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RESEARCH ARTICLE

Knowledge, Attitudes and Practice of Dental Infection Control and Occupational Safety in India: 1999 and 2010

[1]Deepthi Shetty, [2]Mahesh Verma, [3]Sadashiva Shetty, [4]Sumit Dubey, [5]Scott Walters, [5]Ira Bernstein
[5]Katherine Froelich-Grobe, [6]Raghunath Puttaiah

[1]MPH Candidate, University of Texas Houston School of Public Health, Dallas Branch, Dallas, Texas, USA

[2]Director and Principal, Maulana Azad Institute of Dental Sciences, New Delhi, India

[3]Principal, Bapuji Dental College, Davangere, Karnataka, India

[4]Faculty, Maulana Institute of Dental Sciences, New Delhi, India

[5]Faculty and Thesis Committee Members, University of Texas Houston School of Public Health, Dallas Branch, Dallas, Texas, USA

[6]Research Mentor/Chair Thesis Committee and Associate Professor, Diagnostic Sciences, Texas A&M Health Science Center Baylor College of Dentistry, Dallas, Texas, USA

Correspondence: Raghunath Puttaiah, Associate Professor, Diagnostic Sciences, Texas A & M Health Science Center, Baylor College of Dentistry, Dallas, Texas, USA, e-mail: rputtaiah@bcd.tamhsc.edu

ABSTRACT

The objective was to study knowledge, attitudes, practice (KAP) and needs regarding infection control measures using two cross-sectional surveys from 1999 and 2010 conducted in India. Both data collection instruments had only about 35 comparable variables in common. In 1999, there were 456 respondents (dentists) who used a self-administered survey instrument compared to 272 respondents in 2010. Both the 1999 and 2010 samples were mutually independent with no overlap, had regional differences, and therefore were not directly compared for changes in KAP over time. While almost all respondents from both surveys felt that education in dental safety was needed and wanted mandatory dental safety curriculum in dental schools, severe inadequacies in dental safety knowledge, protection against immunizable diseases, and practice of universal precaution were noted. Data from the study demonstrated that there is a substantial opportunity to improve the knowledge, attitude and practice of dental infection control and occupational safety in India. Respondents reported that infectious disease status of a patient is always known and a significant number reported that they had the right to refuse care for patients of known infectious disease status. Stigma in treating HIV/AIDS patients was still a concern, an ethically troubling response suggesting the need for a stronger focus on educating dentists in subjects, such as dental safety, stigma and infectious disease. Information obtained from this study could be utilized for developing policies oriented towards increasing dental safety educational efforts, in both dental schools as curriculum, and for practicing dentists through professional updates or continuing dental education.

Keywords: Knowledge, attitudes and practice (KAP), Dental safety, Dental infection control, Occupational safety, India, Surveys, Stigma, Infectious diseases, Universal precautions.

INTRODUCTION

Dental infection control need assessment studies were conducted in India in 1999 and 2010 to assess the status of dental safety. Data were collected using a self-administered needs assessment survey instrument. Data collected did not include personal information/subject identifiers. Respondents in 1999 were from a convenience sample from Karnataka in South India, and the 2010 survey included respondents randomly selected from a study club in New Delhi from the north. The 1999 data collection instrument was developed by investigators from the Texas A&M University Health Science Center Baylor College of Dentistry and the transcultural unit of the Eastman Dental Institute/WHO Collaborating Center, University College London. This instrument was modified for the 2010 study with only about 35 variables in common between the two surveys. Information obtained from the 1999 study contributed towards developing dental safety standards for Indian oral health professional and in implementing guidelines for continuing dental education in dental safety for practicing dentists in 2009 through the Dental Council of India.[1] Although there are over 290 dental schools in India and a significant case load in HIV sero-positive patients, a mandatory curriculum in dental safety has not been implemented. Further, the CDE programs in dental safety, although mandatory for oral health professionals is only going to be enforced in 2014, for annual license renewal. Although cosmetic dentistry and implantology is almost on par with medically advanced countries, a majority of the dental conferences do not address educational updates in dental safety. Lastly, dental equipment and materials that are commonly used in medically advanced countries are virtually absent in India, requiring active participation by dental industry in increasing their access and availability for safe dental care.

