Estimating the Cost of Illness and its Predictors among Patients with Ischemic Heart Diseases in Dubai, United Arab Emirates

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Abstract

Ischemic Heart Disease (IHD) places a considerable burden on patients in terms of morbidity and mortality and on society in terms of costs. The prevalence of IHD has been increasing in the United Arab Emirates (UAE) in the last two decades, which led to an increase in the utilization and cost of related healthcare services, including out-of-pocket payments. The objective of this study was to estimate the direct cost of Ischemic Heart Disease in the Emirate of Dubai and identify its predictors. Using the prevalence approach, the cost of services, drugs, current procedural terminology (CPT), and healthcare common procedure coding system (HCPCS), was included in the study. Data were collected on services provided in the private sector in Emirate of Dubai from eClaimLink database of Dubai Health Authority.

The total estimated annual cost of IHD in the private health sector in Emirate of Dubai in was AED 61 million, which is equivalent to AED 8,000 per patient, and AED 900 per activity. The out-of-pocket payments contributed by 60% of the total cost. The contributors to the costs were CPT (53%), services (22%), HCPCS (15%), and drugs (10%). 49% of IHD patients were diagnosed with acute myocardial infarction (AMI), and 55% were in-patient visits. 67% of the total cost was spent on AMI, and 31% on Angina Pectoris (AP). AMI contributed to 60% of CPT cost, 59% of the drug cost, 70% of the HCPCS cost, and 83% of the services cost. The study revealed that 57% of the IHD patients were not covered by any health insurance.

The results of the cost of illness study clearly indicated that IHD placed a considerable financial burden on patients and on the United Arab Emirates society. The expected increase in prevalence of IHD caused by aging population and increasing body weight should alarm decision makers of increasing costs in the future. This study was conducted in the context of UAE with some local challenges. The results of the study provided information on the complex cost structure of IHD. The high costs of IHD care may in itself indicate that more research is needed, to unveil the real cost of IHD in the governmental health sector. The move to universal coverage is an urgent need for patients with IHD, where they will have health coverage with limited out-of-pocket payments. Providing caps on out-of-pocket payments for IHD patients may reduce the economic burden on IHD patients and improve their accessibility to health services.

Keywords: Cost of Illness, Ischemic Heart Diseases, Out-Of-Pocket Payments, Health Insurance, Risk Factors, Charlson Comorbidity Score.

CHAPTER I: INTRODUCTION

This chapter introduces the study and describes the specific problem to be examined. It consists of the following parts: the introduction, problem statement, significance of the study, and specific objectives and hypothesis.

1.1 Cost of Illness

Cost of illness (COI) defines disease impact on an individual. The impact includes economic, morbidity, emotional or quality of life of an individual or the society. COI is known also as burden of disease (BOD). The aim of identifying the COI of any disease is to identify and measure all the costs associated with it, including the direct, indirect, and intangible costs (Jo, 2014). When studying the COI, the disease(s) that are prevalent in a society are identified and all the costs of the specific condition are quantified. Prevalent diseases may include but not limited to chronic diseases and their related risk factors. Normally, such diseases included under COI studies are known to have an influence on high costs in utilization of a healthcare system - either regionally or globally (Suhrcke et al, 2006; Trogdon et al, 2015). A COI study provides insight on health care costs caused by specific disease over a specified period of time. Such studies are important since they form a basis of evaluating a country's major health problem. Proper knowledge about COI is vital and helps in formulating and prioritizing the health care policies and interventions, and ultimately distributing health care resources in harmony with budget limitations in order to achieve policy efficacy (Wang et al, 2018).

Since 1960s, COI studies have been one of the most important topics; after the pioneering work of Dorothy Rice, and they have consistently attracted health economists. Despite the fact that those studies were becoming popular since then, their usefulness have been indirectly questioned as well as their reliability in estimating costs (Rice, Hodgson, and Kopstein, 1985). The reliability of COI studies depend on a variety of factors; the scope of the study, the methodology used, and the sources of the data (Nilsen, Hudson and Lindqvist; 2006).

Deciding the COI calculation method depends usually on the study goal. For instance, the calculation method used when looking at the disease prevalence in any study, will not be the same when looking at the disease incidence in another study (Jo, 2014). For example, the research may seek to identify the annual costs of all individuals with a particular disease (prevalent cases) or may seek to identify the lifetime costs of individuals with a particular disease (incident cases). Considering that the reliability and the usefulness of the study have been contented, the study took into account of the methodology used, data source and the scope of the study in order to ensure the usefulness of the study.

1.2 Cost, Price and Expenditure

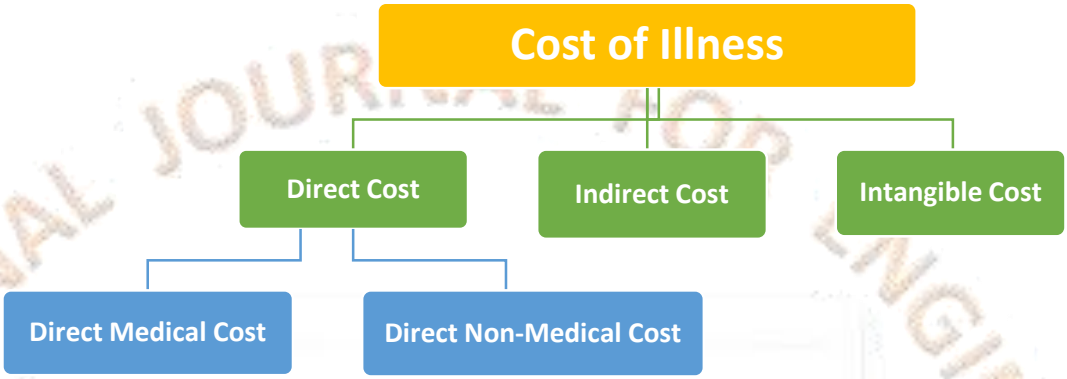
"Cost" is the payment that an industry spends while making a product or service in any given market. **"Price"** is the amount of money which should be paid by the customer to buy the product or have the service (Investopedia, 2018). The two terms can be understood better by considering the difference between the costs of making the product or service and the price of selling it to the consumers make the industry profit. **"Expense"** and cost are usually used interchangeably. In fact, both mean spending funds or resources to provide a service or make a product. The context in which expense or cost is used draws the line of difference between cost and expense. The cost is something that takes away money without profit like paying rents or salaries. Expenses represent the bulk of charges from any business to function and make revenue (Codjia, 2018). Board members usually speak about managing costs in healthcare, which usually refer to the hospital input costs needed to provide care to patients starting from salaries of employees and ending in catering up for overhead costs of the hospital. The hospitalization costs or the hospital charges are the amount of money paid by individuals, insurance companies or even governments to hospitals as a result of providing services to patients (Koppenheffer, 2013).

1.3 The Cost in Cost of Illness Study

The cost of illness is an explanation that includes several aspects of the disease effect on the health outcomes of individuals. The category of COI can range from the incidence or prevalence of disease to its effect on morbidity, quality of life (QoL), and the financial aspects including direct and indirect expenditures that is caused by premature death, disability or injury due to consistent disease and/or its comorbidities (Jo, 2014). The total cost of illness of any disease includes three components: (1) direct costs; (2) indirect costs; and (3) intangible costs (Byford, Torgerson and Raftery, James, 2000). Direct costs are divided into medical costs and non-medical costs. Direct medical costs are the resources spent during diagnosing, treating and caring for a disease or condition. These can include costs paid for inpatient hospitalization, emergency department, outpatient physician visits, nursing home, home care, medications and diagnostic testing (Tsai, Williamson and Glick, 2011). Direct non-medical costs are coming from the utilization of properties and facilities that are directly connected to the illness, but are not considered being health care related. These might include transport costs to attend medical appointments, social facilities, meals eaten outside the house when getting health care, changing own car or renovating the house to accommodate the needs of those who become physically disabled secondary to a disease and so on (Robinson, 2016). Indirect costs include current and future productivity losses of individuals as a result of their current morbidity, disability and mortality attributable to the disease. Intangible costs are incurred due to restriction or reduction in the quality of life of the individuals and their families as a result of the disease condition (Anders et al., 2011). Therefore, estimating the cost of illness can be done in a number of ways. For instance, COI study may decide to compute all the costs (direct, indirect and intangible costs) or it may cover COI from a single cost (direct costs) or even a combination of several cost indicators (direct and indirect). Figure 1.1 below shows a comprehensive pictorial representation of the number of cost indicators that are normally considered in COI studies.

Durand-Zaleski (2008) has shown that the epidemiological studies available to date surpass COI studies with far much difference. This means that COI studies are limited. As a result, it is imperative to undertake COI studies in order to provide some insights on the cost of illness – which have been ignored for a long time.

Figure 1.1 Cost of Illness



*(Adapted from Jo, 2014)

1.4 Ischemic Heart Disease

Ischemic Heart Disease (IHD) is a condition that affects the supply of blood to the heart. The blood vessels are narrowed or blocked due to the deposition of cholesterol on their walls, which is also known as coronary artery disease and coronary heart disease (Karamitsos et al., 2011). IHD can ultimately lead to heart attack (Falk, De Feyter and Shah, 2009). IHD patients may experience a repeated discomfort or chest pains that happens when a part of the heart does not get an adequate amount of blood (Mann, 2011), which usually will be triggered by circumstances that requires the heart to pump greater amount of blood flow mainly during excursion or excitement. IHD counts in the list of the renowned killer diseases. It is considered as one of the primary reason for death globally: as it was responsible for 15.9 % of the total deaths worldwide in 2017 (Institute for Health Metrics and Evaluation, 2018). Despite the fact that the developed countries have shown drops in their mortality rates from IHD (Blackwell, Lucas and Clarke, 2014; Scarborough et al., 2012), other places of the world have not yet managed to subsidize the recorded mortality rates due to an increase in IHD complications (Yotsueda et al., 2017). Besides, IHD is also considered to be the leading cause of disability-adjusted life years lost worldwide (7.32%). it was responsible for 179 million disability-adjusted life-years (DALYs) lost globally (GBD Compare Data Visualization, 2018).

1.5 Background Context of Ischemic Heart Disease in the UAE

The United Arab Emirates' (UAE) population has increased significantly in the last forty years from 287,000 in 1971, to more than 9.3 million in 2016 due to the high levels of migration to the country by expatriate workers to meet the growing job market needs of the country (Fcsa.gov.ae, 2016). The country's median age is 18 for the UAE nationals and 31 for expatriates with cardiovascular diseases being the primary cause of mortality across the country (Hajat, Harrison and Shather, 2012; Loney et al., 2013). In 2017, IHD was the major cause of death among the population of UAE (16.12%). the condition was responsible for more than 5,000 deaths and more than 142,201 DALYs lost in the UAE for that year (GBD Compare Data Visualization, 2019). Obviously, such high prevalence of IHD in the UAE is associated with high prevalence of cardiology related risk factors including obesity, sedentary lifestyle, diabetes, hypertension, smoking and unhealthy diet (Brewer, Svatikova, and Mulvagh, 2015; Bertogilia et al., 2017). According to Dubai Annual Health Statistical Report of 2017, the cardiovascular diseases accounted for more than 27% of the total death cases in Dubai for 2017. This reflects that there is a high prevalence of the condition among the Emirate's population. In regards to Durand-Zaleski (2008), illnesses that have significant burden in term of costs are mostly covered. This explains why the IHD costs in Dubai were studied.

1.6 Healthcare System in UAE

The United Arab Emirates was established in December 1971 from the federation of the seven Emirates; Abu Dhabi, Dubai, Sharjah, Ajman, Fujairah, Umm Al-Quwain and Ras Al-Khaimah. (Clements, 1998). The real GDP growth rate of the UAE's non-oil sector was calculated to be at 5.6% in 2014, supported by the increase in foreign investment inflows, mainly in tourism, real estate and construction sectors, as a result of the favorable market conditions (Dachraoui, K. et al., 2016). In addition, a huge growth in the UAE's population was witnessed; due to the male expatriates working in constructions industry and other industries. The UAE's population for the year 2016 was 69% for males and 31% for females and around 95% of the populations were below 50 years of age (Federal Competitiveness and Statistics Authority, 2018).

In the UAE, there are five governmental key players: Ministry of Health and Prevention, Ministry of Finance, Federal Health Insurance Authority, Dubai Health Authority (DHA), and the Department of Health in Abu Dhabi (it was called the Health Authority of Abu Dhabi (HAAD) earlier). The provision of services is shared between public and private healthcare providers (US-UAE Business Council, 2014). In 2007, the Emirates of Abu Dhabi created its local government related health services which are the Department of Health and the Abu Dhabi Health-Services Company (SEHA) to manage the government-owned health care facilities (SEHA, 2018). The northern emirates (Ajman, Fujairah, Ras Al Khaimah, Sharjah, and Umm Al Quwain) are taken care by the Ministry of Health and Prevention (MOHAP) since 2011 to maintain proper governance in health systems and support the active provision of healthcare services in the country (Ministry of Health and Prevention, 2018). The UAE is enthusiastically working on expanding its general healthcare system to face the rising necessities of its

population and to manage the rising economic variation through worldwide standard medical services. With the intention of containing all of its healthcare expenses, the UAE has been moving in the direction of the universal coverage. In 2005, Abu Dhabi announced a law, which obligates all expatriates and their families living in the emirate to have private medical insurance. Two years later, HAAD and DHA given the command to develop insurance policy and mandated that the population of the whole UAE must be covered by 2016 (US-UAE Business Council, 2014).

According to the World Health Organization (2018), the UAE total expenditure on health as percentage of GDP is (3.6%) compared to UK (9.1%), France (11.5%), Germany (11.3%), USA (17.1%) and Qatar (2.2%). The general government expenditures on IHD healthcare as percentage of the total health expenses are also relatively high. The final consumption and investment expenditures in UAE (72.3%) is low compared to other global expenses (UK 83.1%, France 78.2%, and Germany 76.9%). The healthcare expenditures are projected to reach 19.5 Billion USD in 2020 with its vision to develop world-class healthcare infrastructure, expertise, and services (US-UAE Business Council, 2014).

In 2007, Dubai Health Authority was created with an expanded vision to include strategic oversight for the complete health sector in Dubai and to enhance private sector engagement (Dubai Health Authority, 2018). In addition, Dubai Health Care City (DHCC) is a health care free zone established in 2002 with hospitals, diagnostic laboratories and outpatient medical clinics, which aims at strengthening the health tourism in Dubai (Khairallah et al., 2017). Dubai is perceived as one of the top destinations for medical tourism, in particular, for cosmetic surgery. In first half of 2015, the Emirate hosted 260,000 medical tourists and is targeting 500,000 patients by 2020 (International Medical Travel Journal, 2018).

Treatment is usually free for medical emergency care provided in government hospitals in the UAE (usually for the first 24 hours only), and after that any additional medical care can be costly without proper health insurance coverage. Usually the insurance companies will be very reluctant to provide health coverage to individuals having any kind of sickness at the time of issuing their insurance plan (Bayzat, 2015). For example if you are having high blood pressure, high blood cholesterol or even obesity; which are risk factors rather than a disease. Those patients' insurance policies will most likely to have exclusion for treatment for certain conditions including myocardial infarction, angina pectoris, heart attack, stroke etc. The United States Preventive Services Task Force conducted numerous surveys using large sample sizes in the previous decade. The results revealed that adults without health insurance are less likely to get the suggested preventive and screening services and they are not likely going to receive those services at the required intervals compared to the individuals with insurance (Institute of Medicine Committee ,2002). Therefore, it is mandatory to work ahead with the universal health coverage strategies, but all parties must be protected against any kind of fraud. The fraud that might come from over usage of health insurance plans that might result in demanding higher premiums or poor health coverage from the patients. Besides the fraud, that might come from the insurance companies by providing conditional health policies that, serve their interest not the patient (Weber, 2005).

In UAE, Abu Dhabi Emirate has at least some studies on IHD. Hajat, Harrison and Al Siksek (2012) explored the costs of IHD in Abu Dhabi primary healthcare points. Unfortunately, there is no study on IHD that covers Dubai Emirate. This makes it imperative to cover the region considering that Dubai has put a lot of money, time and effort to promote medical tourism; but till now no comprehensive COI data have been published yet. However, it can be argued that Hajat, Harrison and Al Siksek (2012) findings can be generalized to cover Dubai Emirate; Durand-Zaleski (2008) makes it clear the issue pertaining to external validity that limits such generalization. As such, it is fragile to assume that results can be relevant to other populations apart from the one studied – even though Durand-Zaleski (2008) does not entirely disapprove such possibility. Nonetheless, this makes it important to have context specific COI on IHD more so at a microeconomic level.

1.7 Cost of Ischemic Heart Disease

The main aspects of cost in healthcare are categorized in the literature in terms of four main aspects including cost of sickness/accidents, cost caused by high risk population, cost of system insufficiency and finally the cost of over usage by individuals (Ellis and Albert, 2010; Aqlan et al., 2011; Betancourt, 2014). First, the cost caused by sickness or accidents which are usually sudden and expensive, will force us to think about the necessity of having health insurance (Aqlan et al, 2011). Second, the concept of risk distribution among insurance users is usually invaded by several factors, so the targeted balance of having one premium for both low and high risk population is frequently unmaintainable (Ellis and Albert, 2010). Usually the low risk populations are not insured as they ordinarily do not need to use the healthcare services. On the other hand, the high risk populations are often insured and they are forced to pay high premiums as per the adverse selection strategies of the insurance companies (Ellis and Albert, 2010). Third, the system insufficiencies due to knowledge gap between what the physicians know and what the patient really knows creates another problem of information asymmetries leading to market failures (Betancourt, 2014). Physicians sometimes make risky adjustments in their clinical decisions to reduce the cost as requested by the management or over use of the health sector to meet the patient expectations. Knowing the challenges faced by physicians and the approaches, they use to implement cost-consciousness offers understanding into physician's roles in health care resource use (Sabbatini et al., 2014). Fourth, fears of unfairness might lead to redeployment in health care resources in such way that might lead to injustice or poor management at the long run (Rosen et al., 1995; Braveman, 2003; Betancourt, 2014). On the other hand, the existence of health insurance means that individuals are protected from paying the real costs of medical care, which might lead sometime to high service usage and high medical expenditures (Tulchinsky and Varavikova, 2009). This kind of misuse, as well as examples of insurance fraud, which resulted in many cases to less benefits and higher out-of-pocket share for the insured patients. This moral hazard issue is aggravated by the tax-subsidy while subscribing for the health insurance plan. As a result, the concept of "health economics" was used to enhance health while examining hospitals, clinics, health care provider practices, delivered services and the total health promotion activities (Goeree and Diaby, 2013). Therefore, health economics might be able to guide the government while

planning the rules, health strategies, goals, shaping the insurance market in the country according to the community need and other national health programs (King et al, 2013).

The Health Accounts System of Dubai (HASD) offers an accurate database that contains all the government expenditures account in private sector. In view of the tremendous expansion of the healthcare system in Dubai, the healthcare expenditures in Dubai have witnessed a rapid rise to reach 1.3 Billion AED or 11.5% in 2014 (Health Accounts System of Dubai, 2016). In 2014, Dubai healthcare expenditures reached 12.77 Billion AED which came from government (40%), insurance (34%), households (17%) and corporations (9%); keeping in mind that those figures should have been dramatically changed after the end of 2016 as the universal coverage will be implemented completely and the contribution of the government expected to decrease compared to the insurance contribution. The healthcare costs have reached around AED 17.5 billion in 2017, the share of private insurance has reached to approximately 60% (Dubai Health Authority, 2018). Moreover, the curative care services were responsible for 7,524 Billion AED (59%) of the total health expenditure compared to 585 Thousand AED (5%) on preventive services, which was paid by government with 0% contribution from insurance side. Besides, the big bulk of curative services costs were used in hospitals accounting for 4,887 Billion AED (47%) compared to 1,843 Billion AED (29%) in the outpatient services. The pharmaceutical cost was around 1,547 Billion AED (12%) of the total health expenditure (Health Accounts System of Dubai, 2016). With the high burden of IHD and the current picture of healthcare funding and expenditure in Dubai, the future picture is going to show increase in the cost of curative healthcare services if the insurance companies and usually the private sectors will not work on sustainable solutions to face the burden of non-communicable diseases including IHD, because they are responsible for 70% of the cost sharing according to Dubai Annual Health Statistics Report published in 2016 and that figure is expected to rise after the full implementation of the universal coverage in the emirates (Dubai Health Authority, 2016). As of May 2019, no data was published about the post insurance costs. Therefore, proper insurance coverage plans that contain preventive strategies, support to individuals to adhere to their treatment plans regardless of the cost is not the norm of universal coverage only, but it is a cost-effective measure in the long run (Nakayama et al; 2017). The UAE pharmaceutical market reached a value of USD 2.93 billion in 2015, representing 19.1% of healthcare expenditure. By 2020, the calculated drug expenditure is expected to reach USD 5.7 billion (The Pharma Letter, 2016).

In the healthcare sector, the dilemma of needing medical treatment while an individual's ability to pay the bill is low is increasing worldwide. In the United State in 2013, around 20% of the American adults had difficulty in paying their medical bills, despite the fact that 10% of them were having health insurance (Amadeo, 2019). According to the author, all patients tried to pay the bill somehow, but 16.5% needed more than one year to pay the full bill in instalments, and 8.9 % could not pay it at all (Amadeo, 2019). This in fact is another issue that might affect the healthcare institutions' ability to continue running their business. As the delay in paying, the medical cost by the patients or the inability to pay it at all will affect the available budgets needed to pay the salaries, purchase the consumables or even to run the daily operational activities.

1.8 Cost of Medication

One of the main strategies adopted by the UAE is to reduce the governmental share from the total expenditure on health through partnership with the private sector. Privatization has been proven in the literature to be linked to lower medication prescription cost by selecting specific medication list in the treatment plans or even removal of others by labeling them as non-essential medications like Vitamins (Morgan et al., 2015). Medication costs are the most costly area of total health care expenditures, and the statistics showing continuous increase (Abbass et al., 2017). As a result of the growing costs, insurers have dramatically reduced the drug assistances they deliver, leading to high out-of-pocket costs and making a problematic situation for patients as they have to bear the burden of cost sharing or to face the consequences of not following the treatment when their lives will be at risk (Albright, 2015). So, the chronic disease patients might be mostly susceptible to changes in utilization caused by insurance policies. Patient's out-of-pocket plan has proven to be an effective way of reducing misuse of health care, mainly for outpatient services and the medical visits (González López-Valcárcel et al., 2017). On the other hand, it has been proven by researchers that high patient cost sharing was associated with decrease in medication adherence, which as a result was associated with poor health outcomes (Eaddy et al., 2012). If we are aiming at having a fair healthcare system, which aims at creating more efficient system without jeopardizing the patients' health, understanding the relationship between the insurance role and the treatment modalities of chronic disease is crucial. Besides, insurance companies must understand how the changes in benefits they are implementing on the chronic disease patients are affecting their health and compliance. Therefore, it should be shared responsibility between all parties to create a system that protect the patients from suffering the high cost-sharing plans and keeping the insurance companies business as well by controlling misuse of patients.

Cost of medicine has shown an intense progress, receiving substantial community consideration. Growth in expenditure for medications outpaced spending growth in most of other areas of the health care system in the last years (Letter, 2018). Therefore, many strategies have been adopted by the UAE government to reduce the total expenditure on health among all parties. For example, the Ministry of Health and Prevention has adopted several strategies toward the reduction in the medication prescription cost to align its prices with the neighborhood countries (Gulf Cooperation Council (GCC) countries). The MOHAP's "*Reduction in Medicine Prices*" initiatives have significantly cut the price of around 10,000 drugs by up to 66% since 2011 including medications for cardiovascular diseases, central nervous system disorders, infections, respiratory diseases, endocrine and others (Ministry of Health and Prevention, 2018). Though such initiative, till date the medications prices are still high compared to the majority of the individuals' income. Usually the patients with chronic diseases will take more than one medication for one condition like hypertension, diabetic or cardiac conditions. On the other hand, patients decrease medication costs burden usually through less filling of prescriptions, dividing pills, or missing doses, which make them at a higher risk of adverse health events and complications (Martin et al., 2012). Moreover, the present practices of higher co-payments, coinsurance, and deductibles reveals patients' need in reducing the medications cost inflation without differentiation between important and non-important services

(Choudhry et al., 2010; Robinson, 2010; Hilsenrath et al., 2014). According to Choudhry et al. (2014), lowering co-payments in cardiovascular patients makes their results better mainly among patients with Myocardial Infarction (MI) event; however the effect of lesser co-payments on health differences is unknown. The researchers in USA used self-reported survey among patients post MI and they found that providing complete medication coverage improved the outcomes among all the patients participated in the study regardless their race or ethnicity by reducing the rates of major vascular events 35% and reducing total health care expenditure by 70% (relative spending: 0.30; 95% CI: 0.16, 0.56; $p < 0{:}05$). The concept of value-based insurance designs which focuses on decreasing the patients cost sharing of the lifesaving services compared to the non-life saving services that includes the treatment of chronic condition might be a good step toward improvement of the cost related complications among patients (Choudhry et al., 2010; Moran et al., 2015).

1.9 Prescription Medication Benefits

The insurance companies influenced the healthcare system by not only increasing the individual share and working on reducing the medication cost, but also created complicated system that encourage certain types of medications (Chen et al., 2018). Any insurance plan's prescription medication coverage contains a formulary, or a chosen medication list from where they offer prescription medications. A systematic review of the literature was conducted to identify studies addressing the relationship between medication coverage plan and health outcomes of patients in the USA. The results revealed that several insurance plans have excluded expensive medications from coverage or cut down on refills and increased the patient's out-of-pocket percentage (Kesselheim et al., 2015). The insurance companies tried another strategy to reduce the cost of medications by making partnerships with pharmacies, then negotiating medications prices and force beneficiaries to buy medications from them (Gauld et al., 2015).

Globalizations has affected all life aspects including health and sickness patterns, as we can see the disease trends have moved from being contagious to non-communicable diseases (Sabaté, 2003). Non-communicable diseases are chronic conditions that require long term treatment, individual commitment and medication adherence. According to the report published by the WHO on 2003 about adherence to long term therapies, 50% of patients with chronic conditions are not adhering to their medications in the developing countries (Sabaté, 2003). The high prevalence of non-communicable diseases is not only affecting those who are having it, but it is also putting huge burden on the healthcare systems. In the literature, it has been proven that around 10% of admissions in elderly patients are due to medication non-adherence (Sokol et al., 2005; Jiang and Ni, 2015; Roebuck and Dougherty, 2016). In addition, evidence has shown that the cost of poor outcomes exceeds the real cost of treatment beside the negative effects on people's quality of life (Mattke et al., 2010; Sarangarm et al., 2012). Therefore, to prevent admissions and readmissions, payers and hospitals have implemented programs to improve treatment compliance after discharge through proper communications between hospitals and primary health centers to assure proper rehabilitation and continuity of care (Hesselink et al., 2012; Flink et al., 2015). To summarize, with the current healthcare expenses rising worldwide, the healthcare sectors are looking at the health

insurance sector to overcome the burden of the rising healthcare costs. Premium plans, cost sharing are strategies adopted by insurance companies to run their businesses and to overcome frauds and over usage, unfortunately has led to other issues. Moreover, if the Out of Pocket costs (OOP) or co-pay the patient is going to pay according to his insurance plan is more than the patients' budget, and then we are creating a status of injustice as all individuals have the right to have medical treatment when they are sick regardless their financial status. Therefore, holistic planning and real reform of the healthcare sector might be the solution for such dilemma.

1.10 Universal Health Coverage

The WHO defines universal health coverage as a structure that *"ensures everyone has access to the health services they need without suffering financial hardships as a result"* (World Health Organization, 2013, p.5). Dubai is following the general standards set by the World Health Organization of equity and access to high quality health care by implementing the universal coverage. Since 2016, all residents and visitors of Dubai are obliged by law to have at least a basic healthcare coverage plan. Various modern improvements have been made in health service coverage and in financial risk protection by many countries to adopt the World Health Organization metaphor of universal coverage. Despite those improvements, the gap between the current health services coverage and the universal health coverage concept remains huge for various diseases in many countries and people still suffer financial disasters each year as they have to pay out-of-pocket for the health care services they require (Taylor et al., 2010; Osman, Alsultan and Al-Mutairi, 2011; Law et al., 2012; Sweeney et al., 2016). Low-income people with several chronic disorders are particularly vulnerable (Ruger and Hak-Ju, 2007; Dwivedi and Pradhan, 2017). Some groups, like women, old people, sick individuals, and those living in rural areas, are at a greater financial risk due to their higher spending ratio as out-of-pocket compared to their total income (Braid, 2016). Policymakers must be aware of these increased risks in order to provide adequate resources through comprehensive interventions to alleviate some of this burden on individuals and healthcare organizations (Ford, 2011; Khan, Ahmed and Evans, 2017). Decent healthcare systems that facilitate the individuals usage, will aid in having healthier communities. This will allow the kids to learn in the schools and the families to earn their living. It will help the individuals in escaping from the trap of poverty, and that will make the infrastructure of the long-term economic development of any country.

1.11 Statement of the Research Problem and Significance of the Study

The World Health Definition of Universal Health Insurance "*ensures everyone has access to the health services they need without suffering financial hardships as a result*" (World Health Organization, 2013, p.5), aligns with Dubai Health Strategy 2016-2021 which aims at having a world-class affordable health care with appropriate insurance system (Dubai Health Authority, 2018). High treatment cost have detrimental impact on the economic status of IHD individuals – more so those in low income bracket. Evidently, high cost triggers a chain of effect whereby individuals who are not in a position to keep up with healthcare attendance costs fail to adhere to treatment plan. As a result, deterioration in the patient clinical condition and adverse outcomes, leading to more

invasive procedures, prescribed medications and frequent follow-up visits to treat the disease condition and its complications.

On top of Dubai Emirates spending a significant amount of finances in cardiovascular diseases healthcare services, Durand-Zaleski (2008) noted that the literature framework of COI studies is marginal as compared to epidemiological studies. Further, the available COI studies are also fragile such that their generalization to larger population is also problematic. As such, COI studies therefore have little generalizability capability, which is made more apparent by the methodology in use. This means that even if COI studies on IHD are available in UAE, they may not explain fully the exact context of individual in Emirates, which have different health services settings and insurances. Therefore, it becomes important to add more COI studies in Dubai Emirates while at the same time enhancing the noted methodological considerations.

COI studies have also been cited to be more efficient or applicable within a certain period. Therefore, there is need to have more recent COI studies that are up to date and representative of the current scenario. However, there are no COI studies on IHD in Dubai Emirates – which make it more important to map more recent costs of IHD at a microeconomic level.

According to GBD Compare Data Visualization (2019), Ischemic Heart Disease was the leading killer in the UAE, inclusive of Dubai. However, no studies have gone to an extent of showing the costs associated with the first killer disease in the country. Factually, it is also important to consider mapping the COI of IHD not only to inform the policy makers about the disease context, but also to inform the IHD patients about their probable budgets during the treatment journey in order to be aware of the management approaches that they can choose for healthy living.

Since Dubai has adopted the universal health insurance plan for its population, it has to restructure the healthcare system delivery strategies, as well as its own policies toward the achievements of the universal health insurance coverage in order to attain success. This dissertation has estimated the costs of illness for one of the most prevalent non-communicable diseases in the UAE; the Ischemic Heart Disease for the first time. Besides, the dissertation has evaluated the patient share in the medical bill in term of out-of-pocket and role of insurance in their treatment. In addition, it has examined how the patients demographic, diagnosis, morbidity and encounter type can be used to predict the total cost of illness in Dubai. The findings will allow us to provide a clear picture on the lapses in the practice and to give recommendation to policy makers based on scientific data to help Dubai to achieve its ultimate goal – of having a healthier and happier community (Dubai Health Authority, 2018). Knowledge of the costs of an illness can help policy makers to decide which diseases need to be addressed first by the healthcare prevention policies, and to validate the actions in the intervention programs. In addition, the findings of the study will help in allocating the resources properly and will contribute in the direction of future research studies.

1.12 Research Objectives and Questions

Estimation of the cost of illness of the IHD is very important to direct the healthcare plans toward the important issues that need to be addressed in private sector, which represents 70% of the healthcare sector in Dubai (Dubai Health Authority, 2018). In this study, we are examining the IHD patients in the private sector and showing empirical data that explore their IHD condition, cost of illness, cost of medication, and the out-of-pocket expenses. Moreover, the inferential analysis of this study can be adopted by other researchers to examine the financial burden of other health conditions in the UAE.

1.12.1 Research Objectives

1. To estimate the cost of illness among IHD patients in the private sector in Dubai.
2. To estimate the out-of-pocket expenses paid by IHD patients in Dubai.
3. To examine how the total IHD-related cost is affected by demographic factors (age, gender, and nationality), diagnosis, encounter type and Charlson comorbidity index.

1.12.2 Research Questions

1. What is the estimated cost of illness among IHD patients in the private sector of Dubai?
   1.1. What is the estimated direct cost of IHD patients in the private sector of Dubai?
   1.2. What is the estimated cost of medication among IHD patients in the private sector of Dubai?
   1.3. What is the estimated cost of each diagnosis among the IHD patients in the private sector of Dubai?
   1.4. What is the estimated cost of each patient encounter for the IHD patients in the private sector of Dubai?
2. What is the estimated out-of-pocket (OOP) expense paid by IHD patients in Dubai?

   2.1 What is the estimated OOP amount paid by IHD patients from the direct cost?

   2.2 What is the estimated OOP cost of medication among IHD patients in the private sector of Dubai?

   2.3 What is the estimated OOP cost of each diagnosis among the IHD patients in the private sector of Dubai?

   2.4 What is the estimated OOP cost of each patient encounter for the IHD patients in the private sector of Dubai?

3. What is the association between the total IHD-related cost and patient's demographic factors (age, gender, and nationality), diagnosis, encounter type and Charlson comorbidity index?

1.13 Research Hypothesis

- ***Null Hypothesis***

H_10: There is no association between the total cost of illness among IHD patients and their demographic factors (age, gender, and nationality), diagnosis, encounter type and Charlson comorbidity index.

- ***Alternate Hypothesis***

H_1: There is an association between the total cost of illness among IHD patients and demographic factors (age, gender, and nationality), diagnosis, encounter type and Charlson comorbidity index.

