

## Estimation of average diagnosis and treatment costs of hepatitis C

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### ABSTRACT

**Aim:** the objective of this study was to estimation of average diagnosis and treatment costs of hepatitis C among patients based on their treatment regime, during the one course of treatment and six-month after stopping that.

**Background:** Hepatitis C virus (HCV) infection is a major cause of liver-related morbidity and mortality worldwide and a major public health problem.

**Patients and methods:** All data for this cross-sectional study were collected from medical records of 200 patients with hepatitis C, who referred to a private gastroenterology clinic between years 2005 through 2009. Information related to the 200 patients was extracted from their medical records and finally, 77 patients of them, who their treatment was not interfering with any other disease entered in this study. Therefore diagnosis and treatment costs of these patients were calculated. Attributable costs were reported as purchasing power parity dollars (PPP\$).

**Results:** Mean costs of diagnosis and treatment in one course of treatment and six month after that with standard interferon plus ribavirin (INF-RBV) exceeds 3,850 PPP\$ and for patients who treated with peg-interferon plus ribavirin (PEG-RIBV) was 16,494 PPP\$. Also in both types of treatment, medication cost was found to be a dominant cost component.

**Conclusion:** Hepatitis C represents a very important and potentially costly disease to managed care organizations. Patients with this disease require expensive drug therapies and consume significant health care resources.

**Keywords:** hepatitis C, cost analysis, Interferon, Peg-interferon.

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### Introduction

Hepatitis C virus (HCV) infection is a major cause of liver-related morbidity and mortality worldwide and a major public health problem (1-4). It is estimated that around 170-200 million

individuals are living with HCV infection worldwide (5-7). The prevalence of HCV is varying between different countries from 0.2 up to 40%. In a recent study by Shahin Merat et al. (8) have shown that the prevalence of HCV is rising in Iran. They reported the seroprevalence of HCV in the population studied is 0.5%, which is higher than previous estimates for Iran. Hepatitis C accepted as the most common infection that causes chronic liver disease in the

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world (9); the occurrence of end-stage liver disease cause by HCV is estimated to peak around 2020 (10, 11). According to the other studies, HCV infection is responsible for 20% of acute hepatitis cases, 70% of all chronic hepatitis cases, 40% of all cases of liver cirrhosis, 60% of hepatocellular carcinomas (HCC), and 30% of liver transplants (12, 13).

Chronic HCV infection is also a significant health care economic burden. Although serious and costly complication of HCV infection may develop, such as liver failure, the need for liver transplantation, and cancer, patients with chronic HCV may delay treatment until after symptoms emerge because of the significant direct and indirect cost associated with current treatments (14, 15). Thus, it is not surprising that the health costs of people attract the attention of many policy makers and academics in many countries (16-19).

It always desirable to measure economic burden and health care effectiveness in order to understand and evaluated various intervention programs in the country. In spite of the high costs of HCV to the economic, health and treatment systems, according to the other studies (20, 21), unfortunately there is not available study on estimation of economic burden related to HCV in our country. Therefore, carrying out such a study seems to be essential.

The specific purpose of this study is the estimation of average diagnosis and treatment costs of hepatitis C virus that include: physician visits, expenditure of diagnostic tests, laboratory tests, medication (drug) fees and hospitalization.

## Patients and Methods

All data for this cross-sectional study were collected from medical records of 200 patients with hepatitis C, who referred to a private gastroenterology clinic between years 2005 through 2009 in Tehran. Information related to the 200 patients was extracted from their medical records and finally, 77 patients among the 200 patients, who

their treatment was not interfering with any other disease such as; (Hemophilia, Thalassemia, Diabetes, Hepatitis B and kidney disorders)entered into the study. Therefore for derived the information from medical records of patients we designed the questionnaire (check list).

During the study and by evaluating the patients' file, we concluded that patients have some common costs during their diagnosis and treatment. These costs are as follows:

- Diagnostic tests includes: Endoscopy, Sonography, liver biopsy, Pathology and Electrophoresis.
- Monthly laboratory tests and Measurement of hepatic markers during the treatment, including CBC-diff, AST, ALT, ALP, Bill T and D, Genotyping, PCR and Viral load, etc.
- Short term of hospitalization due to liver biopsy.
- The cost of routine visits by a gastroenterologist.
- Cost of medications.

