



Original Article

The Economic Burden of Viral hepatitis C Infection at Various Stages of the Disease in District Mardan, Pakistan

Sajjad Khan¹ and Misbah Nosheen¹¹Department of Economics, Hazara University, Mansehra, Khyber Pakhtunkhwa, Pakistan

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*Corresponding Author:

Sajjad Khan
 Department of Economics, Hazara University,
 Mansehra, Khyber Pakhtunkhwa, Pakistan
mskhan_pu88@yahoo.com

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ABSTRACT

Hepatitis C is a blood-borne, infectious disease caused by the Hepatitis C virus (HCV). It attacks hepatic cells, causing infection and inflammation in the liver, eventually leading to cirrhosis and hepatocellular cancer (HCC). Globally, around 200M people carry HCV with mortality rate of 350,000 due to chronic complications of the liver triggered by HCV. **Objective:** To assess the overall annual cost borne by chronic HCV patients at various stages of the disease in District Mardan, Pakistan. **Methods:** Out of total 160 patients, 135, 19 and 6 patients had Non-cirrhotic, compensated cirrhosis, decompensated cirrhosis and other complications respectively, Data were obtained from these identified patients through well designed questions based on their social and economic burden in 2019. Descriptive and inferential statistical techniques were applied to estimate the direct and indirect medical costs of HCV in District Mardan. **Results:** This research discovered a significant link between direct and indirect costs and various phases of viral hepatitis C. The per patient annual indirect costs non-medical costs at different stage of HCV infection was found Rs. 10000 (66.57 \$), Rs. 25700 (171.10 \$) and Rs. 83200 (553.92 \$) for non-cirrhotic, compensated cirrhosis and decompensated cirrhosis patients where non-medical costs were estimated Rs. 2000 (13.31 \$), Rs. 3235 (66.57 \$), and Rs. 7540 (50.19 \$), for non-cirrhotic, compensated cirrhosis and decompensated cirrhosis patients and their average were estimated as Rs. 51533 (343.09 \$), and 4258.33 (28.35). whereas The estimated per patient direct cost for non-cirrhotic, compensated cirrhosis and decompensated cirrhosis are Rs. 51060 (339.94 \$), 108650 (723.36 \$) and 224370 (1493.80 \$). **Conclusions:** It was concluded that indirect medical costs grew up with the progression of disease as productivity loss due to absenteeism increases and traveling expenses increases with increased in number of hospital visits.

INTRODUCTION

Hepatitis C is a blood-borne infection caused by the Hepatitis C virus (HCV). It attacks hepatic cells, causing infection and inflammation in the liver, eventually leading to cirrhosis and hepatocellular cancer (HCC). Globally, around 200M people carry HCV with mortality rate of 350,000 due to chronic complications of the liver triggered by HCV [1,2]. The chronic infections including HCC depends upon the type of strain of HCV, environmental factors, host's age, gender, viral load and alcohol consumption. HCV belongs to Hepacivirus genus of Flaviviridae family. It consists of 9.6k genome packed in positive sense single stranded RNA, encoded a single polypeptide. The error prone RNA-dependent-RNA polymerase makes it severe heterogenic and cause approximately 10-2 mutations per nucleotide yearly [3,5]. On the basis of phylogenetic data, it has 7 main

genotypes; that are further classified into 67 subtypes (recognized) and 20 subtypes (provincial). Worldwide, the prevalence of genotype 1 is (46%) and genotype is (30%), contributing the thick amount of HCV triggered liver diseases. Europe see the prevalence of genotype 1, 2 and 3, South Asia genotype 3 (70%), East Asia genotype 2 and 6, Middle East (Arab) genotype 1 and 4, (non Arab-countries) genotype 1, Southern and Eastern Africa genotype 5 [4]. One in every 20 individuals is infected by HCV in Pakistan securing the second largest infected population globally followed by Egypt. In Pakistan, genotype 3a is more prevalent, regionally genotype 3a and 3b holds most percentage in Sindh, Punjab and Khyber Pakhtunkhwa (KPK), followed by 1a and 2a in Baluchistan [7,8,11]. Apparently, the uncontrolled spread of HCV is through

healthcare products, non-sterilized medical equipment, contamination with blood, shared synergies for intravenous drugs etc. The high morbidity and mortality rate caused by HCV effects the socio-economic growth of the country which will evidently increase in the next decade especially in Pakistan [7,8]. In this study, we aim to estimate the direct and indirect cost of HCV in the District Mardan in the province of KPK, Pakistan with a disease prevalence of 6.6 % approximately. By considering the increasing prevalence of HCV related disease burden in Pakistan a comprehensive economic analysis was important to carry out.

