

The Economic Burden of Cardiovascular Diseases in Yemen ; An example of annual direct costs from the Cardiac Center-Althawra Teaching General Hospital- Sana'a

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Abstract:

Background and Objectives: Cardiovascular diseases is a progressing major health problem . The impact of this problem is pronounced in developing countries . Yemen is one of the developing countries and one of the low income country group . Being the only public comprehensive cardiac facility in the country ; The cardiac center of Althawra Teaching General Hospital is one of the busiest health facility in Yemen . The cardiovascular diseases (CVD) causes major medical and social consequences and impose a heavy economic burden on Yemen . The major aim of this study is to estimate the annual cost of direct cardiac services in this center. The economic visibility of establishing cardiac specialty centers in Yemen ; Hence the effect of that on prevention and control as management of CVD.

Materials and methods: This research is retrograde data collected ; the number and costs of the cardiac services provided by the cardiac center to the patients were calculated and evaluated for all the cardiac services including : the visitors to the cardiac out patients clinics (cardiology and cardiac surgery) , admissions , non invasive modalities , invasive procedures , cardiac surgery in adults and pediatrics and pacemakers implantations . All the direct costs were estimated according to average basic costs from four private hospitals in Yemen . Excluded from this calculations the running costs , special subsidiaries and invisible costs during the year 2011 . All data were subjected for statistical evolution using SPSS v. 16 program. The resulted correlations were projected to represent the direct cost of cardiac service per average patient in one year period .

Results: Apart from the country political situation ; during the study period the rate of bed occupancy was high all over the cardiac center , the total capacity of beds were 107 beds out of it 27 were used in CCU (post surgical and medical) , rate of bed rotation was 69.42 cycle and average patient stay was 5.2 (± 3.5) days the basic estimated total cost of hospitalization 1.872.450 US Dollar . The non-invasive procedures for both in patient and

out patients services ; which include : Echocardiography & Doppler examination , Transesophageal Echocardiography (TEE) , Stress ECG , ECG , Holter ECG and 24 hour BP recording , with a total basic average cost of 285.000 US Dollar. Diagnostic coronary angiography was performed in 2053 patients with estimated basic cost of 1.026.000 US Dollar . Adults Catheterization Cardiac interventions include coronary and valvular interventions was 2.785.400 US Dollar. The pediatric diagnostic and interventions with estimated basic cost of 297.000 US Dollar. Patients with permanent cardiac pacing with a cost of 600.600 US Dollar. While the main bulk was for cardiac surgery the estimated basic cost was 4.656.750 US Dollar. The estimated cost out patient visit was minimal 1920 US Dollar due to low fees for consultation .The annual direct cost for cardiac services in the cardiac center is 11.525.120 US Dollar . Excluded from this calculations the running costs , special subsidiaries and invisible costs. Keeping in mind that the cost of establishment of the cardiac center is 5 million US Dollar inclusive the building and equipments .

Conclusions and recommendations: One year on average daily activity, Althawra Teaching General Hospital - Cardiac Center has achieved approximately two and half times the basic establishment cost of the center . The magnitude of CVD problem is high that is mandate the health authority to provide effective prevention and control programs . The cost/benefit equation cannot yet be solved in purely financial terms but from the above, the socio-economic advantages of a local Cardiac Centre should be clear. Establishing governmental and private cardiac center is essential to decrease the health expenses of travelling abroad for cardiac services.

Key words: Costs, Cardiovascular service, Yemen, economics of health.