1.14 Organization of the Dissertation

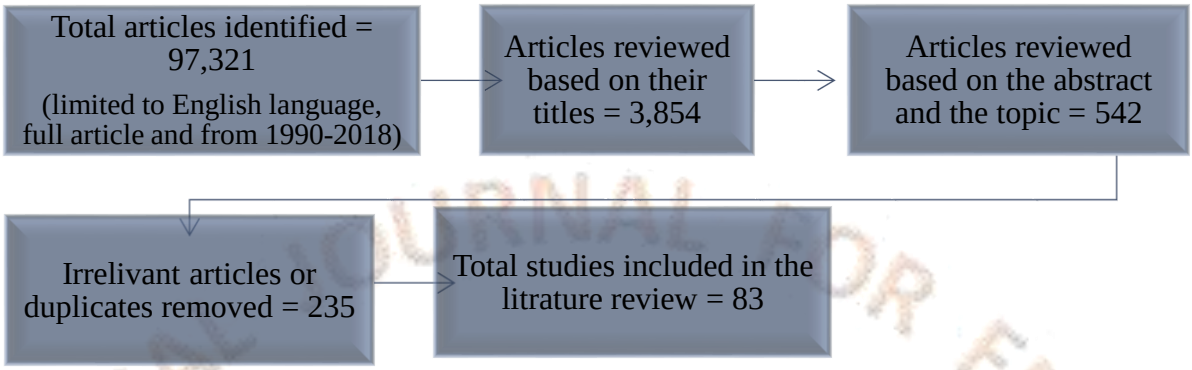
This study is organized into six chapters. This section ends the first chapter, the introduction. Chapter two reviews the literature on cost, ischemic heart disease, insurance coverage and presents the theoretical framework that supports the analysis. Chapter three describes the data set and methods used to define the sample and key study variables. Chapter four presents the results of the analysis of data. Chapter five includes the discussion of the results. Chapter six concludes the dissertation by highlighting the key finding, limitations and opportunities for future research works to fill the gaps in the knowledge. Chapter six was also set to put forward the appropriate managerial and policy recommendations.

CHAPTER II: LITERATURE REVIEW

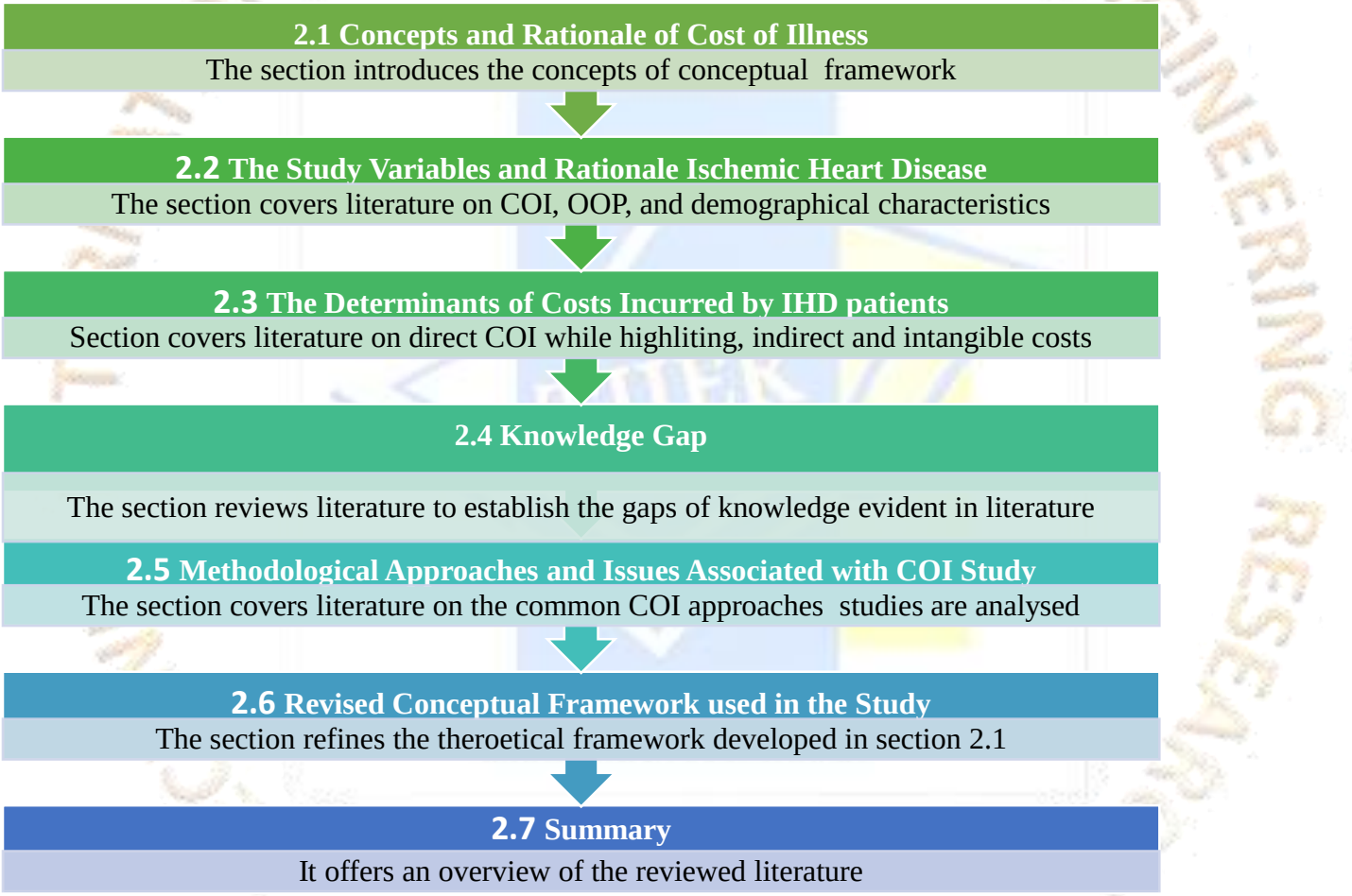
This chapter presents the theoretical framework that this study was based on. Additionally, the reviewed literature related to the theoretical framework of the study was also covered and shown how it related to the overall chapter. Mainly, the literature review covered the health care costs of Ischemic Heart Disease (IHD), the healthcare expenditures and the health outcomes. The section was organized into several sections as shown in figure 2.1 below. The major literature related to the research problem was searched through EBSCO Medline Complete and ProQuest Healthcare Management using the library system of Hamdan Bin Mohammad Smart University, MEDLINE, PubMed, Google Scholar, and World Health Organization (WHO) for articles or published in English between 1990 and 2018. During the literature review the total numbers of useful citation were 235 articles and 83 articles were relevant to study and were included. The search was conducted only on full-text studies published in English. The following key terms were used for the specific literature search: “cost of illness”, “prevalence”, “rate”, “predictors”, “measures”, “classifications”, “interventions” “medication cost”, “cost”, “insurance”, “ischemic heart disease”, “cardiovascular disease”, “coronary artery disease”, “risk factors”, “quality of life”, “health outcome”, “Charlson score”, “comorbidity index”, “GCC”, “Saudi Arabia”, “Dubai” and “UAE” and these words were used either single or in combination. However the literature inclusion criteria did not specifically use demographical variables as keywords, the evaluation of the found literature represented the aspect. As such, the literature depicted evidence; which in most cases associated the condition (IHD) with the demographical

variables and other patient characteristics. The IHD costs had significant association with specific demographical variables or characteristics.

The following flow chart shows the main section and the content covered under those sections.



2Figure 2.1 Flow Chart Overviewing the Sections of the Literature Review



2.1 Concepts and Rationale of Cost of Illness

Any patient before being diagnosed with any chronic disease, will start by having some risk factors that makes him prone to have the illness or even will explicit some symptoms prior to diagnosis (May et al., 2014). However, with the prevalence of chronic conditions like the IHD, diabetes and others, patients now have added burdens of treatment cost to the burdens of the disease symptoms itself (May et al., 2014). These burdens are even worse for those with multiple conditions as they are subjected to added burdens of symptoms and treatment costs. Through

cumulative complexity theory which tries to explain health outcomes of an individual. Shippee et al. (2012) study has shown that the burdens of treatment cost subjected a patient to a sizeable workload. Those patients are stacked between their daily living activities and the proposed modifications by their healthcare providers. Further, some patients also have workloads which require them to use more energy incase their conditions requires them to exercise to stay fit. While trying to associate how this workload may affect a patient's health outcome. Shippee et al. (2012) argued that the more the workloads, the more a patient are pressurized to adhere to all the treatment requirements. Huge workload that surpasses the patient's ability to handle them forces a patient to forego some necessities – in return may affect their health outcomes or even lead to comorbidities (Shippee et al., 2012). Ultimately, the consequences of these workloads are increased costs, deaths among other catastrophic consequences (May, et al., 2014).

Burdens of treatment have various components that affect a patient and their quality of life. Rosbach and Andersen (2017) summarized these components as financial burdens, need to exercise, need to adopt the required diet, and medication burden. This becomes even greater for patients with multiple conditions (May et al., 2014). The only cases where these burdens are not considered as catastrophic are when a patient has the capacity or ability to handle them. For instance, patients with enough financial resources, less tight schedules, functional morbidity and readily available social support system have the capacity to handle the burdens of treatment more effectively that those without such abilities. Evidently, illness comes with burdens components which in other words can be viewed as costs to a patent.

In the same way, patients with IHD patients experience burdens of symptoms and burdens of treatment. IHD patents are subjects to the discomfort that characterizes symptoms and there after they incur treatment burdens when they try to manage their symptoms. This is due to the fact that managing the symptoms through approaches such as therapeutic treatments may consumes IHD patients' financial resources, time while necessitating a lifestyle change (May et al., 2014).

These burdens make the overall cost of illness - which generally refers to the negative impact that is realized on the onset of an illness. The negative impacts entail aspects of morbidity as well as the quality of life of an individual (Zakaria and Asante, 2013). Most of the literature associates the cost of an illness with direct or indirect impacts in an individual's financial wellbeing (Zakaria and Asante, 2013). The expenditure may come about due to the comorbidities (Jo, 2014) as well as the loss of productivity of an individual (Krahn et al., 1996). The loss of productivity is however expansive as it entails more than the afflicted individuals' lost productivity but also the indirect loss of productivity experienced by the informal caregivers. As summarized by Byford et al. (2000) and Zakaria and Asante (2013) the total cost of an illness can be classified into direct costs, indirect costs and intangible costs. Robinson (2016) further classified the direct cost of illness to direct medical costs and direct non-medical costs. Indirect medical costs are linked to the indirect expenditures which are brought about by the

illness such as special diet The direct non-medical costs are usually health care-related and they include transport costs, special meals among others.

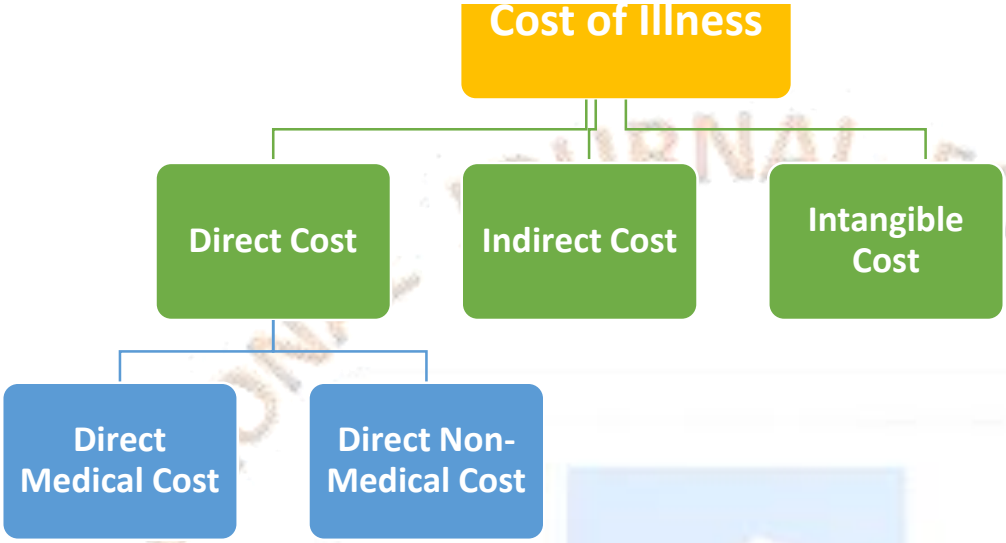
A synthesize of Tsai, Williamson and Glick (2011), Zakaria and Asante (2013), and Anders et al. (2011) studies offered a more detailed explanations of costs that IHD patients have to pay. For instance, Malaria, which is more prevalent in the African continent, has been associated to a number of costs (direct, indirect and intangible costs) by scholars in the region. Zakaria and Asante (2013) study in Ghana outlined that the indirect economic costs of malaria in Ghana surpass the direct economic costs. In this case, the direct costs were shown to include the direct expenses that individual patient used during the diagnosis, treatment and caring for a disease or condition (Tsai, Williamson and Glick, 2011; Zakaria and Asante, 2013). Other indirect costs include the expense expedited during inpatient hospitalization, emergencies, outpatient physician visits, nursing home, home care, medications and diagnostic testing (Tsai, Williamson and Glick, 2011) as well as other associated costs such as transport costs. On the other hand, indirect costs included the productivity loss due to the time consumed in taking care of the malaria patients. Finally, intangible costs are incurred due to restriction or reduction in the quality of life of the individuals and their families because of the disease condition (Anders et al., 2011). In general, most of the literature available views the cost of illness through Zakaria and Asante (2013) perspective. All the studies have linked illnesses with direct and indirect costs. For instance, Ettling and Shepard (1991) showed that Rwandanese residents used more of their income to cater for indirect and direct costs emanating from their illnesses. This was also the same case in Nigeria, Brazil and Kenya where the residents spent over 10% of their income to cater for the costs of their illnesses (Leighton and Foster, 1993).

Direct costs of disorders such as depression have been found to contribute to a significant portion of illness costs. In the United States, Birnbaum et al. (2010) showed that some of the direct costs that the Americans used to treat their depressive conditions were from indirect medical costs. This was also the same case (Kessler, 2012; Greenberg et al., 2015) for cost of depression studies in the region. This means that the overall direct costs may increase in reference to the indirect medical costs.

However Greenberg et al. (2015) and Kessler (2012) did not explicitly classify the costs of the condition into direct and indirect costs; there were themes, which represented direct, indirect and tangible costs of depression in these studies. For instance, those who had depression experienced increased treatment cost (Greenberg et al., 2015), which is a direct cost. They were also found to be absent or tardy in their jobs or else expressed characters of mental capacity impairment which reduced their ability to perform well in their jobs (Kessler, 2012), which are aspects that can be classified as indirect costs. Greenberg et al. (2015) also showed that the rate of suicide had increased in the category of those who were depressed thereby leading to the conclusion that there was also the aspect of intangible costs related to the illness. Even though not all the studies on cost of illness explicitly group the costs of illness to direct, indirect or tangible costs, the variables covered in such studies are easily classifiable to the categories that have been outlined in Byford et al. (2000) and Zakaria and Asante (2013) studies.

In the different approaches that were used to account for the costs of illness, a pectoral representation was made as shown by the below figure 2.2.

Figure 2.2: Representation of the Cost of Illness



2.2 The Study Variables and the Rationale for Selecting Ischemic Heart Disease

The following section provides background information concerning the cost of illness studies, ischemic heart disease, and the utilization and cost of medical care. The majority of these studies included direct and indirect costs; some included intangible costs.

Global and local approximations of acute myocardial infarction, angina and heart failure prevalence by age, sex, and nationality in 1990 and 2010 were estimated by Moran et al., (2014), based on the data taken from a systematic review and nonlinear mixed-effects meta-regression methods. According to them, the age related acute myocardial infarction incidence and angina prevalence decreased globally between 1990 and 2010. While the ischemic heart failure prevalence increased slightly, the global burden of IHD increased by 29 million DALYs between 1990 and 2010. About 32.4% of the growth in global IHD DALYs between 1990 and 2010 was related to the participant's age, 22.1% was related to the population growth. The number of people living with nonfatal IHD increased more than the number of IHD deaths since 1990, but >90% of IHD DALYs in 2010 were due to IHD deaths. In spite of the decreased in the age, related fatal and nonfatal IHD in most counties since 1990, population growth and aging led to a higher global burden of IHD in 2010.

Ischemic Heart Disease (IHD) is the leading cause of death worldwide (Scarborough et al. 2012; Blackwell, Lucas and Clarke 2014; Shepard et al. 2015). In the UAE, the Ischemic Heart Disease was the first leading cause of death in the country by accounting for 22.16% of the total deaths in 2016 (GBD Compare Data Visualization, 2018). Hajat, Harrison and Al Siksek (2012) conducted a comprehensive screening program on adults living in Abu Dhabi from twenty-five primary screening centers from April 1, 2009, to June 30, 2010 using self-reported questionnaire, anthropometric measures, and blood tests of 50,138 participants above the age of 18. Descriptive analysis revealed that 43% of them were male, 35% were obese, 32% overweight, 55% were having central obesity and the age mean was 36.8 years. Moreover, 32% were smoking, 27% were pre-diabetic, 18% were having diabetes, and 44% blood tested positive for dyslipidemia and 23.1% had hypertension. The findings of Hajat, Harrison and Al Siksek (2012) have highlighted the burden of high prevalence of these cardiovascular risk factors in Abu Dhabi. Therefore, such high prevalence of death caused by IHD in the UAE is definitely associated with high prevalence of risk factors among its population.

Khavjou, Phelps and Leib (2016) prepared a report on the projections of cardiovascular disease prevalence and costs from 2015 to 2035 and the American Heart Association commissioned it on 2017. The authors estimated the prevalence and medical costs of hypertension, coronary heart disease, congestive heart failure, stroke, atrial fibrillation and other heart diseases for twenty years, to help in planning future policies. Prevalence of hypertension, coronary heart disease, congestive heart failure, and stroke was estimated using data from the 2007–2014 National Health and Nutrition Examination Survey. In 2035, the number of people with cardiovascular diseases are expected to grow 45.1% compared to 2015, which means an additional 27.1 million people with hypertension, 7.2 million with coronary heart disease, 3 million with congestive heart failure, 3.7 million with stroke, and 2 million with atrial fibrillation. In 2015, 57% of total costs represented direct costs, and 43% represented indirect costs. In 2035, 67% of the total costs will be from the direct cost and 33% represent the indirect costs. Direct costs of cardiovascular diseases are expected to increase by 135% from 318 billion USD in 2015 to749 billion USD in 2035. The report suggested that cardiovascular diseases prevalence and costs are expected to increase significantly over the next 20 years. Proper research, prevention, and treatment strategies are needed if we are to limit the growing burden of cardiovascular diseases.

2.2.1 Direct Cost

Cost of illness studies estimate the detrimental impact of a specific disease, providing a reference for the decision makers to determine the health care priorities by identifying the most costly illnesses and setting priorities for healthcare systems. Two main approaches are used to estimate the cost of an illness. They include prevalence or incidence. The prevalence studies determine the costs of emanating from an illness by all patients in a certain time line - usually one year. The disease incident-based cost estimation, calculates the cost of each patient recently diagnosed with that disease within a defined period to estimate its lifetime costs progression (Nakayama et al.,

2017). Moreover, the cost of illness can be due to direct or indirect costs. Where direct medical costs are the key expenses are coming from inpatient, outpatient, services utilization, and medications costs (Robinson, 2016).

The economic evaluation in the health care sector has been conducted through Cost of Illness (COI) for a very long time. These studies target to manifest the extent to which the society illness imposes burden to the society. The burdens are gauged in terms of the prevalence in health care services consumption as well as the recorded production losses. The economic costs of an illness have been shown to be equal to the economic benefits of health care sector – if the system had eradicated the illness (Byford, Torgerson and Raftery, 2000). This means that the costs of an illness are actually benefits if the illness in context was contained in time.

Schlatter, Hirakata and Polanczyk (2017) conducted a retrospective cohort study to identify and highlight the resources used for the outpatient and inpatients**.** They included 330 patients attended the hospital's ischemic heart disease clinic from January 2000 to October 2015. The information was collected from electronic hospital records and patients' bills. The patients mean age 61 ± 10 years, 55% were male, 89% had hypertension, 48% had diabetes, and 65% had acute myocardial infarction. The hospital costs accounted for 38.6% of the total cost of managing ischemic heart disease and outpatient costs accounted for 61.4%. The mean cost per hospitalization was 1,976 USD, and the costs were higher in the first and last years of follow-up. Unstable angina, revascularization procedures, diabetes, hypertension and obesity were predictors of higher hospitalization costs ($p < 0.05$). In this study, the outpatient costs were proportionately higher than the hospitalization costs in relation to the total cost primarily due to the drug expenditure.

Studies that concentrate on the cardiovascular diseases also show that direct costs are subject to increase based on the patients' characteristics. For instance, a study that specifically studied the costs of ischemic heart disease in Brazil associated gender and age with greater hospitalization costs. In the study masculinity coupled with higher age had higher costs of ischemic heart disease as compared to females with the same demographical characteristics (Schlatter, Hirakata and Polanczyk, 2017).

Greenberg et al., (2015) showed that there was an increase in economic burden for those who had major depressive disorder since the year 2005 up to 2010. Specifically, the economic burden was relatable to the direct medical cost and presenteeism costs. The authors delve deeper and succinctly name the activities that lead to these costs. They include inpatient and outpatient medical services costs. For instance, the direct cost due to the needed pharmaceuticals was said to cost the patients around 15% in 2005 and 13% in the year 2013. Other costs specified in the study include hospitalization costs, earnings lost, workplace costs as well as absenteeism and presenteeism of the working class individuals which can be said to lead to a ripple of effects in an economy as well as to an individual. This is also the same case with Osman, Alsultan and Al-Mutairi (2011) study in Saudi Arabia. The study assessed direct medical expenses linked to IHD at Saudi Arabia. Prince Sultan Cardiac Center - Riyadh, The researchers recruited all inpatients ≥18 years of age who were diagnosed, or already had IHD between April

to June 2009 were followed up until discharge, or listed for surgery, mainly coronary artery bypass graft (CABG), or changed diagnosis. The IHD were stratified into 4 types depending on physician's diagnosis. The total sample size was 205 patients with various types of IHD. The study populations were mostly between 40-75 years old (90%). Moreover, 80% of the study populations were male and 32% were overweight. The total cost of all medical care was SAR 8,233,531 (2,195,608 USD) and the average cost of care per patient was SAR 40,164. The medications cost was SAR 261,220 (69,658.7 USD), or 3.2% of the total costs, including 1577 medication prescriptions, which has revealed a high economic burden on the healthcare system in Saudi Arabia.

Kappelman et al., (2008) also broke down the costs of illness to the expense of time and money in visits paid to the physician office, the emergency department, radiological procedures, pathology/laboratory costs as well as radiological procedures. In the study, either the ill individual or the guardian accompanying minors further added to the costs of the illnesses argued it that in the number of visits to the treatment centers. Perhaps the higher cost impact of Crohn's Disease and Ulcerative Colitis diseases the minors experienced was due to the tendency of heightened parenting and monitoring from the guardians. This would inevitably add on the costs of the illnesses.

2.2.2 Indirect Cost

The studies that have mapped the estimated costs of illness elsewhere show that not always are the direct medical costs and indirect medical costs of an illness are comparable. For instance, Zakaria and Asante (2013) has shown that the indirect cost mostly surpass direct costs significantly. Indirect expenses are more likely to be 3.6 times more than direct cost (Ettling and Shepard, 1991), which further confirms the unequivocal nature of costs of illness classifications. Birnbaum et al. (2010) gave a succinct figure that depicts the relationship of direct and indirect costs. The author found that in every dollar that was spent directly to get medical attention (a direct cost), 1.90 more dollar was spent to cater for indirect costs of illness. In other words, spending direct cost due to a disease, a greater percentage of the original amount was consequently spent as indirect cost. Arguably, Birnbaum et al., (2010) study was a summary stating that the direct costs of an illness are directly proportional to the indirect cost of an illness.

The tendency of indirect costs of an individual to surpass direct costs by greater margins was dependent on an individual. for instance to individuals with the required resources such as financial capability, time and little need for social support did not necessarily attract higher indirect cost as compared to patients who lacked this capacity. Such ability decreases the burdens or the workload and consequently the indirect cost. Similarly, managed conditions that lead to less severe outcomes such as disability or inability to work have little impact on the indirect costs increase. As such, such patients neither need additional support from their families nor they quit their jobs, which is translated to the loss of productivity among other patients.

A ripple of effect is experienced due to an illness. For instance, Greenberg et al., (2015) showed that there was an increase burden for patients in the year 2005 through 2010. Specifically, the burden emanated from presenteeism costs. the indirect costs specified entailed earnings lost, workplace costs due to absenteeism and presenteeism of the working class individuals as well the time lost by other care givers. Ultimately, this led to lead to a chain of connected costs in an economy. Further, the length of stay in a treatment center or healthcare institution was also pinpointed as a specific unit that contributes to the cost of illness. For instance, French, Popovici and Tapsell (2008) noted that the mean length that a drug addict spent in the set institutions had a direct influence on the total costs of episode treatment.

Zakaria and Asante (2015) on the other hands consider loss of lifetime earnings due to an illness as a measure of cost of illness. The study explores a number of specific activities that measure cost of illness such as the impact on the consumption of the ill individual household, the borrowing due to the illness, the costs of the social support groups that an individual may join and the overall impact on one's quality of life. Elements such as the most productivity due to time taken to seek medical services as well as the indirect care have also been outlined as aspects that contribute to the overall economic impact of an illness.

Another study that specifically studied the costs of ischemic heart disease had a wide range of factors that depicted the cost of the condition. Khan et al., (2017) has shown that the costs of the illness through indicators such as surgical procedures whereby they were directly linked to the increased costs of the illness. Other cost emanated from the length of stay, which translated to the total cost of ischemic heart disease. However, when comparing the most relevant event that translated to the high cost of ischemic heart disease treatment, surgical procedure depicted a strong correlation than the length of stay. This means that the length of stay that an individual with ischemic heart disease had in the treatment center did not inflate the costs of the illness as compared to the influence of surgical procedures. Lastly, aspects such as diagnosis and laboratory tests proved otherwise. As such, diagnosis and laboratory tests had no significant association with the total cost of ischemic heart disease.

Nicholson et al., (2016) also cited that Medicare Diagnosis-Related Groups aids in mapping costs of an illness. The study on cardiovascular illnesses used initial hospitalization costs and its procedures, follow-up cost such as re-hospitalization, continuing care after an episode, routine care after discharge, continuing care and end of life costs to tally the cost of cardiovascular diseases.

Dunlay et al., (2011) study has shown that the costs of heart failure after diagnosis have been associated with higher costs compared to the cardiovascular disease diagnosis. As such, the study outlines that higher costs were notable in the diagnosis stage as well as the following months after diagnosis. Critical evaluations of the two studies: Dunlay et al. and Khan, et al. (2017) have shown some inconsistence in the literature pertaining to the cardiovascular conditions. As such, Khan et al., (2017) findings show that diagnosis and laboratory tests as not significantly associated with the total cost of illness whereas on the other hand Dunlay et al., (2011) shows that

higher costs were significantly associated to the diagnosis and laboratory tests costs during the diagnosis of a cardiovascular disease. However, considering that, he two studies were commissioned in two different regions (Pakistan and the USA) then such differences are permissible. This is due to the fact that different regions have different health insurance policies. For instance, some insurance policies can cover the diagnosis and laboratory tests costs while some insurance policies omit the coverage in their plans.

2.2.3 Intangible Cost

Brown, Lipscomb and Snyder (2001); Zakaria and Asante (2013); Jo (2014); Banks, Keynes and Smith (2016) studies have provided a great deal of understanding pertaining to the costs of an illness. As such, whereas some studies only concentrate on costs of an illness from the financial perspective, the studies adopt a mixed approach while evaluating the costs of an illness. For instance, Zakaria and Asante (2013) take into account the financial burden that malaria has on an individual while at the same time the study assess the cost of an illness from non-financial costs such as the intangible costs. This makes it clear that apart from the tangible burdens or costs that a disease introduces since its onset, there are also intangible costs that the individuals go through.

Brown, Lipscomb and Snyder (2001); Zakaria and Asante (2013); Jo (2014); Banks, Keynes and Smith (2016) studies gave a mind map of how the cost of an illness become prevalent to an individual. These studies were associated with disability, mortality and morbidity with economic drain of the ill persons in terms of finances. For instance, Zakaria and Asante portrayed that malaria introduced the prevalence of disability, mortality and potential co-morbidity and later on has led to major consumption of a significant amount of the household's income. Banks, Keynes and Smith (2016) explored the difference in morbidity and mortality of diseases between England and the United States senior citizens and established that the morbidity, disability and mortality lead to healthcare cot in both regions. Additionally, Jo (2014) also depicted that the Korean population affected by liver disease found themselves disabled or morbid. Consequently the Koreans affected by the disease expedite more money than what they were expecting due to the disease characteristics they have experienced. This is also the same case with Brown, Lipscomb and Snyder (2001) study that was associated with the morbidity, mortality and disability caused by cancer and made the patients use more money to cater for their treatment services as well as other related costs. Evidently, these studies lead to the conclusion that a disease introduces some detrimental characteristics such as morbidity, fatality, and disability among other disease characteristics making an individual spend more than they would have spent in absence of the disease. In the same case, Ischemic heart disease is also associated with disease characteristics such as morbidity, mortality and disability thereby leading to costs of illness.

2.3 The Determinants of Costs Incurred by IHD Patients

2.3.1 Charlson Comorbidity Index (CCI)

The total cost of illness might affect by the patient comorbidity as it might add to the complexity of care and the length of stay (Sarfati et al., 2011). The costs of an illness were deemed to increase with the presence of other comorbidities as accounted for in the Charlson Comorbidity Index (CCI). In summary, the more an individual has a number of other comorbidities, the more their cost of illness is likely to increase. However, since comorbidities act as confounders when assessing the statistical significance of the factors that contribute to the cost of illness, controlling for comorbidities is important. This was also the same case for the study where confounders were controlled in order to establish the estimated level of causality.

The (CCI) is commonly used comorbidity index and has been validated in various clinical settings, is commonly used (Quan et al., 2001; Charlson et al., 2008; Tessier et al., 2008). It predicts the one year mortality patients based on their comorbidity data (Charlson et al., 1987). It contains 19 issues including diabetes, congestive heart failure, peripheral vascular disease, chronic pulmonary disease, mild and severe liver disease, hemiplegia, renal disease, leukemia, lymphoma, metastatic tumor, and acquired immunodeficiency syndrome (AIDS), each one is weighted according to their possible effect on mortality as shown in table-1 (Marra et al., 2006; Sarfati et al., 2011). The same calculation methodology is adopted by DHA in calculating the CCI of the patients.

1Table 2.1: Charlson Weighted Index of Comorbidity

Assigned Weight	Condition
1	• Myocardial Infarction • Congestive Cardiac Insufficiency • Peripheral Vascular Disease • Dementia • Chronic Pulmonary Disease • Connective Tissue Disease • Mild liver disease (without Portal Hypertension, Include Chronic Hepatitis) • Diabetic without End Organ damage
2	• Hemiplegia • Moderate or Severe Renal Disease • Diabetic with End Organ Damage (Retinopathy, Nephropathy, Neuropathy, and Brittle DM) • Tumor without Metastatic (Excluded if >5years diagnosis • Leukemia (Acute or Chronic) • Lymphoma
3	• Moderate or Severe Liver Disease
6	• Metastatic Solid Tumor • AIDS (not just HIV positive)

Source: Charlson et al. (1987)

As such, conditions characterizing comorbidity can be regarded as third variables. That ultimately affects the cost of an illness by modifying the total cost of illness. Third variables such as comorbidities are usually of ultimate interest in COI studies. As such, studies have used statistical means or control groups to adjust for the confounders. For instance, Kessler (2012) used control group in order to alienate the confounders. Other studies (Hodgson and Cohen, 1999; Dall et al., 2008; Banks, Keynes and Smith, 2016) have also tried to account for confounding variables in their studies on cost of illness. However, it is doubtable that a study can account for all comorbidities as well as confounding variables in order to deliver findings free from third variable effect.

Therefore, as Yang et al. (2018) noted issues that affect the cost of illness include the comorbidities prevalent in the studied population. If such conditions are not controlled, then the actual cost of an illness cannot be mapped. The comorbidities can act a confounding variable which leads to inconsistent results (Benichou, 2001). Due to the confounding variables, formulas that have been developed to compare and evaluate the differences between individuals with and without an illness become context specific. This means that the formula that combines population-attributable fraction (PAF) and aggregated data can only yield dependable results if only third variable such as age, gender, underlying comorbidities are absent (Jo, 2014).

Another cross-sectional community based study conducted in Al-Ain City; UAE from February 2004 to February 2005 identified the risk factors associated with cardiovascular diseases. Subjects were interviewed, their blood pressure, weight, height, fasting blood sugar, and lipid profile were measured and the Framingham risk scores were used to decide on their risk levels. 817 patients finished the survey, of these 28.4% had a Framingham risk assessment score of more than 20%, 23.3% had diabetes, 20.8% high blood pressure, 37.3% obesity, 22.7% metabolic syndrome, and 19.6% were smoking (male). Coronary heart disease was reported in 2.4%. Lipid profiles were abnormal in 64% of the males, and in 53.9% of the females, generally due to low high-density lipoproteins or high triglycerides levels (Baymouna et al., 2008). Acknowledgement of such relations and interactions among different risk factors is important in the prevention and management of cardiovascular disease and its complications.

Huang et al. (2014) provided a basis in which presence and measure of comorbidities impact on the cost of illness. To predict the risk of mortality among type 2 diabetic patients with nephrology involvement, Huang et al. (2014) examined 533 patients aged 18 years or older and were admitted to the hospital with diabetic nephropathy between 2003 and 2010 in China. Based on the Charlson Comorbidity Index (CCI) scores, the severity of comorbidity was classified into three categories: mild, with CCI scores of 1–2; moderate, with CCI scores of 3–4; and severe, with CCI scores ≥5. The mortality of the participants increased with CCI scores: (1) patients with CCI scores of 1–2 their mortality was 21%, (2) patients with CCI scores of 3-4 their mortality was 56.7%, (3) patients with CCI scores ≥5 their mortality was 22.3%. The CCI gives an easy, economic and valid tool for classifying the comorbidities and predicting the mortality of patients. Therefore, by accounting for comorbidity of the individual

through the CCI score is very useful, as the IHD patients usually will have other comorbidities rather than IHD. For that reason, checking if the patient comorbidity will lead to higher cost among IHD through the use of CCI is of great importance.

Baymouna et al. (2008) proved that a certain condition is associated to a number of comorbidities and risk factors. Through a cross-sectional community based study conducted in Al-Ain City, UAE from February 2004 to February 2005 to identify the risk factors associated with cardiovascular diseases the prevalence of other conditions were mapped.. Subjects were interviewed, their blood pressure, weight, height, fasting blood sugar, and lipid profile were measured and the Framingham risk scores were used to decide on their risk levels. 817 patients finished the survey, of these 28.4% had a Framingham risk assessment score of more than 20%, 23.3% had diabetes, 20.8% high blood pressure, 37.3% obesity, 22.7% metabolic syndrome, and 19.6% were smoking (male). Coronary heart disease was reported in 2.4%. Lipid profiles were abnormal in 64% of the males, and in 53.9% of the females, generally due to low high-density lipoproteins or high triglycerides levels (Baymouna et al., 2008). Acknowledgement of such relations and interactions among different risk factors is important in the prevention and management of cardiovascular disease and its complications.