BACKGROUND

Infection control is defined as "Measures practiced by health care personnel to reduce the risks of transmission of infectious agents to patients and employees (e.g. proper hand hygiene, scrupulous work practices, use of personal protective equipment (PPE), such as masks or respirators, gloves, gowns and eye protection). Infection control measures are based on how an

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infectious agent is transmitted and include standard, contact, droplet and airborne precaution.[2]

Practice and monitoring of infection control is an ongoing task for any surgical field.[3] In the United States of America, Occupational Safety and Health Administration (OSHA) estimates that about 5.6 million workers in the health care industry and related occupations annually are at risk of occupational exposure to bloodborne pathogens, including human immunodeficiency virus (HIV), hepatitis B virus (HBV), hepatitis C virus (HCV), etc.[4] According to Centers for Disease Control and Prevention (CDC), thousands of Americans are infected with HIV but are unaware of their sero-positive status.[5] In 2008, 4.7 million people in Asia were living with HIV, including 350,000 who became newly infected.[6] The number of people living with HIV has risen from around 8 million in 1990 to 33 million today, and is still growing. About 67% of people living with HIV are in sub-Saharan Africa.[7]

Dentistry, a surgical field involves exposure to blood and other potentially infectious materials (BOPIM) responsible for disease transmission through percutaneous means, direct contact, droplets or aerosols.[8] Therefore, high standards in infection control and occupational safety are required in controlling crossinfection and occupational exposures to bloodborne diseases.[9]

Infections may be transmitted in the dental operatory through several routes:[10]

a. Direct contact with blood, oral fluids or other infected materials
b. Indirect contact with contaminated objects (e.g. instruments, equipment or environmental surfaces)
c. Contact of conjunctival, nasal or oral mucosa with droplets (e.g. spatter, containing microorganisms generated from an infected person and propelled a short distance by coughing, sneezing or talking)
d. Inhalation of airborne microorganisms that can remain suspended in the air for long periods.

Dental health care providers must be aware of diseases encountered during provision of dental care and must treat patients following appropriate infection control and occupational safety guidelines and recommendations. Although the science used in dental safety is common, each country or groups of countries have their own policies and regulations on infection control and occupational safety. However, compliance with policies and guidelines vary widely across countries. Failure to follow the prescribed infection control methods can result in iatrogenic or nosocomial disease transmission in the dental setting. Disease transfer from one patient to another in dental clinics is termed as "crossinfection," and disease transmission to dental care providers are referred to as "occupationally acquired infectious diseases," both predominantly bloodborne diseases.[8] Dental infection control and occupational safety can also be referred to as "dental safety". Apart from blood borne diseases, such as hepatitis B, hepatitis C infections and HIV infection, and other sexually transmitted diseases, dental health care workers are at risk of acquiring respiratory diseases due to generation of droplets and infectious bioaerosols during provision of dental care.[8]

Dental patients and dental health care workers (DHCW) may be exposed to a variety of microorganisms via blood, oral or respiratory secretions.[11] These microorganisms may include cytomegalovirus, hepatitis B virus (HBV), hepatitis C virus (HCV), herpes simplex virus types 1 and 2, human immunodeficiency virus (HIV), *mycobacterium tuberculosis*,[3] staphylococci, streptococci and other organisms that infect the upper respiratory tract.[11]