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الأعباء الاقتصادية المترتبة عن أمراض القلب والأوعية الدموية باليمن

مثال على التكلفة المباشرة في مركز القلب – هيئة مستشفى الثورة العام التعليمي – صنعاء

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المخلص:

المقدمة والاهداف: تمثل امراض القلب و الأوعية الدموية مشكلة صحية كبيرة في العالم ويبلغ تأثير هذه المشكلة اقصاده في الدول النامية . ويمثل مركز القلب بهيئة مستشفى الثورة العام التعليمي بصنعاء المركز الحكومي الوحيد للمعالجة الطبية والجراحية لامراض القلب و الأوعية الدموية باليمن , كما انه يمثل اكثر المراكز ازدهما بالمستشفى ان لم يكن باليمن . وثمثلة امراض القلب و الأوعية الدموية باليمن مشكلة حقيقية وكبيرة مما يعكس ذلك على الأعباء الاقتصادية والإجتماعية في الصرف الحكومي على الجانب الصحي باليمن . وكهدف رئيس لهذه الدراسة وهو اظهار الأثر الإقتصادي والأعباء المترتبة عليه وذلك من خلال تحليل واستعراض التكلفة السنوية الاقتصادية المباشرة للصرف على امراض القلب و الأوعية الدموية وكذا الجدوى الاقتصادية من بناء مراكز تخصصية في هذا المجال جنباً الى جنب في تطوير برامج العناية والحماية من امراض القلب و الأوعية الدموية باليمن والعوامل المؤدية إليها

طريقة ومنهجية البحث: هذه الدراسة وصفية تمت بتجميع ملفات المرضى بطريقة رجوعية وتم تحديد نوعية الخدمات الطبية المقدمة لمرضى القلب والأوعية الدموية والتي تقدم بمركز القلب بهيئة مستشفى الثورة . تم حصر عدداً للحالات وكذا الإجراءات الطبية التي قدمت للحالات سواء كان ذلك في العيادات الخارجية او الطوارئ او الترقيد بالمركز بقسميه الباطني والجراحي لكل الفئات العمرية سواء الاطفال او الكبار . وتم تحديد الاجراءات الطبية المقدمة للمرضى سواء كانت اجراءات غير تداخلية ام تداخلية او عمليات جراحية وكذا الترقيد بالسرير العادي او اسرة العناية المركزة وذلك خلال عام 2011. تم تغذية هذه المعلومات لبرنامج حاسوبي احصائي (اس بي اس اس نسخة 16) وتم استنباط واستنتاج نتائج المعلومات وتحديد العلاقات بين المتغيرات المختلفة لمعرفة اثر ذلك على التكلفة المباشرة للخدمات المقدمة بالمركز لمرضى القلب والأوعية الدموية

النتائج: بالرغم من صعوبة الوضع الإقتصادي والسياسي للبلاد وخصوصاً في 2011 كانت نسبة الإشغال السريري مرتفعة في كل اسرة المركز والبالغة 107 سرير منها 27 سرير عناية مركزة وكان معدل دوران السرير 69,42 دورة ومتوسط ايام رقود المرضى بالمركز 5,2 يوم مع معدل الانحراف المعياري $(\pm 3,5)$ يوم. وتبلغ القيمة التقديرية الاساسية للرقود خلال عام الدراسة (1,872,450) دولار امريكي اما الاجراءات الغير تداخلية والتي تشمل فحص القلب بالموجات الصوتية والدوبلر سواء عن طريق الصدر أو المرى وكذا تخطيط القلب العادي وبالمجهود واجهزة تسجيل ضربات القلب والضغط لمدة اربعة وعشرون ساعة وصلت قيمتها (285,000) دولار امريكي . بلغت القسرة القلبية التشخيصية (1,026,000) دولار امريكي . اما القسرة العلاجية والتي تشمل توسعة الصمامات والشرابين وتركيب الدعامات والشبكات للمرضى البالغين (2,785,400) دولار امريكي اما للاطفال فكانت قيمتها (297,000) دولار امريكي. تركيب منظمات ضربات القلب فبلغت (600,600) دولار امريكي . اما جراحة القلب فوصلت الى (4,626,750) دولار امريكي . اجمالي التكلفة المباشرة للمركز خلال 2011 صل الى (11,525,120) دولار امريكي. مع الاخذ بالاعتبار ان التكلفة الغير مباشرة لم تحسب ضمن ذلك مثل تكلفة التشغيل واجور العاملين والمصروفات الجانبية . علماً بأن تكلفة بناء وتجهيز المركز وصلت الى خمسة ملايين دولار امريكي

