

# KNOWLEDGE, OPINIONS AND BARRIERS OF ORAL HEALTH CARE STUDENTS TOWARDS CLIMATE CHANGE, POLLUTION AND CONSERVATION OF RESOURCES IN ORAL HEALTH CARE SERVICES

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## ABSTRACT

**Background:** Climate change is a threat for global health. The changes in the climate can have direct or indirect effect on health. The healthcare systems emit a huge quantity of greenhouse gases into the atmosphere during manufacturing and transport of healthcare goods. Thus, it is mandatory for every healthcare professional to take steps to reduce their carbon footprint and thus decrease the effect of climate.

**Aims:** The aim of the study was to assess knowledge, opinions and barriers of oral health care students towards climate change, pollution and conservation of resources in oral health care services.

**Materials and Methods:** A cross-sectional study was conducted among the students of a private dental college using a pretested, structured questionnaire which was circulated via online platform.

**Results:** A total of 275 dental students participated in the study. The age of the respondents ranged from 18-23 years with mean age being 20.93±1.248. Majority, 261 (94.9%), were concerned about pollution stemming from the health care industry; 250 (90.9%) felt that it was important to understand this issue so that they can help their patients and 238 (86.5%) felt that manufactures should provide information regarding their product's effect on environment during and post production.

### Conclusion

The present study highlights that the respondents are willing to avoid pollution pertaining to their professional practice but lack the information for the same. Thus, steps should be taken to include educational modules to disseminate the information and inculcate the habit in the budding oral health care professionals and thus reducing their carbon footprint.

**Key words:** Oral healthcare professionals, climate change, environment, resource conservation.

## INTRODUCTION

Climate change is a threat for global health. According to United Nations, burning of fossil fuels accounts for 75% of the greenhouse gas emissions. The causes of climate change are generating power by burning fossil fuels, manufacturing goods, mining and construction industry, cutting down forests which decreases the carbon dioxide utilizations by the flora, using transportation which mainly runs on fossil fuels, producing food through deforestation and clearing of land for agriculture and grazing, powering buildings and consuming too much clothing, electronics, and plastics.<sup>1</sup> The various effects climate change include more severe storms, increased drought, a warming and rising ocean, loss of species, shortage of food, more health risks, poverty and displacement of population.<sup>1</sup>

The changes in the climate can have direct or indirect effect on health. The effects of climate change on health include<sup>2</sup> a) Injury and mortality from extreme weather events, b) Heat related illness, c) Respiratory illness, d) Water-borne disease and other water-related health impacts, e) Zoonoses, f) Vector-borne diseases, g) Malnutrition and food-borne diseases, h) Noncommunicable diseases and g) Mental and psychosocial health. Climate change can also affect oral health. The effect on oral health can be either due to a) direct effect on oral cavity and its tissues and b) indirect effect of systemic health problem due to oral health.

It is ironic that the effects of climate change are most prominent on the people who are least contributing towards the climate change i.e., the people in low-income and disadvantaged countries and communities.<sup>2</sup>

Furthermore, the healthcare systems emit a huge quantity of greenhouse gases into the atmosphere during manufacturing and transport of healthcare goods. Thus, it is mandatory for every healthcare professional to take steps to reduce their carbon footprint and thus decrease the effect of climate. Moreover, health care industry uses a lot of disposable materials to avoid the transmission of diseases from one person to another. The production, transport and proper disposal of these materials pose a threat to climate as well as can act as a health hazard if not properly treated and disposed. Post covid – everyone has started using more and more disposable items to prevent spread of communicable diseases. Also, general public also psychosocially prefers to get treatment with a disposable item.

Hence, as an oral healthcare professional, the individual should have a thorough knowledge about the various factors that lead to pollution and climate change. The objectives of the study were:

1. To assess the knowledge and attitudes of oral health care students towards climate change.
2. To assess study population's knowledge and attitudes towards pollution generated by dental health care sector.
3. To assess study population's opinion on inclusion of pollution generated by dental health care sector, its impact on climate change and health of individuals in oral health care curriculum.
4. To assess the barriers faced by the study population from taking responsibility for conservation of resources and prevention of pollution.