Although the potential for HBV transmission in the workplace setting is greater than HIV, the modes of transmission for these two viruses are similar.[12] Both have been transmitted in occupational settings through percutaneous inoculation or contact with an open wound, nonintact (e.g. chapped, abraded, weeping or dermatitic) skin, or mucous membranes to blood, blood-contaminated body fluids, or concentrated virus.[12] Blood is the single most important source of HIV and HBV in the workplace setting.[12] Protective measures against HIV and HBV for workers should focus primarily on controlling exposures to blood as well as immunization against HBV.[12] Health care workers who have received the complete series of Hepatitis B vaccine and have developed immunity to the virus are at virtually no risk for infection.[12] For an unvaccinated person, the risk from a single needle stick or a cut exposure to HBV-infected blood ranges from 6 to 30%, and depends on the hepatitis B antigen (HBeAg) status or degree of infectivity of the source individual.[13]

Studies have demonstrated that dental unit waterlines (i.e. narrow-bore plastic tubing that carries water to the high-speed hand piece, air/water syringe and ultrasonic scaler) becomes colonized with microorganisms, including bacteria, fungi and protozoans.[14-16] Apart from inherent contamination by environmental microbes, microbes and other contaminants from the patient's oral cavity is also an issue. While prevention of suck-back of patient materials through the hand-piece or air/water syringe was thought to be effective by using anti-retraction valves, the latter were found to be very ineffective and possibly allowed suck-back (retraction of fluids from the oral cavity into the water system) contamination of waterlines due to failure in a very short time.[17] These microorganisms could be either non-pathogenic, pathogenic to humans or could be environmental or microbes from the oral cavity with a potential for infecting humans. Microorganisms colonize and replicate on the interior surfaces of the waterline tubing and form biofilms, which serves as a reservoir that can amplify the number of free-floating microorganisms in water used for dental treatment.[14] Reports associate waterborne infections with dental water systems, and scientific evidence of high levels of contamination verifies the potential for transmission of waterborne infections and disease in hospital settings and in the community.[14]

CDC provides specific recommendations on vaccination of DHCWs; protective attire and barrier techniques; hand washing and handcare; use and care of sharp instruments and needles; sterilization of instruments; decontamination of high-touch clinical surfaces; cleaning and disinfection of the dental unit and environmental surfaces; disinfection and the dental laboratory; use, sterilization and care of hand pieces, anti-retraction valves, and other intraoral dental devices attached to air and water lines of dental units; single-use disposables; handling of biopsy specimens; use of extracted teeth in dental educational settings and disposal of waste materials.[11] When implemented, the CDC recommendations should reduce the risk of disease transmission in the dental environment, from patient to DHCW, from DHCW to patient and from patient to patient.[11]

PPE are designed to protect the skin and the mucous membranes of the eyes, nose and mouth of dental health care personnel from exposure to blood or other potentially infectious material.[18] A visible spray is created during the use of rotary dental and surgical instruments (e.g. hand pieces, ultrasonic scalers) and air-water syringes.[15] This spray primarily consists of a large-particle spatter of water, saliva, blood, micro-organisms and other debris.[15] The spray may also contain some aerosol (i.e. particles of respirable size: 10 microns).[15] Aerosols can remain airborne for extended periods and can be inhaled.[15] Appropriate work practices, such as the use of dental dams and high-volume evacuators should minimize droplets, spatter and bioaerosols.[15] OSHA mandates that dental health care workers wear gloves, surgical masks, protective eyewear, and protective clothing in specified circumstances (based on anticipated exposure to BOPIM) to reduce the risk of exposures to bloodborne pathogens.[15]

The principles of infection control remain fairly unchanged, new technologies, materials, equipment require continuous evaluation.[19] The unique nature of most dental procedures, instrumentation, and patient-care settings may also require specific strategies directed towards prevention of disease transmission among DHCWs and their patients.[16] Dental practitioners should understand why these infection control procedures are important.[20] Unless precautions are taken, there is a high possibility that patients and DHCWs will be exposed to bloodborne and other potentially pathogenic infectious materials.[17] By understanding the principles of disease transmission and implementing infection control measures, dental personnel can control disease transmission in the dental setting.[17]

