

# Sero-Prevalence and Risk Factors of Hepatitis C Virus among Yemeni Dental Clinic Workers

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## Abstract

The Dental clinic workers (DCWs) in Yemen have an additional risk of getting infected with hepatitis C virus (HCV) from their work place and till now there is no study in prevalence of HCV infection and associated risk factors among DCWs. The purposes of this survey were to evaluate what proportion of dentists and dental assistants had serological evidence of current or previous HCV infection. Data were acquired from a cross sectional survey conducted among DCWs in 2014 at the Faculty of Dentistry, Sana'a University, in Sana'a city. Enzyme-linked Immunosorbant assay (ELISA) was used to test sera for HCV antibodies. The study included 246 dentists and 263 dental assistants; the sero-prevalence of current HCV infection was 1.6%. In conclusion, the prevalence of HCV infection was high among Yemeni DCWs and exposure to potentially infectious body fluids was high which might lead to high rate of transmit HCV to DCWs, therefore ensures a safer work environment is important in control and prevention of HCV in DCWs in Yemen.

**Key Words:** Hepatitis C virus, Dental clinic workers, Sana'a city, Yemen

## مستخلص

يتعرض العاملون في عيادات طب الأسنان في اليمن لخطر إضافي للإصابة بفيروس التهاب الكبد الوبائي (ج) من مكان عملهم، وحتى الآن لا توجد دراسة عن انتشار عدوى فيروس التهاب الكبد الوبائي وعوامل الخطر المرتبطة به بين العاملين في مراكز الرعاية الصحية. وكان الغرض من هذه الدراسة هو تقدير نسبة أطباء الأسنان ومساعدتي طب الأسنان الذين لديهم الإصابة الحالية أو السابقة بفيروس التهاب الكبد الوبائي. تم الحصول على البيانات من مسح مقطوعياً جري بين مراكز الرعاية الصحية في عام 2014 في كلية طب الأسنان، جامعة صنعاء، في مدينة صنعاء. تم استخدام الفحص المناعي المرتبط بالإنزيم (إليزا) لاختبار مصل الدم للأجسام المضادة. وشملت الدراسة 246 طبيب أسنان و 263 مساعد الأسنان؛ كان معدل انتشار العدوى بفيروس التهاب الكبد الوبائي حوالي 1.6%. كان انتشار عدوى فيروس التهاب الكبد الوبائي مرتفعاً بين مراكز الرعاية الصحية اليمنية وكان التعرض لسوائل الجسم المعدية عالية مما قد يؤدي إلى ارتفاع معدل انتقال فيروس التهاب الكبد الوبائي إلى مراكز الرعاية الصحية.

## Introduction

Viral hepatitis is a major public health problem, occurring endemically in all areas of the world [1,2]. The prevalence of the disease is influenced by numerous factors which may be able to modulate its onset [3,4]. The presence of hepatitis C virus (HCV) in saliva and mucus secretions of mouth provide a biological basis for them as possible sources of HCV infection, although it does not necessarily imply transmission [5,6]. HCV infection is one of the most important infectious occupational hazards in the dental profession [7,8]. A number of reports suggest that a significantly higher incidence of HCV among

dental staff, and a higher rates of HCV especially oral surgeons, periodontists and endodontists [2,9-10]. The endemicity of infection was considered low in Yemen, where prevalence of positive HCV antibody among general population ranged from 0.2% to 1.1% [11,12]. The carriers of infection with HCV in dental practice are blood, saliva and nasopharyngeal secretions. [3-5,10] In intra-orally, the greatest concentration of HCV infection is the gingival sulcus [8,10]. No certain case of HCV saliva transmission has been documented [6,13]. In dental management to prevent infection all patients with a history of hepatitis must be managed as they are

potentially infectious, and aerosols should be minimized [3-5]. We present the results of a 2014 survey of dental personnel in Sana'a city, Yemen. The purposes of this survey were to evaluate what proportion of dentists and dental assistants had serological evidence of current or previous HCV infection, what were their risk factors for exposure, and what was the frequency of use and effectiveness of barrier methods to prevent HCV infection.

