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RESEARCH ARTICLE

THE PREVALENCE OF HEPATITIS C AND ITS DETERMINANTS AMONG HIGH-RISK PATIENTS REFERRED FROM PRIMARY HEALTH CARE CENTERS TO SPECIALIZED PRIMARY HEALTH CARE CENTERS OF HEPATITIS C IN MAKKAHAL-MOKARRAMAH, JANUARY 2020

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ABSTRACT

Background: Hepatitis C represents a major health problem worldwide as it is the leading cause of liver cirrhosis and hepatocellular carcinoma. Additionally, it is mostly asymptomatic, leads to its diagnosis in late stages. **Objectives:** To estimate the prevalence and identify determinants of Hepatitis C infection among high-risk patients referred from Primary Health Care Centers (PHCCs) to specialized Primary Health Care Centers of Hepatitis C. **Design:** Analytical cross-sectional study. **Setting:** Specialized primary health care centers of Hepatitis C in Makkah Al-Mokarramah. **Patients and Methods:** most of the high-risk patients who visited Hepatitis C screening clinics were involved, A self-administered questionnaire was validated and used for data collection. **Main outcome measures:** sociodemographic data, comorbidities, and risk factors of Hepatitis C infection via questionnaire. **Sample Size:** 83 Participants. **Results:** The participants' age ranged between 20 and 75 years with a mean standard deviation (SD) of 50.8±13.7 years. More than half of them (52.4%) were males. The prevalence of Hepatitis C infection among the participants was 4.8%. Older (p=0.048), divorced/widowed participants (p=0.018), diabetic patients (p=0.043), participants who had other chronic diseases (p=0.036), participants with a history of hospital admission (p=0.050), history of blood transfusion (p<0.001) being a prisoner (p=0.010) and those with history of liver diseases (p<0.001) were at higher risk for hepatitis c viral infection. **Conclusion:** Hepatitis C viral infection is relatively more prevalent among high-risk patients, referred from primary health care centers to specialized primary health care centers of Hepatitis C in Makkah Al-Mokarramah, than the general population with some identified risk factors. **Limitation:** short duration of data collection and limited Hepatitis C screening clinics in Makkah Al-Mokarramah as there were 4 clinics, each working one day per week. **Conflict of interest:** None

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INTRODUCTION

Background: Hepatitis C is an inflammation of the liver caused by Hepatitis C Virus (HCV), which can be acute or chronic, ranging in severity from mild condition to serious life-threatening disease (World Health Organization. Hepatitis, 2018) HCV is a blood-borne virus, and the most common mode of transmission is through exposure to blood even small quantities of blood would be enough for virus transmission. Its incubation period from 2 weeks to 6 months and it has six known genotypes (World Health Organization. Hepatitis, 2018)

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Around 80% of HCV infected patients do not develop any symptoms and might be unaware of their infection until complications occur, that is why referred to the silent epidemic (World Health Organization. Hepatitis, 2018) Therefore, screening of HCV infection through rapid anti-HCV antibodies testing followed by HCV ribonucleic acid (RNA) confirmatory test is recommended in the high-risk population, and they include: injection drug users (IDU), patients received blood product or organ transplant before 1992, children born to infected mothers, people with a sexual partner of HCV, prisoners, HIV patients, people with tattoos or piercing (World Health Organization. Hepatitis, 2018) . Treatment of HCV guidelines is currently updated by World Health Organization (WHO) to include pan-genotypic direct-acting agents (DAA) regimens which have proved its

efficacy by 95% cure rate, one of them (Sofosbuvir/Daclatasvir) combination which is the one used in Saudi Arabia. The main goal of treatment is to cure the infection through achieving sustained virologic response (SVR) which means HCV RNA is undetectable in patient's blood in 12 weeks after the end of treatment (SVR12) or after 24 weeks (SVR24) (World Health Organization. Hepatitis, 2018). Hepatitis C represents a major health problem worldwide, according to WHO, the total population who have chronic hepatitis C are estimated to be 71 million around the world (World Health Organization Hepatitis, 2018). In the Arabian Gulf countries, HCV prevalence is estimated to be 1.5%. In Saudi Arabia particularly, the prevalence among nationals was 1.65% (95% CI 1.40–1.91), and among the entire resident population was 1.63% (95% CI 1.42–1.84) (Mohamoud, 2016) HCV is the leading cause of liver cirrhosis, hepatocellular carcinoma as well as the need for liver transplantation in Saudi Arabia and worldwide. Around 399 000 people die yearly due to Hepatitis C complications.