## Materials and Methods

A cross-sectional study was conducted among the students of a private dental college to determine their knowledge, opinions and barriers towards climate change, pollution and conservation of resources in oral health care services. A pretested, structured questionnaire was circulated via online platform. The first section of the questionnaire explained the purpose of the study and the respondents who were interested were asked to give informed consent. The second and third sections collected information on demographic details of the respondents, and knowledge, opinions and barriers regarding health impacts of health sector pollution and climate change, respectively. The respondents were asked to grade their opinions on a 5-point Likert scale viz. strongly agree, agree, neutral, disagree and strongly disagree. For the analysis purposes, the responses agree and strongly agree were clubbed together and recorded as population who agreed to the statement and the responses neutral, disagree and strongly disagree were clubbed together and recorded as population who disagreed to the statement. Also, the age group of the respondents was divided into two groups viz. 18-20 years and 12-23 years.

The collected data was analysed using IBM SPSS Statistics for Windows, Version 26.0. Armonk, NY: IBM Corp. Descriptive statistics including frequency, percentages, mean and standard deviation, were calculated for the demographic details and responses given by the respondents. A Binary Logistic Regression model was developed keeping demographic details as predictor and disagreement with certain statements as outcome variables to assess their relationship. In the present study,  $p < 0.05$  is

considered as statistically significant.

## Results

A total of 275 dental students participated in the study. The age of the respondents ranged from 18-23 years with mean age being 20.93±1.248. Among them, 64 (23.3%) were males and 211 (76.7) were females and majority were doing their internship, 104 (37.8%). (Table 1)

The respondents' knowledge and opinions regarding the health impacts of health sector pollution and climate change is presented in Table 2. It was observed that majority were concerned about the health impacts of climate change; 261 (94.9%), majority were concerned about pollution stemming from the health care industry; 228 (82.9%), majority thought that the disease burden associated with health care sector pollution is of the same order of magnitude as the disease burden associated with medical errors first reported by the Institute of Medicine; 6185 (67.3%) and majority felt that dental professionals had a responsibility to conserve resources and prevent pollution within their professional practice; 244 (88.7%).

The respondents' opinions on inclusion of pollution, climate change and health in the dental curriculum is presented in table 3. It was observed that majority felt that it was important to understand this issue so that they can help their patients; 250 (90.9%) and majority felt that dental professionals had an important role to play in educating patients and the public about the impacts of pollution and climate change on health; 216 (78.5%).

The respondents' opinions regarding ways to promote resource conservation and pollution prevention within their professional practice and barriers to doing so is presented in table 4. It was observed that majority agreed that manufactures should provide information regarding their product's effect on environment during and post production; 238 (86.5%) and majority agreed that medical devices should be tracked to understand their utilization and disposal; 232 (84.4%). It was observed that majority agreed that there was a lack of education on disease burden because of health care pollution; 176 (64.0%) and majority agreed that there was lack of time/production pressure leading to inefficient utilization of resources; 180 (65.5%).

It was observed that majority (42%) of the respondents preferred reusable medical devices,

figure 1. The major factor influencing the preference of reusable or disposable medical devices was infection control (49%), figure 2. Majority (78%) of the respondents agreed that single-use disposable medical devices reduced infection risk, figure 3.

The responses of respondents to certain questions/statements which were significant according to gender and age group is presented in table 5. It was observed that significantly higher number of males had responded that disease burden associated with health care sector pollution is of the same order of magnitude as the disease burden associated with medical errors. It was observed that nearly two thirds of the respondents of the age group of 18-20 years disagreed with the statement "It is important to understand this issue, but it isn't pertinent to patient" which was significantly higher than the older age group. It was observed that 66.7% of the respondents of the age group of 18-20 years disagreed to the statement "Resource conservation and pollution prevention are not a physician's responsibility" which was significantly higher than the older age group. It was observed that 61.8% of the respondents of the age group of 18-20 years disagreed to the statement "Unrealistic expectations of infection risk reduction" which was significantly higher than the older age group. It was observed that 66.7% of the respondents of the age group of 18-20 years disagreed to the statement "Resource conservation and pollution prevention are not a dental healthcare professional's responsibility" which was significantly higher than the older age group.

The Binary Logistic Regression models for relationships between personal characteristics and responses is shown in table 6. It was observed that the odds of disagreement with the statement "Disease burden associated with health care sector pollution is of the same order of magnitude as the disease burden associated with medical errors" was more among females (4.45) when compared to males. It was observed that the odds of disagreement with the 4 statements given in table 6 among 18-20 years group ranged from 1.88 to 2.68 ( $p < 0.005$ ) when compared to 21-23 years.

## Discussion

The present study was conducted to assess knowledge, opinions and barriers of oral health care students towards climate change, pollution and conservation of resources in oral health care services.