METHODS

This is an analytical, descriptive and cross-sectional study, conducted in 2019 on HCV infected patients with liver conditions such as; inflammation, liver cirrhosis and HCC, referred to the District Headquarter (DHQ) Hospital, Mardan and Billand Welfare Hospital Mardan, KPK. Table 1 indicated that Out of 1000, total of 160 patients were randomly selected and determined statistically on the basis of pilot sampling by using a standard questionnaire. There were 76 females (47.5%) and 84 (52.5%). Among them, 84.4 % were having non-cirrhotic liver, 11.9 % compensated cirrhotic, 3.75% decompensated cirrhotic. Patient's records and their billing details were used as a data source and standard questionnaire were designed accordingly. The inclusion criteria was; HCV positive, inflamed liver, HCC and liver cirrhosis.

Valid	Frequency	Percent	Valid Percent	Cumulative Percent
Non-cirrhotic	135	84.38	84.38	84.38
compensated cirrhosis	19	11.9	11.9	96.25
decompensated cirrhosis	6	3.75	3.75	100.00
Total	160	100.0	100.0	

Table 1: Staging of Liver Disease

Socioeconomic Burden Calculations

The socioeconomic burden of HCV in Pakistan has major differences with respect to the other countries of the world as per cost estimation of HCV infections in Pakistan.

The analysis of HCV infection sequel was done by following two steps.

- A. Estimated Direct Cost of the Patients (medical cost and non-medical cost)[16,20]
- B. Estimated Indirect Cost of the Patients (during the course of 12 months)[16,17,20]

Measurement of Direct Economic Cost

Medical records of the patients from January 15st to December 30th, 2019 were used by using specialist and patient's view point. Patients were placed in one group as the large percentage of non-cirrhotic patients in our data

base were present as mentioned in table 1. The direct medical cost includes (inpatient and outpatient cost, cost of drugs purchased, and medical procedures). The annual medical cost of the patients was determined by using the following formula.

$$DMC = AOE + AIE + AESM [14,15,16]$$

Where,

- . AOE is (annual outpatient expenditure per patient)
- . AIE is (annual inpatient expenditure per patient)

Here, AOE and AIE were collected as follows:

- . Average outpatient expense at a visit \times average rate of outpatient visit in three months $\times 4$
- . Average inpatient expense at a visit at certain hospital \times proportion of inpatients at certain hospital \times annual rate of hospital per patient

Measurement of Direct (non-medical) Cost

Self-reports of the patients were used to estimate the non-medical cost. As most of the patients being treated in before mentioned health care centers were living in the outskirts of Mardan and the travel cost, travel time and number of visits were considered the crucial items to add. Yearly average amount of direct non-medical cost could be calculated by using mean of the monthly cost consumption [16,18-20].

Measurement of Indirect Cost

Human capital approach was used to measure indirect cost; this technique measures the increase in productivity by improving health (decrease in the number of absentees from work, number of working hours on daily basis, and life expectancy). However, data was collected by repeated telephonic and one-to-one interviews with the patient referred to the health care centers as mentioned above. The income of the unemployed patients before the treatment and the dependent house wives were considered zero in the study.

Statistical Analysis

For descriptive analysis SPSS software (version 24) were used. Data was presented in the form of percentages, mean and range calculations, whereas, all costs were calculated on the basis of purchasing power parity PPP in USD.

RESULTS

The data included on the standard questionnaire includes the inpatient and outpatient services, their socio-economic status (age, sex, marital status, occupation, number of family members, insurance status, their disease status (liver stages, symptoms, elapsed time of diagnosis, followed up results, their medical expenses (number of physician visits, levels of facilities used, types of checkups, prescribed medicines etc.). Age of the patient ranged from 5-60 years (Table 2).

Valid	Frequency	Percent	Valid Percent	Cumulative Percent
5-18 Years	13	8.1	8.1	8.1
19-32 Years	57	35.6	35.6	43.8
33-46 Years	45	28.1	28.1	71.9
47-60 Years	38	23.8	23.8	95.6
>60 Years	7	4.4	4.4	100.0
Total	160	100.0	100.0	

Table 2: Age of the Patient

The estimated per patient indirect costs and non-medical costs at different stage of the HCV is shown in Table 3 for the period 2019 at District Mardan. The per patient annual indirect costs non-medical costs at different stage of HCV infection was found Rs. 10000 (66.57 \$), Rs. 25700 (171.10 \$) and Rs. 83200 (553.92 \$) for non- cirrhotic, compensated cirrhosis and decompensated cirrhosis patients where non-medical costs were estimated Rs. 2000 (13.31 \$), Rs. 3235 (66.57 \$), and Rs. 7540 (50.19 \$), for non- cirrhotic, compensated cirrhosis and decompensated cirrhosis patients and their average were estimated as Rs.51533 (343.09 \$), and 4258.33 (28.35 (one dollar is equal to 150.20 Rupees Average dollar to PKR exchange rate 2019)(Table 3).