Another study by Orozco-Beltran et al. (2017) specifically addressed comorbidities in cardiovascular condition. The study have assessed the associations among different variables including lipid profile with all-cause mortality and hospitalization due to ischemic heart diseases among high risk population over 30 years in Valencia, Spain. 51,462 participants were involved with a mean age of 62.6 years (52.4% women). The results revealed an average follow-up of 3.2 years for the participants, 919 deaths were recorded, 1,666 hospitalizations for coronary heart disease and 1,510 hospitalizations for stroke were documented too. Statistical significance was found between the factors that presented an increased rate for total mortality, coronary heart disease and stroke hospitalization were associated with HDL cholesterol and triglycerides levels.

Lastly, Age is a significant predictor of survival outcome and has been integrated into the CCI score to create a single index that accounts for both comorbidity and age, the age-adjusted Charlson comorbidity index (ACCI). The individual age is categorized into five groups and each given a different weighted score: <50 years the weight "0", 50-59 years the weight "+1", 60-69 years the weight "+2", 70-79 years the weight (+3), ≥80 years the weight "+4" (Charlson et al., 1994).

It becomes conclusive that confounding factors tend to limit almost each and every cost of illness studies as there are dozens of third variables which will inevitable play role or interact with the studied phenomenon (Benichou, 2001). Considering that the current study could also not account for all the confounders, the most recognized third variables in cost of illness studies were however accounted for. They include aspects such as demographic disposition of the studied individuals (Dawood et al, 2017; Moran et al., 2014) such as age, gender as well as other underlying illness conditions (Osman, Alsultan and Al-Mutairi, 2011; Jo, 2014; Yang et al., 2018).

2.3.2 Demographical Variables

In regards to age, older individuals with or without a condition have been outlined in a number of studies as constant seekers of health services. In other words, the younger generation had poor health seeking behavior than the older generation. Male child under 5 years was portrayed to be taken care well of than the opposite gender of the same age in Lucknow (Katiyar et al., 2017). Five years old Girls were taken to informal care such as homecare and its equivalents while five years boys were taken to healthcare facilities. Evidently, informal care will lead to different out-of-pocket cost for both genders despite having the same age. Thompson et al. (2016) and Dawood et al. (2017) studies have shown that the participants age difference and their health seeking behaviors. The old and retired individuals consulted treatments after a disease onset and the old patients had a higher out-of-pocket cost as they consulted the health services more than the other age groups. The same was found among the university students in the University of Lebanon where young people were studied. The students had low formal health seeking behaviors as they were labelled healthy and the risks of being sick were very low for them.

Out of pocket costs include all the costs that insurance medical covers do not cater for. The out-of-pocket costs may be used to pay for services like illness diagnosis, treatment, and CPT costs. The demographic variables include individual characteristics such as the age, gender, and nationality encounter type and Charlson score.

Gender differences and their ability to impact on the out-of-pocket cost have also been supported by past and contemporary studies. However the studies were not specifically assessing the cost of an illness, the provided beneficial understanding on how gender can impact on out-of-pocket cost in the following ways. Katiyar et al. (2017) showed that girl child had likelihood to have lower out-of-pocket cost since they attended informal care, which is cheaper unlike boys. In another study, women were shown to seek care late than men and worse that they consulted informal care more often than men who were in favor of formal care (Tenenbaum et al., 2016; Thompson (2016); Das et al., 2018). In terms of admissions, women were admitted for long than men (Tenenbaum et al., 2016). Arguably, late health seeking behavior coupled with type of care consulted (either formal or informal) as well as admission period can affect the out-of-pocket cost. This is due to the fact that under the 72 hours policy, women will incur full out-of-pocket cost whereas men will be covered by insurance. In terms of type of care men will incur larger sums of out-of-pocket cost as they consult formal cares. Finally, the period of admission may lead to higher out-of-pocket cost or women since they are admitted for long periods. As such, longer periods may increase the bills beyond the amount an insurance cover allocates thereby forcing women to cater for the extra bills out of their pockets.

The studies have also associated demographical variables of the participants with differences in health seeking behavior, which ultimately lead to out-of-pocket costs. For instance, culture and region Das et al. (2018) nationality and education level (Dawood et al., 2017). Nonetheless, the studies were not specifically addressing the health seeking behavior of a specific disease. Further, the analysis speculated that the demographical variable

affected how an individual adhered to health seeking behavior and in the end affected their out-of-pocket cost either directly or indirectly. Considering that there was no clear and direct answer pertaining to how the demographical variables were linked to the cost of an illness in terms of out-of-pocket costs, then the following hypothesis was formed.

Null hypothesis – The demographic characteristics of an individual do not have an impact on the out-of-pocket cost of the individuals with Ischemic Heart Disease in Dubai.

Alternate Hypothesis - The demographic characteristics of an individual have an impact on the out-of-pocket cost of the individuals with Ischemic Heart Disease in Dubai.

2.4 Healthcare Insurance Plan and Healthcare Utilization Frequency

Medical covers offered by healthcare insuring bodies or even the government play a pivotal role in cost of illness accounting. Zakaria and Asante (2013) explains that the medical covers offered by the healthcare insurance companies cushions patients from negative economic impacts that an illness subjects individuals to. On top of the burdens, it has also been argues that medical covers has the capacity to increase the patients attendance to hospitals and thereby driving health care services utilization rate. The increase in healthcare attendance and engagement in illness management activities is linked to the subsidized costs that the patients incur which is considered reduced burden in terms of finances.

The UAE region health is different from the rest of the regions. Each and every region has unique policies and plans that cover different individuals as per their characteristics. These characteristics range from social economic status, age, employment status, nationality, disease, risk factor, gender and marital status. The case of United States insurance policy as compared to the UAE outlines some insights of how different regions have different health insurance coverage. For instance, most of the health insurance coverage in the US gave the beneficiaries an option to consult a wide range of specialized consultations. On the other hand, the UAE gives the beneficiaries health insurance covers with specific network and any consultation or treatment outside the network, either will be partially covered or will be rejected by the insurance.

Since various regions have different insurance policies out-of-pocket cost for individuals with a certain condition are greatly affected. This explains why an individual with premium health insurance cover will not pay the same out of pocket amount as an individual with ordinary cover. One of the most significant predictor that dictates the type of health insurance cover that an individual will subscribe to is their social status which is also linked to their monthly income (Arpey, Gaglioti and Rosenbaum. 2017). This means that premium health insurance covers will mostly be the wealthy with high income bracket per month while the less wealthy will have basic insurance covers.

More differences in the health insurance covers pertain to how the expatriates and Emiratis are covered by the insuring bodies. For example in Abu Dhabi Emirates UAE, the nationals who are between 18 to 75 years are fully covered by government insurance while the expatriates are covered together 3 dependents under that age of 18. In Dubai, it is different where only the expatriates are covered by their employers. The employees have to cater for their dependents' health insurance plans. However, the Emirates cover the health insurance for the Emiratis in Dubai (UAE Government, 2019). In all seven Emirates, the expats cover is dependent on their monthly earnings. This means that the higher an expat earns the more likely that the employer will cover them with a comprehensive health insurance. Therefore, low income expats can only get general health insurance covers as compared to their counterparts who can enjoy exclusive health insurance covers and moreover opt for private health insurance that is different from the one in employers plan.

On a critical note, the UAE health insurance covers have to a greater extent divided the health instance policies as per their demographic orientations. This means that the characteristics for an individual predict the type of health insurance cover that they are deemed to benefit from. Arguably, the more comprehensive the healthcare insurance cover that an individual is subscribed to, the less likely that their out-of-pocket expenses will be high. The divisions as per an individual's characteristics created by health insuring bodies supports the conclusion that; the age of an individual can impact on their out-of-pocket cost. For instance, the individual below 18 year as well as those above 75 years can be inferred to have a higher out-of-pocket cost as compared to those between 19 and 74 years since they are not covered by the insurance. From another perspective, the wealthier individuals in the region can also be said to be able to cover a more comprehensive health insurance covers making their conditions almost fully covered as compared to their less wealthy counterparts. Therefore, out-of-pocket cost of the wealthier individuals may also be less than those of the financially unstable individuals - who are partially covered. The opposite may also be true considering that individuals with high income or high social status tend to seek health services more than those patients with low income. Definitely spending large sums of finances out of their pockets, but without being a burden on their budget (Kuuire et al., 2015).

Comparing the UAE insurance covers and policies with elsewhere (Norway), it is evident that Norway has tried to limit the chances that an individual can be compensated for their out-of-pocket expenses. As such, Norway has a 72 hours policy in insurance covers that determines if an individual's out-of-pocket cost will be refunded or not. For example, those who report to a hospital late (after 72 hours) after an incidence occurrence may not be covered for their illness cost (Tenenbaum et al., 2017). Considering Tenenbaum et al. (2017) study showed that women tend to report to hospital late (72 hours after incidence occurrence) than males, and then it is evident that women in Norway have high out-of-pocket cost than the males.

Yang et al. (2018) also showed the relationship between insurance and comorbidities on financial burden of a patient. The researcher considered type II diabetes among patients with or without insurance in 100 hospitals across China. Patients 18 years or older and with at least 1 day of hospitalization were included in the study (*n*= 124701). Major chronic comorbidities, including hypertensive diseases, cerebrovascular diseases, ischemic heart diseases, chronic obstructive pulmonary disease, and chronic kidney disease were considered using the International Classification of Diseases 10th Revision (ICD-10) codes. The costs for laboratory tests, imaging studies, and general medical services were higher among type II diabetic patients with myocardial infarction than those without myocardial infarction, and the cost of prescribed medications were higher among type II diabetic patients without myocardial infarction. Hospitalization costs increased significantly in both insured and uninsured type II diabetic patients with any type of comorbidity but uninsured patients were carrying a heavier OOP burden. Although this study is not related to the IHD patients, but still it is related to the concept of the cost burden on patients with chronic diseases regardless of the disease condition.

Dhalla et al. (2009) studied the costs and benefits of providing free medications to Myocardial Infarction (MI) patients who do not have private insurance and public coverage. Markov modelling technique, decision analysis and economic evaluation was done to compare the outcome of providing full public coverage of secondary medication for MI, which was measured through the ratio between cost and quality-adjusted life-year (QALY), gained. The researchers were successful in proving that providing free MI medication through full coverage was associated with higher quality-adjusted life-year gained compared to not being financially covered (7.02 vs. 6.13 QALYs) but at increased cost (20,423 USD vs. 17,173 USD). Therefore, policy makers in healthcare organizations must work on making certain disease conditions like myocardial infarction or ischemic heart disease and its medications free of charges either through the insurance plans or the government share as it is a long term cost effective strategy.

Other studies have also supported the theoretical perceptions postulated above. For example, Kuuire et al. (2015) and Arpey, Gaglioti and Rosenbaum (2017) showed that the poor are less likely to engage in health seeking behavior as compared to the richer individuals. This denotes that the poor may have little out-of-pocket cost as compared to the rich since they do not incur costs of treatment and diagnosis. It is also possible that they incur more out-of-pocket cost since they fail to consult health services upon illness onset, which leads to complications in future necessitating more out-of-pocket costs to contain their illness. In other words, failure to adhere to health seeking behavior may lead to saved out-of-pocket expenses but in the long run may lead to more complications which attract high out-of-pocket expenses in return. However, this is expected to affect the less wealthy group as compared to the wealthy individuals who have a better health seeking behavior.

2.5 The Knowledge Gaps in the Literature Pertaining to the Available Cost of Illness

Illnesses have been shown to lead to a number of costs in terms of prevention, diagnosis, mediation, treatment, follow-up, caretaking and pain to an individual. This makes it imperative to study these costs for a specific disease – ischemic heart disease. Research question one (What is the estimated direct cost of IHD patients in the private sector of Dubai) was developed for a number of reasons. First, there was a literature gap in the regions pertaining to the cost of cardiovascular diseases in the region. For instance, there was no available literature that evaluated the condition comprehensively. The only literature available on cost of cardiovascular disease in the region was a recent (2017) white paper from Emirates Cardiac Conference. The paper was further limited by its tendency to study cardiovascular diseases from one sided approach – the study only considered mortality cost. Whereas studies such as Ettling and Shepard (1991), Dunlay (2011) and Zakaria and Asante (2015) provide evidence that the cost of a diseases ranges from direct financial costs, indirect costs as well as intangible costs. Thereby the paper disregards direct and indirect costs of cardiovascular condition. Further, the paper maps the prevalence of mortality costs all over the Gulf region with no vested interest in a single region like the UAE. This further shows that there is still deficit in literature that specifically addressed the UAE region while addressing the unique characteristics and diversity of the region. Even though the white paper addresses cardiovascular diseases in the Middle East, it still covers a large range of heart diseases. Factually, cardiovascular disease includes but not limited to hypertensive heart disease, ischemic stroke, rheumatic heart disease, ischemic heart disease aortic aneurysm and endocarditis. This makes the paper to analyze the costs of a wide range of cardiovascular diseases. As such, for more definitive and in-depth findings, it was imperative to concentrate on one disease type (ischemic heart disease). The study findings therefore stand in a position to explain how Ischemic Heart Diseases contribute to the overall cost of cardiovascular disease complications.

Aljefree and Ahmed (2015) reviewed the epidemiological data on Chronic Heart Disease (CHD), strokes, and the associated risk factors among adult population in the Gulf countries through a systematic analysis of the published data from 1990 to 2014. The review showed that the GCC countries lack the data collection on the prevalence of CHD with the exception of Saudi Arabia as it was published in the Saudi Medical Journal that the prevalence of CHD is 5.5%. Considering that Aljefree and Ahmed study and Russel study, the findings can be refuted as not up to date. The recent findings can be traced up to four years back (like in Aljefree and Ahmed 2015 study). Within the time span since the publication date, a lot of factors and aspects have changed. Therefore, such findings do not represent the current conditions of the illness. In other words, there should be more recent studies to map the costs of the illness from contemporary settings.

Secondly, some research studies have been deemed to be inconclusive to the cost effect of specific disease studies on the patients (Russell, 2001). Therefore, the first research question was developed after considering the effect of the direct and the indirect costs of any illness on individuals. The findings by Russell (2001) added weight on the need to study ischemic heart disease as the available literature is inconclusive. Finally, whereas there is a vast

volume of studies that assess different global regions, the UAE region – specifically Dubai has no recent studies that can map the condition. The literature that was mapped from other regions is also limited by a number of aspects that were outlined there above.

Khan et al. (2017) study that was conducted in Karachi Pakistan had a vested interest on the costs of ischemic heart disease. The study also assessed the impact of predictors' of the cost of the illness. The researchers found out that demographic characteristics such as age, and gender were not statistically significant with the increasing cost of the studied condition (ischemic heart disease). This was also the same case with other predictors such as the tendency to smoke, comorbidities and family lineage where there was no statistically significant association with the total cost of ischemic heart disease.

Khan et al. (2017) and Schlatter, Hirakata and Polanczyk, 2017 depicted the findings that were contradictory. The contradictions were not expected considering that both studies were measuring the cost of illness of the same disease (Ischemic Heart Disease). As such, it is expected that predictors such as age, sex, family lineage, tendency to smoke and comorbidities to yield same results in costs of ischemic heart disease because the same condition was being evaluated. A critical look into the studies with an aim to decipher why the studies had divergent findings on demographical variables and their impact on the ischemic heart disease shows some major aspect like region that differentiates the studies. The other aspect was the methodological differences and sample sizes of the studies.

Considering the region that the studies were commissioned in, Schlatter, Hirakata and Polanczyk, 2017) study was held in brazil which is in south America while Khan et al. (2017) study was undertaken in Pakistan which is situated in Asia. The two regions have several diversities ranging from political, economic, climatic, cultural and social differences on top of their regional differences. Therefore, such factors can be in a position to affect how the demographical variables contribute to the cost of ischemic heart disease. In regards to the methodological approach that was used to map the costs of illness, the studies had different timelines in which the studies were undertaken. While Khan et al. (2017) study was done in a span of 4 months while Schlatter, Hirakata and Polanczyk (2017) study was done in a span of 5 years. Schlatter, Hirakata and Polanczyk (2017) was a longitudinal study while Khan et al. (2017) was a cross-sectional one. However, both studies were prevelence based. Since the study in Brazil took longer period to map the condition as compared to the Pakistan study, then differences may have appeared in the due course of the study. Such differences may have contributed to the divergent findings. Finally, both studies adopted different sample sizes to map costs of ischemic heart disease. While Khan et al. (2017) used 700 individuals Schlatter, Hirakata and Polanczyk (2017) used 700 files from a hospital. The difference in sample size can also bring about differences in the findings of study. However, the study sample sizes were not significantly divergent and can be considered to be within acceptable range. Thereby they are deemed as sufficient to yield findings that are statistically significant.

The above paragraph shows some of the issues which may have led to differences that were shown in Khan et al. (2017) and Schlatter, Hirakata and Polanczyk (2017) study. Notably, region, sample size and period of study could have informed on the divergent findings. Considering that there was heterogeneity and little consensus in findings of studies measuring the same thing (costs of ischemic heart disease), the first hypothesis of the study was formed. The null hypothesis was - The demographical variables had no impact on the cost of illness of patients with ischemic heart disease. The alternate hypothesis was - The demographical variables had an impact on the cost of illness of patients with ischemic heart disease.

Most of the epidemiological studies concentrate on the economic costs of an illness. The tendency of epidemiological study to concentrate on economic costs of an illness was noted by Rice, Hodgson and Kopstein (1985). In addition, since then, the trend continues up to date since van Gils et al. (2010) study, which concentrates on the economic costs. This is also the same case with a more recent study by Nicholson et al. (2016) whereby cardiovascular events were associated with economic costs. However, despite the wide availability of financial based cost of illness studies on IHD, Dubai lacks a recent COI study on IHD. This makes it imperative to engage in such a study from a financial perspective and later develop more studies on intangible costs.

Additionally, the studies on cost of illness tend to cover a wide area of study. Since most of these studies (Banks, Keynes and Smith, 2016; Nicholson et al., 2016) are based on national figures. This also includes the most current study from American Heart Association that was released in the year 2017. The study also adopts an extensive geographical coverage (the whole of US) to map the costs of cardiovascular diseases. Owing to the tendency to map larger areas, the validity and reliability tend to limit the study due to difference in health contexts and other factors. As such, Cooper and Rice (1976) argue that such studies have tendency to approximate thereby limiting the effectiveness of the study. The propensity of such cost of illness studies to cover a wide area of study also makes the current study to concentrate on a smaller scale area of study (Dubai, UAE) in order to cover the limitations exhibited by the studies outlined above.

In order to conduct such a study in the Dubai region, several adjustments are important to meet the conditions set – such as studying specific disease in the specific region. When studies that cover a specific illness are critically assessed and analyzed, it is notable that the studies have specific codes applicable for the condition. For instance, the (HCPCS) or in other words Healthcare Common Procedure Coding and (CPT) or in other words Current Procedural Terminology System for the Ischemic Heart Disease is somehow different from the coding of diabetes and cancer. Arguably, studies on costs of alcohol use specific CPT relevant to the condition – meaning that the CPT terms of the cost of alcohol study are different from the ones used in cost of ischemic heart disease. Similarly, when studies assess the cost of cancer, they also use different CPT and HCPCS relevant to the cancerous condition covered. Therefore, it can also be assumed that while evaluating Ischemic Heart Condition, context specific diagnosis and treatments procedures and codes will also be used. Additionally, National Research Council showed that grouping of the CPT and HCPCS differs from one commercial episode grouper to another. Therefore, the

coding is not necessarily similar in different disease contexts and regions. Considering the specificity, there is the need to develop context sensitive CPT and HCPCS categories that are valid for the Dubai region and its categories that define cost of the medical services.

The gap of knowledge in the literature that was covered, inconsistencies, regional aspects, disease specificity and uniqueness as well as methodological limitations provides insight s pertaining to the reason why the study concentrated on ischemic heart disease specifically in Dubai region. The literature gap therefore explains how research question one and research question two were formed. Research question three: how is the total IHD-related cost affected by demographic factors (age, gender, and nationality), diagnosis, encounter type and Charlson comorbidity index, was also developed after heterogeneous and divergent findings were found in the literature as shown in the next heading.

2.6 Methodological Approaches and Issues Associated with COI Study

The literature notes a number of the methodical issues that face the validity and reliability of these studies and accordingly outline some of the approaches appropriate for such studies. The below section represents the methodical issues related to the COI studies, consequently, the approaches used by past and contemporary COI studies were also listed. The relevance of the following sections was to understand COI studies and their methodological limitations. Such insights are pivotal as they aid in choosing the theoretical framework of the study. In return, the framework informs on the appropriate literature to cover.

Hodgson and Meiners (Drummond, 1992) outlined the guidelines for the future researchers by providing some of the methodological approaches to conducting COI studies. The guidelines have fairly been replicated in the contemporary studies where (Byford, Torgerson and Raftery, 2000, Koopmanschap, 1998; Rice, 2007) have consulted the guidelines provide by Hodgson and Meiners.

As per several studies, the economic costs of disease were classified as indirect, direct and intangible costs (Koopmanschap, 1998; Byford, Torgerson and Raftery, 2000; Rice, 2007). In relation to direct costs, they include the costs tied to the healthcare costs as well as other costs that might be not related to healthcare costs (non-healthcare costs). The costs that are directly tied to healthcare costs include the expenditures used during diagnosis, and the subsequent expenditures after diagnosis such as treatment, and care. Other directs costs include rehabilitation, terminal care and continued care (Tarricone, 2006). The non-healthcare costs are the expenses that are as a resultant of the illness. They include the transport costs spent in order to get to the healthcare facilities. The non-health care costs is wide considering that additional household expenditures, relocation, and informal care costs also tally as non-healthcare costs (Tarricone, 2006).

Krahn et al. (1996) delves deeper to create an understanding of the indirect costs and associates the term with the productivity loss brought about by the illness in context. Arguably, Krahn et al. (1996) finds it better to replace the indirect healthcare costs with the term productivity as indirect costs is vague and abstract whereas productivity cost is specific and subjective (Weinstein et al., 1996). As such, productivity costs are better divided into costs that emanate from morbidity and mortalities of an illness.

The intangible costs are primarily the costs that an illness causes in the psychological and emotional wellbeing of the afflicted. These psychological and emotional pain costs caused by an illness cannot be easily quantified in monetary terms bust still they are some of the indicators of illness costs. However, due to the lack of metrics to quantify these intangible costs of illness to monetary equivalent measure, the intangible costs have been covered scarcely in the availably literature (Tarricone, 2006).

2.6.1 Types of Cost of Illness Studies

COI studies are classified as per the approaches they adopt to collect and analyze data. The main COI studies include; (1) use of epidemiological data which is better termed as prevalence versus incidence approach, (2) methods chosen to estimate the economic costs also referred to as top-down versus bottom-up, and finally, (3) the time-based association between the start of the study and the collection of data which is also referred to as retrospective versus prospective studies.

2.6.2 Prevalence versus Incidence Based Cost of Illness

Cost of Illness studies are mostly based on prevalence or incidence (Byford, Torgerson and Raftery, 2000). In prevalence studies, the total numbers of illness cases in a period of one year are mostly considered. On the other hand incidences studies is the concentration of the new cases cropping up within a predefined period. From the prevalence approach, the estimation of the direct costs as well as the production loss associated with an illness is considered with that year (Segel, 2006). In the incidence based approach, the lifetime costs that is directly connected to the illness that have cropped up within the predetermined period is considered (Segel, 2006).

It is therefore fundamental to link an illness costs to the year that they were diagnosed in the prevalence approach. In other words the productivity losses and the direct costs that result from a disease are associated with the period in which they appeared or occurred (Tarricone, 2006). This includes the loss expected in the coming years such as unexpected mortality which are also linked to the year of the illness onset. On the other hand prevalence based approach is different. In incidence based approach all the lists of costs associated with an illness are linked to the year in which the illness onset is noticed. The costs totality, both productivity and direct cost are valued at the contemporary time and consequently assigned the illness onset year (Hartunian, Smart and Thompson, 1980; Rice 1994).

From the analysis, it is notable that there is a significant difference between the two approaches. As such, the prevalence-based approach involves approach that offers robust results as compared to the incidence based approach whose results are generally smaller (Hartunian, Smart and Thompson, 1980). Tarricone (2006) noted that this is always evident in the group of illnesses that have extended sequelae. For the illnesses with relatively short term sequelae, the difference between the approaches tends to reduce. Due to the limited duration, the year in which the collective costs are borne is always the actual years of the illness or the incidence – which again translates to the period that the death was caused by the illness. The divergence or the difference between the two approaches (prevalence and incidence based approach) grows with the increase of the average duration of the illness. This gives the incidence based approach an upper hand in the sense that it accounts for some of the cost that might have been missed or unaccounted for in the prevalence based approach (Tarricone, 2006).

The prevalence-based approach is best suited for studies whose aim is to make the decision-makers aware of the COI burden to the population. Generally, the COI burden is usually ignored or underestimated. Prevalence studies are also best suited in instances when planning cost is done as well as the formulation of containment policies. As such Tarricone (2006) argues that such a study provides a roadmap and a vivid picture about the major costs and the overall burden to the decision makers. The clear picture of the scenario helps the decision makers come up with policies pertaining to the areas where cost containment policies will impact greatly.
On the other hand, incidence-based cost of illness studies are best suited for studies whose aim is to come up with preventive measures. Studies using the incidence based approach have a greater capability of predicting the potential benefit of preventive measures that are ought to be implemented to prevent an illness (Tarricone, 2006). Additionally, the incidence-based approach is also pivotal in studies which help to explore or analyze the management of an illness from the onset date up to the death of an individual. The approach has a capability of mapping how the costs are distributed over different stages of the illness. It therefore offers therapeutic guidelines as to how to increase effectiveness as well as the efficiency of the disease management.

2.6.3 Top-down and Bottom-up COI studies

The incidence-based approach has another significant difference from the prevalence based approach whereby the method is based on bottom-up approach. Through the bottom-up approach, the lifetime cost of an illness is accounted for – thereby necessitating the collection of much detailed data as compared to the data needed in the prevalence approach (Tarricone, 2006). The prevalence based approach can be said to be a top-down approach – which requires less comprehensive data than the incidence based approach.

From Dagenais, Caro and Haldeman developments in the year 2008, the top bottom approach was shown as capable of mapping the expenditures of healthcare sector. As such, Dagenais, Caro and Haldeman (2008) showed that most of the expenditures went to primary diagnosis of the illness out of the allocated total by the national healthcare. Cooper and Rice (1976) also showed that the adoption of prevalence approach created a vivid picture of the overall economic costs of illness.

The main disadvantage associated with the top down approach is that it has the potential to misallocate the costs. For instance, in the allocation of the national healthcare expenditure, the approach can either overestimate or underestimate the total direct costs (Tarricone, 2006). The top-down approach has also been associated with its inability to account for other costs that are not represented in the national healthcare expenditure. These costs include aspects such as informal care, transport and other costs of such nature (Tarricone, 2006).

The concluding limitation of the top-down approach is that it considers the primary diagnosis of an illness as the single factor that brings about all the costs that have been mapped. This means that the approach fails to pay attention to other underlying conditions which may also contribute to the costs. The view of the methodological limitation have also been recognized by Tarricone (2006) review that perceive the top-down approach as a flawed approach where confounding variables are not accounted for sufficiently.

2.6.4 Prospective versus Retrospective COI studies

In a retrospective study, all the relevant events take place before the actual study is initiated. This mean that the data collection activities are all tied up to past events and the process if data collection usually refer to the already collected and recorded data (Tarricone, 2006). On the other hand, in prospective studies the relevant events are yet to happen and the data collection starts before the events. In prospective studies, the data is collected while following the patients over time. Both methodological approaches of cost of illness studies can either be performed in a retrospective or prospective manner.

However, retrospective designs have been considered by the literature as advantageous as compared to the prospective design (Scott and Alwin, 1998; Hess, 2004). As such, cost of illness studies that use retrospective approach tend to be cost and time sensitive to the researchers. In other words, they are less expensive as well as consume less time as compared to its counterpart (prospective studies) (Tarricone, 2006). The main factor that makes them sensitive to the researchers' budget and time is the fact that all the relevant events have already occurred prior to data collection. This makes Tarricone (2006) conclude that retrospective studies on the cost of illness can only be initiated if the required data is available and also sufficient to cover the study objectives. Although, Tarricone (2006) argues that in most cases, the data is not always sufficient. This makes such studies initiate even with data gaps. However, Tarricone (2006) suggests that in cases where the required data had not been recorded sufficiently priory or there is insufficient data, secondary data collected for other purposes can also play role. Nonetheless, the secondary data collected for other purposes is also limited by the context in which the data is to be used. For instance for studies covering the national level secondary data d=collected for other purposes at a local level is also inappropriate. This is due to the fact that such data cannot be generalized at the national level.

Whereas the retrospective is limited by the formerly listed aspect of data availability issues the retrospective design gives the researchers the freedom to model the data collection to suit the study needs. The data on the illness as well as the data on the costs can be collected through the designed instrument and presented to the group to be studied (Tarricone, 2006). The flexibility of the design is also captured by the fact that intervention by the researcher is also possible. Additionally, the design is also able to capture the costs that are also not captured from the healthcare perspective. In other words, through the use of prospective design, costs such as transportation cost, relocation costs and informal patient care- which are non-health costs can also be captured (Tarricone, 2006). The design provides a great deal of insights and in-depth data pertaining to the costs of illness. For instance, the patients' absenteeism, tardiness, the informal care takers time schedules, and other associated costs can be collected from the approach of prospective design.

Despite the benefits offered by prospective studies, it also has some limitations. For instance, if the illness time span is long (long timespan has been define as ranging over 30 years in Tarricone, 2006 review), prospective incidence based studies on cost of illness tend to be very expensive. Additionally, they also consume large chunks of time which further adds more costs to the researcher. In order to beat the cost associated with the incidence based cost of illness Tarricone (2006) review suggests that cost of illness studies approached from retrospective design are better off as compared to the former design.

All the approaches and designs that can be used in assessing the cost of illness have been associated with a number of limitations and benefits. Most importantly, the limitation of these designs and approaches is context specific. For instance, Cooper and Rice (1976) show that studies on COI targeting to allocate national healthcare expenditure in a retrospective design from a top to down fashion tend to be biased. Such studies have high probability of biasness and characterized by their tendency to approximate. Even if scholars in the healthcare sector decide to use a prospective incidence based approach with a bottom-up approach, they are still limited by the high demands that characterize the data collection of COI studies using such designs. The main strength of using the approach is that they tend to have in-depth findings.

2.7 Revised Conceptual Framework Used in the Study

Figure 2.3 below shows the revised conceptual framework. The model was realigned to fully cater the aspects of the study settings. This was done by adding relevant constructs to the study while removing the constructs that were not covered in the study. Where direct costs emanating from diagnosis, prevention and treatment were considered in the study, the indirect costs and intangible costs were not considered. The period of the study as well as the content/ length limit of the study could not cater for all the aspects that were outlined in the initial conceptual framework. This explains why the following conceptual framework (figure 2.3) was adopted.

The literature covered on COI explained why IHD patients' illness costs differed among the patients groups in respect to their characteristics such as demographical variables and presence of more than one IHD condition. In respect to the patient's characteristics', cost of their treatment was subject to increase or decrease.

The characteristics that had an effect on the cost of illness of IHD patients included but not limited to the patients' demographic characteristics such as age and sex, social factors such as education, occupation, ethnicity and social relationships. The studies covered depict that these demographic variable of a patient play important roles in the mapping of costs of an illness. For instance, Greenberg et al. (2015) study showed that the age group of an individual had an impact on the nature of costs that emanated from depression. The population that was over 50 years had higher direct and indirect medical costs as compared to other age categories. The lowest age category which was between 18 and 25 years had the lowest costs of illness. Interestingly, those who were between 35 and 49 year had a flat change in costs of illness in between 2005 and 2010.

More studies on cost of an illness of specific diseases have associated more demographical information as predictors of a disease cost. Kappelman et al. (2008) also use socio demographic factors to map how these aspects influence the costs of Crohn's Disease and Ulcerative Colitis. Children who were below 20 years had more costs related to the illness than the adults. Even though age was a cost determining factor for the population with Crohn's Disease and Ulcerative Colitis, demographic variables such as sex had no impact on these costs.

A study on the factors that affect the IHD patient's attitude toward the treatment plan provides more insights as to why different people, genders or nationalities may exhibit different behaviors when it comes to seeking healthcare services (Domingues, 2017). A cross sectional study was conducted using face-to-face interview in Brazil among 374 patient and 141 recorded interview for qualitative analysis between January 1, 2000 and December 31, 2010, with return appointments scheduled from August 1 to December 18, 2014. According to the Morisky adherence questionnaire, only 2% of the samples were having good adherence level. The analysis revealed that 23% paid fully for their medication and 36% of the sample were having at least one of the following factors as a cause of their non-adherence: (1) patient knowledge about their disease and/or medication, (2) difficulty of acquisition, (3) inability to take care of self, (4) access to care difficulties, (5) medication side effect of statins, (6) healthcare support, (7) concerns about the disease prognosis. Therefore, the efficiency of the treatment of IHD depends on the patient's attitude toward the treatment plan, which is influenced by certain sociocultural factors including the treatment cost.