Therefore the questionnaire asked about the frequency of the utilization of health services/resources including physician visits, type of medication usage and fees, diagnostic and laboratory tests, and the short term hospitalizations due to liver biopsy. In addition other variables recorded at questionnaire included: personal information such as; age, gender, profession, geographic region, urban/rural residence and other socio-economic information, history of blood transfusion, addiction (IV drug user) and needle stick and the other risk factors.

Diagnosis and treatment costs were calculated for each patient who entered in this study respect to their specific combination therapy regime during the one course of treatment and six-month after that. We had two type of combination therapy in this study for patients that includes; combination therapy of standard interferon (3 MU three times a week) plus ribavirin (800-1200 mg per day) is for 24 weeks or 48 weeks (22, 23). Combination therapy of Peg-interferon (Alfa 2a; in a fixed dose of 180 micrograms per week) plus ribavirin (800- 1200 mg

per day) is for 24 weeks or 48 weeks (24-26). It is noteworthy that, in this study treatment for HCV patients with genotype 1 were 48 weeks while for patients with genotype 2 and 3 were 24 weeks, And this statement is true in both type of treatment.

Methodology of cost analysis in this paper is based on Centers for Disease Control and Prevention "cost analysis introduction" (<http://www.cdc.gov/owcd/eet/Cost/3.html>) and also is similar to another Iranian studies (27-30).

The study protocol approved by the ethic committee of the Research Center for Gastroenterology and Liver Diseases, Shahid Beheshti University of Medical Science, Tehran, Iran.

### Statistical analysis

The unit cost of different health resources including physician (GP/specialist) visits, diagnosis and laboratory tests, hospitalization were calculated based on the price lists approved by Iranian Cabinet for the Public and Private Health Centers (<http://www.irteb.com/tarefaghanoon/index.htm>). And the prices of medication were retrieved from drug list of Food and Drug Office of Iranian Ministry of Health and Medical Education for years to 2005 to 2009 (<http://www.fdo.behdasht.gov.ir>) Therefore the unit cost of different health resources for each patient calculated based on price of them in different years (respect to years of treatment).

Purchasing power parity dollar (PPP\$) was used in order to make inter-country comparisons. PPP\$ is an economic technique used when attempting to determine the relative values of two currencies. It is useful because often the amount of goods a currency can purchase within two nations varies drastically; based on availability of goods, demand for the goods, and a number of other, difficult to determine factors.

Considering the reports from Iranian Central Bank and World Bank Organization in the years between 2000 and 2009, For example in 2009, one PPP\$ was estimated around of 3,894 Rials. Finally,

3,894 used to convert costs from Iranian Rials to PPP\$ (<http://www.tradingeconomics.com>). Data analysis was performed using statistical package for social sciences (SPSS) 16.0 software (SPSS Inc., Chicago, IL, USA) and descriptive statistics such as mean, standard deviation, percentage were employed. A t-test and one-way ANOVA was used to test the differences among mean of continuous data.  $P < 0.05$  was considered as statistically significant.

**Table1.** Socio-economic characteristics of the study, populations (n=77).

	n	%
<b>Gender</b>		
Male	58	75.3%
Female	19	24.7%
<b>Age group</b>		
21-40	17	22.1%
41-60	54	70.1%
>61	6	7.8%
<b>Marital status</b>		
Single	9	11.7%
Married	68	88.3%
<b>Geographic region</b>		
Capital of Iran	47	61.0%
North	6	7.8%
South	1	1.3%
West	8	10.4%
Center	15	19.5%
<b>Genotype</b>		
1a	22	28.6%
1b	11	14.3%
3a	18	23.4%
3b	1	1.3%
Unknown	25	32.5%
<b>Transfusion</b>		
Yes	4	5.2%
No	73	94.8%
<b>Addiction</b>		
Yes	6	7.8%
No	71	92.2%
<b>Needle Stick</b>		
Yes	3	3.9%
No	74	96.1%

## Results

The study identified 77 patients meeting the inclusion criteria. Mean age ( $\pm$  standard deviation) of patients with HCV infection in this study was ( $49.1 \pm 10.2$ ). 58 (75.3%) patients were male. Majority of patients 68 (88.3%) were married. The demographic characteristics of patients in this study are shown in table 1.