Stigma, or rather the degree to which an identity is spoiled as a result of having an illness, is a key variable in the social construction of illness.[21] Throughout history many diseases have carried considerable stigma.[22] The list includes leprosy, tuberculosis, cancer, mental illness, and many sexually transmitted diseases. HIV/AIDS is only the latest disease to be stigmatized.[19] Only since 1987, studies have been undertaken on the attitudes and behavior of dentists toward HIV-positive patients.[23] Dentistry has witnessed many changes over the past few years.[24] Developments in technology, new materials, managed care, third party payment and infection control requirements as well as the rise in litigation have all created new challenges for the private practitioner.[21] Not only does today's dentist face new practical problems, but the changing conditions of practice have given rise to ethical problems that did not exist until recently.[21] Early detection of HIV related oral lesions can be used to diagnose HIV infection, elucidate progression of the disease, predict immune status, and can result in timely therapeutic intervention.[25] The treatment and management of oral HIV lesions can considerably improve well-being of such patients.[25] Oral health care workers (OHCWs) have an important role to play in the overall health care delivery to patients with HIV/AIDS.[25]

Discrimination or stigma against HIV-infected people has been observed since the epidemics of HIV and HBV. Some discriminatory acts could be overt, such as refusing to provide treatment or making derogatory statements.[26] Other forms are more subtle, such as providing less emotional support or less thorough care than required or acceptable. In India, as in many other countries it is illegal for clinicians, clinics, and hospitals to discriminate on the basis of HIV disease status as strict laws against discrimination against seropositive patients have been proposed.[27]

PURPOSE

The purpose of this study was to understand Indian dentists' knowledge, attitudes and practice (KAP) in dental infection control and safety from two cross-sectional surveys (1999 and 2010) conducted in India, so that the information could be used in developing dental safety education policy.

METHODS

The first dental infection control data collection instrument was developed in 1997 by investigators from Baylor College of Dentistry, Texas A&M Health Sciences Center, Dallas, Texas, USA and the Eastman Dental Institute, University College of London, UK.[8] This KAP/needs assessment instrument (self-administered) was distributed to convenience samples comprising dental faculty, private and government-employed dentists in India, Pakistan, Thailand, Philippines, Taiwan, China, South Korea and the USA.[8] The survey instrument addressed variables including demographics, dental practice, perceived risk of disease transmission with respect to blood borne pathogens, perceived needs for practicing safe methods during patient care, and measures taken to control the spread of infectious disease.[8]

In order to understand how infection control procedures have changed from 1997, a new data collection instrument (2010) was developed by faculty from Baylor College of Dentistry, Dallas, Texas, USA and was utilized by investigators from Maulana Azad Institute of Dental Sciences, New Delhi, India on a random sample of the New Delhi dentists who were

members of the local dental association. The 2010 KAP instrument consisted of 92 questions addressing key topics related to infection control and occupational safety measures. Most variables used in this instrument are dichotomous. The survey instrument addressed variables including dental practice characteristics, perceived risk of disease transmission with respect to bloodborne pathogens, perceived needs for practicing safe methods during patient care, and measures taken to control the spread of infectious diseases. This self administered survey was distributed to a selected sample of about 500 dentists in the New Delhi, India. A trained faculty of MAIDS hand-delivered the instrument and was only present to help dentists in understanding the questions but did not interfere with the response or completion of instruments by the respondents. This was to ensure that understanding of certain terms were consistent. Data were collected without use of subject identifiers. This effort was approved by the Ethics/Human Subject Review Committee of MAIDS New Delhi, India and provided an exempt status. Data collected was the property of MAIDS and was used after obtaining permission formally, from the investigators and the institution.