## Methods

**Study area:** This cross-sectional epidemiological study was conducted among dental clinic personal care whom representative dental clinics .in Sana'a city in Yemen

**Study population and Sample size:** This study was carried out in 2014. A consent form was filled by each participant. The sample size for the study was calculated as follow: First, the rate of HCV was considered among dental clinic personals in Sana'a city, difference (worst acceptable result higher or lower the true rate) and confidence interval as

3%, 0.5% and 99.9% respectively. Accordingly, a sample size of at least 458 subjects was required from the population of dental clinic personals in Sana'a city. The sample was selected by a systematic random method. All dental clinics in Sana'a city were listed (321 clinics), then by the use of a simple random selection, 120 of these dental clinics were selected; finally, all persons working in the clinic were selected. About 2% of the workers refused to participate .in the study

**Data collection:** All participants gave oral consent, completed a questionnaire, and had blood drawn for HCV serological testing. The questionnaire covered demographics, professional characteristics (type, duration, quantity of practice; patient characteristics; procedures performed), protective barrier measures used during dental procedures, occupational exposures to blood and saliva, and other personal risk factors for hepatitis, such as blood transfusion, cupping, .tattoo, etc

## Laboratory tests

**Blood sample collection:** Two ml whole blood was collected by vein puncture; then sera were separated and tested for HCV antibodies by Enzyme linked immune-deficiency syndrome assay (ELISA) using a commercially available kit provided by Roche Diagnostics (Basel Switzerland).

**Case definitions and data analysis:** All persons with anti-HCV antibodies were considered to have had serological signs of HCV infection. To relate possible risk factors for HCV infection, the data were examined in a case-control study format. For HCV, persons with evidence of infection with HCV were matched up with those who were HCV antibodies negative. Differences in categorical variables were assessed using Fisher's exact tests where appropriate. Ninety-five percent confidence intervals for odds ratios were calculated according to the method of Cornfield and 95% confidence limits for simple proportions were calculated by an

exact binomial method using Free Software Package (EPI-INFO).

## Results:

A total of 509 DCWs; 246 dentists and 263 dental assistants were participated in the study. The demographic characteristics of the study sample are shown in Table (1). Among the enrolled dentists 3 (1.2%) (OR=0.64, 95% CI=0.12-3.1, p value=0.53) had serological evidence of HCV infection while a higher non-significant rate and association among the enrolled dental assistants 5 (1.9%), (OR=1.6, 95% CI=0.12-8.4, p value=0.53) had serological evidence of HCV infection. Among the enrolled males 3 (1.2%) (OR=0.65, 95% CI=0.12-3.4, p value=0.55) had serological evidence of HCV infection while higher rate and association among the enrolled females 5 (1.9%), (OR=1.54, 95% CI=0.32-8.2, p value=0.55) had serological evidence of HCV infection (Table 2).

To determine the possible risk factors for HCV acquisition, the 8 DCWs with serological evidence of

HCV infection were compared to the 501 without HCV antibodies. There was a significance risk factors (p value=0.01) of needle stick injuries (OR=8.6, 95% CI=1.1-187), cuts (OR=4.4, 95% CI=0.8 -31, p value=0.04), saliva or blood exposure

to skin (OR=20.8, 95% CI=2.6-454), and non-significant association with saliva or blood exposure to mucus membrane (OR=3, 95% CI=0.62 -14.5, p value=0.1) with serological evidence of HCV infection (Table 3).

**Table 1. Basic profile of study participants**

| Characteristics     | (Dentists (n=246) |            | (Dental assistants (n=263) |            |
|---------------------|-------------------|------------|----------------------------|------------|
|                     | Number            | Percentage | Number                     | Percentage |
| Gender              |                   |            |                            |            |
| Male                | 132               | 53.7       | 112                        | 42.6       |
| Female              | 114               | 46.3       | 151                        | 57.4       |
| Age groups          |                   |            |                            |            |
| ≤ 22 years          | 37                | 15         | 68                         | 25.9       |
| 23-27 years         | 45                | 18.3       | 52                         | 19.8       |
| 28-32 years         | 52                | 21.1       | 57                         | 21.7       |
| 33-37 years         | 44                | 17.9       | 54                         | 20.5       |
| ≥ 38 years          | 68                | 27.6       | 32                         | 12.2       |
| Practice setting    |                   |            |                            |            |
| Private             | 165               | 67.1       | 175                        | 66.5       |
| Governmental clinic | 81                | 32.9       | 88                         | 33.5       |