The fact that the majority ofthe patients are asymptomatic is making this disease hard to be diagnosed until late stages and leads to an increasing number of missed cases. In addition, as there is no available vaccine yet for the prevention of Hepatitis C, therefore health education and spreading awareness play an important role in preventing the disease (World Health Organization Hepatitis, 2018). A well-planned strategy was established by the global health sector and approved by the 69th world health assembly in 2018 which aims to eliminate hepatitis C virus infection by 2030. Therefore, WHO encouraged all countries to participate in developing their own national policies based on updated and reliable epidemiological evidence to achieve the same global target (World Health Organization, 2017) Accordingly, Saudi Arabia developed A national program to eliminate Hepatitis C virus by 2030 (Health SAMof., 2018)

LITERATURE REVIEW

A systematic review and meta-analysis was done by Mohamoud YA. et al in 2016 about hepatitis C prevalence in Arabian Gulf countries among the national and entire populations. 557 prevalence studies were included and one incidence study. A prevalence of 1.63% (95% confidence interval "CI" 1.42-1.84) among national in Saudi Arabia was found, 0.24% (95% CI 0.02-0.63) in United Arab ofEmirates (UAE), 0.44% (95% CI 0.29-0.62) in Kuwait, and a prevalence of 0.51% (95% CI 0.43-0.59) in Qatar. Regarding Oman and Bahrain, no available data were identified. On the other hand, HCV prevalence among entire resident population was as follow: 1.63% (95% CI 1.42-1.84) in Saudi Arabia, 1.64% (95% CI 0.96-2.49) in UAE, 0.30% (95% CI 0.23-0.38) in Bahrain, 0.41% (95% CI 0.35-0.46) in Oman, 1.06% (95% CI 0.51-1.81) in Qatar, and 1.45% (95% CI 0.75-2.34) in Kuwait. Among entire residents, Egyptian residents got the highest prevalence of HCV. The study concludes that the results ofHCV prevalence in Arabian gulf countries were similar to the global prevalence results (Mohamoud, 2016). Mohamoud et al. in their systematic review study done in Egypt, 2013, discussed the results of 146 studies of HCV prevalence and four studies of HCV incidence that met eligibility inclusion criteria by using PRISMA guidelines. The study revealed an overall prevalence of HCV in Egypt was (14.7%) among nationals. therefore, Egypt has the highest prevalence in the world. Among participants, HCV prevalence was found between 5-15% in pregnant women, and 5-25% in blood donors, male blood donors had a higher prevalence than female donors, while Blood donors from rural areas had a higher prevalence compared to those from urban areas, 5.7% among patients' family contacts, 0-40% among other general population (population not at risk of HCV), 10-55% among multi-transfused patients, 50-90% among dialysis patients, and between 10-85% among other high-risk population (IDUs, multi-transfused patients such as hemophiliacs and thalassemic, dialysis patients, and viral hepatitis patients). By using multivariable logistic regression the following risk factors were identified as the most factors positively affecting the prevalence of HCV: advanced age, parenteral anti-schistosomal therapy, residing in a rural area, followed by injections, blood transfusions, surgical and dental procedures. The study shows no significant results on the decline over time in HCV prevalence in the general population (p-value: 0.215) and high-risk population (p-value: 0.426). However, the fact of enormous national prevalence, this issue should be well studied and preventive measures must be taken (Mohamoud, 2013). In a cross-sectional study published in 2011 by Ba-Essa EM, which took a place in Al-Dammam, Saudi Arabia, revealed a prevalence ofHCV of1.9% among DM patients, a sample of 1054 national diabetic patients was taken, results showed HCV risk was increased by 3.7 folds in patients with long-standing DM for more than 5 years, whereas 3.2 folds in DM patients using insulin, HCV risk was also increased among DM patients with liver diseases. Moreover, the risk was increased by 11.5 folds among patients with recurrent hospital admission (3-4 times), while patients with ≥5 admissions had increased risk by 13.6 folds. On the other hand, 8.6 times among patients with frequent surgical procedures (3-4 times) while 39.3 times with ≥5 procedures. Furthermore, 4 times in patients who received a blood transfusion, 8.5 times in patients sharing personal items, and patients with tattooing have HCV risk increased by 6.7 times. The majority ofthe patients were ≥40 years (97.1%), most of them were married (91.8%), and a large proportion of them (89%) were overweight or obese (body mass index "BMI" ≥25 kg/m2) and around (74.9%) were unemployed and (81.93%) non-smoker (Ba-Essa, 2016).