Stage of the disease	Indirect cost Rs	Non-medical cost Rs
Non-cirrhotic	10000(8.41%)	2000(15.65%)
compensated cirrhosis	25700(21.65%)	3235(25.32%)
decompensated cirrhosis	83200(69.97%)	7540(59.02%)
Total	118900(100.00%)	12775(100.00%)
Average	51533.33	4258.33

Table 3: Estimated average per year indirect medical cost and non-medical costs at different stage of viral Hepatitis C disease in district Mardan in 2019

Figure 4 illustrate the estimated annual direct medical costs of HCV infection at different stages of disease. The estimated per patient direct cost for non-cirrhotic, compensated cirrhosis and decompensated cirrhosis are Rs.51060 (339.94 \$), 108650 (723.36 \$) and 224370(1493.80 \$).

Stage of the disease	Visit costs Rs	Diagnostic costs Rs	Drug costs Rs	Other medical procedures Rs	Total direct cost Rs.
Non-cirrhotic	8000 (15.66%)	21280 (41.67%)	18920 (37.05%)	2860 (5.61%)	2860 (5.61%)
compensated cirrhosis	15000 (13.81%)	31550 (25.32%)	51600 (29.05%)	10500 (9.66%)	10500 (9.66%)
decompensated cirrhosis	26600 (11.83%)	52890 (23.53%)	120640 (53.68%)	24600 (10.94%)	24600 (10.94%)
Total	49600	105720	191160	37960	37960

Table 4: Estimated average per year direct medical cost at different stage of viral Hepatitis C disease in district Mardan in 2019

In table 5 shows the total economic burden of HCV associated to per patient at different stage of the disease in District Mardan during 2019. Total economic burden of HCV infection was estimated to be RS.63060 (419.84 \$), Rs.

137585 (916.01 \$), and Rs 315470 (2100.33 \$) for non-cirrhotic, compensated cirrhosis and decompensated cirrhosis.

	Non-cirrhotic	compensated cirrhosis	decompensated cirrhosis	Total direct cost Rs.
Direct medical costs Rs	51060 (80.97%)	108650 (78.96%)	224730 (71.23%)	384440
Direct non-medical costs	2000 (3.18%)	3235 (2.51%)	7540 (2.39%)	12775
Rsln direct Costs Rs	10000 (15.85%)	25700 (18.54%)	83200 (26.38%)	118900
Total	63060 (100%)	137585 (100%)	315470 (100%)	516900

Table 5: Estimated economic burden of chronic Hepatitis C infection

DISCUSSION

The current study was the first study conducted to estimate direct and indirect costs associated to HCV at various stages of the disease. It measured direct medical cost in term of diagnostic expenses incurred during one year, medicine expenses and doctors clinic fee whereas indirect costs were estimated in term of productivity loss, traveling expenses, productivity loss of the attendant and special diet expenses. The direct medical cost of total 160 patients, 135, 19, and 6 patients had non-cirrhotic, compensated cirrhosis and decompensated cirrhosis, respectively with a mean (\pm SD) age of 32 (\pm 2.1) years (range 5-to 75 years). We found significant direct relationship between total direct annual medical cost and disease stage. Higher direct medical costs were found with advanced disease and vice versa. In the initial stage of the disease most of the direct medical costs were associated with diagnostic charges and medical services whereas the decompensated cirrhosis stage a large portion of direct medical costs were related to hospital admission and medication. Figure 2 illustrate the estimated annual direct medical costs of HCV infection at different stages of disease. The estimated per patient direct cost for non-cirrhotic, compensated cirrhosis and decompensated cirrhosis are Rs.51060 (339.94 \$), 108650 (723.36 \$) and 224370(1493.80 \$). In figure 3 shows the total economic burden of HCV associated to per patient at different stage of the disease in district Mardan during 2019. Total economic burden of HCV infection was estimated to be RS.63060 (419.84 \$), Rs. 137585 (916.01 \$), and Rs 315470 (2100.33 \$) for non-cirrhotic, compensated cirrhosis and decompensated cirrhosis. This study also found indirect correlation between patient age and direct medical costs whereas direct correlation indirect costs. The correlation among sex and direct costs were found direct and significant (higher direct costs were found in women than men) whereas Indirect costs were found significantly higher in men than women because most of the women were housewives and not paid worker whereas men were

found to be employed or engaged in some type of paid work.

CONCLUSIONS

We found significant economic burden of HCV infection at different stages of the disease. At the first stage of the diseases relatively low direct and indirect costs were found as compared to second and third stage. At the first stage direct costs were concluded higher and estimated 80.97% of the total cost as compared to 78.96% and 71.23% in second and third stage where as indirect cost where higher in third and second stage 26.38% and 18.54% as compared to 15.85% at first stage and concluded that indirect medical costs grew up with the progression of disease as productivity loss due to absenteeism increases and traveling expenses increases with increased in number of hospital visits.

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