The samples from the two surveys (cross-sectional) were independent samples that could not be simply compared as the demographic, educational and other factors precluded meaningful longitudinal comparisons. However, geographic and in certain instances between time periods were done. Sample for the 1999 survey was from Southern India (Bengaluru) and 2010 from Northern India (New Delhi), both metropolitan areas. The Southern sample is from a region of highest dentist to population ratio and has the highest density of dental institutions in India. Although simple longitudinal comparisons were not appropriate, the information could be used to understand broadly, the KAP of Dentists in India and could be used to develop educational policy in improving KAP in dental safety. Data were entered and edited using Microsoft Excel 2007, and analyzed using statistical software STATA Ver. 11(StataCorp LP, College Station, Texas, USA). Descriptives, such as frequencies generated and bivariate analysis, conducted using cross tabulations and Chi-square statistic.

RESULTS AND DISCUSSIONS

Table 1 describes the overall KAP of infection control without accounting for differences between sample populations. In 2010, only 83% of respondents reported that infectious diseases were on the rise in India as opposed to 93% in 1999. About 68% reported they had adequate knowledge of infectious diseases in 2010 compared to 83% in 1999. About 86% of respondents in 1999 recognized the potential of transmission through percutaneous route, while 73% recognized potential through splash/spatter in 2010. Over 90% of the respondents reported awareness of HBV, HIV and STD's having a potential for being transmitted in a dental clinic. Less than 50% of respondents in 2010 reported being immunized against infectious diseases except for tetanus, for which 85% of respondents were immunized and only 68% respondents reported having adequate knowledge of infectious diseases. About 16% of the respondents in 2010 reported having the right to refuse care to patients with infectious diseases compared to 19.9% in 1999 showing low yet a clinically significant problem. About 27% of respondents reported that infectious status of a patient is always known, compared to 14.7% in 1999 and this is worrisome and contradicts understanding of universal precautions or standard precautions.

Table 1: Knowledge and attitude regarding infection control—comparison between 1999 and 2010 samples

Variable	*2010* %	*1999* %
Epidemiological trend of bloodborne infectious diseases and AIDS in India		
Rise of HIV Infection and AIDS in India	82.7	93.2
Adequate knowledge of infectious diseases to practice safe dentistry	68.4	83.1
Knowledge versus attitude regarding HBV and HIV among respondents		
Potential for HBV and HIV infection transmission in a dental office	91.2	91.7
Potential for HBV and HIV infection transmission through percutaneous route	86.0	53.9
Potential for HBV and HIV transmission through splash/splatter	73.2	68.4
Immunization against infectious diseases		
Respondent immunized against hepatitis-B virus infection	47.4	79.8
Respondent immunized against chicken pox	48.9	68.6
Respondent immunized against mumps	34.6	68.4
Respondent immunized against measles	53.7	73.5
Respondent immunized against rubella (German measles)	39.3	62.3
Respondent immunized against tetanus	84.6	87.1
Respondent immunized against diphtheria	53.7	85.7
Respondent immunized against polio	59.6	89.3
Respondent immunized against influenza	41.5	39.9
Universal precautions—knowledge, attitudes and practice		
All patients must be treated alike irrespective of infectious disease status	58.8	67.3
Infectious disease status of a patient is always known	27.6	14.7
Right to refuse care to patients with infectious diseases	16.2	19.9

Table 2 describes practice measures being implemented without accounting for differences between sample populations. Over 99% of the respondents reported using antimicrobial soap in 2010 compared to the 79.6% in 1999. Over 83% of respondents in 2010 reported using sterile surgical gloves for surgeries compared to 75% in 1999. About 84% of respondents in 2010 double-gloved for persons with a known status of bloodborne diseases or STDs, compared to 75% in 1999 that contradicted principles of universal/standard precautions and was possibly due to stigma with reference to infectious disease patients. In 2010, use of surface barriers was low but 84% of respondents reported use of surface disinfectants (disinfection in lieu of surface barrier usage), and 60% reported use of glutaraldehyde for decontamination or cold sterilization of instruments. Reported usage of ultrasonic instrument cleaners was 30% in 1999 but was 39% in 2010 sample. No significant difference in the usage of autoclave was noted between the two survey samples. About 30% of respondents in 2010, reported using heat sterilizable burs, endodontic instruments, orthodontic pliers and 70% of respondents reported using heat sterilizable dental instruments, a low compliance issue with respect to critical and semi-critical instruments. In 1999 and 2010 about 26% of respondents reported using rubber dam whereas the 1999 sample showed a lower utilization of HVE (35%) in comparison to 72.8% in 2010. Since there were significant differences in the sample population between 1999 and 2010, it was found necessary to consider responses separately based on gender, qualification and occupation.