Al Humayed SM, Department of Internal Medicine, King Khalid University, Abha, Saudi Arabia, published a cross-sectional study in the International Journal ofEnvironmental Research and Public Health, 2018, which was among type 2 diabetes mellitus (T2DM) and non-diabetic patients visiting PHCCs. A sample of 300 participants was included in the study, of those, 150 participants with T2DM and 150 were non-diabetics. Of those, 187 were males (62.3%), and 113 females (37.7%), with an average age of55.9 9 ± 13.4 years. Most ofthe participants were married (80%), educated up to secondary school level and higher (68.3%), and non-smokers (74.3%). The study revealed a prevalence of HCV of 5% (95% CI: 2.9–7.9%). Prevalence was found among T2DM and non-diabetics, (8.0% and 2.0%) respectively. Multivariable factors associated with HCV infection as age, gender, level ofeducation, BMI, history ofblood transfusion, tooth extraction, and surgery. were found to be of no statistical significance. The study concludes that unlike other risk factors, having T2DM is significantly associated with an increased risk of HCV infection by four folds (cOR: 4.261,

95% CI: 1.177–15.422), though the direction of the relationship is not established yet due to the study type limitation. Moreover, the study strongly recommends for HCV screening among T2DM patients in PHCCs and to increase the level of HCV awareness among PHC physicians (Al Humayed, 2018). A cross-sectional survey was done in Al-Amal Hospital, Jeddah, Saudi Arabia by Alibrahim OA et al. in 2018, among injecting drug users, a total of 300-male participants was included, the overall prevalence of HCV was (42.7%). The prevalence found to be higher in single participants (45.9%), unemployed (44.3%), and those with low educational level (up to primary school) have a prevalence of (57.6%). Moreover, initiating injections at the age of 15 or more was associated with a higher prevalence of HCV (47.4%) compared to those IDUs who started injections before the age of 15 years (Alibrahim, 2018)

Rationale

- The researcher is interested in Hepatitis C as one of her cousins suffered from hepatocellular carcinoma as a complication of Hepatitis C, may Allah's mercy be upon her.
- Up to the researcher's knowledge, no similar studies have been conducted at the holy city Makkah Al-Mokarramah.

Aim of the Study: To evaluate the prevalence of hepatitis C infection and its determinants among high-risk patients to eliminate hepatitis C virus.

Objectives

- To estimate the prevalence of Hepatitis C infection among high-risk patients referred from Primary Health Care Centers to specialized Primary Health Care Centers of Hepatitis C in Makkah Al-Mokarramah, January 2020.
- To identify the determinants of Hepatitis C infection among high-risk patients referred from Primary Health Care Centers to specialized Primary Health Care Centers of Hepatitis C in Makkah Al-Mokarramah, January 2020.

METHODOLOGY (MATERIALS AND METHODS)

STUDY DESIGN

An analytical cross-sectional study was implemented.

STUDY AREA

The study was conducted in the holy city of Makkah Al-Mokarramah, located on the western edge of Saudi Arabia. The holy mosque which is the largest mosque in the world located in the center of Makkah, which has Ka'ba that represents Qibla, all Muslims around the world face Ka'ba in their prayers. The city is divided into four inner and three outer sectors of primary health care. The researcher is concerned with all primary health care centers (PHCCs) with HCV screening clinics. Therefore, this study took place in Al-Adel, Al-Nawareyyah, Al-Sharayea, and al-Eskan PHCCs as they are the referral centers for diagnosis and treatment of Hepatitis C cases in Makkah up to primary health care's (PHC) level.

Study Population

All high-risk patients as defined by the national program to eliminate hepatitis C by 2030 from Saudi Arabia:

- First degree relatives to HCV positive patients.
- History of long-term hemodialysis.
- Receiving a tattoo/Hijama in an unregulated facility/ setting.
- History of transfusion with blood or organ transplantation before 1992.
- Elevated liver enzymes.
- Were ever in a prison.
- History of illicit injection drug use.
- Patients with Hepatitis B or HIV.
- Treating physician's assessment that a patient has a risk for HCV.
- Adults born from 1945 through 1965 should be screened once in their lifetime.

All nationalities, male and female, visiting HCV screening clinics in Makkah's PHCCs mentioned previously.

Eligibility Criteria

INCLUSION CRITERIA

- All Hepatitis C high-risk patients attending Hepatitis C screening clinics in Makkah's PHCCs.
- Both genders.
- All nationalities.