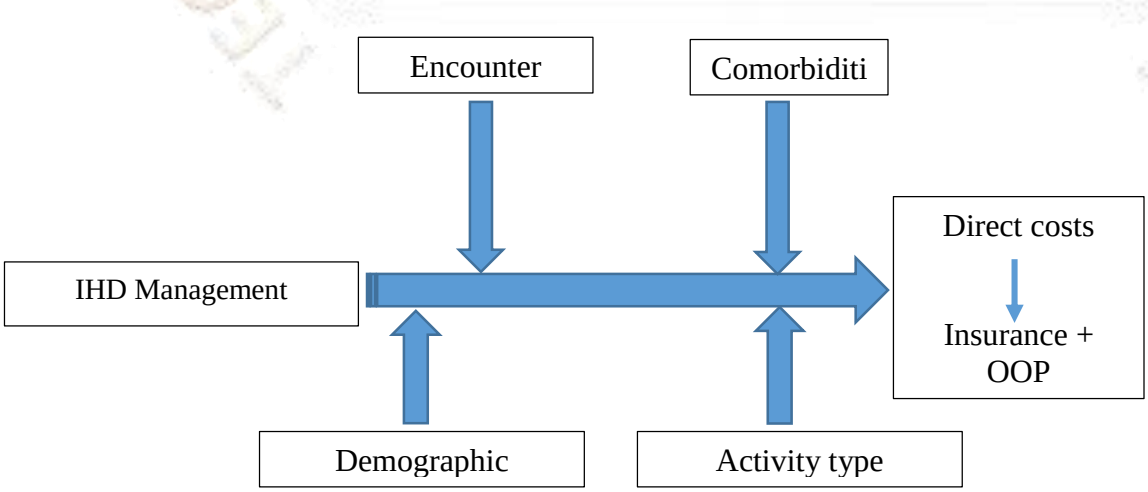
Several patients do not adhere to their medications, as they cannot pay for their prescription medicines, which as a result put them at a high risk of adverse health outcomes. A study conducted in Canada by Law et al. (2012) predicted the prevalence of and examined its related features keeping in consideration the presence of drug insurance. The authors used the data from the 2007 Canada Community Health Survey and the answers of 5,732 patients who have responded to the questionnaire in relation to the cost of the treatment. Logistic regression was

used to examine some key demographic variables including age, sex, income, health condition, place of residency and the availability of health. In the adjusted model, they found that 2.64% were in poor health, 3.29% were with lower income. Most importantly, 4.52% were without drug insurance and 2.56% were the patients who live in British Columbia were more likely to report cost related to non-adherence. Moreover, the study predicted rates of from 3.6% between patients with health insurance and high incomes to 35.6% between patients without health insurance and low incomes. In other words might be at risk due to the health insurance system inconsistency – whereby medications are not covered. Evidently, nationality, insurance availability and coverage, demographical variable and individual's perception of their health status, influenced their end cost. Overall, such demographical variables and other characteristics were predictors of whether an individual would seek services and at the end their decisions influenced their cost of illness.

The healthcare context and setting of a region was also in a position to dictate the overall cost of patients. For instance, the mode a patient utilizes the healthcare services (inpatient or outpatient) or even the level of cost-sharing – which depends on the insurance plan. The status of their health was also recognized as a significant predictor of IHD cost. For instance, episodes of cardiovascular attacks, number of the present conditions and illness signs. These cost determining factors are in a position to explain why the patients could have different cost of illness (IHD). For instance, a child or middle aged IHD patients may have little cost of illness (IHD) as compared to the old IHD patients.

The review of the literature was also in a position to show that IHD patients with more than one condition was most likely to record high costs as compared with other IHD patients with few conditions. As such, a patient with Myocardial Infarction and Peripheral Vascular Disease was most likely to pay higher medical costs as compared to patients with a few cardiovascular condition. In other words their Charlson Comorbidity index was way higher than that of those with a few conditions – thereby indicating their susceptibility to mortality. This was a scenario that was not only evident in the IHD costs context but it was also evident in costs of other diseases.

Figure 2.3: Ischemic Heart Disease Conceptual Framework



Regarding the above figure 2.3, costs of illness are mainly due to the costs of treatment. Costs of treatment included diagnosis, treatment, and CPT charges. Combining all these costs made up the direct medical costs of the IHD patients. Direct costs comprised of both the costs that were catered for by the insurance as well as the out of pocket costs from the IHD patients'. Whereas the direct costs of ischemic heart disease were evaluated, the demographic characteristics of the Dubai population with the cardiovascular condition were integrated. As such, the ability of the demographic variables to impact on direct insurance costs as well as direct out-of-pocket costs was tested. Extrapolating more on the demographical characteristics, it was presumed that aspects such as age and gender could in one way or the other affect the amount of direct costs or out-of-pocket costs.

For instance, integration of other relevant factors such as multiple IHD conditions, the mode consumption of healthcare services (encounter type) and the demographic variables tend to moderate these costs. In other words, the IHD conditions such as Myocardial infarction, Angina Pectoris and other Acute MI as well as patient's age, gender, and nationality and the encounter type could affect the total direct medical cost, either by reducing the cost or by inflating it. Therefore, these factors were considered as moderating variables which had the potential to impact on the association between IHD management activities and the total direct medical cost.

2.8 Summary

Literature review manifest that COI studies offer invaluable insights to decision makers while implementing policies in the healthcare sector realm. As such, the policy makers use evidence based findings to come up with policies that guide the all the stakeholders such as the healthcare institutions, medical insurance institutions as well as the state department of health.

The literature also shows that diagnosis, treatment, prevention, drugs, productivity, emotional pain, morbidity, mortality and costs are the common aspects that are used to assess the cost of an illness. Most of the healthcare costs due to chronic diseases lead to financial burdens on a patient as well as affect the overall economy and government expenditure. Indirect costs have been shown to extend beyond the immediate family of the afflicted patients and spill over to the entire society where productivity tends to decrease.

The healthcare industry is continually changing and so is the aspect that characterizes healthcare costs. Therefore, despite the existence of a number of studies mapping cost of illness, they are still far off from attaining promising interventions to the illnesses. More so with the existence of various risk factors that predicts costs of patients such as IHD.

On top of scarce literature in regards to studies that concentrates on the costs of ischemic heart disease, there are several gaps in the reviewed literature. The prior work done to look at the cost of illness, medication cost and the effect of financial burden on the patient with IHD is not sufficient and the same time it is not up to date. Further,

it mostly covers other regions rather than the UAE. Therefore, it is imperative to bridge the gap in literature by replicating the settings of the UAE to map the costs of ischemic heart disease in the region.

The conceptual framework developed at the end of the study depicts that ischemic heart disease management activities are associated to some costs. These costs include all the costs associated with ischemic heart disease, which can be divided into costs covered by the insurance costs as well as out-of-pocket cost. Insurance costs involve all the costs that insurance body covers such as the diagnosis, treatment, and CPT costs. The out-of-pocket costs include all the costs that insurance does not cover.

It was notable that COI studies usefulness has always been debated upon by various scholars in the healthcare sector. Mostly, the formulas adopted in these studies to calculate COI among IHD patients are portrayed as limited by confounding factors and case sensitivity. This makes the findings of some of these studies less reliable and valid. Irrespective of the contentions surrounding methodologies, most of the literature aligned to COI studies show that it is worth to engage in COI studies.

Other limitation of the literature covers included divergent findings; as such there was no concession on the relationship between an individual's demographic variable and the cost of illness. As such, some studies found the demographic characteristics as predictors of ischemic heart disease cost whereas other studies refuted that the characteristics of an individual were not in any way related to the final cost of an illness. The divergent and heterogeneous findings were not only noted in studies that specifically oriented to the ischemic heart disease but they were also prevalent in the general studies that assessed the cost of illness for other diseases. It was therefore conclusive that it was imperative to account for demographical variable effect on the cost of illnesses.

Despite most of the available studies on ischemic heart disease covering the cost of the cardiovascular condition, few studies delved deeper to assess out-of-pocket expenses for the afflicted patients. Specifically, no study was set to assess out-of-pocket costs as per the demographic variables. Deficit of such studies was prevalent despite the availability of a wide body of literature covering the costs of illnesses.

CHAPTER III: METHODOLOGY

This chapter introduces the key research methodology used to achieve the study objectives. It focuses on the study design, study subjects and settings, data collection, sampling, and data analysis techniques. The procedures for obtaining the permission to conduct the research and the maintenance of confidentiality are presented. Additionally, research philosophy and research paradigm appropriate for the type of data collected was used. The main aim of this chapter is to extrapolate on the methods used in order to come up with conclusive findings. The chapter has five main sections. Section one provides a recap of the study whereby the research questions are reiterated. Section two shows the source of data for cost of illness data. Section three covers study design and aspects such as the sample size and sampling technique. Section four explains the covered data type in order to explain the type of statistical analysis used. Section five manifested the data analysis technique used to analyze the data.

3.1 Research Objectives

1. To estimate the cost of illness among IHD patients in the private sector in Dubai.
2. To estimate the out-of-pocket paid by IHD patients in Dubai.
3. To examine how the total IHD-related cost is affected by demographic factors (age, gender, and nationality), diagnosis, encounter type and Charlson comorbidity index.

3.2 Research Questions

1. What is the estimated cost of illness among IHD patients in the private sector of Dubai?

   1.1 What is the estimated direct cost of IHD patients in the private sector of Dubai?

   1.2 What is the estimated cost of medication among IHD patients in the private sector of Dubai?

   1.3 What is the estimated cost of each diagnosis among the IHD patients in the private sector of Dubai?

   1.4 What is the estimated cost of each patient encounter for the IHD patients in the private sector of Dubai?

2. What are the estimated out-of-pocket expenses paid by IHD patients in Dubai?

   2.1 What is the estimated OOP amount paid by IHD patients from the direct cost?

   2.2 What is the estimated OOP cost of medication among IHD patients in the private sector of Dubai?

   2.3 What is the estimated OOP cost of each diagnosis among the IHD patients in the private sector of Dubai?

   2.4 What is the estimated OOP cost of each patient encounter for the IHD patients in the private sector of Dubai?

3. What is the association between the total IHD-related cost and patient's demographic factors (age, gender, and nationality), diagnosis, encounter type and Charlson comorbidity index?

3.3 Research Hypothesis

Null Hypothesis

- **H_10:** There is no association between the total cost of illness among IHD patients and their demographic factors (age, gender, and nationality), diagnosis, encounter type and Charlson comorbidity index.

Alternate Hypothesis

- **H_1:** There is an association between the total cost of illness among IHD patients and demographic factors (age, gender, and nationality), diagnosis, encounter type and Charlson comorbidity index.

3.4 Data Source

Dubai Health Authority (DHA) is the regulatory body of all healthcare entities in Dubai, including private hospitals, one day surgery centers, and health insurance companies, specialized and cosmetic clinics. Moreover, as mentioned earlier in Chapter 1, DHA provides healthcare services too. As part of the regulatory role of DHA, all practicing healthcare entities in Dubai provide their data to DHA through the eClaimLink. That data is not limited to workforce portfolio, but it includes all the demographic data of patients, their illness data, treatments modalities, medications, insurance details, and cost of treatments. The eClaimLink portal is proposed to manage e-Claims and health data (eClaimLink.ae, 2018). In addition, it will help to link all the healthcare community of Dubai and through its many anticipated modules will raise the quality of care, enhance efficiency, and reduce mistakes, fraud and abuse in the Emirate of Dubai (eClaimLink.ae, 2018).

Therefore, the estimated cost of illness and medication among Ischemic Heart Disease patients was taken from the eClaimLink portal through DHA approval, as it is the most accurate and representative data for all the patients getting treatment in Dubai, regardless of their nationality or place of residence (70:30 private to government healthcare distribution in Dubai). The ethical approval is obtained from the Medical Education Department in DHA after fulfilling all the requirement of data confidentiality.

3.5 Study Design

To achieve the main objectives of the study, retrospective secondary data analysis design was used to analyze the eClaimLink data of patients with IHD in the private sector of Dubai using the International Classification of Diseases, 10th Revision (ICD-10) codes. According to the ICD-10 codes, the Ischemic Heart Disease (I20-I25) includes angina pectoris, myocardial infarction, current complications following myocardial infarction, and chronic ischemic heart disease (Becks, 2015). Therefore, all patients with IHD available in the eClaimLink system according to the ICD-10 codes from 01/01/2016 until 30/06/2017 were selected, the complete data set were extracted using the software to have sample of 98,684 patients activity during that period. The data contained the member ID, diagnosis based on ICD-10 codes, age, and gender, type of patient encounter (inpatient and outpatient), the medication price, activity type (medication, service, investigation or procedure) and the net payment amount per activity.

To answer the first research question, all the activities costs were calculated and analyzed according to the diagnosis, age group, encounter type, cost per individual, and cost per medication. Providing average utilization and cost of illness among IHD patients in Dubai is useful for comparison purposes. To overcome the risk of possible inaccuracies in estimating costs in the study, the medical costs attributable specifically to IHD was included only in the study and no other reasons for visiting the healthcare sector like dental care. The out-of-pocket paid by patients in term of total cost and as cost of medication were calculated to answer the second research question. Moreover, to answer the third question of the study, correlations analysis was conducted to compare the independent variables (age, gender, nationality, encounter type, activity type, CCI scores and the diagnosis) against the dependent variable (total cost). To answer the fourth question and the research hypothesis multiple linear regression analysis was conducted between the total cost of illness among IHD patients and their demographic data (age, gender, and nationality), diagnosis, encounter type and Charlson score.

Due to the different modes of data collected, the research hypothesis adopted several statistical test were based on the data types. For instance, to calculate the total direct cost and out of pocket costs, means were computed and tabulated in a table. Crosstabs were tabulated to expand bivariate relationships of the study variables. In order to establish the association between demographical characteristics of patients with IHD and the cost of illness (IHD), person correlation coefficient, Analysis of Variance, and t-test were the statistical formulas were used. In associating the gender and the cost of illness (IHD), the independent t-test was used. In associating the age and the cost of illness (IHD), Pearson correlations were used for continuous variables, but when the age was grouped into categories the difference in the total direct cost means for the respective age categories was tested through the use of the analysis of variance. This was also the same case with CCI index after it was grouped into categories. In associating the nationality and the cost of illness (IHD), t-test statistical formula was used. In associating diagnosis and the cost of illness (IHD), ANOVA statistical formula was used. In associating encounter

type and the cost of illness (IHD), t-test statistical formula was used. In associating Charlson comorbidity index and the cost of illness (IHD), Pearson correlation statistical formula was used for the continuous variables.

3.6 Study Population and Sampling Technique

The participants in this study were selected from the eClaimLink based on the convenience sampling technique (non-probability). The eClaimLink data base is having all the patients attending the private sector, regardless of their diagnosis. All patients with one or more primary or secondary IHD diagnosis were extracted from the e-claim data. Convenience sampling is discouraged due to the inability to generalize research findings, bias and the high sampling error (Brodaty et al., 2014). In our study, those risks were excluded as the convenience sampling part took place while selecting the patients of IHD from the full population only, after that stage the full population of IHD patients under the inclusion criteria was selected. Usually, the convenience sampling is criticized for the threats to external validity (Raina, 2015), but in our study despite the usage of convenience sampling, the sample size is compensating the risk of sampling technique, as it was including all the IHD patients; in other words, we have taken the full population of IHD in the private hospitals of Dubai during the specified study period of 01/01/2016 to 30/06/2017.

3.7 Measurement of Key Study Variables (Operational Definitions)

In Dubai, the patients are categorized according to their diagnosis, through the usage of ICD-10 coding system. Therefore, all patients diagnosed with Ischemic Heart Diseases and the cost of their illness can be estimated through the health service utilization. Apparently, patients who use the services of the healthcare more frequently contribute to the increase of the total healthcare cost. For that reason, factors that affect the individuals behavior toward the healthcare services utilization, will as a result affect the cost of treatments of that specific condition. In table 3.1 the study variables are identified and the level of measurement of each one was mentioned prior to the decision of which statistical analysis will be used to answer the research questions. During the correlation analysis, the missing data was excluded.

2Table 3.1 Description of the Study Variables

Variable	Variable Type	Definition	Possible Range/ or the codes used for SPSS)	Type of Measurement
Total Cost	Dependent variable	Cost of seeking medical care including the sum of all the activities	Cost in AED	Continuous
Out-of-pocket	Independent variable	Amount of money paid by patients during the hospital visit	Cost in AED	Continuous
OOP percent	Independent variable	The OOP percent	1: 0-20, 2: 21-40, 3: 41-60, 4: ≥61	Categorical
Insurance status	Independent variable	If the participant is having insurance or not	1: Yes, 2: No	Dichotomous
Age	Independent variable	Age of the participant	Number of years	Continuous
Age	Independent variable	Age of the participant	0: missing data, 1: 1-19, 2: 20-39, 3: 40-59, 4: 60-79, 5: ≥80	Categorical
Gender	Independent variable	Participant Sex	0: Female, 1: Male	Dichotomous
Nationality	Independent variable	Participant nationality as per their residency visa	0: Non-UAE, 1: UAE	Dichotomous
Nationality	Independent variable	Participant nationality as per their residency visa	Codes from 1-110 given for 110 different nationalities	Continuous
Encounter	Independent variable	The participants visit type	1: Inpatient Visit 0: Outpatient visit	Dichotomous
Activity	Independent variable	The type of services given to the patient	1: Drugs, 2: CPT, 3: Services, 4: HCPCS	Categorical
Charlson Comorbidity Index	Independent variable	The degree of the patient sickness rather than IHD	The CCI number	Continuous
Charlson Comorbidity Index	Independent variable	The degree of the patient sickness rather than IHD	0: Missing, 1: Mild, 2: Moderate, 3: Severe	Categorical
Diagnosis	Independent variable	The diagnosis presented with in the medical sector	1: Angina Pectoris, 2: Acute MI, 3: Subsequent STEMI and NSTEMI MI, 4: Complications following MI, 5: Other acute IHD	Categorical

- **Dependent Variable**

The dependent variable (or outcome measure) for this study was the direct cost of IHD for each individual. All direct medical costs equaled the sum of the main four categories:

1. **CPT:** Procedures - medical, surgical, laboratory and diagnostic services
2. **HCPCS:** Supplies and Consumables
3. **Drugs:** Prescription Medication
4. **Services**: including consultation from the Dubai Service List (DSL)

➢ Independent Variable

The main independent variable was Ischemic Heart Disease. Other independent variables of this study included Andersen's Behavioral Model of Health Services Utilization factors. They were categorized into three groups: predisposing factors, enabling resources, and need factors.

▪ Predisposing Factors

Age, sex, nationality were identified as part of the patient demographic data in this study and as the Andersen's Behavioral Model of Health Utilization suggests.

▪ Enabling Resources

The availability of health insurance and the OOP percentage were identified by the researcher as enabling factors that might enhance or affect the utilization of the services. OOP levels were defined by determining percentage of total cost paid by the patients. The OOP patients were categorized into two categories; no healthcare insurance and with healthcare insurance. Healthcare insurance was considered as enabling factors whereby those who had been insured for most of the healthcare services were most likely to seek healthcare unlike the patients who had basic healthcare insurance plans which cover for a few services.

▪ Need Factors

Patients who were diagnosed with one or more comorbidity tend to use the medical services more than others (Glader et al, 2010; Crowley et al., 2012; Juarez et al., 2015). Charlson Comorbidity Index was used to predict the morbidity and mortality scores of the population and if it has any relation with the cost of illness (Yoon, S.-J. et al., 2015). Based on the CCI scores, the severity of comorbidity was classified into three categories: mild, with CCI scores of 1–2; moderate, with CCI scores of 3–4; and severe, with CCI scores ≥5.

➢ Operational Definitions

- **Charlson Comorbidity Index (CCI):** Validated index that measure the degree of the population sickness due to other diseases rather than the one of interest (IHD in our study) (Charlson et al., 2008).
- **Comorbidity:** Pre-existing medical condition present at the time of admission or hospital visit.
- **ICD-10 for IHD**: International Statistical Classification of Diseases and Related Health Problems 10th Revision for patients with IHD from I20-I25 and it is including many sub codes and for the analysis purpose in our study it was made into five groups:

1. Angina pectoris
2. Acute Myocardial Infarction
3. Subsequent ST Elevation (STEMI) and non-ST Elevation (NSTEMI) Myocardial Infarction
4. Other Acute Ischemic Heart Diseases
5. Chronic Ischemic Heart Disease

- **Cost of Illness:** Usually calculated by the sum of direct and indirect cost, in this study the cost of illness will be calculated from the direct cost only due to data limitation.
- **Direct Cost:** Includes all the costs derived from seeking medical care (the sum of CPT, HCPCS, services and medication cost).
- **Out-of-Pocket Costs**: The portion of the claim or hospital bill that the patient has to pay according to his insurance plan.
- **Encounter Type**: The way the patients visit the healthcare setting and seek the services, in Dubai it is divided to several categories. In our study all encounters were categorized into two main groups; inpatient encounter and outpatient encounter.
- **Suitability of the Data:** The data was considered as reliable and valid considering that it had been collected for other purposes than for the study objective. The data was collected for official use therefore it has a low probability of having traces of bias. Further considering that the data was collected from top bottom approach, then misrepresentation of data or intentional cost inflation could not be present. Therefore, the limitation that characterize bottom up approach had little or no chance to characterize the current study setting. The only limitation that was evident in the data was missing entries which took time to clean. The missing records were omitted in some of the statistical analysis like the Pearson correlation. Despite the literature noting that cost of illness studies are limited by unavailable data, the current study was cushioned from such limitations as the data was readily available.

3.8 Statistical Analysis

Major characteristics of the study population and cost analysis were explored using descriptive statistics. To answer the first research question, detailed cost analyses were conducted against patient's age group, nationality, gender, encounter type, CCI category, and diagnosis type. To answer the second research question, descriptive analysis was conducted to explore the population OOP categories, the real insurance availability, and then detailed cost analyses were conducted against patient's age group, nationality, gender, encounter type, CCI category, and diagnosis type. Healthcare cost data are usually positively skewed because a small proportion of the patients incur very high costs. The total cost variable in our study was explored and tested for normality and was skewed to the right side (positive). To answer the third research question, different correlation analysis were conducted according to each variable. The parametric analysis techniques were used despite the skewness of the dependent variable as the big sample size has overcome that risk (Limpert and Stahel, 2011). The total direct cost mean was compared against the independent variables means using parametric analysis. The Pearson correlation was used between the total direct cost, age and CCI, as all those variables were continuous. The independent t-test was used between the dependent variable and the gender, nationality (UAE or Non-UAE), encounter type, as the independent variables are dichotomous. One-way ANOVA was used between the total cost direct cost and the age category, CCI category and the diagnosis group variable. Finally, to answer the fourth research question and the research hypothesis multiple linear regressions were conducted. The assumption of normality was invaded as

mentioned earlier, therefore, logarithmic transformation; Natural Log (LN) of the total direct cost using the Arithmetic function (Log10) in SPSS was done to overcome it. The multiple linear regression predictors were: Charlson Index, Activity Type, Nationality, Diagnosis Group, Gender, Age, Encounter Type and the dependent variable was the log of the total cost and the *p* value was < 0.05. All statistical analyses of the data were done using the SPSS software version 25.

CHAPTER IV: RESULTS

This chapter begins with the presentation of the descriptive analysis of the demographic and cost data, correlation of the direct cost against the independent variable, and then a multiple linear regression analysis of the dependent variable and the independent variables using the SPSS software version 25 was conducted. The descriptive statistics were used to present costs and patients' demographics. The total cost mean was compared against the independent variables means using parametric analysis. Logarithmic transformation (Natural Log) of the cost data was performed since the total cost variable was positively skewed. The multiple linear regression analyses were performed to determine the predictors of the total costs.

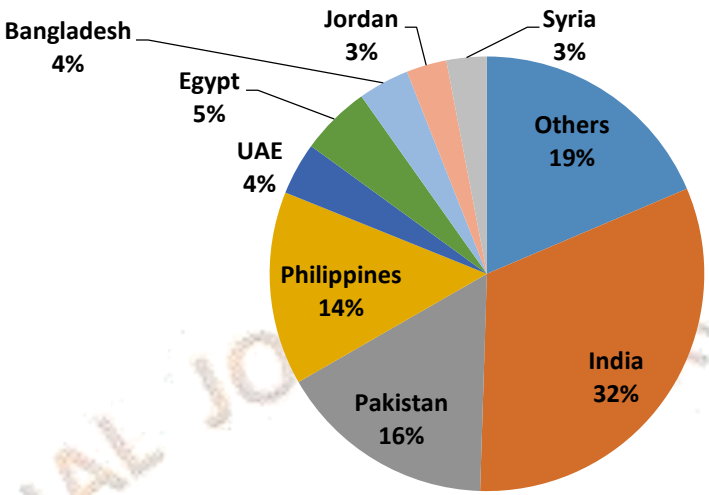
4.1 Descriptive Analysis

During the study period from 01/01/2016 till 30/06/2017, the full population who visited the private sector in Dubai were included. All the patients during each visit had to be ordered some activities; medications, investigations and so on. During the study period there were a total of 98,684 patient's activities with IHD in the private sector of Dubai. From these visits, males represented the vast majority of the patients at 42% while females had a relatively low proportion of 7% of the IHD patients in Dubai and 47% of the patients their gender was not recorded during the registration. The high percentage in the male gender is justifiable, as the majority of the Non-UAE national in the UAE are working males without families. Moreover, many entities in the UAE including the health sector are requiring their customer to present their Emirates ID at the registration desk to provide their demographics, so having such huge number of patients with missing gender might be due to not having their Emirates ID when they visited the healthcare.

3Table 4.1 Descriptive Statistics of Demographic Characteristics

Gender		
Female	7,022	6.8
Male	43,383	42.2
Missing	48,278	47.0
Nationality		
UAE	4,007	3.9
Non-UAE	98,746	96.1
Age Categories		
Missing	52,348	50.9
1-19	343	0.3
20-39	15,202	14.8
40-59	29,426	28.6
60-79	5,294	5.2
80≥	140	0.1
Diagnosis		
Angina Pectoris	45,976	44.0
Acute Myocardial Infarction	50,721	49.4
Subsequent STEMI and Non-STEMI	815	0.8
Complications Following MI	246	0.2
Other Acute IHD	4,995	4.9
Activity Type		
CPT	42841	43.4
HCPCS	3,833	3.8
Drugs	25,442	25.7
Services	26,566	27.0
Encounter Type		
Outpatient Services	46,675	45.4
Inpatient Services	56,078	54.6
Health Insurance Availability		
Patients with Health Insurance	41,995	43.0
Patient without Health Insurance	56,689	57.0

Figure 4.1 Top Nationalities among the IHD Patients in Dubai



The UAE has a highly multicultural environment which was evidenced by the presence of patients from various nationalities around the world. Table 4.1 shows that 96.1% of the population were Non-UAE national, while 3.9% were UAE nationalities. The analysis indicated that IHD patients in Dubai were from 110 different countries. Figure 4.1 show that, Indians comprised the majority of patients at 32% followed by Pakistanis and Filipinos at 16% and 14%. The local people (i.e. UAE nationals) comprised 3.9% of the total encounters. Other nationalities included Egypt (5%), Bangladesh (4%), Jordan (3%) and Syria (3%).

The IHD different diagnoses were classified according to the ICD-10 codes into several conditions under five main groups. The "Angina Pectoris" group which has represented around 44% of the total patients, and the "Acute Myocardial Infarction" group which has represented around 49% of the IHD population. While the "Subsequent ST Elevation Myocardial Infarction" (STEMI) group, the "non-ST Elevation Myocardial Infarction" (NSTEMI) group, the "Other Acute Ischemic Heart Disease" group and the "Chronic Ischemic Heart Disease" group has represented around 5% of the total IHD diagnosis only.

As mentioned earlier in our study 98,684 different activities were included throughout all the patients visits, around 43% of those activities were procedures that have included medical, surgical, laboratory and diagnostic services. Besides, the descriptive analysis of the data revealed that 27% of the activities were for consultation services and around 26% were for patient's medications during the study period. Moreover, the majority of the patients have visited the healthcare sector as inpatients encounter (55%).

4.1.1 First Research Question

To answer the first research questions in the study, detailed descriptive analysis was conducted and the results were presented in the below figures and tables. The estimated direct cost among IHD in Dubai was calculated against the gender, age group, nationality (either being UAE or Non-UAE), CCI categories and the diagnosis groups. The direct cost was collected against each activity and against the insurance availability among the IHD patients. From the data analysis it was found that the male patients were responsible for the big proportion of the direct cost, and age being between 40 – 59 years old was a risk factor for higher cost compared to other age groups. Moreover, being Non-UAE national and having mild CCI score lead to higher cost among the IHD patients in Dubai. This finding is supporting the fact that the majority of the Non-UAE citizens are workers in their mild age; therefore, those figures are representing the reality in Dubai. Which mean usually those patients after the age of 60 years, they will go back to their countries, and that will explain why being above the age of 60 years is not contributing to higher proportion from the total cost during our study period.

4Table 4.2 Descriptive Cost Analysis of IHD According to the Gender, Age, Nationality and CCI Scores

	CPT Cost (AED)	Drugs Cost (AED)	HCPCS Cost (AED)	Services Cost (AED)	Total cost (AED)
Age					
1-19	116,699	13,392	52,921	38,446	221,459
20-39	5,923,860	984,145	1,895,949	1,704,943	10,508,897
40-59	15,273,873	2,692,178	6,932,499	4,098,010	28,996,560
60-79	3,260,874	572,874	1,051,744	619,277	6,231,081
80≥	144,086	15,499	51,973	35,440	246,998
Missing	23,607,537	4,696,001	9,956,459	6,893,753	45,153,751
Gender					
Female	2,925,133	480,367	711,617	924,543	5,041,661
Male	21,794,261	3,797,720	9,701,378	5,869,855	41,163,334
Missing	23,607,537	4,696,002	9,956,460	6,893,754	45,153,752
Nationality					
UAE	2,181,498	332,480	885,011	598,423	3,997,412
Non-UAE	46,145,432	8,641,609	19,484,444	13,089,850	87,361,335
Encounter Type					
Inpatient	9,519,326	935,733	3,085,508	4,734,037	18,247,604
Outpatient	38,807,605	8,038,475	10,629,644	15,635,418	73,111,143
CCI Score					
Mild CCI	11,426,912	2,610,389	3,452,087	5,525,529	23,014,917
Moderate CCI	2,349,857	536,112	920,288	1,068,083	4,874,340
Severe CCI	66,362	13,967	12,862	17,134	110,325
Missing	34,483,799	5,813,620	9,302,915	13,758,830	63,359,165
Grand Total	**48,326,930**	**8,974,088**	**13,688,152**	**20,369,576**	**91,358,747**

The estimated total direct cost of IHD during the study period was about 91 million AED; around 18 million AED came from the inpatient cost, while 73 million AED was from the outpatient cost. The patient total direct cost was around 8,000 AED and around 900 AED per activity. Although, the majority of the IHD patient used the inpatient service, but still the outpatient encounters were the majority of the direct cost. Usually the patients even if they access the private sector and if they are critically ill or their condition might need longer medical care, they will be transferred to the government hospitals for further care. The private hospitals usually accept the stable cases, follow-up and non-complicated cases. Moreover, as mentioned earlier the big proportion of the direct cost is coming from the CPT and HCPCS, and during the critical cases the patients might refuse some procedures due to their cost, while the outpatient services in the private sector rely on ordering several procedures in the form of CPT or HCPCS for the patients during their visit.

5Table 4.3 Descriptive Cost Analysis of IHD According to the Patient's Diagnosis Group

Diagnosis	*CPT Cost (AED)*	*Drugs Cost (AED)*	*HCPCS Cost (AED)*	*Services Cost (AED)*	*Total Cost (AED)*
Angina Pectoris	18,214,025	3,175,848	3,795,650	3,162,506	28,348,029
Acute MI	28,902,452	5,466,498	9,542,845	16,869,372	60,781,167
Subsequent STEMI and Non-STEMI	145,222	408,676	177,468	162,299	893,665
Complication post MI	53,372	29,383	25,245	12,427	120,427
Other Acute IHD	272,271	157,138	10,664	178,865	618,938
Missing					596,521
Grand Total	**48,183,862**	**9,237,543**	**13,551,872**	**20,385,469**	**91,358,747**

Around 53% of the total direct cost among IHD patients in our study is coming from the CPT activities. The private sector in Dubai has huge range of high standard medical and surgical procedures which is provided according to the patient's convenience day and night. Moreover, it is one of the high revenue areas, which explains the high demand on it. The HCPCS cost among IHD patients was 13,551,872 AED which is relatively high too. The HCPCS codes are continuation of the CPT codes, which include some services, procedures or medications not included in the CPT list (Nusgart, 2013), and that explains why the HCPCS cost is high in our study. From table 4.3 the most costly diagnosis group among IHD patients in the private sector of Dubai was the Acute MI (60,781,167 AED) followed by angina pectoris (28,348,029 AED). This as explained earlier, shows that patients are seeking the healthcare services after becoming sick. Around 10% of the IHD cost in the private sector of Dubai was paid for medications only, which is relatively considered to be high. The medications prices in the UAE are high compared to other countries, as the majority of the medications sold in UAE are imported from other countries mainly Europe and USA, besides the country does not have clear strategy for controlling the medication prices (MacLaren, 2016). Chronic conditions depends mainly on medications in controlling and preventing complications at the long run, and the current figures of medication's cost in our study add to the challenges and difficulties faced by the patients during the journey of treatment.

4.1.2 Second Research Question

To answer the second question, a descriptive analysis was conducted to calculate the patients share from the total bill of the IHD in Dubai. The analysis has assessed the use of inpatient and outpatient services and estimated the out-of-pocket cost among the IHD patients in Dubai during the study period. As mentioned earlier, the highest use of health care services was for the inpatient care and the highest cost was for the outpatient care. In figure 4.2, around 30% of the patients had out-of-pocket coverage ranging between 0-20 percent, while the majority of the patients (58%) had to pay more than 61% as out-of-pocket. The health insurance coverage is an important factor affecting the amount of out-of-pocket should be paid by the patient. The study results provide an indication for high need to expand the health insurance coverage plans, mainly among the patients with IHD.

From the initial analysis of the main diagnosis types among IHD patients and the encounter types, it is clear that the IHD patients in Dubai are seeking the healthcare sector during the acute stages mainly, not as normal health check-up or as usual follow up. Consequently, it was essential to check the availability of health insurance among those patients, and according to the data analysis; 57% of the IHD patients were not having health insurance. In addition, 43% of those patients were having health insurance, but that insurance was not of great help, as 58% of the insured patients their OOP share was ≥60% of the total bill and only 30% of the IHD patients with insurance their OOP were less than 20% from the total bill (Figure 4.2). It is obvious that the availability of the health insurance among the IHD patients is not of great value, as the main purpose of having health insurance is to prevent the patient's from suffering any related financial burden which was not the case among our study population or to increase their access to care and enhance the health assessment and prevention, rather than going mainly during the acute or life threatening situations.