Tables 3 to 8 list variables with significant odds ratio for 1999 and 2010 samples by gender, qualification and occupation. In 1999, the only variables for which the difference in responses was significant between males and females were—(a) the epidemiological trend "rise in HIV infections and AIDS"; (b) double gloving; (c) use of surface disinfectants; and (d) regular use of sterilizable dental instruments. In 2010, the variables showing significant differences between males and females were the epidemiological trend - rise in HIV infections and AIDS, immunization against Diphtheria, use of sterile surgical gloves, regular use of surface barriers and regular use of ultrasonic cleaners. In the 2010 sample, males were less likely to believe that HIV infections and AIDS were on the rise in comparison to female respondents; this effect changed from 1999 sample where more males believed HIV infections and AIDS were on the rise.

When comparisons were made stratifying by qualification, the 1999 sample showed that the differences were significant between BDS degree holders and specialized degree holders with respect to the belief of rise in HIV infections and AIDS, knowledge of infectious diseases, immunization against infectious diseases (i.e. mumps, rubella, polio and influenza), use of sterile surgical gloves, double gloving and use of certain heat sterilizable instruments (i.e. endodontic instruments, orthodontic pliers and dental instruments). Compared to specialists, BDS degree holders were more likely to report being immunized, using personal protective equipment and heat sterilizable instruments. In the 2010 sample, responses on several variables differed significantly by achieved qualification. Results were inconsistent for knowledge of infectious disease trends and risks, use of personal protective equipment, regular use of surface barriers, regular use of instrument reprocessing devices and control of aerosols.

Table 2: Practice measures being implemented—comparison between 1999 and 2010 samples

Variable	*2010 %*	*1999 %*
Regular use of any antimicrobial hand soap	99.6	79.6
Use of personal protective equipment (PPE)		
Regular use of sterile surgical gloves for surgeries	83.1	71.5
Double gloving for persons with known bloodborne infectious diseases	83.8	75.0
Regular use of surface barriers	39.7	62.5
Use of chemical germicides		
Regular use of any surface disinfectant	84.2	71.9
Immersion disinfectant		
Regular use of gluteraldehyde	60.3	53.5
Use of instrument reprocessing devices		
Regular use of ultrasonic cleaners	39.3	30.3
Regular use of autoclave	83.5	86.6
Use of heat sterilizable instruments		
Regular use of heat sterilizable burs	30.1	47.4
Regular use of heat sterilizable endodontic instruments	30.1	52.9
Regular use of heat sterilizable orthodontic pliers	33.5	39.9
Regular use of heat sterilizable dental instruments	69.9	83.6
Regular use of heat sterilizable mouth mirrors	47.1	88.2
Control of aerosols		
Regular use of rubber dam	26.1	26.9
Regular use of high volume evacuator	72.8	34.6

Table 3: Comparison by gender for 1999 sample

Variable	Males	Females	OR	p-value
Rise of HIV infection and AIDS in India	95.5%	89.5%	2.47	0.02
Regular use of any surface disinfectant	74.9%	66.0%	1.54	0.05
Regular use of heat sterilizable dental instruments	86.4%	79.0%	1.69	0.04

Table 4: Comparison by gender for 2010 sample

Variable	Males	Females	OR	p-value
Respondent immunized against diphtheria	61.5%	48.5%	1.69	0.04
Regular use of surface barriers	52.3%	31.3%	2.41	0.00
Regular use of ultrasonic cleaners	52.3%	30.7%	2.48	0.00