Sample Size

As provided by the coordinator of the national program in Makkah, the total number of high-risk patients visiting the HCV screening clinic in the PHC setting in November was 68 patients. The sample size was calculated by using Raosoft statistical program. A prevalence of 1.65% was chosen according to a study investigating the prevalence of HCV in the Arabian Gulf countries showing that the prevalence among nationals in Saudi Arabia (SA) particularly was 1.65%, the confidence interval was 95% with a margin of error of 5%. The minimal sample size required for the study was calculated to be 19 patients. To avoid loss of cases, the researcher is planning to take all patients visiting HCV screening clinics in January 2020.

Sampling Technique

As the total number of patients visiting the HCV screening clinic is limited and not fixed, the questionnaire was distributed to all patients visiting HCV screening clinics.

DATA COLLECTION TOOL (INSTRUMENT): A self-administered questionnaire validated by two consultants, was in both Arabic and English language. The questionnaire consisting of 2 sections, socio-demographic data and risk factors assessment of HCV infection. It includes a total of 28 questions.

DATA COLLECTION TECHNIQUE: The questionnaire was distributed among all patients visiting HCV screening clinics in Makkah's PHCCs mentioned previously in a one-month duration, with a cover page where all needed information by the participant is available. The questionnaires were distributed to the patients by the researcher and by well-trained medical students as data collectors; a certificate of appreciation was given as a gift. Educational materials were provided with a questionnaire as a gift for the participants. All hard copies were stored in a safe locked place.

STUDY VARIABLES

Dependent variable

- Hepatitis C

Independent variables

- Personal Data: Age, gender, nationality, education, occupation, marital status, and income.
- Relevant risk factors of HCV infection (contact with HCV patient, tattoo/hijama in unregulated setting, surgeries, blood transfusion, tooth extraction, hemodialysis, been in prison, IDU).
- Other: comorbidities and duration, smoking, BMI.

Data Entry and Analysis

Data were analyzed using The Statistical Program for Social Sciences (SPSS) software version 25.0. Qualitative variables were expressed in frequency and percent while quantitative variables were expressed in mean and standard deviation. Categorical variables were compared with chi-square or Fischer exact test while quantitative variables were compared using Student`s t-test and significance was considered at a p-value less than 0.05.

Pilot Study/ Pretesting

A pilot study was conducted in Al-Eskan PHCC, by using the same data collection tool and applying a full methodology to check for gaps and defects to be identified and modified. Accordingly, no changes were needed.

Budget, Fund or Grant

This study is self-funded.

RESULTS

Socio-demographic characteristics: The study included 83 participants. Table 1 presents their personal characteristics. Their age ranged between 20 and 75 years with a mean±standard deviation (SD) of 50.8±13.7 years.

More than half of them (52.4%) were males, the majority of them (93.9%) were Saudi nationals and 79.6% were married. The majority of the participants (97.6%) live in Makkah and over one-third of them (36.5%) were Bachelor holders. Over half of them (52.4%) were working and the income of 33.7% of them ranged between 5000 and 10000 SR/month.

Table 1. Personal characteristics of the participants (n=83)

Variables	Frequency	Percentage
Gender		
Male	43	52.4
Female	40	47.6
Age (years)		
Range	20-75	
Mean±SD	50.8±13.7	
Nationality (n=82)		
Saudi	77	93.9
Non-Saudi	5	6.1
Marital status		
Married	66	79.6
Single	9	10.8
Divorced/widowed	8	9.6
Place of residence		
Inside Makkah city	81	97.6
Outside Makkah city	2	2.4
Level of education (n=82)		
Bachelor degree	30	36.5
Secondary school	19	23.2
Intermediate school	9	11.0
Primary school	15	18.3
Illiterate	9	11.0
Employment status (n=82)		
Working	43	52.4
Not working	39	47.6
Income (SR/month)		
<5000	27	32.5
5000-10000	28	33.7
>10000-15000	16	19.3
>15000	12	14.5

MEDICAL HISTORY

History of diabetes was reported among 51.8% of the participants; 4.8% type I and 47% type II as illustrated in Figure 1. Duration of diabetes was available in 43 patients, it exceeded 5 years among more than half of them (58.1%) as shown in Figure 2. Among them, more than one-third (34.9%) were treated with insulin. Figure 3. History of chronic diseases other than diabetes was reported among 44.6% of the participants as shown in Figure 4. Hypotension was the commonest (87.4%) as clear from Figure 5.