Every industry plays a role in the degradation of the environment at various levels. Right from the materials' extraction from raw state from the earth to its manufacturing into a usable product, its packaging and distribution and its disposal after usage in health care industry, there is some effect on the environment. In some cases, the effect to the environment can lead to health impacts. So, it becomes the duty of every individual to use and dispose the healthcare product and equipment properly.

In the present study it was found that the majority of respondents agreed to the health impacts of the climate change and were concerned about pollution stemming from the health care industry which is similar to the study by Ryan EC et al.<sup>3</sup> Since the respondents are accepting their concern regarding the impact on climate change, they can be further taught about the various effects and they will be eager to learn about it. Though majority understood that climate change was important so that they can help their patients but they felt it was not pertinent to the patient care directly. The respondents perhaps feel that they can share their knowledge about climate change to their patients as a part of educating them but they think that there is a lack the relationship between climate change and patient care. Though majority feel that medical devices should be tracked to understand their utilization and disposal but only a little more than half of them feel that resource conservation and pollution prevention are physician's responsibilities.

It was observed that in the present study lack of education on disease burden because of health care pollution and lack of time/production pressure leading to inefficient utilization of resources was felt as barriers to promote resource conservation and pollution prevention within their professional practice. This was similar to the Sarfaty M et al.<sup>4</sup> A study by Teherani A et al suggests that the dental students should be taught about various objectives of sustainable healthcare education at preclinical, clinical and post graduate levels and delineates the objectives in their paper.<sup>5</sup>

It was observed that the younger age group was more zealous towards patient care and dental healthcare professionals' responsibilities towards resource conservation. This is similar the study by Ryan EC et

al.<sup>3</sup> This might be because they were in the preclinicals and were more aspirations towards perfect patient care but the older respondents may be more concerned about their patient quota completion and did not find it significant to be concerned about resource conservation.

**Limitation:** The results of the present study represent data collected from students of one dental college. Further studies are needed to collect data from all over India to assess the knowledge and opinions of the students.

**Recommendation:** The students can be taught about the effects of healthcare products on environment and thus climate change through various continuing dental education programs. Also, they must be sensitized regarding the usage and disposal of materials appropriately and adequately and thus minimizing the wastage of the product. The dental instructors can act as a guide to the students and teach them the conservation techniques they are practicing.<sup>3</sup>

## Conclusion

The present study highlights that the respondents are willing to avoid pollution pertaining to their professional practice but lack the information for the same. Thus, steps should be taken to include educational modules to disseminate the information and inculcate the habit in the budding oral health care professionals and thus reducing their carbon footprint.

## REFERENCES:

1. <https://www.un.org/en/climatechange/causes-and-effects-climate-change>
2. <https://www.who.int/news-room/fact-sheets/detail/climate-change-and-health>
3. Ryan EC, Dubrow R, Sherman JD. Medical, nursing, and physician assistant student knowledge and attitudes toward climate change, pollution, and resource conservation in health care. *BMC Medical Education*. 2020 Dec;20:1-4
4. Sarfaty M, Mitchell M, Bloodhart B, Berg C,



Maibach E. Key findings of a National Medical Association physician survey. National Medical Association, George Mason University Center for Climate Change Communication. 2014 Jun 25

5. Teherani A, Nishimura H, Apatira L, Newman T, Ryan S. Identification of core

objectives for teaching sustainable healthcare education. Med Educ Online. 2017;22(1):1386042

6. Kohn LT, Corrigan J, Donaldson MS. To err is human building a safer health system. Washington, DC National Academy Press; 2000

## TABLES AND FIGURES

**Table 1: Demographic details of the respondents**

		Frequency	Percentage
<b>Age group</b>	<b>18-20 years</b>	102	37.1
	<b>21-23 years</b>	173	62.9
<b>Gender</b>	<b>Male</b>	64	23.3
	<b>Female</b>	211	76.7
<b>Year of study</b>	<b>First Year</b>	16	5.8
	<b>Second Year</b>	38	13.8
	<b>Third Year</b>	67	24.4
	<b>Fourth Year</b>	50	18.2
	<b>Intern</b>	104	37.8

**Table 2: Respondents' knowledge and opinions regarding the health impacts of health sector pollution and climate change**

	<b>Agree</b>		<b>Disagree</b>	
	<b>N</b>	<b>%</b>	<b>N</b>	<b>%</b>
I am concerned about the health impacts of climate change	261	94.9	14	5.1
I am concerned about pollution stemming from the health care industry	228	82.9	47	17.1
Do you think disease burden associated with health care sector pollution is of the same order of magnitude as the disease burden associated with medical errors first reported by the Institute of Medicine (To Err is Human)	185	67.3	90	32.7
Dental professionals have a responsibility to conserve resources and prevent pollution within their professional practice	244	88.7	31	11.3