**Table 2. The prevalent rate and odds ratio (risks) of contracting HCV for different occupations, gender, practice setting and duration of the work for DCWs, Sana'a city, Yemen**

| Factors                          | Infection(%) | Odds ratio | CI 95%    | <i>p value</i> |
|----------------------------------|--------------|------------|-----------|----------------|
| <b>Occupations</b>               |              |            |           |                |
| Dentist (n=246, 48.3%)           | 1.2          | 0.64       | 0.12-3.1  | 0.53           |
| Dental assistants (n=263, 51.7%) | (1.9%) 5     | 1.6        | 0.12-8.4  | 0.53           |
| Crude (n=509)                    | (1.6%) 8     | --         | --        | --             |
| <b>Gender</b>                    |              |            |           |                |
| Male (n=244, 47.9%)              | (1.2%) 3     | 0.65       | 0.12-3.14 | 0.55           |
| Female (n=265, 52.1%)            | (1.9%) 5     | 1.54       | 0.32-8.2  | 0.55           |
| <b>Practice setting</b>          |              |            |           |                |
| Private (n=340, 66.8%)           | (1.8%) 6     | 1.5        | 0.3-10.8  | 0.61           |
| Government (n=169, 33.2%)        | (1.2%) 2     | 0.67       | 0.1-3.7   | 0.61           |
| <b>Duration of the practice</b>  |              |            |           |                |
| <5 years (n=111, 21.8%)          | (0.9%) 1     | Reference  |           |                |
| 5-10 years (n=224, 44%)          | (1.3%) 3     | 0.8        | 0.14-36   | 0.7            |
| >10 years (n=174, 34.2%)         | (2.3%) 4     | 2.0        | 0.4-9.3   | 0.34           |

Seventy-five percent of the DCWs reported consistent use of protective gloves. Only 25.3% consistent use of protective glasses and 28.3% consistent use of protective face mask. Also among these DCWs, the odds of HCV infection differ but not statistically significant according to the consistent use of gloves (OR=2.98, 95% CI=0.62 -14.4, *p* value=0.1), face masks (OR=1.2,

95% CI=0.21-8.6, *p* value=0.83) or eye glasses (OR=2.4, 95% CI=0.3 -3.4, *p* value=0.45), suggesting that these modalities had limited or no efficacy (Table 3).

Over 78% of the DCWs reported that they obtain a risk factor history for hepatitis B, C, and HIV in their clinics from patients mostly by written means and mostly only at the first visit (Table 4).

**Table 3. Occupational possible risk factors for HCV among DCWs with previous and current HCV infection**

| Possible risk factors         | Exposure<br>(%) | Infection<br>(n=8) (%) | Odds<br>ratio | CI 95%     | <i>p value</i> |
|-------------------------------|-----------------|------------------------|---------------|------------|----------------|
| Needle stick injuries         | 45.6            | 3%                     | 8.6           | 1.1-187    | 0.01*          |
| Cuts                          | 209 (41.1)      | 6 (2.9%)               | 4.4           | 0.8-31     | 0.04*          |
| Contact with blood/saliva     |                 |                        |               |            |                |
| On skin                       | 133 (26.5)      | 7 (5.3%)               | 20.8          | 2.6-454    | <0.001*        |
| On mucus membrane             | 129 (25.3)      | 4 (3.1%)               | 3             | 0.62-14.5  | 0.1            |
| Consisting using of gloves    |                 |                        |               |            |                |
| Yes                           | 379 (74.4)      | 4 (1.1%)               | 0.34          | 0.1-1.6    | 0.1            |
| No                            | 130 (25.6)      | 4 (3.1%)               | 2.98          | 0.62-14.4  |                |
| Consisting using of face mask |                 |                        |               |            |                |
| Yes                           | 144 (28.3)      | 2 (1.4)                | 0.84          | 0.17- 4    | 0.83           |
| No                            | 365 (71.7)      | 6 (1.64)               | 1.2           | 0.21-8.6   |                |
| Consisting using of glasses   |                 |                        |               |            |                |
| Yes                           | 129 (25.3)      | 1 (0.8%)               | 0.42          | 0.002- 3.4 | 0.45           |
| No                            | 380 (74.7)      | 7 (1.8%)               | 2.4           | 0.3 -52    |                |
| * indicates p<0.05            |                 |                        |               |            |                |