الاستنتاج والتوصيات : التكلفة المباشرة والتي وفرها مركز القلب بهيئة مستشفى الثورة العام التعليمي على الدولة خلال عام 2011 بلغت مرتين ونصف انشاؤه وتجهيزه. إنشغال المركز بهذا الحد يعكس حجم مشكلة أمراض القلب والأوعية الدموية باليمن وهذا يحتم على السلطات الصحية أن تتبنى السياسات وتتخذ الإجراءات الوقائية من هذه الأمراض وكذا العوامل المسببة لها. تعكس الدراسة مدى الجدوى الاقتصادية من انشاء مركز وحيد تخصصي للقلب والعمل على انشاء مراكز مماثلة في عدد من المدن بغرض الحد من الإنفاق على السفر لخارج اليمن لمعالجة هذه الامراض

Introduction:

The burden of cardiovascular diseases (CVD) globally is escalating and 30% of all deaths worldwide are caused by cardiovascular conditions. Morbidity and mortality attributed to cardiovascular diseases are still a tremendous in the developed countries and are responsible for more than a third of all deaths in North America⁽¹⁾. The economic burdens of Cardiovascular diseases and its consequences on the North American society are enormous⁽²⁾. Recently, death rate due to cardiovascular diseases in least developed countries has been increased substantially especially in Yemen^(3,4). United nation to statistical information, indicates that Yemen is one of the youngest population countries in the world in as much as more than 50 percent of its population is less than 30 years of age⁽⁵⁾. The pattern of cardiovascular diseases has changed in recent decades; the mean age of cardiovascular diseases has decreased, whereas their prevalence has increased^(6,7). Therefore, cardiovascular diseases beget significant medical and social costs and impose a heavy economic burden on our society and individuals by causing increases in health care costs, as well as losses in employment, wages, and household work.

Despite the substantial knowledge of practice variations and cost-effective analysis in the United States, Canada, and the United Kingdom, little is known about the burden of cardiovascular diseases in Yemen⁽⁸⁾. To our knowledge, a cost analysis of cardiovascular diseases has never been reported from this country. Results from studies conducted in North America or Europe cannot be extrapolated and applied to this region because of major variations in methodology and population. We, therefore, conducted this study to evaluate the annual direct cost of cardiac procedures performed during in-hospital admissions among all cardiac centers in the year June 2010- June 2011. A main aim of this study is to assess the annual cost of direct cardiac services in this center. The economic visibility of establishing cardiac specialty centers in Yemen; Hence the effect of that on prevention and control as management of CVD.

Methods and Materials:

This study was established through retrograde collected data from the cardiac center records; the number and costs of the cardiac services provided by the cardiac center to the patients were considered and estimated for all the cardiac services including: the visitors to the cardiac out patients clinics (cardiol-

ogy and cardiac surgery), admissions, non invasive modalities, invasive procedures, cardiac surgery in adults and pediatrics and pacemakers implantations.

As there is no direct costing price list provided by health authorities; All the direct costs were estimated according to average basic costs from four private hospitals in Yemen. Excluded from this calculations the running costs, special subsidiaries and invisible costs during the year 2011. All data were subjected for statistical evolution using SPSS v. 16 program. The resulted correlations were projected to represent the direct cost of cardiac service per average patient in one year period.

Results :

This study was performed during 2011 when the country political situation was quite chaotic. during the study period the rate of bed occupancy was high all over the cardiac center, the total capacity of beds were 107 beds out of it 27 were used in CCU (post surgical and medical), rate of bed rotation was 69.42 cycle and average patient stay was 5.2 days the basic estimated total cost of hospitalization 1.872.450 US Dollar. The main patient characteristics (Table 1) points out a mean age of 34.2 ±19.5 years, mostly males 58.4%, active smoker 11.7% and khat chewers 40%.

