 pandemic may have largely contributed to the reduction in cardiology admission.

Average age of patients with heart diseases tend to decrease over the years, The increased prevalence of risk factors for CVD especially in developing nations shifted the average age of having heart disease towards younger adults. Prevention and control of cardiovascular risk factors must be included in strategies to reduce incidence and burden of CVD.

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