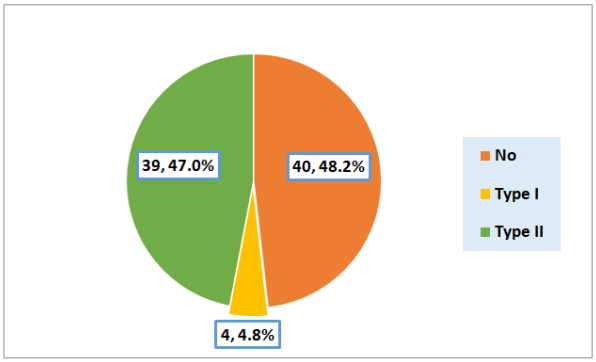

Figure 1. History of diabetes mellitus among the participants

Risk Factors: Table 2 presents the distribution of all risk factors for hepatitis C. Having a 1st degree relative with hepatitis C was reported among 4.8% of them. History of hospital admission and performing surgery was reported among 48.3% and 50.6% of the participants, respectively. Among females, a history of abortion was reported among 27.5% of them. Smoking, blood transfusion, and sharing personal items were reported in 32.5%, 12.5%, and 9.6% of the participants, respectively.

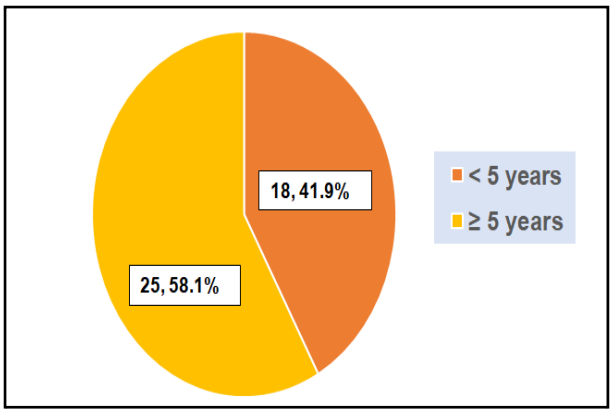

Figure 2. Duration of diabetes among diabetic patients (n=43)

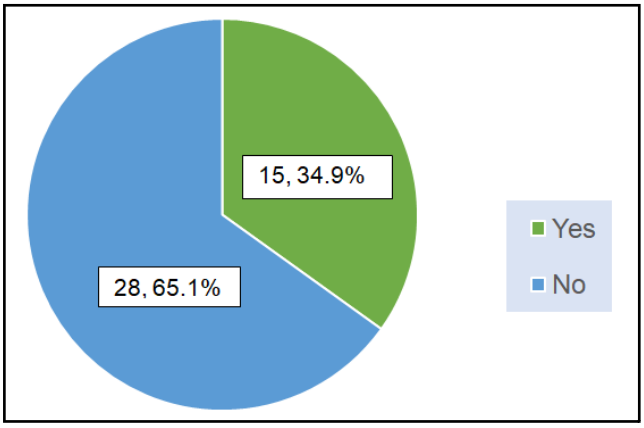

Figure 3. History of treatment with insulin among diabetic patients (n=43)

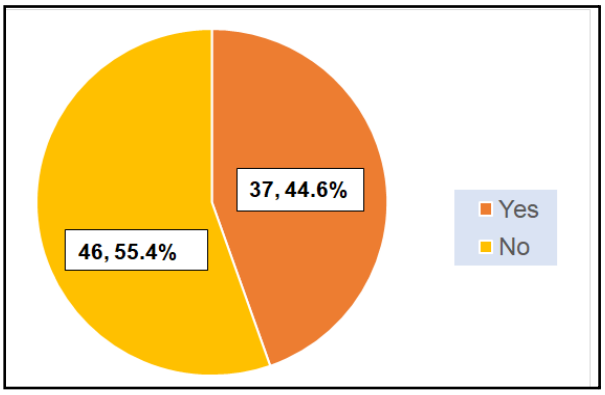

Figure 4. History of other chronic diseases among the participants

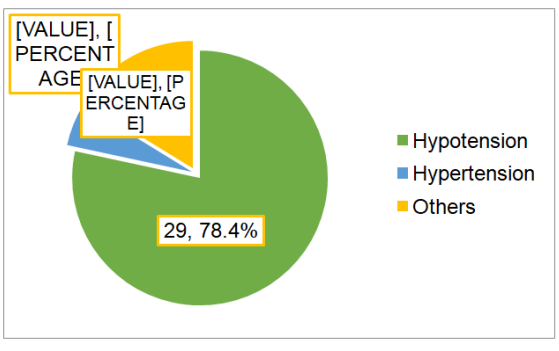

Figure 5. Chronic diseases other than diabetes among the participants (n=37)

Table 2. Distribution of different risk factors for hepatitis C among the participants