Table 1 Clinical characteristics of the population (n=887)

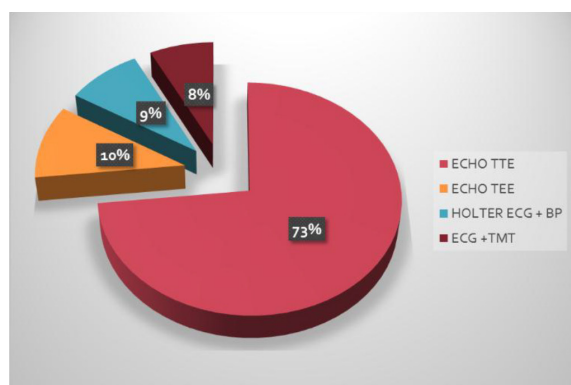
	N (%)*
Mean age, years	34.2 ±19.5
Male sex	518 (58.4)
Diabetes mellitus	69 (7.8)
Hypertension	96 (10.8)
Positive family history	18(2)
Previous smoking	51(5.7)
Active smoking	104(11.7)
Dyslipidemia	61 (6.9)
Khat chewer	354 (40)
O +ve blood group	405(45.7)
HCV	21(2.4)
HBsAg	22(2.5)

*when it is valid

Patients were diabetics 7.8% , dyslipidemic 6.9% and Hypertensive 10.8% .

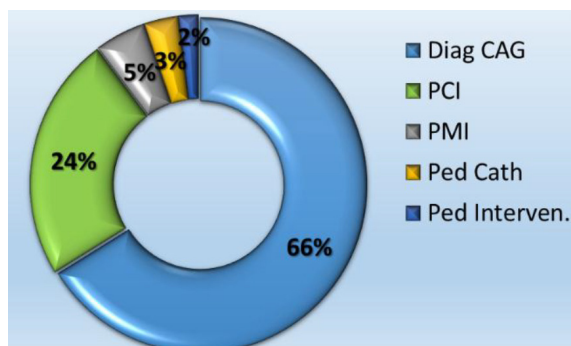
The non-invasive procedures for both in patient and out patients services ; which include : Echocardiography & Doppler examination , Transesophageal Echocardiography (TEE) , Stress ECG , ECG , Holter ECG and 24 hour BP recording , with a total basic average cost of 285.000 US Dollar.

Graph 1 : Non invasive procedure in one year



Diagnostic coronary angiography was performed in 2053 patients with estimated basic cost of 1.026.000 US Dollar . Adults Catheterization Cardiac interventions include coronary and valvular interventions was 2.785.400 US Dollar. The pediatric diagnostic and interventions with estimated basic cost of 297.000 US Dollar. Patients with permanent cardiac pacing with a cost of 600.600 US Dollar.

Graph 2: Invasive procedure during one year



While the main bulk was for cardiac surgery the estimated basic cost was 4.656.750 US Dollar(Table 2). The estimated cost out patient visit was minimal 1920 US Dollar due to low fees for consultation .The annual direct cost for cardiac services in the cardiac center is 11.525. 120 US Dollar . Excluded from this calculations the running costs , special subsidiaries and invisible costs. Keeping in mind that the cost of

establishment of the cardiac center is 5 million US Dollar inclusive the building and equipment .

Table 2: Cardiac surgery procedures in one year

Type of surgery	%	TOTAL
CABG	27	235
CABG+VALVE REP	2	13
CHD complex	3	25
DVR	18	159
MESCIL.OPER	1	4
SVR	31	271
SV Repair	2	21
CHD simple	10	110
PDA	6	49
	100	887

All the previous results reflect how dynamic cardiac services the cardiac center offers .