Figure 4.2 Out-of-Pocket Percentages among IHD Patients in Dubai

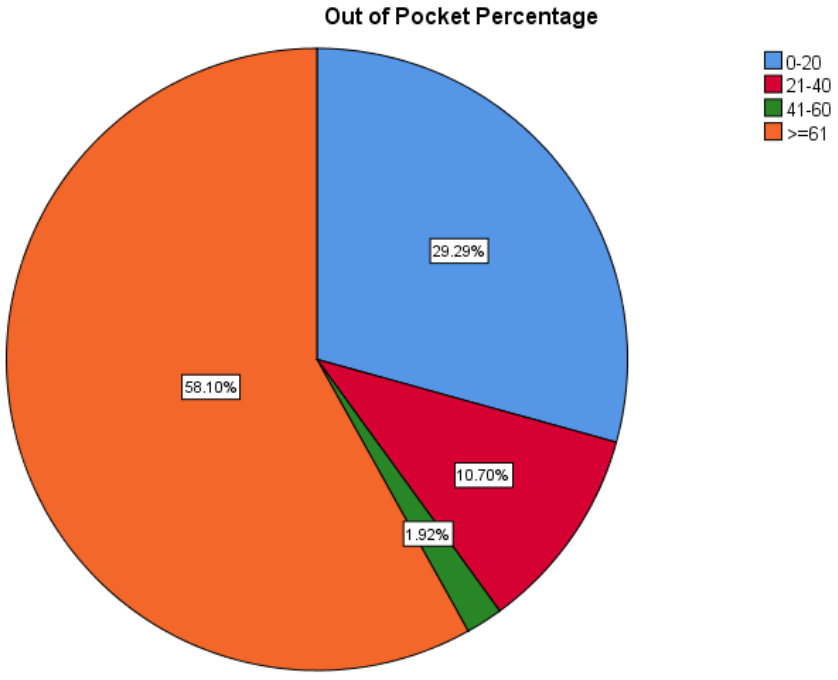


Table 4.4 OOP Analysis of IHD According to the Age, Gender, CCI Categories, Encounter Type and Nationality

	Total Cost(AED)	*OOP (AED)*	*(%) of the Patient Share*
1-19	**221,459**	**145,923**	**65.9**
Drugs	13,392	8,857	66.1
CPT	116,699	77,240	66.2
Services	38,446	24,981	65.0
HCPCS	52,921	34,775	65.7
20-39	**10,508,897**	**7,328,627**	**69.7**
Drugs	984,145	688,467	70.0
CPT	5,923,860	4,083,214	68.9
Services	1,704,943	1,191,977	69.9
HCPCS	1,895,949	1,364,969	72.0
40-59	**28,996,560**	**19,602,736**	**67.6**
Drugs	2,692,178	1,840,034	68.3
CPT	15,273,873	10,150,403	66.5
Services	4,098,010	2,735,558	66.8
HCPCS	6,932,499	4,876,741	70.3
60-79	**6,231,081**	**4,219,448**	**67.7**
Drugs	572,874	373,706	65.2
CPT	3,260,874	2,174,601	66.7
Services	917,559	619,277	67.5
HCPCS	1,479,654	1,051,744	71.1
80≥	**246,695**	**148,607**	**60.2**
Drugs	15,499	7,997	51.6
CPT	144,086	82,789	57.5
Services	35,440	23,583	66.5
HCPCS	51,973	34,541	66.5
Missing	**45,153,752**	**29,766,160**	**65.9**
Drugs	4,696,002	3,106,463	66.2
CPT	23,607,537	15,622,758	66.2
Services	6,893,754	4,476,269	64.9
HCPCS	9,956,460	6,560,670	65.9
Gender			
Female	5,041,661	3,311,370	65.7
Male	41,163,334	28,120,710	68.3
Missing	45,153,752	29,766,160	65.9
CCI Score			
Mild	23,014,916	15,650,143	68.0
Moderate	4,874,340	3,270,682	67.1
Severe	110,325	74,359	67.4
Missing	63,359,165	42,260,563	66.7
Encounter Type			
Inpatient	18,247,484	12,251,793	67.1
Outpatient	73,111,263	48,946,447	66.9
Nationality			
Non-UAE	87,361,215	58,656,538	67.1
UAE	3,997,412	2,541,582	63.6

Grand Total	**91,358,747**	**61,198,240**	**67**

The estimated total direct cost of the IHD was around 91 million AED; and the estimated out-of-pocket was around 61 million AED, or in other words those patients paid around 67% of the total treatment bill from their pockets. When compared the OOP% with the age, CCI category, encounter type and gender, shown that there is no changes in the OOP% among those factors which was on average around 66%. The nationality was associated with very minimal differences; 64% among the UAE national compared to 67% among the Non-UAE patients. The age groups 20-39 years and 40-59 years, was associated with around 70% OOP in term of drugs and HCPCS. Usually during that age group the physicians will depend on medications and investigations during the treatment plan, which explain the study findings.

Table 4.5 Cost Analysis According to the Activity Type and the Insurance Availability

Activity/Insurance	*Total cost (AED)*	*OOP Paid (AED)*
Drugs	**8,974,089**	**6,024,693**
No Insurance	5,264,007	5,264,022
With Insurance	3,710,081	760,670
CPT	**48,326,931**	**32,193,585**
No Insurance	27,920,540	27,920,550
With Insurance	20,406,390	4,273,035
Services	**13,688,152**	**9,074,741**
No Insurance	7,886,971	7,886,988
With Insurance	5,801,181	1,187,753
HCPCS	**20,369,455**	**13,905,101**
No Insurance	12,157,210	12,157,210
With Insurance	8,212,246	1,747,891
Grand Total	**91,358,627**	**61,198,120**
No Insurance	53,228,728	53,228,770
With Insurance	38,129,899	7,969,349

Table 4.5 illustrated the total direct cost analysis of the IHD patients according to their activity type and the insurance availability, the total cost was around 91 million AED and the cost of the patients without insurance was around 53 million AED out of that. The total cost of the insured patients was around 38 million AED and those patients paid as OOP around 8 million AED from the total bill, which means the average of the OOP share among the IHD patients with insurance in Dubai was around 20%. Moreover, the total cost of medication was around 9 million AED; the insurance share was less than 3 million AED, which is around 33% of the total medication bill. Such OOP percentage will show again the high risk of developing complications with those patients due to the high burden of treatment cost.

4.1.3 Third Research Question

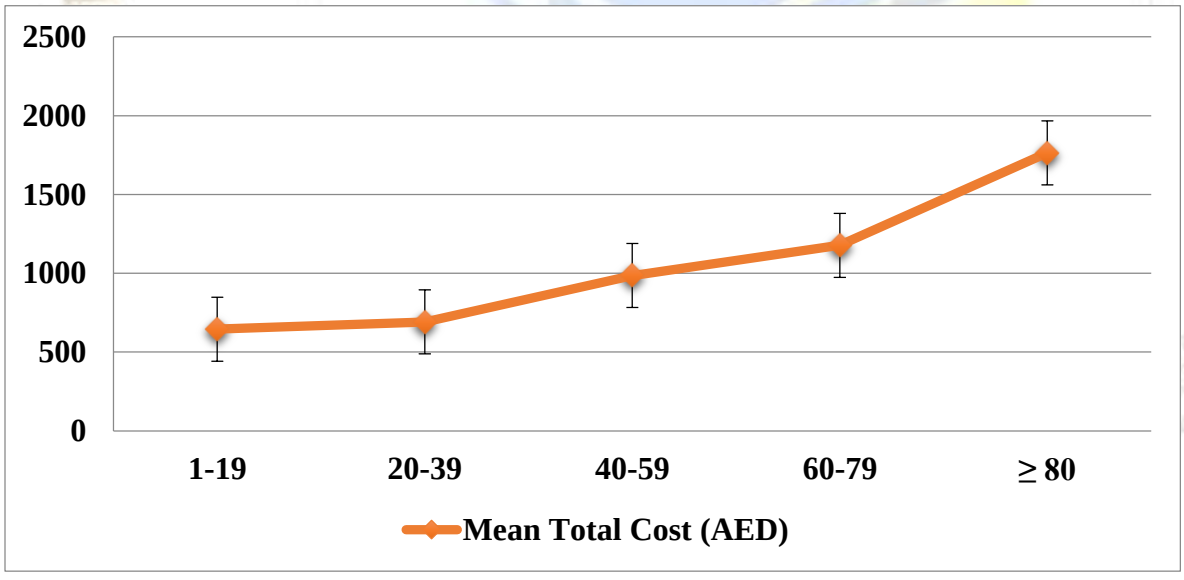
To answer the third research question the total direct cost mean was compared against the independent variables means using parametric analysis in binary analysis. The Kolmogorov-Smirnov's test of the dependent variable was (*P*= 0.000), and a visual inspection of their histograms, normal Q-Q plots and the box plots showed that the dependent variable; the total direct cost was approximately normally distributed, with a skewness of 11.136 (SE= 0.008) and a kurtosis of 204.914 (SE = 0.016). Moreover, the Pearson correlation was used between the total direct cost and the age and the CCI scores, as those variables were continuous. Therefore, a Pearson correlation coefficient was computed to assess the relationship between the total direct cost and the patient age. There was a positive, moderate correlation between the two variables, r = 0.47, n = 98,683, *p* = 0.001. Besides, the Pearson correlation coefficient was computed to assess the relationship between the total direct cost and the patient CCI score. There was a positive, moderate correlation between the two variables, r = 0.50, n = 98,683, *p* = 0.000. From the previous results we can summarize that the total direct cost among IHD patient were moderately correlated to their age and CCI score.

Moreover, the independent t-test was used between the dependent variable and the gender, nationality (UAE or Non-UAE), encounter type, as those independent variables were dichotomous in additional binary analyses. The independent t-test was conducted to compare the means between the total direct cost and the gender. The data analysis revealed that there was a significant difference between the patient gender and the total direct cost; for the female (M=717.98, SD=32.7) and the male (M=948.84, SD=16.9); t = 5.238, *p* = 0.000. These results suggested that the total direct cost of IHD is affected by gender; the mean cost among the male patients was higher compared to the female patients. In addition, the independent t-test was conducted to compare the means between the total direct cost and the nationality of the patients. There was a significant difference between the patient nationality and the total direct cost; for the Non-UAE (M=919.67, SD=10.94) and the UAE (M=1,083.02, SD=60.5); t = 2.87, *p* = 0.000. These results suggested that the total direct cost of IHD is affected by nationality; the mean cost among UAE was higher compared to Non-UAE. The independent t-test was conducted to compare the means of the total direct cost and the encounter type. There was a significant difference between the patient type of visit and the total direct cost; for the inpatient encounter (M=1,376.46, SD=20.0) and the outpatient encounter (M=423.61, SD=3.48); t = 44.58, *p* = 0.000. These results suggested that the total direct cost of IHD is affected by the type of patients' encounter; the mean cost among inpatient was significantly higher compared to the outpatient encounter. The descriptive analysis usually has its limitation, as clearly shown in our study. When taking the example of the encounter type, the big bulk of the total direct cost bill was paid for the outpatient services. However, in depth analysis on which patient is experiencing a higher cost among both encounters, shown that the inpatient services had a higher cost means compared to the outpatient services. These results again show the importance of the enhancement of the health prevention and promotions concepts among the IHD in Dubai.

In addition, one-way ANOVA was used to test if the total direct cost mean differs among different variables including the age groups, CCI categories and the diagnosis groups respectively. The one-way ANOVA assumptions were tested before running the test with each variable separately. There were no outliers and the data was almost normally distributed for each variable, as it was assessed by the boxplots and the Shapiro-Wilk test ($p < 0.05$). Levene's test used to assess the equality of variance, the results confirmed that the assumption of homogeneity of variance has been met ($p > 0.05$).

One-way ANOVA was used to test if the total direct cost mean differs among different age groups. The statistical results showed that there were statistically significant differences among the different age groups (F (5, 98,677) = 24.54, $p = 0.000$). A Tukey post hoc test was conducted to assess which particular differences between pairs of means are significant (the dependent variable and each age group). The results of each age group revealed the following: the age group 1-19 years was statistically significantly affecting the patient total direct cost (645 ±2,138 AED, $p = 0.000$) and the age group 20-39 years was statistically significantly affecting the patient total direct cost (691 ± 2,693 AED, $p = 0.000$). A Tukey post hoc test revealed that the age group 40-59 years was statistically significantly affecting the patient total direct cost (985.4 ± 3551 AED, $p = 0.000$). The age group 60-79 years was statistically significantly affecting the patient total direct cost (1,177 ± 4,444 AED, $p = 0.000$) compared to the age group ≥80 years which was statistically significantly affecting the patient total direct cost (1,764 ± 4,789 AED, $p = 0.000$). Those results have supported the hypothesis that when IHD patients becomes older, they will incur higher cost, as the total cost mean was increasing among different age groups (direct proportionate, which was clear in figure 4.3).

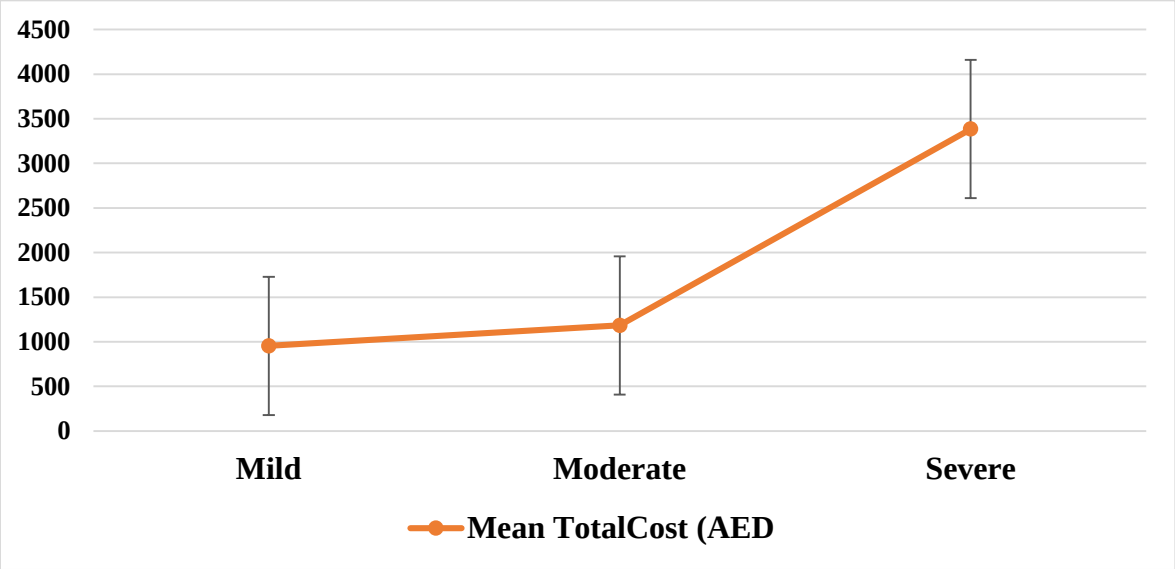
Figure 4.3 Total Cost Means Plots as per the Age Groups



One-way ANOVA was used also to test if the total direct cost mean differs among different CCI categories. The statistical results showed that there were statistically significant differences between the different CCI categories (F (3, 98679) = 10.06, $p = 0.000$). A Tukey post hoc test revealed that the CCI category "Severe" was statistically significantly affecting the patient total direct cost (3,385 ± 4,382 AED, $p = 0.000$) and the CCI category

"Moderate" was statistically significantly affecting the patient total direct cost (1,184 ± 3,803 AED, p = 0.000) compared to the CCI Category "Mild", which was statistically significantly affecting the patient total direct cost (954 ± 1,068 AED, p = 0.000). The findings support the hypothesis that as the patients CCI score will increase, they will incur higher direct cost, as the total direct cost mean was increasing among different CCI categories, moving from mild to moderate then to severe CCI scores.

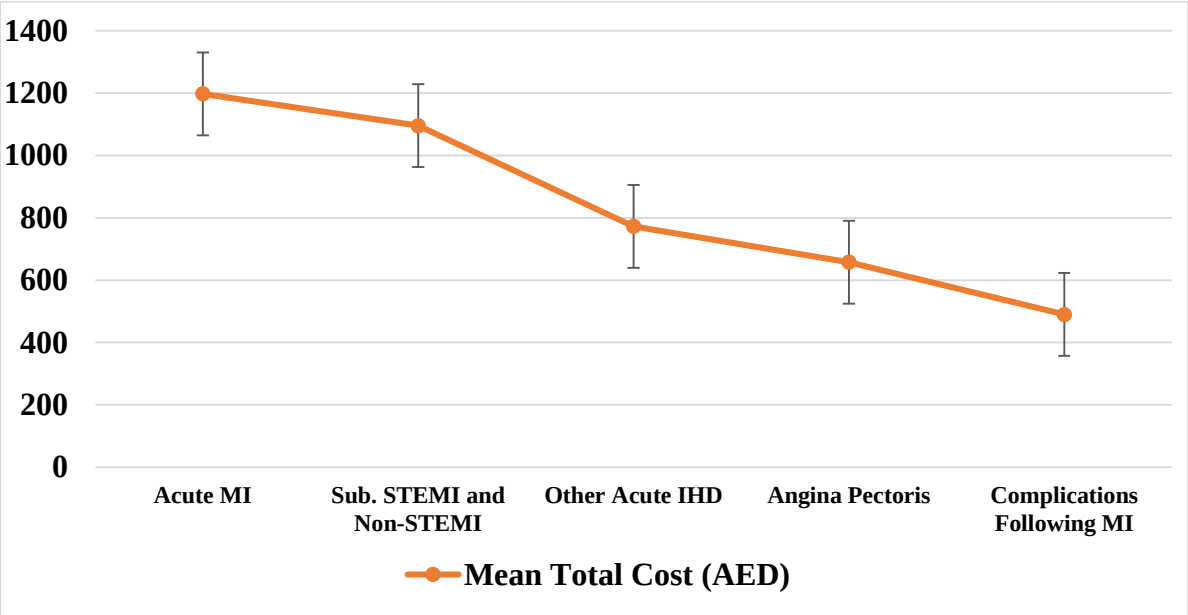
Figure 4.4 Total Cost Means Plots as per the CCI Categories



One-way ANOVA was used to test if the total direct cost means differs between different diagnosis groups among IHD patients. The results showed that there were statistically significant differences between the different diagnosis groups (F (5, 98,678) = 174.6, p = 0.000). A Tukey post hoc test revealed that the diagnosis group "Acute Myocardial Infarction" was statistically significantly affecting the patient total direct cost (1,198 ± 4,210 AED, p = 0.000) and the diagnosis group "Subsequent ST-Elevation Myocardial Infarction and Non-ST Elevation Myocardial Infarction" was statistically significantly affecting the patient total direct cost (1,096 ± 2,920 AED, p = 0.000). The diagnosis group "Other Acute Ischemic Heart Diseases" was statistically significantly affecting the patient total direct cost (773 ± 2,523 AED, p = 0.000) and the diagnosis group "Angina Pectoris" was statistically significantly affecting the patient total direct cost (628 ± 2,140 AED, p = 0.000) compared to the diagnosis group "Complications Following Myocardial Infarction" was statistically significantly affecting the patient total direct cost (490 ± 1,240 AED, p = .000). The findings supported the hypothesis that patient's diagnosis will affect their total direct cost. The results showed that patients with diagnosis from the group "Acute Myocardial Infarction" will incur higher direct cost compared to other IHD diagnosis groups; followed by the patients with the diagnosis from the "Subsequent ST-Elevation Myocardial Infarction" and Non-ST Elevation Myocardial Infarction" groups. Patients from the "Other acute Ischemic Heart Diseases" and "Angina Pectoris" groups will have almost the same total direct cost. The patients with the diagnosis group "Complications following Myocardial Infarction" will incur the lowest total cost, which makes sense in our case, as usually the follow up treatment is less costly

compared to the acute care treatments, as usually the cost of diagnostic and invasive procedures will increase the cost incurred by patients.

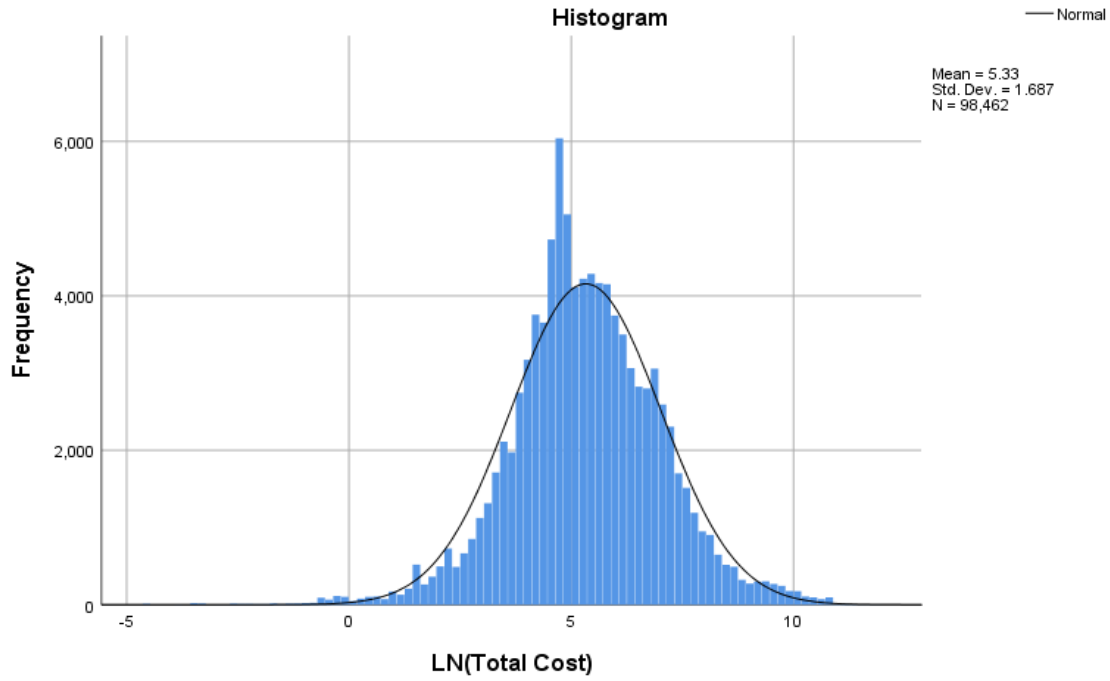
Figure 4.5 Total Cost Means Plots as per the Diagnosis Groups



4.2 Regression Analysis

A multiple regression analysis was carried out to investigate if the total direct costs incurred by the IHD patients in Dubai could be predicted using several independent variables including the gender, nationality, age, encounter type, activity type, the OOP share of patients and the Charlson Comorbidity Index score. Moreover, the diagnosis group variable was divided to five dummy variables for the ease of interpretation; each dummy variable was representing a diagnosis group. The regression results are easiest to interpret when dummy variables are restricted to two specific values, for example 1 and 0. Typically, 1 represents the named variable attribute, and the 0 represents the absence of others attributes. Before running the regression analysis, we tested for the assumptions. The first assumption of multiple regressions was the normality distribution; as we mentioned earlier the data was skewed to right slightly. Therefore, before running the regression analysis, the natural log (LN) of the total direct cost variable was taken to maintain the normality assumption, and then the new variable was tested against the same. The data visualization (figure 4.6) and the Skewness was -0.139 (SE = 0.008) and the Kurtosis values value was 1.289 (SE = 0.016) and the Kolmogorov-Smirnov test was not significant (P = 0.38) so the new variable; natural log of the total direct cost was normally distributed.

[10]Figure 4.6 Histogram of the Natural Log of the Dependent Variable (Total Direct Cost)



An analysis of standard residuals was carried out, which showed that the data contained few outliers (Standard Residual Minimum = 1.9, Standard Residual Maximum = 2.9), but the scatterplot of standardised predicted values showed that the data met the assumptions of homogeneity of variance and linearity. Tests to see if the data met the assumption of collinearity indicated that multicollinearity was not a concern as the VIF value was less than 10, or the Tolerance was greater than 0.1 (Gender, Tolerance =0.110, VIF = 9.1; Age, Tolerance = 0.109, VIF = 9.2; Nationality, Tolerance = 0.957, VIF = 1.0; CCI, Tolerance = 0.996, VIF = 1.0; Activity Type, Tolerance = 0.979, VIF = 1.0; Encounter Type, Tolerance = 0.659, VIF = 1.2; OOP share, Tolerance = 0.984, VIF = 1.0; Angina Pectoris Group, Tolerance = 0.79, VIF = 1.3; MI Group, Tolerance = 0.980, VIF = 1.0; Sub. STEM and Non-STEM Group, Tolerance = 0.951, VIF = 1.0; Complication Following MI Group, Tolerance = 0.658, VIF = 1.5; Other Acute IHD Group, Tolerance = 0.990, VIF = 1.0). Moreover, the data met the assumption of independent errors (Durbin-Watson value = 1.747) and the histogram of the standardized residuals indicated that the data contained approximately normally distributed errors, as did the normal P-P plot of standardized residuals, which showed points that were not completely on the line, but they were minimal in number. The data also met the assumption of non-zero variances (Gender, Variance = 4.8; Age, Variance = 23.4; Nationality, Variance = 0.36; CCI, Variance = 0.78; Activity Type, Variance = 0.68; Encounter Type, Variance = 0.25; OOP share, Variance = 1.85; Angina Pectoris Group, Variance = 0.98; MI Group, Variance = 140; Sub. STEM and Non-STEM Group, Variance = 16.2; Complication Following MI Group, Variance = 7.5; Other Acute IHD Group, Variance = 5.5).

Table 4.6 Coefficients, Collinearity and the Variance of the Model Predictors

The Model Independent Variables	Unstandardized Coefficient (B)	Significant (*P* Value)	Collinearity (Tolerance)	Collinearity (VIF)	Variance
Constant	52	0.000			
Age	0.04	0.000	0.109	9.2	23.40
Nationality	0.101	0.000	0.957	1.0	0.36
Gender	0.036	0.000	0.110	9.1	4.80
Encounter Type	0.132	0.001	0.659	1.2	0.25
Activity Type	0.331	0.004	0.979	1.0	0.68
Angina Pectoris Group	0.070	0.000	0.79	1.3	0.98
MI Group	0.192	0.000	0.980	1.021	140
Sub. STEM and Non-STEM Group	0.403	0.000	0.951	1.051	16.2
Complication Following MI Group	0.539	0.000	0.658	1.519	7.5
Other Acute IHD Group	0.114	0.000	0.990	1.010	5.5
CCI	0.320	0.023	0.996	1.004	2.2
OOP Share	-0.067	0.741	0.984	1.017	1.85

The linear regression performs an important role in terms of helping to describe how the dependent variable responds when the independent variables change. In the context of the present study, this type of model was used to help understanding the relationship between the total direct costs incurred by the IHD patients in Dubai and the various independent variables which include the gender, the nationality, the age, the encounter type, the activity type, the diagnosis group, the OOP share and the Charlson Comorbidity Index. The R value represents the simple correlation between the variables and it was 0.945, which indicates a relatively high degree of correlation. The results of the regression indicated that the model explained 79% of variance (R square = 0.79) and that the model was a significant predictor of the total direct cost among IHD patients in Dubai; F (11, 98260) = 2380.47, *P*= 0.000. The model total cost predictors were the age (B = 0.04, *P*= 0.000), the patient gender (B = 0.036, *P*= 0.000), nationality (B = 0.101, *P*= 0.000), encounter type (B = 0.132, *P*= 0.001), activity type (B = 0.331, *P*= 0.004), the Angina Pectoris Group (B = 0.070, *P*= 0.000), Myocardial Infarction Group (B = 0.192, *P*= 0.000), Sub. STEM and Non-STEM Group (B = 0.403, *P*= 0.000), Complication following MI Group (B = 0.539, *P*= 0.000), Other Acute IHD Group (B = 0.114, *P*= 0.000) and the Charlson Comorbidity Index among patients

(B = 0.320, *P*= 0.023), while the OOP share was not a predictor (B = -0.027, *P*= 0.741). The regression model was statistically significant (*P* = 0.000). The initial predictive model of the total direct cost among IHD patient based on their gender, nationality, age, encounter type, activity type, Angina Pectoris Group, MI Group, Sub. STEM and Non-STEM Group, Complication following MI Group, Other Acute IHD Group and Charlson Comorbidity Index was:

LN (Total Direct Cost) = $\beta_0 + \beta_1$ (Age) + β_2 (Gender) + β_3 (Nationality) + β_4 (Encounter Type) + β_5 (Activity Type) + β_6 (Angina Pectoris Group) + β_7 (Myocardial Infarction Group) + β_8 (Sub. STEMI and Non-STEMI Group) + β_9 (Complications Following MI Group) + β_{10} (Other Acute IHD Group) + β_{11} (Charlson Comorbidity Index)

LN (Total Direct Cost) = 52 + 0.04 *Age + 0.036 *Gender+ 0.101*Nationality + 0.132 *Encounter Type + 0.331 *Activity Type + 0.070 *Angina Pectoris Group + 0.192 * Myocardial Infarction Group + 0.404 *Sub. STEM and Non-STEM Group + 0.539 *Complication following MI Group + 0.114 *Other Acute IHD Group + 0.32 *Charlson Comorbidity Index

The model as a result suggests that collectively the above independent variables can be used to predict the total direct cost that an IHD patient is likely to incur in Dubai. In our model, the dependent variable is in its natural log transformation status, while the independent variables are in its original metric. To interpret the amount of change in the original metric of the total direct cost, we exponentiate the coefficient of each independent variable (βx) to recall the scale of the dependent variable (y)

$$\ln(y) = \beta x \quad \rightarrow \quad e^{\beta x} = y$$

To calculate the percent change, we can subtract one from this number and multiply by 100.

$$\rightarrow \%\Delta\, Total\ \ Direct\ Cost = d\ \text{Independent Variable}\ \ e^{\beta x} - 1 \times 100$$

Therefore, in order to be able to interpret the model we need to assure that certain assumptions are maintained.

- Gauss Markov Assumptions Hold, to warranty the validity of the ordinary least squares to be able to estimate the regression coefficients (Weaver and Wuensch, 2013).
- Our coefficient estimate is statically significant.
- We hold all other independent variables constant.

The above assumptions were applied for each predictor when trying to explain the regression mode.

4.2.1 Explaining the Effect of the Age on the Total Direct Cost:

$\left(\frac{\partial}{\partial \text{ Age}}\right)$ LN(Total Direct Cost) = $\beta_0 + \beta_1$ (Age) + β_2 (Gender) + β_3 (Nationality) + β_4 (Encounter Type) + β_5 (Activity Type) + β_6 (Angina Pectoris Group) + β_7 (Myocardial Infarction Group) + β_8 (Sub. STEMI and Non-STEMI Group) + β_9 (Complications Following MI Group) + β_{10} (Other Acute IHD Group) + β_{11} (Charlson Comorbidity Index)

$$\rightarrow \frac{d \text{ Total Direct Cost}}{\text{Total Direct Cost}} = d \text{ Age} \times e^{\beta 1} - 1$$

$$\rightarrow 100 \times \frac{d \text{ Total Direct Cost}}{\text{Total Direct Cost}} = d \text{ Age} \times e^{\beta 1} - 1 \times 100$$

$$\rightarrow \%\Delta \, Total \;\; Direct \; Cost = d \text{ Age} \times \; e^{\beta 1} - 1 \times 100$$

$$\rightarrow \%\Delta \, Total \; Direct \; Cost = d \text{ Age} \times e^{0.04} - 1 \times 100$$

To interpret the amount of change in the original metric of the total direct cost, we exponentiate (exp) the coefficient of the age to obtain exp (0.04) = 1.0408107741924. To calculate the percent change, we can subtract one from this number and multiply by 100. Thus, for a one unit increase in the age variable, the total direct costs increase by 4 percent. That means if the age of the patient will increase by one unit (one year), the total cost incurred by that patient will increase by 4%.

4.2.2 Explaining the Effect of the Gender on the Total Direct Cost:

$\left(\frac{\partial}{\partial \text{ Gender}}\right)$ LN(Total Direct Cost) = $\beta_0 + \beta_1$ (Age) + β_2 (Gender) + β_3 (Nationality) + β_4 (Encounter Type) + β_5 (Activity Type) + β_6 (Angina Pectoris Group) + β_7 (Myocardial Infarction Group) + β_8 (Sub. STEMI and Non-STEMI Group) + β_9 (Complications Following MI Group) + β_{10} (Other Acute IHD Group) + β_{11} (Charlson Comorbidity Index)

$$\rightarrow \frac{d \text{ Total Direct Cost}}{\text{Total Direct Cost}} = d \text{ Gender} \times e^{\beta 2} - 1$$

$$\rightarrow 100 \times \frac{d \text{ Total Direct Cost}}{\text{Total Direct Cost}} = d \text{ Gender} \times e^{\beta 2} - 1 \times 100$$

$$\rightarrow \%\Delta \, Total \;\; Direct \; Cost = d \text{ Gender} \times \; e^{\beta 2} - 1 \times 100$$

$$\rightarrow \%\Delta \, Total \; Direct \; Cost = d \text{ Gender} \times e^{0.036} - 1 \times 100$$

To interpret the amount of change in the original metric of the total direct cost, we exponentiate (exp) the coefficient of the gender to obtain exp (0.036) = 1.0366558464909. To calculate the percent change, we can subtract one from this number and multiply by 100. Thus, for a one unit increase in the gender variable, the total

direct costs increase by 3.6 percent. The gender of the patient will affect the total cost of IHD by 3.6 %, (female coded 0 and the male coded 1) which means the male patient will incur 3.6 % higher cost compared to female patient.

4.2.3 Explaining the Effect of the Nationality on the Total Direct Cost:

$\left(\frac{\partial}{\partial \text{ Nationality}}\right)$ LN(total Cost) = $\beta_0 + \beta_1$ (Age) + β_2 (Gender) + β_3 (Nationality) + β_4 (Encounter Type) + β_5 (Activity Type) + β_6 (Angina Pectoris Group) + β_7 (Myocardial Infarction Group) + β_8 (Sub. STEMI and Non-STEMI Group) + β_9 (Complications Following MI Group) + β_{10} (Other Acute IHD Group) + β_{11} (Charlson Comorbidity Index)

$$\rightarrow \frac{d \text{ Total Direct Cost}}{\text{Total Direct Cost}} = d \text{ Nationality} \times e^{\beta 3} - 1$$

$$\rightarrow 100 \times \frac{d \text{ Total Direct Cost}}{\text{Total Direct Cost}} = d \text{ Nationality} \times e^{\beta 3} - 1 \times 100$$

$$\rightarrow \%\Delta \, Total \;\; Direct \; Cost = d \text{ Nationality} \times \; e^{\beta 3} - 1 \times 100$$

$$\rightarrow \%\Delta \, Total \; Direct \; Cost = d \text{ Nationality} \times e^{0.101} - 1 \times 100$$

To interpret the amount of change in the original metric of the total direct cost, we exponentiate (exp) the coefficient of the nationality to obtain exp (0.101) = 1.1062766417634. To calculate the percent change, we can subtract one from this number and multiply by 100. Thus, for a one unit increase in the nationality variable, the total direct costs increase by 10.6 percent. The patient nationality will affect the total cost by 10.6 %, to be interpret categorical variable, it must be converted to dummy variable (the UAE was coded 1 and the Non-UAE was coded 0) we can conclude that if the patient is from UAE, his cost will increase by 10.6 % compared to the Non-UAE patients (other variables are kept constant).