Risk factors	Frequency	Percentage
History of having a 1st degree relative with hepatitis C		
No	79	95.2
Yes	4	4.8
History of hospital admission		
No	43	51.8
Yes	40	48.3
Once	15	37.5
Twice	10	25.0
>twice	15	37.5
History of performing surgery		
No	41	49.4
Yes	42	50.6
History of abortion (n=40)		
No	29	72.5
Yes	11	27.5
Once	7	63.6
>once	4	36.4
History of smoking		
No	56	67.3
Yes	27	32.5
History of blood transfusion (n=80)		
No	70	87.5
Yes	10	12.5
History of sharing personal items		
No	75	90.4
Yes	8	9.6
History of tattoos/Hijama		
No	57	69.5
Yes	25	30.5
History of dental extraction		
No	11	13.3
Yes	72	86.7
History of use IV drug injection		
No	48	57.8
Yes	35	42.2
History of being in a prison		
No	79	95.2
Yes	4	4.8
History of liver diseases		
No	77	92.8
Yes	6	7.2
History of having increased levels of liver functions		
No	81	97.6
Yes	2	2.4

History of tattoos/Hijama, dental extraction, use IV drug injection, and being in a prison was reported among 30.5%, 86.7%, 42.2%, and 4.8% of the participants, respectively. History of liver diseases and history of having increased levels of liver functions were observed among 7.2% and 2.4% of the participants, respectively.

Prevalence of Hepatitis C: It is realized from Figure 6 that the prevalence of Hepatitis C infection among high-risk patients referred from Primary Health Care Centers to specialized Primary Health Centers of Hepatitis C was 4.8%.

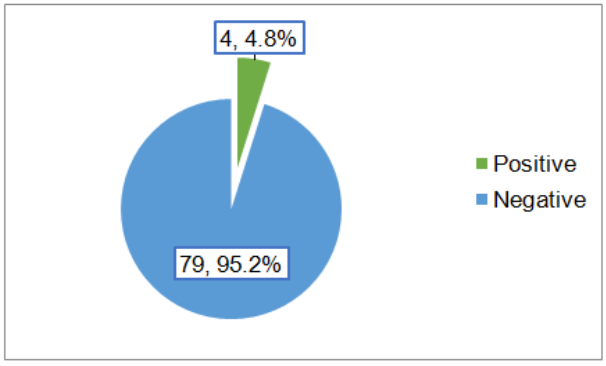

Figure 6: Prevalence of Hepatitis C infection among high-risk patients referred from Primary Health Care Centers to specialized Primary Health Care Centers of Hepatitis C in Makkah Al-Mokarramah

Table 3. Association between personal characteristics of the participants and hepatitis c viral infection

	Hepatitis C viral infection		p-value
	Negative	Positive	
	N=79	N=4	
Gender			
Male (n=43)	39 (90.7)	4 (9.3)	
Female (n=40)	40 (100)	0 (0.0)	0.067*
Age (years)			
Mean±SD	50.2±13.6	63.5±8.7	0.048[t/]
Nationality (n=82)			
Saudi (=77)	74 (96.1)	3 (3.9)	
Non-Saudi (n=5)	4 (80.0)	1 (20.0)	0.226*
Marital status			
Married (n=66)	64 (97.0)	2 (3.0)	
Single (n=9)	9 (100)	0 (0.0)	
Divorced/widowed (n=8)	6 (75.0)	2 (25.0)	0.018**
Place of residence			
Inside Makkah city (n=81)	77 (95.1)	4 (4.9)	
Outside Makkah city (n=2)	2 (100)	0 (0.0)	0.905*
Level of education (n=82)			
Bachelor degree (n=30)	30 (100)	0 (0.0)	
Secondary school (n=19)	18 (94.7)	1 (5.3)	
Intermediate school (n=9)	8 (88.9)	1 (11.1)	
Primary school (n=15)	14 (93.3)	1 (6.7)	
Illiterate (n=9)	8 (88.9)	1 (11.1)	0.532**
Employment status			
Working (n=43)	42 (97.7)	1 (2.3)	
Not working (n=39)	36 (92.3)	3 (7.7)	0.260*
Income (SR/month)			
<5000 (n=27)	24 (88.9)	3 (11.1)	
5000-10000 (n=28)	27 (96.4)	1 (3.6)	
>10000-15000 (n=16)	16 (100)	0 (0.0)	
>15000 (n=12)	12 (100)	0 (0.0)	0.279**

*Fischer exact test**Chi-square test[t/]Student t-test

Table 4: Association between the medical history of the participants and hepatitis c viral infection