**Table 4. The methods of taking patients history for infection (HBV, HCV, HIV) by DCWs for the dental clinic visitors**

| Methods                    | Number | Percentage |
|----------------------------|--------|------------|
| Type of patients history   |        |            |
| Written only               | 146    | 28.7       |
| Oral only                  | 34     | 6.7        |
| Written and oral           | 83     | 16.3       |
| Non                        | 254    | 49.9       |
| Patients history frequency |        |            |
| At first visit             | 212    | 41.6       |
| At certain intervals       | 35     | 6.9        |
| Each visit                 | 8      | 1.6        |

## Discussion

During recent years, in Yemen, Health care authorities as well as patients and family patients are increasingly concerned about possible professional to-patients and visa-versa transmission of hepatitis B virus (HBV), HCV and other blood born viruses. Such general anxiety is well reflected in conducted this study, in our opinion this emerging issue should be more extensively discussed in medical community in Yemen. Until now, no reports or limited studies conducted about prevalence of HCV among DCWs and associated factors which might be increased the possible professional to-patients and vice-versa transmission of HPV. Our results suggest that occupational transmission of HCV in dental settings occurs sometimes, and frequently. The finding that more than 1.6% of Sana'a city DCWs, who had HCV antibodies, was opposing with prevalence of zero% found among general dentists in Japan [14] but roughly similar to that reported in other Asian and North America

in which the prevalence rate of HCV among general dentists was about 1.8%.[15] On the other hand, our rate (1.6 %) is lower than that reported by Hussain, et al. in Iraq in which the prevalence rate of HCV among general dentists was 9.3%. [9] Also our rate is roughly similar to that reported among blood donors in Yemen in which 1.1% of the donors in Hajjah Governorate were infected with HCV.(11) However our prevalence rate (1.6%) among DCWs is higher than that reported by Al-Nabahi, et al. [12] in which the prevalence of HCV in 2014 in Sana'a city and Aden city among general population were 0.2% and 0.6% respectively. Also the prevalence of HCV among our individuals is higher than that reported from the neighboring countries including in which it is ranged from 0.5% to 1.0% among general populations [16]. Such small differences in prevalence rates may be explained by the fact that DCWs are risk group of HCV [17]. The specific dentist prevalence rate was 1.2% slightly lower than

dental assistant prevalence rate (1.9%). This result was similar to that reported in Taiwan and other developed countries where a higher prevalence among dental assistants was found [2,18]. With regard to this slightly difference between percentages of infection in dentists and dental assistants, this is may be attributed to several possible reasons. One of the most common reasons is the different level of unprotected exposure to patients' body fluids and needle stick injuries in both groups. Other reasons of being infected with hepatitis virus may be related to family history and dental procedures [3]. The specific male prevalence rate was 1.2% slightly lower than female prevalence rate 1.9%, which was similar to the sex distribution of HCV infection in African and American countries where equal distribution is the features in all reports of general population and risk groups [19,20]. When we considered, the practice setting, there was slightly higher rate of HCV among private DCWs (1.9%), comparing with 1.2% for

governmental DCWs. This result was different to that reported in Taiwan and German where similar prevalence among DCWs was found. [18,21] This continuing high risk in both the practice settings could be in part due to inconsistent use of or ineffectiveness of recommended barrier prevention measures to prevent transmission of blood-borne infections in, private and government practice settings. The results of this study indicated that the prevalence of HCV among Yemeni DCWs was none significantly affected by the duration of the practice (long duration independent). Some studies that covered wider range of duration in several groups indicated that the prevalence of HCV is long duration dependent, in which the rate increase with increasing duration of practices [18,20-22]. An exposure can be defined as a percutaneous injury (e.g., needle stick or cut with a sharp object) or contact of mucous membrane or no intact skin (e.g., exposed skin that is chapped, abraded, or with dermatitis) that occurs during the course of

persons employment, with blood, saliva, tissue, or other body fluids that are potentially infectious. Because accidents with needles are one of the most common types of injury in the health care setting, injuries from needles are often called needle stick injuries [23]. In our study 45.6% of our HCWs were exposed to needle stick injuries, and significant risk for HCV infection after a needle stick was 8.9 (OR) (p value=0.01), and the prevalence of HCV in dental staff exposed to this was 3%. Our result was in the same range that reported by Tokars and others in which the prevalence of HCV in dental staff exposed to needle stick injuries has varied from 0 to 6.2%.[5,24,25] Also Ppolito and others [26,27] stated that the risk following a needle stick injuries in DCWs is known and is believed to be greater if the source patient is positive for HCV RNA, with no transmission occurring from HCV RNA negative sources. In this study 41.1% of our HCWs were exposed to cuts, and significant risk for HCV infection after a cut was