Table 2 shows the number of patients based on their type of treatment, that we calculated the diagnosis and treatment costs for each type of treatment separately.

**Table 2.** Characteristics of patients respect to their treatment.

Treatment group	Total n (%)	Males n (%)	Females n (%)
INT+RBV*	42 (54.5)	30 (39.0)	12 (15.6)
PEG+RBV†	35 (45.5)	28 (36.4)	7 (9.1)
Total	77 (100)	58 (75.3)	19 (24.7)

\*Standard Interferon plus Ribavirin

†Peg-interferon plus Ribavirin

Average costs of diagnosis and treatment of HCV infection for patients who treated with PEG-RBV were significantly higher than the diagnosis and treatment costs of INF-RBV (16,494 PPP\$ vs. 3,850 PPP\$;  $P < 0.001$ ). In both group of treatment most expenses are related to the medication fees 14,334 PPP\$ for PEG-RBV and 1,905 PPP\$ for INF-RBV treatment (Table 3).

Overall, of 77 patients who entered in this study 50.65% patients achieved a sustained virological response (SVR). The rate of SVR for patients who treated with INF-RBV was 38.10% and 65.71% for patients who treated with PEG-RBV (Table 4).

## Discussion

In this study we aimed at obtaining an estimate of the diagnosis and treatment costs per one course of treatment and 6 months after stopping for each type of combination therapy. Unfortunately very limited studies are available in the literature to compare and contrast with these observations in our country. Our study is one of the first empirical, detailed per patients diagnosis and treatment cost analyses for HCV patients in Iran.

According to our results, the costs of diagnosis and treatment of HCV with PEG-RBV have significantly higher than those courses which treated with INF-RBV ( $P < 0.001$ ). This difference is undoubtedly related to the high cost of PEG-RBV medication. As we mentioned in above, this study shows that in both group of treatment most expenses are related to the medication. But the cost of medication associated with PEG-RBV approximately, is six times higher than the cost of medication with INF-RBV. Although, the cost of treatment with PEG-RBV is very high but the rate of SVR among patients who treated with PEG-RBV is higher than patients who treated with INF-RBV. Even though more patients achieved SVR with PEG-RBV, but in developing countries like Iran INF-RBV therapy is used because of financial reasons.

The study by Armstrong EP et al (21) reported median HCV-related costs in patients receiving Interferon were \$2,470 and median total healthcare costs exceeded \$4,600. And one of the latest studies by Solomon M. et al (31) on HCV-related costs in patients treated with PEG-RBV have shown that total direct medical exceeded \$28,547 and similar our study medication cost was found to be a dominant cost component.

**Table3.** Direct costs of HCV according to the type of treatment. Costs are expressed in PPP\$.

Treatment	Genotype	Hospitalization	Diagnosis Test	Physician Visit	Laboratory Test	Medication	Total cost
Interferon + Ribavirin	Unknown	36 (1.08)	128 (3.79)	385 (11.37)	1,067 (31.55) *	1,765 (52.21)	3,381 (100)
	1a	39 (1.00)	78 (1.97)	298 (7.56)	1,331 (33.81) *	2,191 (55.66)	3,936 (100)
	1b	37 (0.76)	74 (1.55)	348 (7.23)	1,788 (37.21) *	2,560 (53.25)	4,807 (100)
	3a	20 (0.53)	77 (2.06)	248 (6.63)	2,272 (60.82) *	1,119 (29.95)	3,735 (100)
	3b	74 (1.64)	117 (2.61)	227 (5.04)	2,166 (48.12) *	1,916 (42.59)	4,501 (100)
	<b>Total</b>	<b>35 (0.92)</b>	<b>97 (2.53)</b>	<b>329 (8.55)</b>	<b>1,483 (38.52)</b>	<b>1,905 (49.49) †</b>	<b>3,850 (100) †</b>
Peg + Ribavirin	Unknown	37 (0.24)	144 (0.94) *	440 (2.87) *	1,368 (8.92) *	13,349 (87.04) *	15,337 (100) *
	1a	28 (0.18)	62 (0.42) *	194 (1.29) *	1,352 (8.99) *	13,413 (89.12) *	15,050 (100) *
	1b	16 (0.05)	25 (0.08) *	206 (0.65) *	1,654 (5.24) *	29,692 (93.99) *	31,592 (100) *
	3a	23 (0.17)	50 (0.37) *	249 (1.86) *	2,595 (19.38) *	10,476 (78.22) *	13,393 (100) *
	<b>Total</b>	<b>27 (0.17)</b>	<b>75 (0.46)</b>	<b>276 (1.67)</b>	<b>1,781 (10.80)</b>	<b>14,334 (86.90) †</b>	<b>16,494 (100) †</b>
<b>Total</b>		<b>32 (0.33)</b>	<b>87 (0.91)</b>	<b>305 (3.18)</b>	<b>1,619 (16.87)</b>	<b>7,554 (78.72)</b>	<b>9,597 (100)</b>