	Hepatitis C viral infection		p-value
	Negative	Positive	
	N=79	N=4	
History of diabetes			
No (n=40)	40 (100)	0 (0.0)	
Yes, type 1 (n=4)	3 (75.0)	1 (25.0)	
Yes, type 2 (n=39)	36 (92.3)	3 (7.7)	0.043**
Duration of diabetes (n=43)			
≤5 years (n=18)	18 (100)	0 (0.0)	
>5 years (n=25)	21 (84.0)	16 (4.0)	0.103*
Treatment with insulin (n=43)			
No (=28)			
Yes (n=15)	26 (92.9)	2 (7.1)	
	13 (86.7)	2 (13.3)	0.436*
History of other chronic diseases			
No (n=46)	46 (100)	0 (0.0)	0.036*
Yes (n=37)	33 (89.2)	4 (10.8)	

*Fischer exact test**Chi-square test

Factors Associated With Hepatitis C

Personal Factors: From Table 3, it is shown that the age of hepatitis C positive patients was significantly higher than that of hepatitis C negative participants (63.5±8.7 versus 50.2±13.6), p=0.048. One-fourth of divorced/widowed participants compared to none of the singles and 3% of married showed positive hepatitis C results, p=0.018. Although 9.3% of males compared to none of the females had positive hepatitis C results, the difference did not reach a statistically significant level, p=0.067. Other personal characteristics (nationality, place of residence, level of education, employment status, and income) were not significantly associated with hepatitis C infection.

MEDICAL HISTORY: One-quarter of type I diabetic patients compared to 7.7% of type II diabetics and none of the non-diabetics had hepatitis C infection, p=0.043. Participants who had other chronic diseases were more likely to develop hepatitis C infection than their counterparts (10.8% versus zero), p=0.036. Duration of diabetes and treatment with insulin were not associated with hepatitis C infection. Table 4

Risk Factors

Participants with a history of hospital admission were more likely to have HCV infection than others (10% versus none). However, the difference was borderline insignificant, p=0.050. Forty percent of participants who reported a history of blood transfusion compared to none of those without such history had HCV infection, p<0.001. Half of the participants with a history of being in a prisoner compared to 2.5% of others had HCV infection, p=0.010. Two-thirds of

participants with a history of liver diseases compared to none of those without this history had HCV infection, p<0.001. Other studied risk factors were not significantly associated with hepatitis C infection. Table 5

DISCUSSION

It has been well documented that HCV infection represents a major burden on both health and economic status of communities (Hanafiah, 2013) As one of the main health aims of the health authority in the Kingdom of Saudi Arabia (KSA) is the elimination of HCV by the year 2030, the present study was done to estimate the prevalence and risk factors of HCV among high-risk patients defined by the national program. The prevalence of HCV among the high-risk group of patients referred from PHCCs to specialized PHCCs of Hepatitis C in the present survey was 4.8%. This rate is higher than those reported in other Saudi studies carried out on specific populations such as blood donors (1.43%), (Al-Knawy, 1995) diabetic patients (1.9%) (Ba-Essa, 2016), and premarital group (1.31%). In Arabian Gulf countries, a systematic review and meta-analysis revealed a prevalence of 1.63% among Saudi nationals, 0.24 in United Arab of Emirates (UAE), 0.44% in Kuwait, and 0.51% in Qatar, however, among the entire resident population, the prevalence in Saudi Arabia was 1.63%, 1.64% in UAE, 0.30% in Bahrain, 0.41% in Oman, 1.06% in Qatar, and 1.45% in Kuwait.

Also, the figure reported in the present study is higher than the estimated prevalence of HCV in Saudi Arabia (1-3%) (Abdo, 2012) and that reported among the general population in Southwestern Saudi Arabia (2.2%) (Al Humayed, 2017) as well as global prevalence (2–3%) (Antonelli, 2014) However, it is far from that reported among hemodialysis patients (15-80%), (Karkar, 2007) and male injecting drug users, (42.7%) (Alswaidi, 2010) in the Kingdom of Saudi Arabia and also from the figure reported in Egypt, which had the highest prevalence all over the world (14.7%) reaching up to 25% in blood donors, 55% among multi-transfused persons, 90% in dialysis patients and 15% in pregnant women while it was 5.7% among family contacts and between 10-85% among other high-risk population (IDUs, multi-transfused patients such as hemophiliacs and thalassemic, dialysis patients, and viral hepatitis patients) (Mohamoud, 2013). and comparable to that reported among type 2 diabetic patients (5%) (Al Humayed, 2018). The relatively higher prevalence of HCV in the present study could be attributed to the fact of choosing a high-risk group of people in this study and those patients usually live unrecognized and are discovered accidentally when receiving health care for other complaints (Spradling, 2012).