Table 5: Comparison by qualification for 1999 sample

Variable	BDS	Specialization	OR	p-value
Rise of HIV infection and AIDS in India	95.4%	90.2%	2.26	0.03
Respondent immunized against mumps	72.9%	62.4%	1.62	0.02
Respondent immunized against rubella (German measles)	67.6%	55.2%	1.69	0.01
Respondent immunized against polio	94.7%	82.0%	3.89	0.00
Respondent immunized against influenza	44.7%	33.5%	1.60	0.02
All patients must be treated alike irrespective of infectious disease status	72.1%	60.8%	1.67	0.01
Regular use of sterile surgical gloves for surgeries	75.6%	66.0%	1.59	0.02
Double gloving for persons with known blood borne infectious diseases	79.4%	69.1%	1.72	0.01
Regular use of heat sterilizable endodontic instruments	57.3%	46.9%	1.52	0.03
Regular use of heat sterilizable orthodontic pliers	44.7%	33.5%	1.60	0.02
Regular use of heat sterilizable dental instruments	87.8%	77.8%	2.05	0.01

Table 6: Comparison by qualification for 2010 sample

Variable	BDS	Specialization	OR	p-value
Right to refuse care to patients with infectious diseases	27.7%	12.6%	2.67	0.00
Regular use of surface barriers	60.0%	33.3%	3.00	0.00
Regular use of any surface disinfectant	93.8%	81.2%	3.54	0.02
Regular use of ultrasonic cleaners	64.6%	31.4%	3.99	0.00
Regular use of rubber dam	43.1%	20.8%	2.89	0.00

Table 7: Comparison by occupation for 1999 sample

Variable	Private practice	Faculty	OR	p-value
Respondent immunized against mumps	70.8%	57.0%	1.83	0.02
Respondent immunized against measles	75.6%	63.3%	1.79	0.02
Respondent immunized against rubella (German measles)	66.1%	44.3%	2.45	0.00
Regular use of heat sterilizable dental instruments	85.9%	72.2%	2.36	0.00
Regular use of heat sterilizable mouth mirrors	90.5%	77.2%	2.79	0.00

Table 8: Comparison by occupation for 2010 sample

Variable	Private practice	Faculty	OR	P value
Adequate knowledge of infectious diseases to practice safe dentistry	73.1%	61.0%	1.74	0.04
Potential for HBV and HIV infection transmission in a dental office	95.8%	83.8%	4.42	0.00

When stratified by occupation, the 1999 sample showed that responses differed significantly between faculty and private practitioners for immunization against infectious diseases (i.e. mumps, measles, rubella) and use of certain heat sterilizable instruments (i.e. dental instruments and mouth mirrors). Private practitioners were more likely to be immunized and use heat sterilizable instruments compared to faculty. In 2010, the differences by practice setting were related to adequate knowledge of infectious diseases, immunization against infectious diseases, regular use of surface barriers, regular use of instrument reprocessing devices and use of heat sterilizable instruments. Overall, private practitioners were less likely to report adherence to these practices and report immunization against infectious diseases. .

The results from this study broadly demonstrated lack of dental safety. Due to regional differences in the two samples as well as based on gender, qualification and occupation, results cannot be simply compared over time. However, the findings illuminate some interesting reported outcomes in terms of knowledge, attitude and practices in dental infection control and occupational safety.

In the past 10 years, India has been investing more in the medical care of HIV patients. Availability of inexpensive and locally manufactured antiretroviral drugs, and drug cocktails were a breakthrough in treatment of HIV/AIDS when Indian pharmaceutical companies produced generic antiretrovirals that were similar to those made by large pharmaceutical companies, but significantly cheaper.[28] Based on the 2010 UNAIDS report, India has shown a 50% drop in the number of new HIV infections in the recent 10 years.