4.2.4 Explaining the Effect of the Encounter Type on the Total Direct Cost:

$\left(\frac{\partial}{\partial \text{ Encounter type}}\right)$ LN(total Cost) = $\beta_0 + \beta_1$ (Age) + β_2 (Gender) + β_3 (Nationality) + β_4 (Encounter Type) + β_5 (Activity Type) + β_6 (Angina Pectoris Group) + β_7 (Myocardial Infarction Group) + β_8 (Sub. STEMI and Non-STEMI Group) + β_9 (Complications Following MI) + β_{10} (Other Acute IHD) + β_{11} (Charlson Comorbidity Index)

$$\rightarrow \frac{d \text{ Total Direct Cost}}{\text{Total Direct Cost}} = d \text{ Encounter Type} \times e^{\beta 4} - 1$$

$$\rightarrow 100 \times \frac{d \text{ Total Direct Cost}}{\text{Total Direct Cost}} = d \text{ Encounter Type} \times e^{\beta 4} - 1 \times 100$$

$\longrightarrow \%\Delta\ Total\ \ Direct\ Cost = d$ Encounter Type $\times\ e^{\beta 4} - 1 \times 100$

$\longrightarrow \%\Delta\ Total\ Direct\ Cost = d$ Encounter Type $\times\ e^{0.132} - 1 \times 100$

To interpret the amount of change in the original metric of the total direct cost, we exponentiate (exp) the coefficient of the encounter type to obtain exp (0.132) = 1.1411083192672. To calculate the percent change, we can subtract one from this number and multiply by 100. Thus, for a one unit increase in the encounter type variable, the total direct costs increase by 14 percent. The encounter type of the patient will affect the total cost of IHD by 14 %, (outpatient coded 0 and the inpatient coded 1) which means the inpatient encounter will incur 14 % higher costs compared to the outpatient encounter among IHD in Dubai.

4.2.5 Explaining the Effect of the Activity Type on the Total Direct Cost:

$\left(\frac{\partial}{\partial \text{ Activity Type}}\right)$ LN(total Cost) = $\beta_0 + \beta_1$ (Age) + β_2 (Gender) + β_3 (Nationality) + β_4 (Encounter Type) + β_5 (Activity Type) + β_6 (Angina Pectoris Group) + β_7 (Myocardial Infarction Group) + β_8 (Sub. STEMI and Non-STEMI Group) + β_9 (Complications Following MI Group) + β_{10} (Other Acute IHD Group) + β_{11} (Charlson Comorbidity Index)

$\longrightarrow \frac{d\ \text{Total Direct Cost}}{\text{Total Direct Cost}} = d$ Activity Type $\times\ e^{\beta 5} - 1$

$\longrightarrow 100 \times \frac{d\ \text{Total Direct Cost}}{\text{Total Direct Cost}} = d$ Activity Type $\times\ e^{\beta 5} - 1 \times 100$

$\longrightarrow \%\Delta\ Total\ \ Direct\ Cost = d$ Activity Type $\times\ e^{\beta 5} - 1 \times 100$

$\longrightarrow \%\Delta\ Total\ Direct\ Cost = d$ Activity Type $\times\ e^{0.331} - 1 \times 100$

To interpret the amount of change in the original metric of the total direct cost, we exponentiate (exp) the coefficient of the encounter type to obtain exp (0.331) = 1.3923597923082. To calculate the percent change, we can subtract one from this number and multiply by 100. The activity type among IHD patients was responsible for 39 % increase in the total direct cost.

4.2.6 Explaining the Effect of the Angina Pectoris Group on the Total Direct Cost:

$\left(\frac{\partial}{\partial \text{ Angina Pectoris Group}}\right)$ LN(total Cost) = $\beta_0 + \beta_1$ (Age) + β_2 (Gender) + β_3 (Nationality) + β_4 (Encounter Type) + β_5 (Activity Type) + β_6 (Angina Pectoris Group) + β_7 (Myocardial Infarction Group) + β_8 (Sub. STEMI and Non-STEMI Group) + β_9 (Complications Following MI Group) + β_{10} (Other Acute IHD Group) + β_{11} (Charlson Comorbidity Index)

$$\rightarrow \frac{d\ \text{Total Direct Cost}}{\text{Total Direct Cost}} = d\ \text{Angina Pectoris Group} \times e^{\beta 6} - 1$$

$$\rightarrow 100 \times \frac{d\ \text{Total Direct Cost}}{\text{Total Direct Cost}} = d\ \text{Angina Pectoris Group} \times e^{\beta 6} - 1 \times 100$$

$$\rightarrow \%\Delta\ Total\ \ Direct\ Cost = d\ \text{Angina Pectoris Group} \times\ e^{\beta 6} - 1 \times 100$$

$$\rightarrow \%\Delta\ Total\ Direct\ Cost = d\ \text{Angina Pectoris Group} \times e^{0.070} - 1 \times 100$$

To interpret the amount of change in the original metric of the total direct cost, we exponentiate (exp) the coefficient of the Angina Pectoris Group to obtain exp (0.070) = 1.0725081812542. To calculate the percent change, we can subtract one from this number and multiply by 100. That means if the patient will be under the Angina Pectoris Group diagnosis, his total cost will increase by 7% as per the regression model.

4.2.7 Explaining the Effect of the Myocardial Infarction Group on the Total Direct Cost:

$$\left(\frac{\partial}{\partial\ \text{Myoardial Infarction Group}}\right) \text{LN(total Cost)} = \beta_0 + \beta_1\ (\text{Age}) + \beta_2\ (\text{Gender}) + \beta_3\ (\text{Nationality}) + \beta_4\ (\text{Encounter Type}) + \beta_5\ (\text{Activity Type}) + \beta_6\ (\text{Angina Pectoris Group}) + \beta_7\ (\text{Myocardial Infarction Group}) + \beta_8\ (\text{Sub. STEMI and Non-STEMI Group}) + \beta_9\ (\text{Complications Following MI Group}) + \beta_{10}\ (\text{Other Acute IHD Group}) + \beta_{11}\ (\text{Charlson Comorbidity Index})$$

$$\rightarrow \frac{d\ \text{Total Direct Cost}}{\text{Total Direct Cost}} = d\ \text{Myocardial Infarction Group} \times e^{\beta 7} - 1$$

$$\rightarrow 100 \times \frac{d\ \text{Total Direct Cost}}{\text{Total Direct Cost}} = d\ \text{Myocardial Infarction Group} \times e^{\beta 7} - 1 \times 100$$

$$\rightarrow \%\Delta\ Total\ \ Direct\ Cost = d\ \text{Myocardial Infarction Group} \times\ e^{\beta 7} - 1 \times 100$$

$$\rightarrow \%\Delta\ Total\ Direct\ Cost = d\ \text{Myocardial Infarction Group} \times e^{0.192} - 1 \times 100$$

To interpret the amount of change in the original metric of the total direct cost, we exponentiate (exp) the coefficient of the Myocardial Infarction Group to obtain exp (0.192) = 1.2116705169649. To calculate the percent change, we can subtract one from this number and multiply by 100. That means if the patient will be under the Myocardial Infarction Group diagnosis, his total cost will increase by 21% as per the regression model.

4.2.8 Explaining the Effect of the Subsequent STEMI and Non-STEMI Group on the Total Direct Cost:

$\left(\frac{\partial}{\partial \text{ Sub.STEMI and Non-STEMI Group}}\right)$ LN(total Cost) = β_0 + β_1 (Age) + β_2 (Gender) + β_3 (Nationality) + β_4 (Encounter Type) + β_5 (Activity Type) + β_6 (Angina Pectoris Group) + β_7 (Myocardial Infarction Group) + β_8 (Sub. STEMI and Non-STEMI Group) + β_9 (Complications Following MI Group) + β_{10} (Other Acute IHD Group) + β_{11} (Charlson Comorbidity Index)

$\longrightarrow \frac{d \text{ Total Direct Cost}}{\text{Total Direct Cost}} = d$ Sub. STEMI and Non-STEMI Group $\times e^{\beta 8} - 1$

$\longrightarrow 100 \times \frac{d \text{ Total Direct Cost}}{\text{Total Direct Cost}} = d$ Sub. STEMI and Non-STEMI Group $\times e^{\beta 8} - 1 \times 100$

$\longrightarrow \%\Delta\ Total\ \ Direct\ Cost = d$ Sub. STEMI and Non-STEMI Group $\times\ e^{\beta 8} - 1 \times 100$

$\longrightarrow \%\Delta\ Total\ Direct\ Cost = d$ Sub. STEMI and Non-STEMI Group $\times e^{0.192} - 1 \times 100$

To interpret the amount of change in the original metric of the total direct cost, we exponentiate (exp) the coefficient of the Sub. STEMI and Non-STEMI Group to obtain exp (0.404) = 1.4978039469581. To calculate the percent change, we can subtract one from this number and multiply by 100. While if the patient's diagnosis was from the Sub. STEMI and Non-STEMI Group his cost will be affected by 49.8% increase in their total direct cost.

4.2.9 Explaining the Effect of the Complications Following MI Group on the Total Direct Cost:

$\left(\frac{\partial}{\partial \text{ Complications Following MI Group}}\right)$ LN(total Cost) = β_0 + β_1 (Age) + β_2 (Gender) + β_3 (Nationality) + β_4 (Encounter Type) + β_5 (Activity Type) + β_6 (Angina Pectoris Group) + β_7 (Myocardial Infarction Group) + β_8 (Sub. STEMI and Non-STEMI Group) + β_9 (Complications Following MI Group) + β_{10} (Other Acute IHD Group) + β_{11} (Charlson Comorbidity Index)

$\longrightarrow \frac{d \text{ Total Direct Cost}}{\text{Total Direct Cost}} = d$ Complications Following MI Group $\times e^{\beta 9} - 1$

$\longrightarrow 100 \times \frac{d \text{ Total Direct Cost}}{\text{Total Direct Cost}} = d$ Complications Following MI Group $\times e^{\beta 9} - 1 \times 100$

$\longrightarrow \%\Delta\ Total\ \ Direct\ Cost = d$ Complications Following MI Group $\times\ e^{\beta 9} - 1 \times 100$

$\longrightarrow \%\Delta\ Total\ Direct\ Cost = d$ Complications Following MI Group $\times e^{0.539} - 1 \times 100$

To interpret the amount of change in the original metric of the total direct cost, we exponentiate (exp) the coefficient of the Complications Following MI Group to obtain exp (0.539) = 1.7142917130402. To calculate the percent change, we can subtract one from this number and multiply by 100. That means the diagnosis Complication following MI Group will lead to around 71.4 percent increase in the patient total cost.

4.2.10 Explaining the Effect of the Other Acute IHD Group on the Total Direct Cost:

$\left(\frac{\partial}{\partial \text{ Other Acute IHD Group}}\right)$ LN(total Cost) = $\beta_0 + \beta_1$ (Age) + β_2 (Gender) + β_3 (Nationality) + β_4 (Encounter Type) + β_5 (Activity Type) + β_6 (Angina Pectoris Group) + β_7 (Myocardial Infarction Group) + β_8 (Sub. STEMI and Non-STEMI Group) + β_9 (Complications Following MI Group) + β_{10} (Other Acute IHD Group) + β_{11} (Charlson Comorbidity Index)

$$\rightarrow \frac{d \text{ Total Direct Cost}}{\text{Total Direct Cost}} = d \text{ Other Acute IHD Group} \times e^{\beta 10} - 1$$

$$\rightarrow 100 \times \frac{d \text{ Total Direct Cost}}{\text{Total Direct Cost}} = d \text{ Other Acute IHD Group} \times e^{\beta 10} - 1 \times 100$$

$$\rightarrow \%\Delta\, Total\ \ Direct\ Cost = d \text{ Other Acute IHD Group} \times\ e^{\beta 10} - 1 \times 100$$

$$\rightarrow \%\Delta\, Total\ Direct\ Cost = d \text{ Other Acute IHD Group} \times e^{0.114} - 1 \times 100$$

To interpret the amount of change in the original metric of the total direct cost, we exponentiate (exp) the coefficient of the Other Acute IHD Group to obtain exp (0.114) = 1.1207521248842. To calculate the percent change, we can subtract one from this number and multiply by 100. That means if the patient belongs to the diagnosis group of "Other Acute IHD" his total cost will increase by around 12% as per the regression model.

4.2.11 Explaining the Effect of the Charlson Comorbidity Index on the Total Direct Cost:

$\left(\frac{\partial}{\partial \text{ Charlson Comorbidity Index}}\right)$ LN(total Cost) = $\beta_0 + \beta_1$ (Age) + β_2 (Gender) + β_3 (Nationality) + β_4 (Encounter Type) + β_5 (Activity Type) + β_6 (Angina Pectoris Group) + β_7 (Myocardial Infarction Group) + β_8 (Sub. STEMI and Non-STEMI Group) + β_9 (Complications Following MI Group) + β_{10} (Other Acute IHD Group) + β_{11} (Charlson Comorbidity Index)

$$\rightarrow \frac{d \text{ Total Direct Cost}}{\text{Total Direct Cost}} = d \text{ Charlson Comorbidity Index} \times e^{\beta 11} - 1$$

$$\rightarrow 100 \times \frac{d \text{ Total Direct Cost}}{\text{Total Direct Cost}} = d \text{ Charlson Comorbidity Index} \times e^{\beta 11} - 1 \times 100$$

$$\rightarrow \%\Delta\, Total\ \ Direct\ Cost = d \text{ Charlson Comorbidity Index} \times\ e^{\beta 11} - 1 \times 100$$

$$\rightarrow \%\Delta\, Total\ Direct\ Cost = d \text{ Charlson Comorbidity Index} \times e^{0.32} - 1 \times 100$$

To interpret the amount of change in the original metric of the total direct cost, we exponentiate (exp) the coefficient of the Charlson Comorbidity Index to obtain exp (0.32) = 1.377127764336. To calculate the percent change, we can subtract one from this number and multiply by 100. Thus, for a one unit increase in the Charlson Comorbidity Index variable, the total direct costs increase by 37.7%. That means if the Charlson Comorbidity Index of the patient will increase by one unit (one number), the total cost incurred by that patient will increase by 37.7% as per the regression model.

4.3 Summary of the Key Findings

The data analyses have revealed interesting findings, which can be a starting point for several researchers to dig deeply in the findings. The descriptive analysis of the data has shown that the majority of the patients were male, Non-UAE national and their age group were between 40-59 years. The results have shown that those patients have visited the private health sector in Dubai as inpatients mainly, either under the Acute MI diagnosis group or the Angina Pectoris diagnosis group mainly. The majority of the population (57%) was not having insurance and more than 60% of the total cost was paid in term of out-of-pocket. Moreover, the analysis findings supported the hypotheses that as patient's age group and CCI score increase, they will incur higher cost, as the total cost mean was increasing among different age groups and CCI categories. In addition, the findings supported the hypothesis that patient's diagnosis will affect their total cost. The results showed that patients with diagnosis from the group "Acute Myocardial Infarction" will incur higher cost compared to other IHD diagnosis groups. Moreover the regression model shown that the model was good predictor of the dependent variable. The R value was 0.945, indicating relatively high degree of correlation. The regression model explained 79% of the variance (R square = 0.79) and that the model was a significant predictor of the total direct cost among IHD patients in Dubai; F (11, 98260) = 2380.47, *P*= 0.000. In our model, some independent variable had very strong effect on the dependent variable (total direct cost). The patient age was increasing the total direct cost incur by the patient by 4 percent for every year increase. The male patients were incurring 3.6 percent more cost compared to the female patients. If the patient was from UAE, his cost will increase by 10.6 percent compared to Non-UAE patients. Accessing the healthcare setting as inpatient will increase the total direct cost incurred by the patients by 14 percent compared to the outpatient services. The activity type among IHD patients was responsible for 39 percent increase in the total direct cost regardless of its type. The Charlson Comorbidity Index was increasing the total direct cost incurred by the patient by 37.7 percent for every one digit increase. Moreover, the diagnosis of the patient was a strong predictor in most of the cases, for example being from the Complication following MI Group will lead to around 71.4 percent increase in the patient total cost, while if the patient's diagnosis was from the Sub. STEMI and Non-STEMI Group his cost will be affected by 49.8 percent increase in their total direct cost. Therefore, it is very important to consider the study findings in the insurance plan of the IHD patients in Dubai to make sure that the cost burden is not a reason for not accessing the healthcare services.

CHAPTER V: DISCUSSION OF THE RESULTS

The chapter discusses the results that were computed and presented in chapter four of the study. The chapter was set to critically analyse, synthesize the results and relate them to the available literature that was compiled in chapter two of the study. Integrating the study results with the reviewed literature played a pivotal role of triangulating and comparing the study findings with past scholarly work. Further, discussing the results put the study findings in their context by outlining the convergences or divergence from the extant literature covered. While discussing the results, conceptual framework that was developed in chapter two guided the discussion and comparison with the literature. Discussion chapter was organized as per the research questions. Therefore, the discussion of each and every research question was outlined below its respective research question or hypothesis heading. This COI study involved a large sample size with IHD in Dubai. The analysis was based on cost and secondary data retrieved from the DHA. This is a study to provide estimates of the total direct costs associated with IHD care in Dubai and the predictors that might affect it.

5.1 Overview of the Studied Patients

Most of the patients were males while the females made the least percentage of the patients with Ischemic Heart Disease (IHD) in Dubai private sector. The finding was expected considering that the expatriates as well as the general workforce in the UAE comprises of working males (United Arab Emirates Population, 2019). Therefore, such a high number of males in UAE explain why IHD patients were males. Even though, the analysis shows that the number of males surpassed that of the women, it was not still conclusive if there was a significant difference between both genders due to the huge missing data on the gender variable.

The literature covered also provides a theory that can also be used to explain why the number of males attending the Dubai private hospitals was high as compared to that of the females. For instance, Das et al. (2018) studied Kolkata - a city in India, while Katiyar et al. (2017) studied Lucknow (a city in India also) and found that females had the tendency to consult informal care as compared to the males who consulted formal care. Private sector being a formal healthcare point, then it was more likely to receive male patients since studies elsewhere (Tenenbaum et al., 2016; Thompson, 2016; Katiyar et al., 2017; Das et al., 2018) showed that males have the tendency to attend formal care. This is also supported by the fact that, close to a third of the population were nationals of India. That makes it highly likely that the Indians introduced their practices in Dubai private healthcare sector. As such, Hofstede cultural dimensions theory shows that a dominant culture may influence the practices of a region. Therefore, through the cultural dimensions theory, it is highly probable that the Indian culture dominated the Dubai Emirates – thereby making more men to consult formal healthcare as compared to the women.

The most relevant study on illness cost estimates to compare the current IHD cost estimates with was that one of Hajat, Harrison and Al Siksek (2012) as it reflected Emirates region aspects (Abu Dhabi). The male patients from twenty-five primary screening centres who attended the comprehensive screening program had insignificant difference from the patients' males who attended Dubai private healthcare. Hajat, Harrison and Al Siksek (2012) recorded 43% male attendees from the 25 centres while the current study recorded 42.2% in the private healthcare. Since both studies are from the same region, then it is evident that more males in the region attend formal health care points than females. Additionally, a similar study that was conducted in Saudi Arabia, the demographic characteristics of the IHD patients (in terms of gender) is relatively similar. As such, the patients with IHD studied by Osman, Alsultan and Al-Mutairi (2011) in Saudi Arabia males represented over three quarters of the studied population. The findings implies that cultural dimensions factors appended to an individual and can be carried together with them to their environments just like how the Indian males were still in favour of formal healthcare in Dubai.

Most common age category of Dubai individuals with IHD was 40 to 59. This finding was expected since most of the population in Dubai was working population below the age of 59 – since those above the age of 60 are required to retire (UAE government, 2019). Arguably, other nationalities make 96 percent of the nationalities meaning that they probably returned to their nationalities after their retirement. Literature by Schlatter, Hirakata and Polanczyk (2017) recorded almost similar age range where the patients mean age was 61 ± 10 years in the US. In a region with similar cultural settings - Saudi Arabia, the age categories was almost similar since the IHD patients age range was between 40-75 years (Osman, Alsultan and Al-Mutairi, 2011). The finding implies that the propensity of IHD may be associated with the higher age categories. Apparently, the prevalence of the condition in the said age ranges makes patients with IHD to visit healthcare points more frequently than any other age category. As a result, the age category regular visit to the healthcare points makes the age bracket data more available that any other category. It is therefore inferable that the most of the IHD patients in the MENA region range from 40 years and above. Further, considering that a 2011 study in the region had relatively the same IHD patients of a similar category (Osman, Alsultan and Al-Mutairi, 2011), it is most likely that the tendency of the outlined age category to visit healthcare points has remained the same since 2011 through to 2017 and it is still prevalent in the contemporary period. Evidently, this age category is more common in healthcare points than any other age category. Practically, the data available in healthcare points at any time series comprise of high number of individuals over 40 years' age categories.

Angina Pectoris and Acute Myocardial infractions are the most common forms of IHD for patients in Dubai private healthcare sector. Acute Myocardial infractions were expected to be most common while the prevalence of Angina Pectoris was not expected to characterise Dubai private healthcare. However, the findings showed that Angina Pectoris had almost similar patient count to Acute Myocardial infractions in the private healthcare points. Acute Myocardial infractions were expected to be high since Schlatter, Hirakata and Polanczyk (2017) study informed that two third of the US population had acute myocardial infarction – making it presumable that the

same condition may also present in the UAE. The lack of definite expectation towards the outcome of Angina Pectoris was due to the limited literature on the same. Further, most studies addressed Acute Myocardial Infraction, thereby making acute MI data readily accessible than the status of Angina Pectoris. The finding implies that Acute Myocardial Infractions are common across nationalities, just like how Schlatter, Hirakata and Polanczyk (2017) found the condition to be prevalent in the US. Due to the limited studies assessing the cost of common IHD conditions such as Angina Pectoris prevalence; it is recommended that more studies on the Prevalence of Angina Pectoris and its cost should be undertaken across the globe as well as the UAE.

Demographical characteristics covered above were in line with the conceptual framework that was developed in chapter two above. The model explains and gives a pictorial representation denoting how demographical variables affect direct costs of IHD. In this sense, higher age bracket (above 40) was the most common age range of IHD patients meaning that due to their huge numbers, they dictated a bigger portion of the IHD costs. This was also the same case with gender – where the number of males was higher than that of the females and consequently made a larger of the IHD costs. Possible explanations were that different dispositions choose the points that they were likely to receive healthcare services – with women having a liking to informal care. As a result, this is the most likely reason that male patients count is high than that of females at a particular time series since males prefer formal healthcare.

In regards to the IHD conditions like Acute MI, analysis of the IHD patients was also in line with the conceptual framework. As such, due to Acute MI, the patients had to consult healthcare services and consequently moderated the direct costs of the illness. Upon combining multiple IHD conditions such as Myocardial infractions and Angina Pectoris, direct costs of IHD were further moderated.

Overall, the finding that males surpassed the number of women during the study period (01/01/2016 to 30/06/2017) provides insightful notes for the policy makers to consider. Intermediate conclusion shows that the finding can be used not only to inform other studies but also to guide the healthcare policy makers in Dubai. Conclusively, there may be underlying factors that limits an equivalent number of females from acquiring IHD healthcare services more frequently like males. Al-Qasem, Smith and Clifford (2011) and Khan et al. (2017) outlines that; fear of stigmatization, unequal distribution of resources and familiar roles of women make them prefer informal healthcare services. It is therefore possible that women will be avoiding formal healthcare points due to the factors noted down by Khan et al. (2017). Arguably, the current study provides a basis in which other studies and Dubai healthcare policy can build upon to assess the gap in healthcare points attendance depicted by both genders. Such studies have the potential to unearth more invaluable insights on the cost of IHD in the UAE. For instance, they can offer explanations whether IHD cost for females is always higher or equivalent to that of the males only that their health seeking behaviour makes it impossible for studies to account for all their IHD costs.

Conceptual framework that guides the study shows that the direct costs of an illness are mainly due to the illness due consumption of healthcare services by the patients with an aim to manage their conditions. These services that make up direct medical cost include; costs due to Current Procedural Terminology (CPT), costs due to Medication/ Drug, costs due to services and costs due to HCPCS. Tallying all these direct medical cost gives the overall direct cost of patients with IHD in Dubai. Therefore, from this point onward, the section has been organised in respect to the revised theoretical framework that was presented in the literature review.

5.2 The Estimated Direct Cost of the Patients from IHD Management Activities

5.2.1 Current Procedural Terminology (CPT) Cost

Out of the cumulative direct cost of IHD, largest percentage of the cost (around 50%) was from Current Procedural Terminology. Services in the CPT category includes; procedures cost, medical, surgical cost, laboratory cost and diagnostic services cost – which means that all these services and procedures immensely contributed to the aggregate cost. Whereas Dubai Emirates cost of illness (IHD) was majorly influenced by the CPT costs that made up more than half of the total, studies in other regions shows otherwise. This makes the current cost estimations unique and different from cost estimations of other regions. On a specific note, Khan et al (2017) study showed that diagnosis and laboratory tests did not contribute to inflated total cost of illness. Khan et al statistics outlined that only 10.47% of the total directs cost of ischemic heart disease emanated from laboratory and diagnosis cost.

Khan et al. (2017) study divergences can however be overlooked after considering the flaws in methodological approaches adopted in the study. The study used convenience sampling - where only 75 sample files were selected from a population of 700 files of patients with IHD in Pakistan. The study therefore used a sample size of 75 IHD related cases to come into conclusions. Notably, a sample size of 75 IHD cases out of a population of 700 cases is not a sufficient representation of the study population. This means that the sample size used by Khan et al (2017) could not warrant valid and reliable findings leave alone generating cost estimates that can be estimated for overall population. Moreover, the sample size was also selected using convenience sampling which tends to be limited by aspects such as bias, inability to generalise research findings as well as a high sampling error (Brodaty et al., 2014). Studies such as Dunlay et al. (2011) which adopts appropriate methodologies, sample size and adjustments for confounders had CPT cost estimations that had a reference to the cost estimations of the current study. Dunlay et al. (2011) study converges with the current findings by noting that higher cost of IHD was significantly associated to the diagnosis and laboratory tests costs (CPT costs) during the diagnosis of a cardiovascular disease.

More on Khan et al. (2017) CPT costs which tended to differ to the current estimations from the Dubai cost estimations, the study only considered diagnosis and laboratory test as the only measures of CPT activities. This means that the study did not actually account for all the CPT activities, services and procedures – like how the current study did. As such, CPT services and procedures were broken down to procedures cost, medical, surgical

cost, laboratory cost and diagnostic services. This makes it evident that the inability of the study to account for all the CPT services was likely to misrepresent the actual costs of CPT activities.

The implication of the cost estimations is that the costs from medical, surgical, laboratory and diagnostic services were the services that led to higher direct medical cost of IHD in Dubai private sector healthcare. This means that more than half of total direct cost of illness (IHD) was directly linked or made up of CPT services and activities costs. A comparison of the CPT costs with other IHD management activities that patient engages in, it is evident that the other IHD management activities make up the remaining part of aggregate cost – which turns out to be less than half of the total cost of IHD.

The estimation of CPT costs in Dubai private healthcare sector for patients with IHD drives forward that burden of illness was largely due to procedures cost, surgical cost, laboratory cost and diagnostic services that were necessary in their treatment sessions. Otherwise, if such procedures and processes were not performed, they would have spent much less. Albeit, these procedures and processes are imperative and patients must compulsorily use them. Therefore, the finding informs the Dubai policy makers that as a way of reducing the IHD cost burden on the patients, the individual activities that make up the overall CPT costs must be tamed or controlled.

5.2.2 Medication/ Drug Cost

The analysis depicts that the medication costs makes up to 9.8% of the direct cost of IHD. Medications for IHD patients were therefore the aspect that made the least impact on the estimated direct costs. Cost of medication in various studies offered differing views. For instance, Tarride et al., (2009) and Liu et al., (2002) recognise drugs or medications to make larger share of IHD costs while Osman, Alsultan and Al-Mutairi study depicted medications to make the least amount of the total cost. Such divergent findings can be explained by country specific practices and policies or insuring bodies that try to control the direct costs of illness.

Even though the medication costs were a little bit higher than the ones in Osman, Alsultan and Al-Mutairi study, drugs still made the least percentage of the overall direct cost for IHD patients in Dubai. As such, the total costs of medication as per Osman, Alsultan and Al-Mutairi study were less as compared to those of the current study as they made up only 3.2% of the total costs. Despite the difference both studies, which are based in the gulf region, come into a consensus that medication costs mostly makes up the least percentage of the cost of illness (IHD). Citing drug cost to have the least percentage towards the overall direct cost of illness among patients with IHD in Dubai healthcare sector renders Abbass et al. (2017) findings as inconsistent. According to Dunlay et al. (2011), medication costs were perceived as among most costly product in the aspects that make up the total health care expenditures. Further, they were presumed to continually increase with time. Nonetheless, the cost of drug in Dubai for patients with IHD was not the highest contributor towards direct total cost in the private healthcare sector. Region specific factors such as regulating bodies and per capita GDP can explain such divergences. For instance in developed countries with high GDP per capita are normally characterised by cost of illness elasticity – where such countries experience higher costs.

The finding that drugs cost amount to the least percentage of the total cost of illness (IHD) implies that MOHAP's initiative that targeted to reduce the cost of drugs by up to 66% in UAE is probably effective. Evidently, the aim of the initiative may have been attained since the cost of medications for IHD makes the least percentage of the cost. Though the initiative have been trying to reduce medication cost for other conditions since 2011, reduction of cardiovascular diseases cost started in the year 2018. Since the start of 2018, the initiative implemented drug cost reduction for central nervous system disorders, infections, respiratory diseases, endocrine and others (Ministry of Health and Prevention, 2018). As a result, it is probable that the slashed drug cost by MOHAP's initiative contributed to medication being the least contributor towards the overall direct cost of illness. However, concluding that MOHAP's initiative was meeting its goals could not be succinctly supported. This is due to the fact that the current study was pioneering study on cost of IHD in Dubai- meaning there was none other like it. Therefore, there was no data that could show the previous cost of IHD medications as there exists no previous study on the same. Little contribution of drugs towards the total cost of IHD cannot be based solely on MOHAP's initiative. Apparently, it can also be due to recent changes of effective methods to treat ischemic heart disease in the healthcare sector – thereby making drugs less needed. Low drug use will therefore translate into low cost of drugs.

The findings that drug consist of a small portion of the IHD costs lays a foundation for future studies to substantiate if MOHAP's initiative is working. If consequent studies on cost of IHD in Dubai establish that the drugs cost have increased above 8,974,088 AED as depicted in the current study, then it can be argued that MOHAP's initiative is ineffective. The opposite is also true - low cost of IHD drugs is an indicator of MOHAP's effectiveness.

5.2.3 Healthcare Common Procedure Coding System (HCPCS) Cost

About 15% of the total cost of illness (IHD) was from Healthcare Common Procedure Coding System. Considering that CPT and HCPCS goes in handy, the finding was therefore expected. There was however no available findings from Dubai region that could be used to compare these findings as well as substantiate their validity and reliability. Literature available from other global regions – specifically US, aided in establishing the extent to which HCPCS converges or diverges from figures available elsewhere. While Dunlay et al. (2011) in the US recorded Medical equipment and other consumables used by outpatients to make 2.7% of the overall cost of illness, the current study outpatients contributed to 11.6% of the total cost. The difference between the US based outpatients and Dubai outpatients' contribution towards total cost is wide apart. Arguably, the US patients made a higher composition of the total cost as compared to the IHD patients in Dubai. literature elsewhere shows that Dubai cost of illness (for outpatients) was higher than that developed nations tend to have higher cost of illness in all aspects (direct and indirect costs) as compared to the developing nations, the current findings are still relevant. Evidently, Dunlay et al. (2011) study was published in the year 2011 while the current study covers recent period findings. As such, since 2011, a lot has changed in the healthcare industry. The changes have not

been limited to healthcare technological advancements but are also inclusive of changes in the economic performance of both nations. Therefore, the Dubai based study can be said to have been influenced by the said changes in medical technology and the economic performance of the region that has been soaring year by year. The US based COI was also performed sometimes ago (1987 to 2006) a period which had a different economic performance as compared to the contemporary period. As a result, the prevailing economic condition by the time of study coupled with changes in the medical field may have had an impact on the COI.

Further scrutiny on the methodological approach used by both studies to map the cost of cardiovascular illnesses was in a position to explain the differences. Dunlay et al. (2011) used incidence based approach to measure lifetime cost of cardiovascular condition. On the other hand, the current study used prevalence based approach to measure cost of cardiovascular condition for a period of 32 months. First, incidence based methodology have been shown to yield much lower cost of illness as compared to prevalence based studies due to their tendency to discount for medical costs (Segel, 2006). Secondly, incidence based studies are hedged on the assumption that the medical costs will not change significantly in the near future. In a bid to account for any potential future changes, incidence based studies discount for the costs of consequent costs of the coming years throughout the study period (Segel, 2006). The more the costs of the consequent years are discounted, the more the total cost of illness reduces (Segel, 2006). Factually, policy makers and changes experienced in the medical care technology changes the scope and operations in the healthcare industry making the predictions used by incidence based studies inaccurate.

When an incidence based study continues for long periods due to greater length of the assessed illness, the more incidence and prevalence based studies yield divergent result (Segel, 2006). This was also a notable characteristic with Dunlay et al. (2011) study: where mapping COI took a relatively long period. Dunlay et al. (2011) COI study used incident based approach from 1987 up to 2006 – which is evidently a very long period. Lastly, the inability of the researchers to classify some of the cost into their respective groups can also contribute to the existing gap between the US based study outpatients and the current study.

The study implies that, probably, the medical technology and revision of healthcare policies have changed since the year Dunlay et al. (2011) study was published. In essence, the medical technology impacted on the COI for the outpatients HCPCS. Outlining the total costs associated with HCPCS (HCPCS made 15% of the total cost with the outpatients making 11.6% of the total cost) was imperative. It evidences that the outpatients made the highest contribution of HCPCS costs as compared to the inpatients. Therefore, the cost estimation makes the Dubai healthcare policy makers aware that the estimated cost of IHD inpatient and outpatients are due to HCPCS services cost. However, outpatients experience the HCPCS cost tend to inflate the estimated costs as compared to the inpatient. As a result, the policy makers can now be in a position to consider approaches to reduce the factors that makes the outpatients HCPCS costs to skyrocket.

5.3 The Estimated Direct Costs of IHD

5.3.1 Overall Direct Cost

The overall cost of IHD in the current study was 91 million AED (approximately US $25 million) in the span of 32 months, in respect to the range of the data used. The expected finding was that Dubai's cost of Ischemic Heart Disease would at least make approximately similar percentage of the GDP when compared to other IHD studies in the region. Unfortunately, few GCC regions have comprehensive data on the prevalence and cost of IHD (Aljefree and Ahmed, 2015). This makes the total cost of illness less comparable to any other study in the regions since they were few – apart from Osman, Alsultan and Al-Mutairi (2011) which provided some outdated comparisons. Specifically, Osman, Alsultan and Al-Mutairi (2011) study was not only conducted some years ago (2011) but it estimated the cost of illness for relatively short period.