**Table 3: Respondents' opinions on inclusion of pollution, climate change and health in the dental curriculum**

	Agree		Disagree	
	N	%	N	%
It is important to understand this issue so I can help my patients	250	90.9	25	9.1
It is important to understand this issue, but it isn't pertinent to patient care	118	42.9	157	57.1
I feel I can learn about this issue through observation in clinical practice, not classroom-based learning	183	66.5	92	33.5
The training and testing we receive in dental school already requires a lot of my attention, there is no time to learn about this issue	103	37.5	172	62.5
I think there is a role for dental professionals in addressing this issue, but it is not my personal interest area	110	40.0	165	60.0
It is important to understand this issue because dental professionals have an important role to play in educating patients and the public about the impacts of pollution and climate change on health	216	78.5	59	21.5
Pollution and climate change should not be included in the dental professionals school curriculum	85	30.9	190	69.1

**Table 4: Respondents' opinions regarding ways to promote resource conservation and pollution prevention within their professional practice and barriers to doing so**

	Agree		Disagree	
	N	%	N	%
Important ways for dental healthcare professionals to promote resource conservation and pollution prevention				
Manufacturers should provide information regarding their product's effect on environment during and post production.	238	86.5	37	13.5
Medical devices should be tracked to understand their utilization and disposal	232	84.4	43	15.6
Evidence-based recommendations on minimizing unnecessary procedures and services	199	72.4	76	27.6
Resource conservation and pollution prevention are not a physician's responsibility	122	44.4	153	55.6
Important barriers that inhibit dental healthcare professionals from taking responsibility for resource conservation and pollution prevention				
Lack of education on disease burden because of health care pollution	176	64.0	99	36.0
Lack of time/production pressure leading to inefficient utilization of resources	180	65.5	95	34.5
Unrealistic expectations of infection risk reduction	147	53.5	128	46.5
Resource conservation and pollution prevention are not a dental healthcare professional's responsibility	118	42.9	157	57.1

**Table 5: Responses of respondents to certain questions/ statements according to gender and age group**

**(Only significant findings are tabulated)**

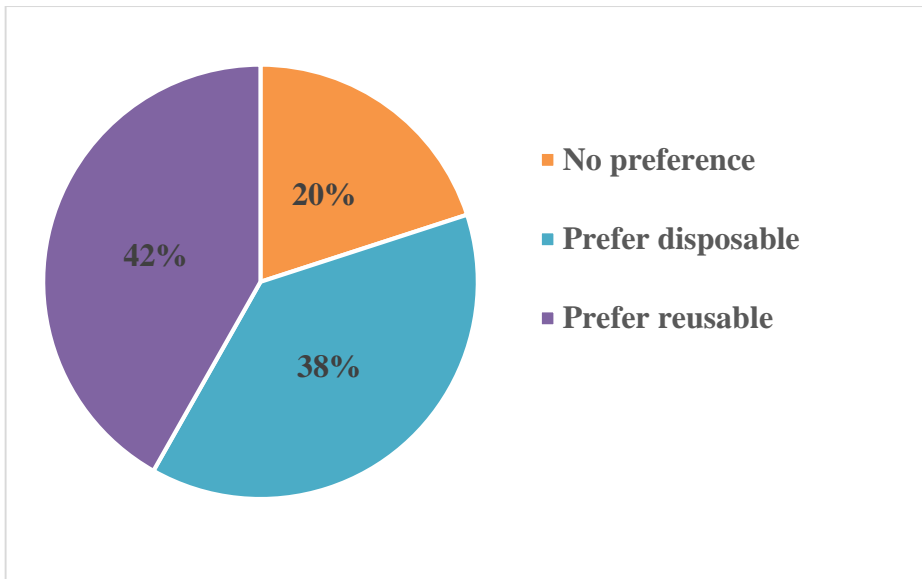
		Male		Female		P value
		n	%	n	%	
Do you think disease burden associated with health care sector pollution is of the same order of magnitude as the disease burden associated with medical errors first reported by the Institute of Medicine (To Err is Human).	Agree	56	87.5%	129	61.1%	.000*
	Disagree	8	12.5%	82	38.9%	
		18-20 years		21-23 years		P value
		n	%	n	%	
It is important to understand this issue, but it isn't pertinent to patient	Agree	32	31.4%	86	49.7%	.003*
	Disagree	70	68.6%	87	50.3%	
Resource conservation and pollution prevention are not a physician's responsibility	Agree	34	33.3%	88	50.9%	.005*
	Disagree	68	66.7%	85	49.1%	
Unrealistic expectations of infection risk reduction	Agree	39	38.2%	108	62.4%	.000*
	Disagree	63	61.8%	65	37.6%	
Resource conservation and pollution prevention are not a dental healthcare professional's responsibility	Agree	34	33.3%	84	48.6%	.014*
	Disagree	68	66.7%	89	51.4%	