Discussions :

In Yemen , all the cardiac measures were managed in both governmental and private hospitals . The direct cost of health care services including in-hospital cardiac procedures is determined by cardiac market needs and it is a matter of the cardiac patients needs , wants and demands versus profits of the private sector providers . In the absence of a governmental body who assess and estimates the cost of service ; this study estimates the cost of service as an average of price list provided by four major private cardiac centers and that reflected on the service provided by a governmental cardiac center – Althawra Cardiac Center . Similar to other services, the cost of cardiac procedures in governmental hospitals is in compliance with the annual income per capita and those cost are subsidized and supported by the government through referring patients through specialized medical committees in the main governorates; however, staff salaries and other costs of the cardiac services are different in the private centers throughout the country. Still the range in the private hospital is nearly close to each other. Hence utilizing average of those prices is valid in this case. The prevalence of cardiovascular disease (CVD) in Yemen is one of the highest in the region rheumatic fever and rheumatic heart disease still highly prevalent in the country^(9–11) ,Arterial hypertension and is high in both rural and urban area ⁽¹²⁾. Acute coronary syndrome and consequent heart failure is a significant cardiac disease and

morbidity⁽¹³⁾. While predisposing factors for CVD are abundant as streptococcal infection, central obesity, diabetes mellitus and proteinuria.⁽¹⁴⁻¹⁶⁾ The socioeconomic burden of CVD is consistent with the framework of their main predisposing factor, this might potentially become distressing as Yemen has more young population. Reports from the World Health Organization (WHO)⁽¹⁷⁾, chronic diseases as CVD is now the major cause of death and disability worldwide. The WHO states that the low and lower-middle income countries will contribute to >70 % to the global distribution of non-communicable chronic disease deaths in this decade, and the probable death rates from cardiovascular diseases in many of these countries would be more than the death rates from infectious diseases. From the economic point of view, the data on the cost of treatment and annual income are mandatory due to disability and deaths rates of CVD and should ideally come from the same population, indicating a better view of estimates for economic burden. There is an increasing epidemic of coronary heart disease (CAD) in low income countries⁽¹⁸⁾ and this is obvious in our study; CAD represents the immense proportion of patients either on admission, non-invasive & invasive diagnostics, procedures and coronary artery bypass surgeries. The cardiac center – Althawra Teaching General Hospital achieved twice the cost of its establishment in one of the difficult years 2011 still this is visible for the service providers in the country as the center became a locality for managing CVD patients and training of the personals. Those findings were supported by a study from Bahrain conducted by Reece et al (1995) where the visibility of establishment of such centers maintains similar aims.⁽¹⁹⁾ Public facilities had an essential role in service delivery. However, private sector had developed fast in Yemen in capacity and service delivery. In public sector, there was a 2.9 fold increase in the number of beds in R1 to R6 in 2013. This ratio was 69.9 fold for private sector⁽²⁰⁾. In a study conducted in Turkey (2010) by G Ak-san et al; concluded that majority of people living in underdeveloped areas are uninsured, the expansion of the private sector may not contribute in reducing the inequalities in access to health care service⁽²¹⁾. This may widen the existing gap for access to health between high and low income earners in these underdeveloped areas. This also could reflect the case in Yemen; still surveys in this regard are needed.

Study limitations :

This is a retrospective study based on patients' records, it has similar characteristics of ecologic research and analytic structure is restricted. Also, availability data do not reflect the overall availability since obtained data is only collected from one cardiac center. As no governmental body to issue the cost of service.

Conclusions and recommendations :

Over a period of one year on average daily activity, Althawra Teaching General Hospital - Cardiac Center has achieved approximately two and half times the basic establishment cost of the center. The extent of CVD problem is high that mandates the health authority to provide effective prevention and control programs. The high rate of occurrence of CVD in young age population with high prevalent comorbid factors mandates more efforts from governments, social bodies and health personals to collaborate together to limit those factors. The cost/benefit equation cannot yet be solved in purely financial terms but from the above, the socio-economic advantages of a local Cardiac Centre should be clear. Establishing governmental and private cardiac center is essential to decrease the health expenditures of travelling outside the country for cardiac services.

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