Whereas the current study spanned for a period of 32 months while Osman, Alsultan and Al-Mutairi (2011) was based on 3 months. Therefore the mean cost of illness (IHD) for the 32 months was averaged to outline only 3 months for ease of comparison of the costs. As such, the current study average cost of illness (IHD) for the 3 months was around 8.5 million AED (approximately US $2.33 million); whereas Osman, Alsultan and Al-Mutairi (2011) average cost of illness (IHD) for the three months was around 8 million SAR (US $2 million). Therefore, the current finding in Dubai UAE was closely relatable to Osman, Alsultan and Al-Mutairi (2011) findings in Saudi Arabia apart; from the difference of $136,144 in total costs. The difference in the total cost of illness (IHD) ($136,144) for the three months can be explained and accounted for by the differences that characterize settings of both studies. The current study assessed all the medical, surgical, laboratory and diagnostic services among other measures of direct cost of illness such as medication cost, HCPCS cost, and services cost . On the other hand Osman, Alsultan and Al-Mutairi assessed only the costs of diagnosis which were consequently followed until patients with IHD were discharged, or listed for surgery, or when their diagnosis Procedures changed. This means that the study assessing costs of IHD in Osman, Alsultan and Al-Mutairi study did not consider surgery costs while the current study considered the surgery costs – as grouped under CPT category. Arguably, such omissions can explain the slight differences in the total cost of illness (IHD) between the two regions. Additionally time lapse; since 2011, and the population difference can also account for the differences of IHD cost

The finding implies that Dubai patients with IHD incur healthcare services cost (averagely 926 AED per person spanning over 32 months). The findings contribute immensely to the cost of illness literature that is available in the UAE; specifically Dubai. As such, no previous study was available that could approximate the cost of illness for IHD in Dubai. Therefore, the current study findings give the estimated IHD cost in the Emirates of Dubai, thereby forming a basis in which future IHD studies can compare the tendency of the cost to increase or decrease.

The estimated cost of IHD cost in Dubai not only by acting as a pioneering study, but also by complementing a recent (2017) white paper from Emirates Cardiac Conference. The white paper assessed cost of cardiovascular

disease in the region from one side approach, the study only considered mortality cost. Therefore, the current study adds that apart from the estimated mortality costs mapped, direct costs also burden these patients. The recent findings can be traced to be many years back (Aljefree and Ahmed 2015). These findings can be refuted as not up to date. Considering the current study backdates only 3 years ago, the findings offer more recent cost of IHD costs.

However the cost of illness of patients with IHD in Dubai private sector healthcare was mapped, a knowledge gap pertaining to the burden of the direct cost of illness could not be covered sufficiently. This is due to the fact that the IHD patients' income brackets were not included in the data collected. If the estimated income of the patients was included, then it was possible that the actual burden of Ischemic Heart Disease could be established. Moreover, it was not possible to include the relative income of the patients as the data had already been uploaded to eClaimLink data base and there was no possible way to contact the patients in order to establish their income bracket. Apparently, a new research question that future studies should consider arises from the noted gap. These studies should therefore integrate a patient's income as a demographic construct. Through such approach, the economic drain that IHD has on the patients can be computed accordingly. Finding that give specific cost of burden of the IHD patients in the region gives policy makers as well as the insuring body's deep insights in regards to how the direct cost of illness burden the patients.

5.4 The Estimated Out-of-Pocket (OOP) of the IHD Patients in Dubai (Burden of Illness)

Patients with IHD paid approximately 61 million AED as OOP. Therefore, the total out of pocket costs paid by the IHD patients in the Emirate makes around 67% of the total direct costs of IHD. Around 58.1% of the population with IHD have to pay more than 61% of the direct total cost of the illness. It was expected that the UAE based patients with IHD would eventually have some out of pocket expenses, paying 61% as the OOP was considered to be relatively high. Having to pay for some out of pocket costs was expected since not everyone with IHD in Dubai has the same insurance plan. This means that some of the IHD patients' healthcare insurance plans did not cover all the activities or services they received in the hospital (Adler, Fiedler, Ginsburg, Hall, Trish, Young. and Duffy, 2019) and as they had to pay for the services using their funds. Apart from the different healthcare insurance plans that the IHD patients in Dubai may have, Behavioural Model of Health Services also explains why the researcher expected the IHD patents to have some OOP costs. According to Andersen (1968) theories covered in Behavioural Model of Health Services, need factors such as an individuals' physical condition and signs of illness makes an individual to adhere to health seeking behaviour. More so, when an individual's health status has been evaluated through professional assessments, they tend to adhere more to health seeking behaviours. The more they visit the healthcare points due to their conditions; they attract expenses related to healthcare services or activities. As a rule of thumb, most insurance have cost sharing policy (Albright, 2015). In respect to cost sharing between the patients and the insurance, the patient will have to contribute some funds to cover for their treatment from their own pockets. The fees pad will therefore be considered as out of pocket costs.

However, the type of health insurance plan and the Behavioural Model of Health Services theory explains why OOP costs exist; contributing OOP costs that are more than 20% of the total direct costs was not expected. The researcher expected that the patients' out of pocket contributions would be at least or close to the range of 20% of the total direct cost of IHD. The expectation was based on the understanding that the cost sharing between an individual and the healthcare insurance bodies in the UAE stand at 20% of the total cost (Chaudhary, 2016). Making the IHD patients entitled to pay a maximum of up to of 20% of their total direct cost. This means that out of the total direct cost of IHD treatment that an insured individual spends, 80% is catered for by the insuring body while the remaining 20% becomes out of pocket expenses. The 20% contribution should come from the patient's side - which is regarded as out of pocket cost. The fact that more than 58% of the IHD patients paid around 61% OOP costs in comparison to the total direct cost of IHD, then 61% can be considered high. Nonetheless, since it is probable that some of the patients would probably have no healthcare insurance that covers treatments in the private healthcare sector, it is inferable that the OOP cost was inflated due to such individuals.

Existing literature covered were essential in explaining the unexpected finding which can be explained by the health insurance policies (Chaudhary, 2016), type of cover (Nakayama et al; 2017) as well as the nature of the illness in context (Tarride et al, 2009). In each and every insurance plan, the insurer may decide to allocate maximum threshold (Chaudhary, 2016) – of which individual subscribing to these health insurance plans are not supposed to exceed. This means that the healthcare insurer sets a minimum amount and maximum amount of aid that they are willing to offer to an individual to cater for their healthcare services. Upon exceeding the set maximum limit in their healthcare services expenditure, the amount that they exceed with will have to be catered for by the subscriber. The minimum and maximum aid cap off limit is also based on the type of healthcare insurance plan that an individual has subscribed to, therefore premium priced healthcare insurance plans will have a higher maximum cap off limit as compared to the basic healthcare insurance plan. Therefore, it is probable that most of the IHD patients in Dubai private healthcare sector exceeded the maximum limit which made them cater for the extra charges. It is possible to exceed the maximum limit since IHD healthcare services and activities have been found to be costly (Tarride et al., 2009; Benjamin et al., 2018).

The institutions that offer healthcare insurances have been found to adopt practices in order to ensure that the subscribers do not misuse their healthcare insurance plan benefits (Kesselheim et al., 2015). It also acts as a move to cushion the healthcare insurers from huge and unnecessary expenditures. It is due to such reasons that the health insurance bodies scraps some of the activities and services that they are willing to covers for the subscribing patient (Kesselheim et al., 2015). Arguably, maximum limit on the medical expenses cover and reduction of the number of sponsored/ covered services by the health insurer can explain why patients may part with high OOP expenses. The healthcare insuring bodies have also been found to take some time before including new medications and technologies under their insurance covers (Schlatter, Hirakata and Polanczyk, 2017). As such, new technologies and procedures are not immediately included under insurance like the old technologies and procedures since they are considered as safe and appropriate. Therefore, new procedures and technologies takes

time before the healthcare insuring bodies decide to cover them under the insurance plans. So, the presence of new technologies and procedures in the healthcare industry, more so in the IHD treatment departments can lead to inflated OOP (Schlatter, Hirakata and Polanczyk, 2017). In the real sense, drugs, new technologies, costly procedures among other aspects take time before they start being covered by the health insurances. Possibility of such a scenario in Dubai private .healthcare sector is high due to the ever increasing technological and procedural innovations – thus explain the potentiality of having high out of pocket cost.

Again, based on the type of health insurance cover that an individual subscribes to, the OOP is subject to change. For instance, the decision to acquire private premium insurance by an individual makes the individual pay premium price for their premium rated medical cover. In return, such individuals enjoy extended range of services with little or no OOP as compared to individuals under basic healthcare insurance cover (Nakayama et al., 2017). Arguably, basic health insurance covers cannot be in a position to cover all the costs of an illness as the patients holding such plans contribute far much less monthly contributions. This means that the range of components that health insurance covers is limited as compared to the wide range of products that a premium priced health insurance cover. Notably, an illness (IHD) that have been numerously associated with significantly high total cost of illness (Tarride et al., 2009; Benjamin et al., 2018) after cancer and accidents, can be costly to the health insuring bodies to cater for all aspects of treatment under basic covers.

Even though all the above factors can lead to a high OOP expense of an individual, not all of these factors were evident in the current study. Only the type of health insurance cover explained why majority of the IHD patients had high (61%) OOP expenses. By critically analyzing the data, a spectacular data trend that showed the share of OOP expenses for all the patients with IHD was observed. As such, the individual with IHD in Dubai with insurance covers had a relatively low OOP expenses ($\leq$ 21%) all through the different healthcare services and activities categories. On the other hand, the patients with IHD who had no insurance cover were characterised by a total cost of healthcare OOP expenses equivalent to their total direct cost of IHD. This means that their cost of treatment was exactly the same to the amount that they paid at the end of the study period. Apparently, all these OOP costs were solely catered for by these patients from out of their pockets. The patients with IHD but had not subscribed to any insurance cover were the main reason why the current study had recorded an inflated amount of OOP expenses (67% paid by all the IHD patients). There is a potential that all the OOP expenses were within the set maximum range (20%) of cost sharing between a patient and the health insurance body that they subscribed to. But since some of few individuals were not covered by the insurance bodies, their OOP costs spilled effects towards the aggregated share of OOP costs the impact introduced by lack of healthcare insurance plan was also evident in Flores et al., (2017) Study where children who had not been insured had high out of pocket costs and at the end increased the overall figure of OOP in the US.

Perceiving that some of the IHD patients in Dubai had no health insurance cover can again be termed as flawed and inapplicable. This is due to the fact that, it is mandatory for all the residents working or living in the UAE to have an insurance cover (Internations, 2019). Therefore, no resident may have been living in Dubai with no insurance cover. The notion leads to an inference that; those who were termed as not having insurance cover were probably patients who had attended private hospitals that were not under the network group of insurers. Accordingly, insuring bodies in most cases makes medical costing deals with a group of hospitals whereby these healthcare points are contracted to offer healthcare services to the patients who have subscribed to insurance plan from the insuring body (Chaudhary, 2019). In return, the group of hospitals contracted to treat these patients are compensated by the insuring body that they have made contract with. Such kind of partnership forms a network group of hospitals, and in order an individual to benefit from their healthcare insurance subscription, they should attend a healthcare recognised by their healthcare insurance provider. It is highly possible that high number of IHD patients were termed to have no insurances as they attended the wrong network group hospital. Attending the appropriate network group makes the patients to be compensated if the subscriber receives healthcare services from the network of hospitals contracted to offer healthcare services by a respective insurer. This means that if IHD patient attends a healthcare point that is not contracted to offer healthcare services by the respective insurer, then their treatments would not be compensated.in return such expenses become categorized as OOP expenses. Such cases are evident in UAE as compared to the US. Whereas the US healthcare insurance policy gives an individual the freedom to visit specialists, the UAE cover – mostly the government sponsored, only allows the insurance subscribers to only visit government owned hospitals or the contracted network hospital.

In regards to Flores et al. (2017) study, immigrants who had moved to the US and individuals who had not yet mature insurance plans since they had just subscribed to healthcare insurance were the core reason for individuals to have no healthcare insurance plan. Replicating the same case to Dubai, it is highly probable that the IHD patients in the private healthcare were new immigrants, medical tourists or patients whose healthcare insurances were not yet mature. As a result, they were regarded as patients with no healthcare insurance plan.

From the findings of the study, drugs had the least out of pocket costs for those with insurance. This means that either the drugs meant for IHD treatment were cheap or they were covered by most of the healthcare insurance plans. It implies that the patients with IHD in Dubai enjoyed less costs out of their pockets when acquiring medications for IHD. However, not all of the IHD patients could enjoy more cover for drugs. As such, those with insurance covers applicable at their healthcare points had less out of pocket costs for drugs as compared to those whose health insurance covers were not applicable to their point of treatment.

Patients with IHD in Dubai who were over 80 years of age were more likely to pay more out of pocket costs than any other age category. They were likely to pay for higher percentage of OOP costs for drugs; whereby the cost sharing was estimated to be almost 50%. The older Dubai IHD patients got, the more likely they were to pay higher drug costs. Arguably, the patient with IHD band over 80 years can be argued to absorb the most impact in

their of OOP costs when acquiring drugs. As such, their cost sharing ratio tend to be higher than any other age category.

While insured IHD patients had insignificant drugs costs sharing, their HCPCS cost sharing contributions were regarded as the highest as compared to all the other healthcare activities. Such high cost sharing figures was prevalent to those who were between 60 to 79 years. The probability of having high out of pocket costs in the higher age categories was expected. Considering HCPCS and CPT were made up of a range of healthcare services/ activities, then the OOP costs were expected to increase dramatically in these categories. For instance, diagnosis and surgery were combined under CPT category. Therefore, when the OOP costs from the categories were summed up, then they were deemed to increase. Since HCPCS also comprised of a range of healthcare activities services, it is explainable why the OOP costs from this category are high.

The finding that the out of pocket costs paid by patients with IHD in Dubai exceeds the set cost sharing limit by far can– probably be due to the fact that those who attend private healthcare are not under network group of their health insurance. Attending a hospital that is not covered under the insurer's network group is a common phenomenon - with Adler et al. (2019) explaining that patents ignore attending to hospitals under their network group since the lack facilities or the specific healthcare services that they need. For instance, the need for specialised treatment or the need to consult a specialist may force an individual to attend a healthcare point that is not covered by their specific insurance body. Such a case is highly probable in Dubai considering that UAE nationals attended the private healthcare points despite them having government sponsored healthcare insurances. Internations (2019) also reinforces the view that Dubai private healthcare sectors may have specialised treatment/ IHD specialists by noting that the Dubai public and private healthcare are equally reputable but the private healthcare has invested much in specialty. With private healthcare in Dubai differentiating itself from the public healthcare centre, then it is quite clear why the UAE nationals consulted the private healthcare sector services despite the sector's services attracting costs from them. The tendency of patients to attend specialised healthcare points is not unique to Dubai as it was evident in the US. However, the main difference was that the US based patients who sought specialised treatments and consultations were mostly reimbursed by their insurers – considering that the US healthcare insurances have little or no restriction as to which healthcare point a patient attends to

Considering Thompson et al., (2016) and Dawood et al., (2017) studies, the age had the tendency to influence older patients consult healthcare services for treatment. Integrating both Thompson et al., (2016) and Dawood et al., (2017) studies, the higher the age cluster that an individual belongs to, the more frequent they were likely to visit or seek healthcare services. Practically, the IHD patients belonging to the higher age categories visit the healthcare points or seek for their services. Consequently, the more likely that they exceed the maximum set insurance cover limit for the health services. Evidently, if a limit that is set to limit the total cost of drugs an individual takes per month, then their tendency to exercise health seeking behaviour may make them exceed this cost limit. Upon exceeding the limit, then the extra costs would be catered from their pockets. Therefore, finding

that those over 80 years pay more in drugs aligns confirms Thompson et al., (2016) and Dawood et al., (2017) perception that age may lead to higher cost of illness as well as out of pocket costs. Noting that patients above the age of 80 and with IHD in Dubai are more likely to pay high OOP costs when acquiring drugs is in line with Andersen (1968) theory. Arguably, then age fits in line to the Andersen's theory as a predisposing factor.

Overall, more than half of the patient with IHD in the Dubai private healthcare sector paid over two thirds of the Total direct costs for IHD rom their own pockets. This is an indicator that that most of the patients with IHD in the Dubai private healthcare sector use a great deal of expenses from their own pockets to cover for their healthcare services. They contribute as much as three times of the total direct costs as compared to their healthcare insuring bodies. Moreover, the finding outlining the estimate of OOP is significant as no other study has ever mapped the prevalence of OOP more so in the UAE. This makes the study of utmost importance as it pioneers in the exploration of COI (IHD) especially in Dubai – thereby giving future studies a niche to build on. Secondly, finding out that being a UAE citizen (who paid 64% OOP) you were likely to pay as much as non UAE citizen (who paid 67% OOP) is a significant finding that denotes a problem in the healthcare setting of Dubai. The outright explanation is that; UAE nationals might have the perception that government healthcare centres (where their Tax-based insurance covers are applicable) are not capable of meeting their needs and therefore they favour the private healthcare (where insurance-based systems is in effect). This makes the UAE nationals pay substantial amounts of OOP. Unearthing that UAE nationals have relatively small OOP burden as compared to the non UAE patients' shows that the government health insurance cover may be ineffective. This is an insights to Dubai healthcare policy makers as it shows that the dislike of public healthcare by the UAE may be due to ineffective services and mostly likely lack of specialised treatments (Internations, 2019), which characterise public healthcare institutions.

5.5 The Role of Demographic Profiles, Encounter Types, Healthcare Context and Comorbidity in Moderating the IHD Costs in Dubai Private Healthcare

Preliminary Discussion on the Association between the Total IHD Cost and the Demographic Variables.

Age correlated with the total direct cost of IHD of an individual. The r value being positive (r=0.047), and the *p* value within the set confidence level ($p \leq 0.05$), it is evident that there was some form of association between the variables. In such a case, as the age of an IHD patient increased the more they were likely to pay higher cost of illness (IHD). Such finding was however expected considering that the reviewed literature showed that age was a predictor to whether an individual would seek health services or not. For example, in the Thompson et al., (2016) and Hassali et al., (2017) studies the age difference of the participants has affected their health seeking behaviours. The old and retired individuals consulted treatments after a disease onset. Generally, associating age of older individuals to high direct costs of an illness is based on their susceptibility to illness. The older one becomes the more prone one becomes to comorbidities, thereby making one seek healthcare services more than the younger individuals (Thompson et al., 2016 and Dawood et al., 2017). But generalizing that as one's age

increases their health seeking behaviour also increases is not true always. Type of illness in question also acts as a great influencer to the likelihood of an individual of any age to consult healthcare services. This means that different illnesses have been depicted in the literature to manifest differencing findings. For instance, Greenberg et al. (2015) shows that the influence of age to impact health seeking behaviour was modified by the comorbidity. The opinion was validated through a study on mental illnesses. The younger generation had a higher health seeking behaviour than the older generation. All in all, age coupled by underlying health condition made the older generation to seek healthcare services more Greenberg et al. (2015), but not always. In summation, the older one became, the more they were likely to seek healthcare services (leading to high costs due to frequent attendance) as compared to the younger population. Considering that the current study participants' age ranged from one year and above, then it was expected that older individuals would seek healthcare services more just like the reviewed studies showed. From Schlatter, Hirakata and Polanczyk (2017) perspective, the cost of illness would shift to high or low based on age shift. Practically, if a patient with IHD age was 5 years, then their total direct cost of IHD would be low but as that individual age increased their total direct cost for IHD also increased. This is the reason why the study showed that individuals over 50 years had higher cost of ischemic heart disease as compared to the patients below that age category.

Another study that had relatively the same aim (assessing the cost of illness associated with cardiovascular condition) substantiates the validity of the finding. As such, the finding is associable or similar to Dunlay et al., (2011) study which notes that age impacts on the respective total cost of illness. More profoundly, Schlatter, Hirakata and Polanczyk (2017) depicted that population that was over 50 years had higher direct and indirect medical costs as compared to other age categories. The lowest age category which was between 18 and 25 years had the lowest costs of illness. This is an indicator that the older the IHD patient, the more costly that the total direct costs of IHD health services were and contrastingly, the younger the IHD patient, the cheaper the direct health services.

According to Khan et al., (2017) - a study that also assessed the cost of illness of ischemic heart disease had divergent findings, the study found out that demographic characteristics such as age were not statistically significant with the increasing cost of the studied condition (ischemic heart disease). Despite the study being aligned to study the costs of IHD - which is also the same aspect that the current study assessed, Khan et al., and (2017) findings were contradicting. Nonetheless, the contradictory findings from a recent literature were overlooked after considering the research settings adopted by Khan et al., which were listed earlier. As such, little sample size and sampling technique (Brodaty et al., 2014) had the potential to affect the study's finding to an extent of making them divergent to the available literature on IHD.

5.5.1 Association between the Total IHD Related Cost and the Age Categories

Considering various age categories; 1-19 years, 20-39 years, 40-59 years, and 60-79 years, a notable trend was evident all through. Each age category had a statistically significant effect on the cost of IHD throughout the Dubai private healthcare sector. The lower the age category, the lower the IHD cost while the higher the age category, the higher the cost of the illness (IHD). Again, based on, Schlatter, Hirakata and Polanczyk (2017) findings that the age category of patients between 18 and 25 years had the lowest costs of illness, it was expected that the age clusters would be in a position to affect the overall cost of IHD.

The mean of total direct cost for the age categories, 1-19 years, 20-39 years and 40-59 years were statistically significantly different and also had the potential to affect the total direct cost of a patient. There was however no studies that had gone to an extent to analyse the association of age categories with the total cost of IHD. Even though Dunlay et al., (2011) study was comparable as it had had at least analysed the significance of age categories in depicting the cost of IHD, the categorization of the patients age was different from the one in the current study. In Dunlay et al., (2011) study age categories were well defined after age 55. This means that age category below age 55 were absent as well as over 85 age category. This left only a few age categories (55-64, 65-74, 75-84) for comparison with the age categories of the current study (1-19 years, 20-39 years, 40-59 years, and 60-79 years). Again succinct comparison was not possible considering there was a disparity in age categorization used by both studies. For instance, the current study age categories included 20 years clusters while Dunlay et al., (2011) study categories were based on 10 years cluster.

Despite the different age categorization criteria in both studies, IHD patients who were between 60-79 years and those who were over ≥80 years had different means of total direct cost of IHD that were statistically significant. Therefore, it was conclusive that as the age category increased further the more the individuals in those categories were in a position to statistically significantly affect the patient cost. The findings were in line with Dunlay et al., (2011) study where categories 65-74 years and 75-84 years had a mean of total direct cost of IHD that was statistically significant and capable of influencing the overall direct cost of IHD as the patient age increases throughout the brackets. The age category 55-64 years had no statistically significant association with the overall cost of IHD (Dunlay et al., 2011), unlike those who were in associable category 40-59 years, and 60-79 years in the current study. The difference depicted by both studies can be explained by the small sample size used by Dunlay et al., study. As such out of the 1054 IHD study subjects since the year 1987 to 2007, the average age was 76.8 years. This means that most of the IHD participants' age was closer to 75-84 years age category than they were to 55 to 64 years age cluster. Arguably, the cluster of IHD patients between 55 to 64 years was left with a smaller size to determine the significance level. Evidently, the smaller the sample size, the less the data can be in a position to establish association or correlations.

The finding was significant for the UAE context considering that the stylized facts were confirmed through a statistical model. Therefore, the finding validates the perception of the correlation model by establishing a statistically significant difference between the age's categories total direct cost means – the validation also proves that age categories had a causal association with the total direct cost of IHD. Arguably, the finding contributed towards establishing the role played by age in determining cost of IHD. As a result, the healthcare policy makers in Dubai can be in a position to establish approaches to tame the cost of illness burden associated with the age of senior citizens of Dubai. The study was also significant considering that it showed that the age of an individual acts as an influencer to seek healthcare services for older individuals with IHD. The study confirms Greenberg et al. (2015) study that ages combined with a particular illness have the potential to push older individual to seek healthcare services. These finding also confirms that the perception that age coupled with IHD made a patient seek healthcare services for IHD was high unlike Greenberg et al. (2015) findings where illness (mental condition) coupled with younger age influenced healthcare service seeking behaviour.

5.5.2 Association between the Total IHD Related Cost and the Gender

The mean direct cost of IHD was significantly different for both genders of Dubai patients in the private healthcare sector. The finding denotes that the difference between the means of total direct cost of illness (IHD) between the males and females was statistically significant. This is an indicator that the males were paying significantly higher total costs for the IHD treatment compared to the females. The difference in cost between genders was expected considering the theoretical perception of Andersen (1968) theory of Behavioural Model of Health Services. From the theory's perspective, gender was a predictor influencing an individual to seek health services. As a result one of the genders (either male or female) with IHD was expected to visit the healthcare more than the other. Sensitivity to health status would make either of the genders to express health seeking behaviour than the other – with the end results being higher direct costs for the gender that frequents healthcare points. The current study outline males had a significantly higher average in cost of IHD in Dubai private healthcare sector than the females. Other studies have also confirmed the existence of significant difference between the total direct costs of an illness. In a preliminary analysis, Schlatter, Hirakata and Polanczyk (2017) found that there was a level of association between gender and the total cost of IHD. The study depicted that there was an association between the two variables with men having the larger costs of IHD. From stylized facts approach (where empirical analysis is always shallow) the study was in line with the current study findings. Their study agrees that each gender have different total direct cost of illness in a specific time series of COI study. The same case depicted by Schlatter, Hirakata and Polanczyk (2017) findings is also available elsewhere such as the Asian region (Aljefree and Ahmed, 2015 and Khanet al., 2017) where either the men had higher cost of illness than the women. Therefore, there was a significant difference in the aggregated costs for each gender. It was possible for males to have a higher illness cost than females since males attended formal care for all healthcare services unlike the females. Females may have considered informal care for some conditions (Tenenbaum et al., 2016; Thompson (2016); Das et al., 2018; Katiyar et al., 2017) making their cost different from the males. Further, Katiyar et al.

(2017) also explains that females are more likely to consult informal healthcare points due to their economic status – whereby they were economically disadvantaged as compared to men. As a result, it can be argued that women are not economically well up like men to a point where they can afford formal care. Extant literature body, more so the literature covered in the current study, was more concerned with showing the overall cost of illness difference between male and females (Osman, Alsultan and Al-Mutairi, 2011; Jo, 2014; Aljefree and Ahmed, 2015; and Yang et al., 2018). However, none of these studies went a step further to map the statistical significance of the different illness costs noted between the two variables. The significance level is important as it forms a basis of establishing if the difference in total direct cost means of the two genders is statistically viable or it is due to the unequal sample size. Using stylized facts empirical findings to make judgments may be misleading considering that association is not always an indicator of causality, as Schlatter, Hirakata and Polanczyk (2017) study proved through further analysis.

The finding that there is a tendency of the males to have a high cost of illness (IHD) than males was contributory, not only to the Dubai healthcare policy makers but also to making the COI studies more conclusive. In regards to Russel (2001), most of the COI studies are inconclusive. Inconclusiveness of studies have been evidently presented; where these studies define the amount of cost each gender contributed towards the total cost of illness but fail to assess if the share of each gender is different due to statistically significant reasons or it is due to the unequal distribution of count in both genders in the sample size. Establishing significance is paramount as it was in a position to show that males in Dubai private healthcare sector had a larger IHD burden than the female. Their relatively higher cost of IHD than that of the women was not due to high number of the sampled males but due to statistically significant reasons associated with males. The finding is also contributory by showing that the men in Dubai private healthcare sector had characteristics comparable to men in other regions (Liu et al., 2002; Schlatter, Hirakata and Polanczyk, 2017) whereby they have a tendency of having higher total direct cost of illness than the women have. This finding was also considered as significant since it informs the policy makers on the importance of considering men when devising IHD prevention approaches – considering that men cost the healthcare services sponsors more than the women did.

5.5.3 Association between the Total IHD Related Cost and the Nationality

Patients with IHD from other nationalities had a lower mean of total direct cost of IHD as compared to the IHD patients from UAE. The confidence level was within the set range thereby denoting that the means of total direct cost of patients of nationalities and UAE had a statistically significant difference. IHD patients in the Dubai private healthcare sector who paid significantly lower cost of illness (IHD) were the foreigners where the citizens had significantly higher costs. Even though the association of a nationality and the tendency for a price to hike was explained to be due to statistical significant reasons, the finding generated peculiar interest. It was strange that patients from other nationalities would have low total direct cost of illness (IHD) as compared to the nationals. Such a difference was expected considering that the majority of the study subjects who were UAE national had

a government sponsored cover - which means that they were likely to pay higher in Dubai private healthcare sector since the governments insurance plans did not cover the private sector (UAE Government, 2019). Therefore, the nationals cost of illness (IHD) would be relatively lower as compared to the average cost of non-nationals. Evaluating the total direct cost of IHD in Dubai from private healthcare sector perspective means that, the UAE nationals have a higher burden than the non-nationals whenever they consider seeking IHD services treatments from the private healthcare sector. All the IHD patients would succumb higher direct cost per person since private healthcare in the UAE is more focusing on the customer needs compared to the public healthcare in term of private room's availability and the appointment system feasibility (Internations, 2019). Additionally, they have specialist services (Internations, 2019) which makes specialist consultations to inflate the aggregate direct COI further. Since the UAE nationals and the non-UAE were in the same healthcare settings (private sector), it is inferable that COI (IHD) per person from any nationality would amount to relatively the same – but the findings have invalidated the expectation by depicting different total costs between individual total. Possible explanation to the scenario is that the nationals had a high health seeking behaviour than IHD patients from other nationalities. In addition, frequent visits to the private healthcare motivated by the nationals' interest to stay healthy can thereby lead to high costs in healthcare services and products that are used in each visit that they make. However, the most relevant explanation was that the nationals attended private healthcare points, which were not applicable for their government sponsored health covers (Chaudhary, 2019).

Most of the literature compared the cost of illness (IHD) based on the various ethnic groups in the area of study. Blair, Huffman and Shah (2013) compare the Hispanic, African American, white, and Chinese American cost of cardiovascular disease but does not take into account their nationalities. Failure to dissect the cost of cardiovascular illness as per the population nationality makes such data scarce. Arguably, it is also an aspect that makes the current study to be regarded as a pioneering study as it compares the cost if illness based on nationality. This makes immense contributions to the available literature framework by comparing the cost of burden on the Non-UAE nationals as compared to the UAE nationals. Even though, the limited length of the study could not accommodate the comparison of the UAE nationals COI with respect to the different nationalities of the Non-UAE national. The diversity as well as the fact that there was dozens of different nationalities would generate voluminous data, which could not be contained in the limited space of the study. The finding was significant in the sense that it confirmed Blair, Huffman and Shah (2013) study which showed that indeed different nationalities had incurred different medical costs.

5.5.4 Association between the Total IHD Related Cost and the Diagnosis Group

It was portrayed that IHD patients diagnosed with Acute MI, Subsequent STEMI and NSTEMI, Other Acute IHD, Angina Pectoris, and Complications Following Myocardial infarctions had significantly different means of total direct costs of illness. As such, IHD patients with Acute MI have the highest cost that is significantly different to other diagnosis groups, which had significantly lower costs such as Subsequent STEMI and NSTEMI. Even

though Acute MI, STEMI, and NSTEMI diagnosis had huge and significantly different cost of illness amounts, other Acute IHD and Angina Pectoris have much smaller but significantly different costs evident within the two groups of diagnosis. Only the patients with complications following MI incurred the lowest total cost that was significantly different from the other diagnosis groups.

Such difference in costs within the various groups of cardiovascular conditions diagnosis was expected considering that each and every condition necessitates different procedures and activities for treatment (Osman, Alsultan and Al-Mutairi, 2011). The varying levels of the required services and activities of healthcare treatments for the diagnosed condition make them translate into different costs cluster over a period of time. The finding implies that having condition as Myocardial Infarction in the UAE had the potential to inflate mean total direct costs. The finding was significant in the literature context and the Dubai policy makers as it was in a position to outline the IHD condition that significantly contributed to high cost of illness in the private healthcare sector. The finding was also significant after considering the benefits that the finding offers to the healthcare policy makers. In this case, they will be in a position to formulate strategies to reduce the overall cost of MI, as it seems the some of the government expenditure in the healthcare costs emanated from individuals with MI.

5.5.5 Association between the Total IHD Related Cost and the Encounter Type

Outpatient or inpatient total direct cost means of IHD patients visiting the private healthcare sector in Dubai for healthcare services had different means in total direct cost that was statistically significant. The outpatient IHD patients had lower mean total cost of IHD treatment services as compared to the inpatient IHD patients. The statistically significant difference in IHD healthcare services cost in respect to the encounter type (outpatient or inpatient) was thereby validating that inpatients paid more than the outpatients did for their cardiovascular conditions. The finding was expected since being an inpatient is different from being an outpatient. As a result, the range of healthcare activities, services and other aspects prevalent in both cases are completely different (Dunlay et al., 2011). Out of the differences that characterize the context and environment in which outpatient or inpatient is treated under; the costs of healthcare services are subject to differ. Such understanding makes it expectable that the encounter type of the IHD patients were in one way or the other capable of defining the cost of illness at the end.

According to Li et al. (2012), inpatients mostly pay significantly different total direct costs for their healthcare treatments as compared to the outpatients. This explains why some regions as if China adopts healthcare support policies where inpatients insuring is taken more seriously than outpatient healthcare services (Li et al., 2012). However WHO does not regard the China approach of enhancing inpatient care as universal coverage framework as put by the organization (WHO). Nonetheless, the prevalence of China population to pay high costs as outpatients provides a justification that inpatients pay relatively higher total direct costs than the outpatients do. Therefore, it can be argued that Dubai private healthcare system is not different from healthcare systems from

other regions. Meaning that most of the regions (Dunlay et al., 2011; Schlatter, Hirakata and Polanczyk, 2017) also experience significantly different inpatients total direct costs as compared to the outpatients.

The finding becomes significant as it pinpoints the encounter type in the Dubai private healthcare sector that leads to high costs of illness. This implies that if the policy makers in Dubai can manage to control the cost of inpatients by reducing the patient out-of-pocket share, then the total direct costs of IHD can be reduced with a significant percentage. The finding is also significant considering that no other study in Dubai had assessed the significance of mean direct cost after being admitted as an inpatient or as an outpatient. The study provides insights that the mean total direct cost differs significantly for the population based on the encounter type. From the Dubai's context, the finding implies that the inpatients cases of IHD are consuming more healthcare services compared to the outpatients.