In the current study, older participants, divorced/widowed, diabetics, participants having chronic diseases other than diabetes, those who reported a history of blood transfusion, being a prisoner, and those having liver diseases were at higher risk for HCV infection. In another Egyptian systematic review, advanced age, parenteral anti-schistosomal therapy, residing in a rural area, history of injections, blood transfusions, surgical and dental procedures were the identified risk factors in multivariate logistic regression analysis. In a Saudi study carried out in Dammam among diabetic patients, the significant predictors of HCV infection were longer duration of diabetes mellitus, using insulin, liver diseases, recurrent hospital admission, frequent surgical procedures, blood transfusion, sharing personal items, tattooing (Ba-Essa, 2016). In another Saudi study carried out in Abha by Al Humayed et al. (2018) age, gender, level of education, BMI, history of blood transfusion, tooth extraction, and surgery were not significant predictors for HCV and the only significant factor was type 2 diabetes mellitus. In a study carried out among male drug users in Jeddah (KSA), the prevalence of HCV was higher in single, unemployed participants, and those with low educational level (up to primary school). Moreover, initiating injections at the age of 15 or more was associated with a higher prevalence of HCV. (Alibrahim, 2018) In the current study, the prevalence of HCV among type 1 diabetic patients was 25% whereas among type 2 diabetic patients, it was 7.7%. Our figure is comparable to that reported by Al Humayed S, et al (8%). Lower figures were reported in Dammam, KSA (1.9) (Ba-Essa, 2016), and overseas in Greece (1.65%) (Sotiropoulos, 1999) and France (3%).[19] However, higher figures were observed in Nigeria (11%)[20] and Pakistan (36%). (Ali, 2007) Additionally, two previous published review studies (Guo, 2013; White, 2008) as well as studies carried out in Abha, (Al Humayed, 2018) Dammam (KSA)[7], and Pakistan (Jadoon, 2010) revealed A strong association between diabetes and HCV infection. Due to the design of this study as cross-sectional, we could not specify the direction of the relationship between diabetes and HCV infection. However, Cuadros DF documented a bi-directional relationship between diabetes and HCV infection (Cuadros, 2015).

It has been documented that the association between HCV infection and diabetes could be attributed to the biological effect of chronic HCV infection on the pathogenesis of diabetes (Arase, 2009) On the other hand, Antonelli et al [14] reported that type 2 diabetes mellitus existence enhancing HCV infection as a result of the immunocompromised state of diabetic patients. The difference between studies regarding the risk factors associated with HCV infection could be mainly due to variation in the characteristics of the population. Up to our knowledge, this is the first study to assess hepatitis C infection among the high-risk group of patients at least in Makkah Al-Mokarramah. However, it has some important limitations that should be mentioned. First of all, the relatively small size of participants and of HCV cases which might be underpowered to detect significant associations, therefore, caution is required in interpreting our results. Second, also we could not control for confounders through performing logistic regression analysis as a result of a small number of cases with hepatitis C infection (4 cases). Third, the study was carried out only among high-risk patients, referred from primary health care centers to specialized primary health care centers of Hepatitis C, which affects the ability to generalize the results over population in other healthcare facilities in Makkah Al-Mokarramah. Finally, its design as a cross-sectional study impacts the temporal relationship between the cause and the effect.

Conclusion

Hepatitis C viral infection is relatively more prevail among the high-risk group of patients, referred from primary health care centers to specialized primary health care centers of Hepatitis C in Makkah Al-Mokarramah, than the general population. Older patients, divorced/widowed, diabetics,

patients having chronic diseases other than diabetes, those who reported a history of blood transfusion, being a prisoner, and those having liver diseases were at higher risk for HCV infection.

RECOMMENDATIONS

Based on the results of this study, the following are recommended:

- Ministry of Health as well as different health care sectors in the Kingdom of Saudi Arabia should focus on eliminating HCV infection by the year 2030.
- Expanding screening for hepatitis C among high-risk group of patients from different disciplines in Makkah Al-Mokarramah, particularly diabetic patients and those with chronic and liver diseases.
- Increase awareness of the population regarding possible risk factors for HCV infection, particularly blood transfusion.
- A further larger longitudinal study with more sample size including high-risk patients from different disciplines in Makkah Al-Mokarramah in order to have a clearer image.

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ANNEXES

Annex 1
The questionnaire