4.4 (OR) (p value=0.04), and the prevalence of HCV in dental staff exposed to cuts was 2.9%. Our rate among DCWs exposed to cuts (2.9%) was in the same range that reported by CDC in which the prevalence of HCV in dental staff exposed to cuts has varied from 0 to 6.2% [5,24,25] Resemblance to findings in New York City, [7] where cut injuries were the most frequently recorded exposures among dental workers, the use of manual instruments for tooth cleaning appears to be associated with the highest rate of occupational injury in our study. This is somewhat similar to findings in the UK, which noted that the greatest percentage of exposures amongst dental workers occurred during tooth cleaning [28]. Manual cleaning of teeth and root surfaces requires dexterity and good techniques. Our study suggests that there may an indication for more training of the dental care workers especially in work practice controls. Such controls might include restricting the use of the fingers for tissue retraction and minimizing the

potential uncontrolled movements of scalars and similar instruments. No prophylactic measures involving drugs or immunoglobulins are at present available so first aid management is very important. It is essential a baseline sample is taken at the time of injury. No effective vaccination has been developed against HCV [5]. Twenty-seven percent of the HCWs were exposed to blood or saliva on skin. The prevalence rate to HCV to DCWs exposed to blood or saliva on skin was 5.3%. The risk following a blood splash is unknown but is believed to be greater if the source patient is positive for HCV RNA, with no transmission occurring from HCV RNA negative sources.

Among the these DCWs, the odds of HCV infection differ but not statistically significant according to the consistent use of gloves, face masks or eye glasses, suggesting that these modalities had limited or no efficacy. Unfortunately, there are few other comparison data about the efficacy of barrier prevention

measures. Studies conducted during the 1990s and 80s showed no relationship between the use of gloves, face masks, or eye protection and previous HBV infection.[29,30] However, in two studies, so few dentists used face masks that the power to detect a protective effect was low [7,30]. The conclusion that face masks may have reduced the risk of HCV infection must be interpreted with some caution as the small number of HCV infected dentists precluded a multivariate analysis to examine potential confounding factors. In addition, this study only had an approximately 50% power to detect a fourfold reduction in the odds of previous infection by gloves or eye glasses. Nevertheless, the fact that the point estimates of the odds ratios were  $1 \pm 1$  would suggest that no significant effect would have been found even with a much larger sample size. Also, DCWs use of personal protective equipment in this study, which is a critical component of standard precautions, was found to be similar to Ammon, et al. [21]

and Kim, et al. [31], who noted that the use of protective eyewear was inadequate similar to our result for example only 25.3% of the DCWs in this study were wearing protective eye shields. Although some DCWs wore prescription glasses, prescription glasses alone are not acceptable to adequately protect the eyes. Protective eyewear should have solid side shields or alternatively a face shield [22,32]. This finding, however, is not peculiar to Sweden, as the study in the UK also noted that 60 percent of the students were not wearing protective eyewear when they experienced an exposure incident [30,33]. While the risk of infection is less with mucosal splash than via percutaneous injuries, this may be an important route of exposure in this population, considering the fact that saliva and blood splashes were the next most commonly cited exposures after puncture wounds. DCWs should receive instructions to help them understand the risks associated with treating patients without protective eyewear; hopefully, comprehension

of the risks will improve compliance with the use of protective eyewear.

**Conclusion:** A combination of standard precautions, engineering, work practice, and administrative controls are the best means to minimize occupational exposures amongst all oral health care workers. It is the responsibility of training institutions to ensure the safety of the DCWs by requiring mandatory HBV vaccination prior to exposure and adequate training in work safety. It is important that there are written policies and procedures to facilitate prompt reporting and management of all occupational exposures; this information should be made easily accessible to all workers. Adequate monitoring mandates the reporting of all occupational exposures and is a means of quality control in health care delivery. We would like to recommend, therefore, that processes for monitoring occupational exposures be made functional in all Yemeni dental clinics and schools to promote safety, quality, and value in the oral health care services provided.

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