Immunization, the first line of defense against preventable disease among respondents from both regions, was low with significantly lower rates in the 2010 regional sample. This low response rate was consistent in all the groups (males, females, BDS degree holders, specialized degree holders, involved in private practice, faculty members) with the exception of dental faculty members. Faculty members were better in terms of immunization rates and certain practice measures possibly because of institutional updates in immunization requirement for employment and implementation of the infection control practice measures. In addition, they have to comply with certain internal rules and accreditation audits prescribed by the Dental Council of India as compared to private practitioners not requiring such accreditation or compliance measures.

According to Times of India, in 2010, about 90% of the people in Delhi were not immunized against hepatitis B, possibly a regional issue and not a secular one with respect to the rest of India. Although a requirement by the Dental Council of India, a vast majority of dental schools still have not implemented immunization requirements for student admissions.[1] The low immunization rates can be linked to few respondents having adequate knowledge of infectious diseases or who have grownup in high immunization coverage/achievement areas. Only 68.4% of respondents reported having adequate knowledge of infectious diseases. In both, 1999 and 2010 samples, respondents with specialized degree were more likely to have adequate knowledge of infectious diseases. It is important to increase awareness about preventable infectious diseases and ensure individuals immunized against them infectious diseases.

Stigma in treating HIV/AIDS patients is still a concern. Not only does stigma increase discrimination between infectious and noninfectious patient, it also affects the practice of universal precautions based on anticipated exposure to BOPIM. In the 2010 sample a little over one half of respondents stated that all patients should be treated as potentially infectious, an outcome that is very disturbing. One out of seven respondents felt they could refuse care to patients with infectious disease contrary to the laws set by the Government and the National AIDS Control Organization, the latter is a governmental body. Although there were minor differences between various groups, these findings on stigma and infectious diseases are ethically wrong and deleterious to patients, patients' rights and human rights. These findings suggest the need for a strong emphasis on educating dentists in the ethical and legal issue of stigma and care of infectious/potentially infectious patients. Dentists may not be always aware of the infectious disease status of a patient as some may not report it or they may not have been tested, however, all patients must be treated as potentially infectious and must be treated with professionalism and respect.

Today, in United States all devices that are introduced into the oral cavity are either single-use disposable supplies or always heat sterilized between use on patients. This compares to only 30% of Indian respondents reporting to use heat sterilizable instruments in the 2010 sample. Faculty used sterilization measures more possibly due to institutional checks and balances. This finding is of grave concern as it indicates that dentists may be using inappropriate cold sterilization methods or other unapproved sterilization methods that cannot be validated. In short, responses from both the 1999 and 2010 samples revealed inadequate understanding of the principles of dental safety, negative attitude towards infectious patients, and practice lacking in dental safety. Public health measures and improvement in the field of medicine are being addressed in India, but the field of dentistry still lacks implementation of the

much needed safety regulations, knowledge, training and equipment. It would therefore be in the economic and social interest to facilitate and sustain a robust program in Dental Infection Control and Safety Program for India.

CONCLUSIONS

While it was difficult to draw to concrete conclusions on the trends between the 1999 and 2010 samples, data from this evaluation (both surveys) demonstrated that there was a substantial opportunity to improve the knowledge, attitude and practice of dental infection control and occupational safety in India. Regulations mandating dental safety, although in place need to be emphasized and implemented. Affordable education, including online or distance self-study and testing programs must be promoted for all dentists, dental auxiliaries in the currently mandatory field dental safety. State's dental councils in India must emphasize the need for dentists to provide proof of training in dental safety for annual renewal of the dental license. All schools must adopt a comprehensive curriculum in dental safety. Immunization against preventable infectious diseases must be publicized and required. Training of a core group of local experts in dental safety should be carried out under the auspices of the Dental Council and premier Dental Educational Institutions in India. Dental industry from within India and abroad must be encouraged in making equipment and materials accessible for the practice of dental safety. Lastly, all CDE programs that are provided in any dental subject must include dental safety as an integral aspect of education.

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