†Statistical significant among total cost of HCV at  $P < 0.05$ .

\*Statistical significant among genotypes of HCV at  $P < 0.05$

**Table4.** Frequency of the outcome among the patients under study.

Treatment	Genotype	Improvement (SVR)	Stop treatment (Withdrawal)	Improvement but Recurrence	Resistance	Stop treatment with Dr consultation	Total
Interferon + Ribavirin	Unknown	10 (23.81)	0 (0)	1 (2.38)	1 (2.38)	4 (9.52)	16 (38.10)
	1a	1 (2.38)	2 (4.76)	2 (4.76)	1 (2.38)	5 (11.90)	11 (26.19)
	1b	3 (7.14)	0 (0)	1 (2.38)	0 (0)	3 (7.14)	7 (16.67)
	3a	2 (4.76)	2 (4.76)	0 (0)	0 (0)	3 (7.14)	7 (16.67)
	3b	0 (0)	0 (0)	1 (2.38)	0 (0)	0 (0)	1 (2.38)
	<b>Total</b>	<b>16 (38.10)</b>	<b>4 (9.52)</b>	<b>5 (11.90)</b>	<b>2 (4.76)</b>	<b>15 (35.71)</b>	<b>42 (100)</b>
Peg + Ribavirin	Unknown	6 (17.14)	2 (5.71)	1 (2.86)	0 (0)	0 (0)	9 (25.71)
	1a	6 (17.14)	3 (8.57)	2 (5.71)	0 (0)	0 (0)	11 (31.43)
	1b	3 (8.57)	1 (2.86)	0 (0)	0 (0)	0 (0)	4 (11.43)
	3a	8 (22.86)	0 (0)	2 (5.71)	1 (2.86)	0 (0)	11 (31.43)
	<b>Total</b>	<b>23 (65.71)</b>	<b>6 (17.14)</b>	<b>5 (14.29)</b>	<b>1 (2.86)</b>	<b>0 (0)</b>	<b>35 (100)</b>
<b>Total</b>	<b>39 (50.65)</b>	<b>10 (12.99)</b>	<b>10 (12.99)</b>	<b>3 (3.90)</b>	<b>15 (19.48)</b>	<b>77 (100)</b>	

Our diagnosis and treatment costs for HCV were lower than these studies. It may be due to lower cost of physician visits, medication fees, or other health services in a developing country like Iran compared to western countries. Regarding hospitalization costs, we considered a short term (1day) of hospitalization due to liver biopsy; and in

this study only 35 (45.5%) patients had liver biopsy and also these patients were admission in public hospital so the short stay and hospitalized in public hospital are the reason of the low costs of hospitalization in this study. As expected, because of these differences among various health care systems,

the diagnosis and treatment costs of HCV estimated in our study different from those in other countries.

As we mentioned in above, we calculated diagnosis and treatment costs for HCV patients during one course and six month after that. During the one course of therapy, the rate of SVR was 50.65% thereby for raising the rate of SVR; patients require more than one course of treatment. Obviously, with increasing duration of treatment, costs will be increased.

Our study has several limitations; first this study was not population-based. Second, measuring the frequency of health resource use by patients was mostly based on medical records defect and this could also be a source of bias. Third, in the estimation of unit costs of each health service, the minimum applicable cost was considered, this might cause an underestimation of costs. Despite the limitations of this study, the results are valuable in that they show the importance of hepatitis C as a costly disease to managed care organizations. Patients with this disease require expensive drug therapies and consume significant health care resources.

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