\*Statistically significant  
Pearson's Chi Square test

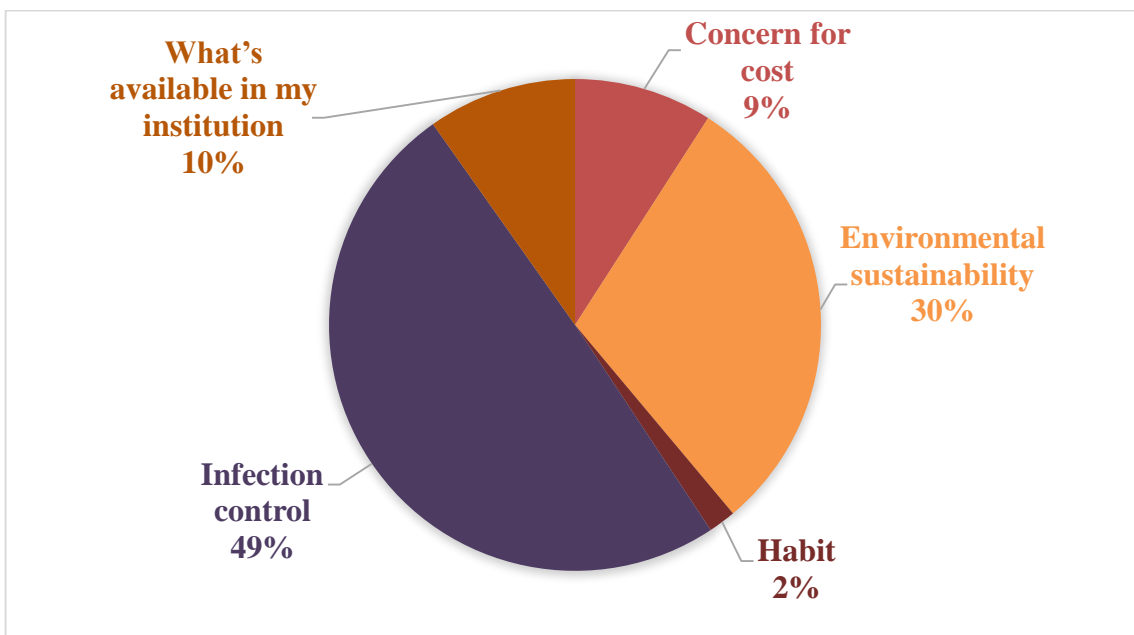
**Table 6: Binary Logistic Regression models for relationships between personal characteristics and responses**

Outcome variable	Predictor variable	Odds Ratio	95% CI		Sig.
			Upper	Lower	
<b>Disagreement with the statement:</b> Disease burden associated with health care sector pollution is of the same order of magnitude as the disease burden associated with medical errors	<b>Gender</b>				
	Male (Ref)	1			
	Female	4.45	2.01	9.81	0.000*
<b>Disagreement with the statement:</b> It is important to understand this issue, but it is not pertinent to patient care	<b>Age Group</b>				
	18-20 years	2.16	1.29	3.61	0.003*
	21-23 years (Ref)	1			
<b>Disagreement with the statement:</b> Resource conservation and pollution prevention are not a physician's responsibility	<b>Age Group</b>				
	18-20 years	2.07	1.24	3.44	0.005*
	21-23 years (Ref)	1			
<b>Disagreement with the statement:</b> Unrealistic expectations of infection risk reduction	<b>Age Group</b>				
	18-20 years	2.68	1.62	4.44	0.000*
	21-23 years (Ref)	1			
<b>Disagreement with the statement:</b> Resource conservation and pollution prevention are not a dental healthcare professional's responsibility	<b>Age Group</b>				
	18-20 years	1.88	1.13	3.13	0.014*
	21-23 years (Ref)	1			

**Figure 1: Preferences on usage of reusable or disposable medical devices**



**Figure 2: Factor influencing the preference of reusable or disposable medical devices**



**Figure 3: Opinion of the respondent whether single-use disposable medical devices reduce infection risk**