5.5.6 Association between the total IHD Related Cost and Charlson Comorbidity Index

From "stylized facts" empirical approach, preliminary findings outline a predictable association between the CCI score and the overall total direct cost of IHD patients. The higher the IHD patient CCI score was, the more the total direct cost was subject to increase as depicted by the correlation coefficient. In each and every mean of the total direct cost of illness (IHD) of the CCI groups, there was a statistically significant difference. . IHD patients within the severe CCI group had the highest mean of total direct cost of illness (IHD) followed by those within CCI group "moderate" and finally the CCI group "mild" – out of which all the accounted differences in total direct cost of illness were statistically significant. The finding was considered valid considering that elsewhere the CCI groups were some of the reasons why total direct cost of cardiovascular diseases increased (Schlatter, Hirakata and Polanczyk, 2017). However, the difference between the current study and Schlatter, Hirakata and Polanczyk (2017) study was that the previous study only mapped a few IHD diagnosis groups as compared to the current study, which listed and tested a number of them. The finding makes the current study significant in the body of literature as it substantiates the statistical significance of mean of total direct costs of a wide range of diagnosis group. Such finding suggests that when IHD patients have other comorbidities, they are likely to incur higher direct costs mean – which are significantly different from other IHD patients in different CCI index. The total direct cost means for the different CCI groups revealed that patients with low level of comorbidities had significantly lower cost of illness compared to other patients with mild or severe comorbidities.

The finding outlining that severe comorbidities are associated with high COI due to statistically significant reasons is contributory to the available literature framework. As no other study in Dubai emirates had previously mapped the association of comorbidities in the region, the findings of the current study thereby provide a basis for future studies to estimate if the impact of comorbidity index on the total direct cost of illness has shifted to the better or to the worse.

5.6 Predictors of the Direct Cost among Patient with IHD in Dubai

Multivariate linear regression generated and expressed a model that manifested the relationship of the demographical variables and the total direct cost of illness. The model aided the researcher to group the most significant predictors of ischemic heart disease direct costs. The predictors of ischemic heart disease cost were age, nationality, gender, encounter type, activity type, and diagnosis and Charlson Comorbidity Index. Each and every predictor had a statistically significant influence to the overall direct cost of Ischemic Heart Disease.

Complication following MI Group had the most predicting power of 71.4% towards the patient direct total cost followed by the patient's diagnosis where Sub. STEMI and Non-STEMI Group have a 49.8% to increase a patient's total direct cost. The Charlson Comorbidity Index of the patient can increase the patient's total direct cost incurred by that patient will increase by 37.7 %. Then the activity type for the IHD patients has a predictive power of 39 % - whereby the total direct cost will increase by 39%. Then the patient diagnosed with Myocardial Infarction Group, his total cost has a potential to increase by 21%. The inpatient encounter will incur 14 % higher costs compared to the outpatient encounter among IHD in Dubai. The patient belongs to the diagnosis group of "Other Acute IHD" his total cost will increase by around 12 percent as per the regression model. The patient's nationality whereby being a UAE national the cost will increase by 10.6 % compared the IHD patients from other nationalities. Angina Pectoris Group diagnosis followed whereby the patient direct total cost will increase by 7 percent as per the regression model. The age follows where the patient will increase by one unit (one year), the total cost incurred by that patient will increase by 4%. Finally, the variable with least predictive power of the total direct cost was gender affiliation. Being a male has a predictive power of 3.6 % to one's total direct cost of IHD. Arranging the demographical characteristics with their predictive power, the most significant predictor that had the most influence on the total direct cost was; Complication following MI Group, Sub. STEMI and Non-STEMI, Charlson Comorbidity Index, activity type, Myocardial Infarction, encounter type, patient's nationality, age, and finally gender had the least potential of informing on one's total direct cost of IHD.

The magnitude of the above characteristics to predict the total cost varied greatly. This means that; if patients visited the hospital or were hospitalized the cost they would pay for the healthcare services would be based on their characteristics or other associable factors. For example, the diagnosis was the leading factor in predicting the overall cost as the study results shown that patients diagnosed with "Complications Following MI" would incur higher cost compared to patients from other diagnosis group such as Acute MI. After diagnosis group , any existing comorbidity impacted on the total cost of IHD; with those with severe comorbidity score paying higher than those with mild comorbidity score who had low cost. the type of services or activity given to IHD patient in a healthcare followed and determined the total cost greatly; with those whose services were mostly CPT paying higher than the IHD patients who were in need of medications – who had low costs. Myocardial Infarction Group followed which is also a diagnosis group but with lower predictive capability than Complications following MI and Sub. STEMI and Non-STEMI. Encounter type followed in terms of its magnitude to predict cost where

inpatient would attract high total direct IHD cost as compared to the outpatients. Nationality magnitude followed where UAE nationals would attract high total direct IHD total costs than IHD patients from other nationalities. Age magnitude followed after diagnosis and the higher the IHD patient age was the more they attracted high costs as compared to the younger age category. Finally, the magnitude of gender to predict the final cost was the lowest with females paying higher costs for IHD treatment than the males.

Literature on diagnosis type has been in a position to show practically how a certain diagnosis can predict the total direct cost of IHD. In Dhalla et al. (2009) study, through economic evaluation assessed the outcome of secondary medication for MI. The researchers were successful in proving that providing free MI medication through full coverage was associated with increased cost (20,423 USD vs. 17,173 USD). However the study did not outline the percentage of increase, but calculating the percentage of increase from the figures above show that there was an 18.9% increase – which is close to the predicting power of the current study (21%). The current study has defined magnitude that each and every characteristic and aspect contributed to the overall cost of illness (IHD) in Dubai. Arguably, these demographic variables and other aspects as encounter type, comorbidities and other complications thereby become predictors of the total cost of illness. The current study finding classifying the predictors as per their magnitude towards the cost of illness of (IHD) has significance in the available literature body. The available literature is lacking studies that give empirical data to show the predictors of cost among IHD patients. As such, the finding of the current study help in understanding the exact impact or predictive power of those variables characterizing an individual on the total direct costs of illness (IHD). Furthermore, the finding provides a formula in which the Dubai patients with IHD and the insurance bodies can use to predict an estimated cost of IHD patient over time. The finding therefore implies that IHD patients can now be in a position to predict their probable total direct costs and plan appropriately (Durand-Zaleski, 2008). However, despite the significance of the finding, it has been limited by the formula complexity. As such, illiterate IHD patients cannot utilize the formula to estimate their cost of illness over a given period.

All the demographical variables (age, gender, and nationality) as well as other characteristics (diagnosis, encounter type and Charlson Comorbidity Index), had a significant level of association with the total cost of illness among IHD patients. This means that the confidence level was below the set range ($p=<0.05$). Therefore, the null hypothesis was rejected and alternate hypothesis was accepted. It was evident that there is an association between the total cost of illness among IHD patients and demographic factors (age, gender, and nationality), diagnosis, encounter type and Charlson Comorbidity Index.

The findings suggest that hypothesizing that the demographical variables and the other patients characteristics such as diagnosis, encounter type and Charlson Comorbidity Index position to inform on the expected direct cost of illness the patient might incur. The finding becomes significant not by outlining the COI predictors but due to its ability to show the magnitude of each factor towards the aggregate COI (IHD). While other studies had shown the predictors as per their magnitude, the current study depicts that predictors are regional specific and cannot be

probably replicated elsewhere. This makes such finding imperative more so in the Dubai context, which had no similar previous study.

5.7 Summary

From the extant COI literature, the unequal distribution of the demographical variable, for example the gender in the healthcare points has always been depicted to be mostly made up of larger percentage of men compared to women. This was also the same case in Dubai where males made a larger part of the study population. Evidently, having more males than females who attended the private healthcare sector in Dubai explains why the mean cost of males was higher than that of female over the period of study. The discussion was also in a position to manifest that the burden associated with the IHD, in terms of cost, was mainly due to the high CPT costs. Nonetheless, drugs cost was least making the IHD leading to the conclusion that the insurance covers covered the drugs cost significantly in their plans. Although, IHD patients above 80 years had high costs for medications. Contrary to the expectations, UAE nationals were the had high out of pocket costs despite having health insurance policy covers from the Emirates federal government. Notably, such finding arouses more interest to explain how the scenario came to be. Interestingly, the huge amounts OOP expenses by the UAE nationals were associated with the inefficiency in the public healthcare points – which they were supposed to use in order to benefit from their cover. Instead, the UAE nationals have always favored private care points, of which their health insurance covers do not cater for. This leaves them with significantly high OOP. Lastly, each and every factor or aspect that characterized a patient with IHD had diversified magnitude of influencing the end cost of IHD, with activity type being the most impactful aspect on the aggregate cost.

CHAPTER VI: CONCLUSION AND RECOMMENDATIONS

The purpose of the study was to assess the total direct costs and out of pocket costs for patients with IHD in Dubai Emirates. Completion of this study marked it as one of the pioneering study on the total direct cost of IHD patients in the Dubai Emirates. In order to conclude the study, this section draws the main and the significant findings from the study. Overall, the implication, significance of the study, recommendation and limitations of the study were all consolidated in this chapter. The main aim of the chapter is to draw conclusions on the findings of the study and evaluate if the aims that were developed at the preliminary stage of the study were met. The section refers to the main findings while offering conclusion to the study findings as well as the implications of the study. The section also outlines the significance of the study findings and finalizes by noting down the limitations facing the study as well as offering some recommendations.

6.1 Conclusion

6.1.1 The Cost of Ischemic Heart Disease in Dubai Private Healthcare Sector

The IHD costs in Dubai private healthcare was driven by foreigners. It becomes evident that most of these costs recorded in the private healthcare were either due to the expatriates, medical tourists and other foreign nationalities residing in the UAE. It was also evident that the prevalent IHD condition for both UAE nationals and non-nationals was acute Myocardial Infarction – which again influenced the estimated cost of direct costs greatly. In all the IHD conditions prevalent among the patients', most common disease management activity was CPT services. Therefore, most of these costs were largely due to Current Procedural Terminology followed by services costs, and then HCPCS cost. Finally, drugs had the least impact on the on the aggregate cost of illness (IHD). When the cost of illness (IHD) was assessed under the scope of variables such as age, gender, comorbidity, activity type and nationality, each variable category had different mean cost.

Based on the estimate of IHD cost, it was concluded that most of the services cost paid by the Dubai federal insurance and other institution insuring individuals was used to cater for CPT services. Drugs/ medications used up the least funds that the insurers contributed to cover for IHD costs. Therefore, CPT services were more costly than drugs during the study period. By noting that drugs as a cost indicator of IHD had the least impact on the estimated direct cost, it could be concluded that the government initiative of introducing subsidy on drugs was effective since drugs costs contributed little to the estimated direct cost of IHD..

Different mean cost based on the variable characterizing IHD patient led to the conclusion that cost differences are not due to unequal sample size for each variable but due to the diversity of variable characteristics exhibited by each and every IHD patient. In conclusion, cost of illness (IHD) can be influenced by the characteristics that define an IHD patient. The finding also implies that unless patients with IHD had exactly similar characteristics in all variables such as age, gender comorbidities, nationality and encounter type, their cost of illness (IHD) is a subject to differ.

Overall, the findings can be applied practically by Dubai healthcare policy makers and institutions insuring for healthcare needs henceforth. Where Dubai healthcare policy makers can use the data from the current study to compile a budget for IHD related cases. By allocating budgets of IHD, the institution can be in a position to commission more research into the condition as well as decide where to set priorities in the overall healthcare system. Healthcare insurance providers can now be in a position to note healthcare activities or services that costs them more and in return commission a research or approaches meant to understand how the condition can be prevented or maintained with the lowest costs possible. Practically, Dubai private healthcare centres are private entities and profit based institutions. And therefore, they need to reduce their overall input while maximizing their output so that they can attain much higher profit margins. For instance, these private healthcare institutions dealing with IHD in Dubai Emirates used most of their resources to attend to non-nationals, those with Acute Myocardial

Infarction by primarily offering them those CPT services. With that being noted, these healthcare institutions can decide to unveil new and cost friendly disease management approaches for acute Myocardial Infarction – which will in return reduce the overall costs of CPT services.

The findings above were complemented by the significant contributions they make to the available body of literature. The findings contributions to the literature framework are significant since; there was no recent estimations of direct costs of IHD in Dubai region – apart from Emirates Cardiac Conference white paper. Therefore, the current study pioneers cost of illness studied (IHD) that are context specific. Context specificity was imperative considering that the study was in a position to come up with a study that is first of its kinds which could be consulted by future studies from the same region. On a practical note, the basis that the findings set offers an opportunity for consequent studies in Dubai Emirates to manifest the trend of IHD costs in the near future. As a result, the possibility of an increasing or reducing cost of illness (IHD) in Dubai will be informed by comparing future studies IHD cost with the cost outlined in the current study .

Secondly, the study contributes significant insights towards the development of healthcare policies in Dubai. There was no past data that could be used to by Dubai healthcare policy makers to make fact based decision towards IHD costs management. Unavailability of data in the Dubai Emirates (Emirates Cardiac Conference, 2017), has however changed with the introduction of the findings from the current study. In totality, the findings pertaining cost of illness (IHD) were in a position to close the existing knowledge gap in the literature. The ability of the study to cover the knowledge gap was evident where clear outlines associated with the inconsistencies introduced by methodologies (Tarricone, 2006; Drummond, 1992) are made. In closing knowledge gap emanating from regional aspects, discussion showed that different regions have varying levels of IHD cost, and the study showed that Dubai have a bit higher costs than other counterparts in the GCC region - the patients based in Saudi Arabia.. The study also made the costs of a specific disease known thereby closing a knowledge gap. From the literature, cost of illness studies were available in Dubai Emirates and they covered other diseases such as diabetes, depression among others but only a few indulged in finding the actual costs of IHD. When the estimated costs of IHD were compared to such studies, it was notable that due to disease specificity (disease type), some diseases like the diabetes may have high medication costs (Yang et al., 2018) but IHD have maintained lower medications cost.

In regards to complementing the issues of methodology outlined in the literature, the study findings adopted a different methodological approach. Instead of using incidence based approach which generates disputable cost of illness (Segel, 2006; Tarricone, 2006), the current study used prevalence based approach to counter the methodological limitation such as cost discounting. Whereas incidence based approach would have used cost discounting for the forthcoming illness costs, the current study used actual cost figures thereby mapping the actual illness costs at the period of study.

6.1.2 Out-of-Pocket (OOP) Expenses Paid by IHD Patients in Dubai

Patients with IHD in Dubai paid out of pocket costs equivalent to 61 million (67% of the total cost). The insured paid 7 million AED of the direct medical costs of IHD patient in Dubai private healthcare – meaning that the rest (53million) was paid by IHD patients who were regarded to have no insurance. In terms of patients count 58.1% of IHD patients paid around 61% OOP out of the total cost of illness.

The age category that experienced the most cost burden of IHD was those between 20- 39 years of age more so on HCPCS services. The burden of IHD also succumbed those with mild CCI score. While on the other hand, non-nationals were the IHD patients' category which experienced high IHD burden when it came to managing the condition.

The estimation of OOP for IHD patients in Dubai private healthcare informed that the patients attending private healthcare sector were burdened by the IHD condition. An overview of the out of pocket cost can be misleading owing that it shows that IHD patients from Dubai private healthcare sector use more expenses from their own pockets than the expenses that their insurers paid to cover for their healthcare services. However, this is not true since the high out of pocket costs recorded were due to IHD patients with no healthcare insurance plans. As such, those who had no health insurance covers absorbed all their healthcare costs. This means that they paid for each and every service or activity that was required to manage their condition from their own pockets. Therefore, it was concluded that IHD patients in Dubai private healthcare experienced little or no burden from their illness. The healthcare insuring bodies had covered the activities/ services that these patients used in order to manage their conditions. It also becomes apparent that the healthcare insuring bodies in the UAE have been in a position to make healthcare services more affordable for their clients– more so for the IHD. Additionally, the healthcare insurance providers had conformed to the government directive that required them to have cost sharing plan not exceeding 20%of an IHD of the total cost. .

The findings imply that out of the total cost of illness (IHD), most of the funds came from the IHD patients. The finding also implies that when it came to the private healthcare sector health insurance bodies or the government sponsored insurance contributed much less than the IHD patients. The finding can be used practically to inform the Dubai healthcare policy makers to strictly enforce the need for everyone to have current healthcare treatment cover from the healthcare insurance providers or the patients to attend their network group of hospitals. Reason being, some of the IHD patients were found to have no insurance plans when seeking IHD treatment/ management services.

The issue of medical cover or having no medical cover led to the conclusion that; IHD patients in Dubai private healthcare contributed much from their pockets to have their IHD conditions maintained not because the healthcare system was expensive but due to lack of medical cover. In real sense, if each and every IHD patient was covered by health care insuring bodies, they would have paid very little money to manage their conditions.

Overall, it can be inferred that, high out of pocked costs for the IHD patients in Dubai private healthcare sector was due to non-current medical cover and the patients tendency to visit healthcare canters that were not covered by their healthcare insurance providers.

Since the study lays a foundation that future studies on OOP costs can consult, the findings can be regarded as significant. Notable, the finding outlining the average OOP paid by Dubai IHD patients in the private healthcare has significant contributions to the literature. It contributes to the little body of OOP costs literature. Estimating OOP costs in the Emirates of Dubai is significant as no other study has ever mapped the prevalence of OOP costs, more so in the UAE. Secondly, the significance of the study finding is depicted by the ability to present OOP costs characterizing Dubai private healthcare sector. Such findings make the study to be regarded as a pioneering study in the exploration of OOP costs of IHD in Dubai. Third, significance of the current study finding is based on the need to have recent COI studies that has an explicit interest on the OOP costs. The finding was in a position to outline the most recent OOP expenses in the Dubai healthcare literature – thereby complementing the available literature on OOP costs with latest and updated findings.

From the perspective of the patients who have IHD, the study findings become significant by outlining the patients who are most likely to incur the most OOP costs. The high risk group that is likely to experience surprise costs in terms of OOP costs can therefore be able to plan ahead – after they have considered the study's finding to establish their risk category. Practically, no licence will lead to a 100% OOP cost which can be termed as surprise costs.

6.1.3 The Role Played by the Patient's Demographic Factors while Estimating IHD Costs

As age increases, the cost of illness (IHD) increases with a significant difference on the mean total cost for each age category. The finding led to the conclusion that the older IHD patients led to more IHD healthcare services cost than the younger population. The conclusion implies that the older the Dubai based IHD patients became, the more they costed the healthcare insurers and the federal government health insurance. Males had higher and significant mean costs of illness (IHD) as compared to the females. The finding could not lead to solid conclusions owing that around half of the patients' genders had not been captured. Therefore, most of the costs denoting cost of IHD in Dubai private health sector were either due to males or the females with a little or more variance in their contributions.

Acute Myocardial Infarction had the highest cost of illness followed by STEMI and NSTEMI, other cute IHD and Angina Pectoris. As the number of comorbidities, that IHD patient has increases (severe) the costs of illness increased also as compared to IHD patients with few (mild) comorbidities. The conditions mean costs were statistically significant leading to the conclusion that treating IHD patients in Dubai with comorbidities like Acute Myocardial Infarction costed the healthcare insuring bodies more than those with Angina Pectoris. The conclusion implies that no single patient with certain comorbidity had the same illness costs. Also when an IHD patient suffered from more than one condition related to IHD, the more their cost of illness (IHD) increased.

Inpatients with IHD had lower mean illness costs as compared to the IHD outpatients. The finding led to the conclusion that admitting IHD patient in the private healthcare of Dubai always led to significantly higher illness costs. Therefore, it was concluded that, consuming IHD treatment services as an inpatient led to increased IHD costs. The same effect spills to the private healthcare providers in Dubai where it was conclusive that when the healthcare centres offered services to IHD patients as outpatients, they were more likely to consume less hospital resources.

UAE nationals with IHD in the Dubai private healthcare sector had significantly lower mean cost of illness (IHD) than IHD patients from other nationalities. The finding led to the conclusion that being a UAE national in Dubai private healthcare led to low cost of illness. The finding implies that cost of illness (IHD) in Dubai private care was sensitive of nationality with the non-nationals driving the cost of illness much higher.

Findings associating various variables that characterize a patient with predictive capability of cost of illness (IHD) have a significant contribution to the literature. They first conform to the tendency of COI studies to use stylized facts as basis to make conclusion based empirical analysis (Schlatter, Hirakata and Polanczyk, 2017; Khan, Mairaj, Khan, Ahsan and Ali, 2017; Aljefree and Ahmed, 2015). In addition, by doing so the study confirms that indeed stylized facts can lead to high levels of association but cannot fully explain causality. Therefore, the finding can be said to contribute much to the available body of literature by noting that even though stylized facts are used, it is important to establish causality as the association may not be true always – a factor that makes most COI studies inconclusive (Russel, 2001). Based on Russel remarks that most COI studies are inconclusive due to their failure to map significance between demographical variables or even causalities, the study built more concrete evidence. The additional evidence was significant considering that it added a conclusive study to the literature framework after assessing the statistical significance between demographical variables and characteristics. A such statistical significance between characteristics such as age, gender, nationality, comorbidity and encounter type and cost of illness (IHD) was established thereby making it clear that the unequal distribution of the sample size did not influence the mean cost of illness but the variables nature had power to alter the cost of illness even in equally distributed sample size. The finding was not only a significant contributor to the inconclusive literature framework but also contributed resourceful insights pertaining to the scarce literature in the UAE region on cost of illness (IHD). The specific interest on the association between variable characteristics and cost of illness made literature on COI (IHD) study available in the UAE region, Dubai Emirates with conclusive evidence in regards to the association between demographical characteristics and cost.

6.1.4 Predictors of the Direct Cost among Patient with IHD in Dubai

Demographic characteristics and other patients' factors can be used to approximate the cost of illness (IHD). The predictive strength of these factors and characteristics varied greatly with activity type having the most significant influence on cost followed by, Charlson Comorbidity index, diagnosis, age, encounter type, nationality and finally gender. The finding led to the conclusion that; each and every characteristic or factor that defined a patient influenced the cost of their illness but not as effective as the combination of all the factors/characteristics. However some of the predictors can be concluded to have a stronger effect on the IHD cost than others. For instance, activity type was more capable of inflating the IHD cost as compared to gender. This means that activity type during IHD treatment or management could inform if the IHD cost of a patient would be higher or lower as compared to other predictors' which could not inform the total IHD costs to greater extents.

The finding implies that; mapping IHD patients cost in the Dubai private healthcare is more accurate when all the demographical variables and other characteristics defining an individual are combined together.

Finding out that a combination of demographical variables and other characteristics can be used to predict IHD patient cost offers an opportunity for generalisation of the formula to other Emirates; like Abu Dhabi. By using the formula, other Emirates in UAE can as well predict their cost of illness based on their identifying variables. The finding can be used in such a manner considering that Emirates have almost similar healthcare system. Additionally, the study population was large thereby beating the limitations of few sample size and insufficient data records (Tarricone, 2006).

6.2 Limitations and Recommendation

6.2.1 Limitations

CPT comprised of a range of healthcare services such as procedures cost, medical, surgical cost, laboratory cost and diagnostic services – of which overall costs of these services were consolidated into a single measure. Each and every factor under CPT is characterised by its own direct costs; which are independent from each other. Nonetheless, the study was not in a position to assess the aspects consolidated under the CPT individually due to the limited length of the study. If each and every aspect under the consolidated categories such as the HCPCS and CPT were tallied individually, voluminous amount of data would have been generated. Such data would require more space than the one allocated for the study. Also, analysis needed to cover such data requires unlimited space in order to come up with comprehensive findings. Consolidating a range of activities and services under CPT category acts as a limitation to the study since it is an assumption that all the factors under CPT have equal contributions towards the overall cost of CPT activities. Main limitation of this assumption is that the finding cannot be used by Dubai healthcare policy makers to assess the actual HCPCS or CPT service that they should divert their interest to in order to maintain costs or reduce the burden of illness associated with such aspects. In relation, assuming that procedures cost, surgical cost, laboratory cost and diagnostic services amounted to equal

costs for the patients is flawed. Every aspect has its own unique costs: which can rarely be shared between different aspects. Considering these insights, the study was therefore in no position to tally succinct direct costs associated with the type of healthcare service or activity utilized by the Ischemic Heart Disease (IHD) patients. Rather, an aggregated cost was represented – which was all inclusive of the consolidated aspects and activities. Even though the overall direct cost of IHD would not have changed if the individual activities or services were analysed independently, there would have been deeper insights. For instance, the actual cost of illness from each and every healthcare service or activity would have been evident. But the main factor was that; the aggregate cost of illness (IHD) had been mapped. And the study being first of its kind in the Dubai region manifesting general understanding of IHD costs is sufficient for now. The study acting as a pioneering study in the Emirates was in a position to offer sufficient background data which further provides a framework that future studies can consult.

Although it was inconclusive if the OOP expenses were inflated by the aspect where the IHD patients were said to have no insurance. The meaning of the term "no insurance" could not be established. The secondary data did not really distinguish if the term meant that the IHD patients completely had no healthcare insurance plans (not subscribed to any insurance plan) or they had basic insurance covers (health insurances covering a few basic care services) or they attended private healthcare points that were not recognised by the network group of the insuring bodies. All in all, despite lack of understanding pertaining to the actual meaning of the term, reliable and valid OOP costs were established. However, it was first imperative to establish if the OOP costs were relatable to any other study. The reliability and validity of the findings was established by comparing the estimated number of patients who paid OOP costs in Dubai and those in Nigeria. Oyibo (2011) showed that 63.6% of the studied population relied on OOP costs for their healthcare services – which is comparable to 58% for Dubai patients who paid significant amounts of OOP.

The study has adopted some of the most common measures which have been used throughout the literature to map direct medical cost and OOP (Byford et al., 2000; Jo, 2014). The cost measures used include CPT and HCPCS, drugs, and services. Nonetheless, there exist other cost of illness measures like indirect costs and the intangible costs (Byford et al., 2000), some of the direct costs measures have been included in this study but intangible costs and indirect costs have not been measured. It therefore becomes a limitation to depict the current costs as an exhaustive representation of the IHD patients cost of illness (Ernstsson, Gyllensten, Alexanderson, Tinghög, Friberg and Norlund, 2016). The researcher avoided the limitation by noting in the literature review that there are various approaches which can be used to analyse cost of illness. Further, the researcher specified that only direct costs were being considered. Therefore, it made it clear that there was a knowledge gap that needed to be filled, since the study was interested in only assessing costs from a single sided perspective (direct costs). It acts as a call for future studies to build upon the study settings and develop research questions that will map indirect or intangible IHD costs.

The study argued that those who had no healthcare insurance inflated the overall OOP cost for all the IHD patients' including those who had healthcare insurance. But the study would become a great hindrance when practically applied by Dubai healthcare system to establish why OOP costs turned out to be very high for the patients. Evidently, it has not been substantiated why Dubai residents would have no healthcare insurance owing that it is a mandatory thing. This makes the analysis of OOP costs incomplete as it was not possible to explain further if actual lack of healthcare insurance, attending non-healthcare insurance covered hospital or basic covers covering for limited services were the actual cause of being termed as having no healthcare insurance. However, with data being available on the insurance covers for the IHD patients, it could have been possible to deduce what no insurance meant. Unfortunately, the data available did not cover the healthcare insurance details much deeper. The researcher dealt with the issue by noting that the estimated costs were the valid OOP costs within the study period. This made it clear that there was the need to research further to determine the content and impact of no insurance term in the private healthcare of Dubai. Such a study is possible only when data is collected from another approach (bottom-up approach) as opposed to the top-down approach that was used in the current study.
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However the study mapped the total direct cost of illness (IHD), there was no clear indication which healthcare sponsor absorbed these costs. Arguably, the healthcare bills are catered for by the healthcare insurance bodies, sponsors, and the government. In order to inform the healthcare services sponsors, it was more beneficial to map the specific party that catered for the direct costs. Through such an approach, the respective body would be in a position to know how much funds they spent on IHD through the study period. Another reason for the need to show the costs associated with each party was the fact that an expenditure of one party is the income for the other. Therefore, when one part expenditure increases, the other party income increases proportionally. When the exact expenditure or income of a certain party becomes known then it becomes possible to establish a common point for the sponsors to balance their expenditure and income.

6.3 Recommendation

6.3.1 Recommendation to the UAE Healthcare System

The total cost of out of pockets that was paid by the patients was within the permitted range. However, for those without medical covers had a 100% out of pocket cost, where they were required to fund their treatment with their own finances. As a result, it makes it look like the IHD patients in Dubai private healthcare are experiencing high burdens of illness. Shippee, Shah, May, Mair and Montori (2012) through cumulative complexity theory shows that the more burdens of an illness increase the workload also increases and in return affect the patients' health outcomes. In connection to poor health outcomes, mortality, disability, lost productivity and income, high dependency on others also increases. Therefore, it becomes evident that IHD costs which translate to burden on patients should be managed. It is recommended that the government should enact policies where everybody should have a current medical cover always. Optionally, patient should also be advised to attend hospitals that are within their network group and if it is not possible, they should have medical covers that gives them an option to claim the out of pocket funds used during their treatments. Through the approach, the OOP cost realized in Dubai private healthcare would go down.

Since the inpatients have been found to be impacted most by high out of pocket costs, it is advisable that the healthcare system should start using Heart Failure Disease Management (HFDM). The model involves taking phone roll call of a patient as an alternative to primary care service, sending of mails to the patients, telemedicine technologies where telecommunication infrastructures are used, and face to face visits are the most common HFDM communication approaches (Jerant and Nesbitt, 2005). Such communication approaches can also be adopted for IHD patients' management in Dubai. Use of HFDM model concepts is further very much applicable in Dubai since the Emirates support the tools that the model uses to deliver its benefits. For instance, most of the HFDM model communication tools uses telecommunication infrastructures to deliver its benefits. Considering that Dubai has advanced greatly in the technological field, then the application of the HFDM model should not be problem. Only one HFDM model communication tool uses tradition approach (face to face visits). As telecommunication cannot support this HFDM encompassment, the mobility efficiency in the region comes in handy. Dubai mobility is effective ranging from private cars and public means – of which all are efficient. Therefore, they can be in a position to facilitate face to face meetings with the Dubai IHD patients. Despite the wide array of infrastructures that are in position to support implementation of HFDM model for the IHD patients, there are also some limitations that can limit the effectiveness of the HFDM model replication. The impending factors include; little or no incentives to start and maintain the model, mainly due to incompatible reimbursement system (Jerant and Nesbitt, 2005). The scenario was evident in the U.S where incentives to facilitate the model lacked due to the reimbursement structure of the US healthcare system. Noting that there was incongruity between incentives and reimbursement structure in the US does not however mean that the HFDM model did not deliver its core purpose but it means that the model needed a favourable reimbursement structure complemented by

incentives. As a result, HFDM model can be applied in the private healthcare sector of Dubai only if the Emirates lays down the facilitating requirements; reimbursement structure that supports incentives. As a subsidiary recommendation for the workability and replication of HFDM model to Dubai, it is recommended that the Emirates should align the healthcare reimbursement structure with the initiatives in order to make HFDM model effective.

CPT services depicted as the aspect of healthcare services that translated into the largest contributor of costs. In order to reduce costs emanating from the CPT category, it is recommended that the healthcare system should commission research and development studies to establish cost saving CPT services. Cost saving CPT services can include researching and enhancing one or several categories classified under CPT such as surgeries. In reducing surgery costs, cost saving surgery procedures can be introduced thereby bringing the surgery costs down and perhaps the entire CPT category costs. Coming up with a cost saving healthcare services was supported by the literature as a method of ensuring cost effectiveness. On a specific note, introduction of cost-saving medications were used for hospitalized heart failure patients (Jerant, and Nesbitt, 2005.). The applicability of the cost reduction though research based cost reduction of CPT category (surgery) is also supported by the UAE's ability to position itself globally as a healthcare tourism destination. The reputation has seen the region reputation grow while at the same time attracting foreign direct investors in the medical field (Dachraoui, K. et al., 2016). Expertise from the global players can therefore be stimulated to come up with cost effective surgery methods, cost effective treatment and cost effective laboratory procedures as well as technologies. Upon introduction of such cost effective healthcare services more so in the CPT category will lead to cost effectiveness in treating and maintaining IHD. The recommendation is however limited by the relative novelty of UAE in the healthcare industry. Even though UAE has positioned itself as a destination for healthcare tourism, it has not been specialising in the trade for long. The aspect leaves doubt whether UAE will be in a position to innovate such cost effective tools and services. Additionally, the recommendation is time based and cannot yield results instantly after its implementation. This is due to the fact that research and development meant to innovate new technologies, processes and procedures may take time before breakthrough.

Notably, Dubai Private healthcare sector is made up of healthcare institutions that operate under profits and loss accounts business model. They therefore, need more returns on their investment in order for them to operate efficiently and profitably. It is therefore recommended that private healthcare institutions in Dubai should consider cutting operational cost on activities that are mostly used by the IHD patients. They include CPT services, HCPCS services and outpatient services. Reason being, by reducing operating costs will automatically lead to profits due to the saved resources. However the recommendation is very much applicable to the Dubai private healthcare sector, it has a major limitation. Reducing operating costs may at some point tamper with the quality of services provided to the IHD patients. Therefore, the recommendation is reinforced by suggesting that applicable costs reduction approaches grounded by research and other management theories like lean management and continuous improvement are implemented.

6.3.2 Recommendation for Future Studies

The study adopted a top-bottom approach to map the cost of illness (IHD). However, the study was not limited by unavailability of data that is prevalent in top-bottom approach; it is highly recommended that consequent studies should build on the current study settings. Consequent studies should use bottom-up approach to map the illness among the Dubai patients in the private healthcare sector. By using another approach, the studies will be in a position to substantiate the reliability and validity of the current study by comparing the end results. In applying the recommendation, there is a high probability of successful application considering that the current study has laid basis that these future studies should build on. The only limitation that faces the application of the recommendation is availability of data to be used in the bottom-up approach. Notably, bottom –up approach uses patients' data to map such costs and in some cases such data may lack or may be misrepresented (Segel, 2006). In cases where such studies are commissioned with no enough data, the probability of coming up with flawed cost figures is high. However, use of large sample size can counteract the effect of unavailable data (Brodaty et al., 2014). It is therefore recommended that consequent studies using bottom-up approach should use large study sample as a way of ensuring reliable and valid findings.

The study evaluated direct cost of illness (IHD) from top-down approach by considering prevalence of cases throughout the study period. Evidently, cost of illness from other cost indicators such as indirect costs and the intangible costs were overlooked – despite their importance. Additionally, using the prevalence of IHD cases as the perspective to take also overlooks the importance of incidence based perspective. Whereas when we consider the prevalence based perspective limitations, it is evident that results from such a study are noting a position to predict future costs of illness the way incidence based perspective does. In regards to the inability to cover all the related and fundamental aspects such as indirect costs, intangible costs and incidence based perspective, it was recommended that future researchers should integrate the noted aspects in their consequent studies (Ernstsson, 2016). Such studies will offer a resourceful scope in respect to the convergences and divergences of the findings from the current study findings.

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