SURVEY

Knowledge and Practice of ICDAS and ICCMS in Young Children: A Cross-sectional Study among Final-year Dental Students in Malaysia

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Abstract

Background: To evaluate the association of sex, type of institution, and satisfaction of educational activities with dental students' knowledge of International Caries Detection and Assessment System (ICDAS) and International Caries Classification and Management System (ICCMS) in young children.

Materials and methods: This was a cross-sectional study involving final-year dental students from all accredited dental institutions across Malaysia. A self-constructed questionnaire was given through an identified personal contact from each school. The students' responses on the association of sex and institution type with the satisfaction of education activities and ICDAS and ICCMS knowledge were tested using the independent *t*-test. The relationship between satisfaction of educational activities and knowledge of ICDAS and ICCMS among dental students was evaluated using Spearman's correlation analysis. Statistical significance was set at $p < 0.05$.

Results: A total of 440 responses were obtained. Out of this, 312 (70.9%) were female and 126 (28.6%) were male respondents, and 2 with unknown sex. There were 231 responses (52.5%) from the private institution and 209 responses (47.5%) from the government institution. Males had a higher level of satisfaction toward the education activities. No significant difference was observed between the knowledge of ICCMS and ICDAS and sex or institution type.

Conclusion: Male dental students felt more satisfied with pediatric lectures conducted during preclinical years and were more prepared to treat patients independently upon graduation. Sex and type of institution did not play a role in the knowledge and dental students were more knowledgeable in ICDAS compared to ICCMS.

Keywords: Dental students, International caries classification and management system, International caries detection and assessment system, Knowledge, Malaysia.

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Introduction

Dental caries is an infectious disease that results in localized destruction and dissolution of the calcified tissue.[1] This happens through the interaction of bacteria mainly *Streptococcus mutans*, and the sugar from food, through its byproducts on tooth enamel resulting in cavitation of the teeth.[2,3] This disease has proven to be an impending issue for worldwide public health.[4] According to the American Academy of Paediatric Dentistry (AAPD), Early Childhood Caries (ECC) is defined as the presence of one or more decayed (non-cavitated or cavitated lesions), missing (due to caries), or filled tooth surfaces in any primary tooth in a child 71 months of age or younger.[2] Although this condition can be prevented with proper oral hygiene, dietary measures, and the use of fluoride; surprisingly, it is still one of the most common chronic diseases among young children, outranking some other diseases such as asthma or hay fever.[5,6]

In children, dental caries can drastically affect their quality of life because of the long-term ramifications arising from caries such as severe pain, chewing difficulty, poor speech and articulation, abscesses, low self-esteem, malnutrition, and increased risk for future caries.[7] Being highly prevalent in both developing and industrialized countries, this poses a serious public health concern. The rates of caries in developing nations such as Africa and Southeast Asia seem to be approaching worrying proportions at around 44–82.5%.[3] The first Malaysian national epidemiological survey done on 5-year-old pre-school children in 1995 shows that almost 9 out of 10 children had tooth decay. Ten years from then in the National Oral Health Survey of Preschool Children 2005 (NOHPS 2005), an improvement was present but quite insignificant in terms of dental caries status among the 5-year-old children. Standing at a staggering percentage of 76.2%, the caries level in deciduous teeth stood at a mean dmft of 5.6 with highly unmet treatment needs.[8] The awareness, understanding, and early risk assessment for these children facilitates the identification of parent-infant groups with high risk for caries and would benefit significantly from early preventive intervention.[7] Despite the urgency and importance of

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early risk assessment, only a limited workforce is available to address their oral health needs.

Pediatric dentistry has been considered as the most needed but neglected area of all the services performed by dental practitioners. There is a lack of knowledge in the preventive aspects of caries.[9] There needs to be a more thorough understanding of the progression of caries and the intervention or management of caries in children. Dental practitioners are expected to diagnose and manage effectively childhood dental diseases that are within the knowledge and skills acquired during dental education.[10] For this to become a reality, dental practitioners need to be well versed in this field of oral healthcare and thereby enable more children to have access to dental services. Given the importance of such knowledge in treatment planning, dental students need to more aware of pediatric oral health to be able to recognize and classify them accordingly, hence be able to diagnose and instigate prevention or intervention methods.

The International Caries Detection and Assessment System (ICDAS) and International Caries Classification and Management System (ICCMS) provide a comprehensive list of criteria using a standardized system based on clinical evidence for early and late stages of caries. In a systematic approach, the risk factors would be assessed, a diagnosis and prognosis formed, and informed decision-making in the comprehensive management of the carious teeth would be carried out.[11,12] International Caries Detection and Assessment System is a globally adopted method for classifying different stages of dental caries and the activity status of lesions which can be integrated into the ICCMS(TM).[12] The ICCMS(TM) enables dentists to integrate the patients' dental information including caries risk status, for the purpose of formulating a treatment plan, managing, and reviewing dental caries.[12] Despite the availability of these caries risk detection tools, it is unsure if this was taught in the dental schools and the knowledge of the students was appropriately measured. This study aimed to evaluate the association of sex, type of institution, and satisfaction of educational activities with dental students' knowledge of ICDAS and ICCMS in young children.

Materials and Methods

Study Participants

This was a cross-sectional study conducted on final-year dental students in the form of a survey. Approval was obtained from the ethical committee of International Medical University before the commencement of this research project (BDS I-01-14 (15) 2017). Thirteen accredited institutions in Malaysia offering a pre-doctoral program in dentistry were identified. Of the 13 institutions, 11 consented to participate in the research. Five were private institutions whilst six were public institutions. The survey was conducted using forms distributed in hard copies through a representative of each school identified through personal contacts. The representatives were briefed to ensure that the forms were completed and followed up thereafter. Written informed consent was obtained from all the participants.

Data Collection Instrument

The questionnaire contained three sections: the sociodemographic status of the participant (sex, age, institution type, and year of treatment commencement for pediatric patients), second section to determine the satisfaction level with education activities conducted in the pediatric module of the pre-doctoral dentistry program and the third section consisted of a series of questions to assess their knowledge on ICDAS and ICCMS. The third section was made up of five questions for ICDAS and seven questions for ICCMS. This was developed based on the ICDAS and its ICCMS methods for the staging of the caries process and enabling dentists to manage caries.[12,13] Each of these questions had a scale of 1–5, with 1-Strongly Disagree, 2-Disagree, 3-Not Sure, 4-Agree, and 5-Strongly Agree. Participants were allowed to choose one answer per question. The pilot study was conducted among 37 dental students and it was found that the questions were comprehensible and not ambiguous.

Statistical Analysis

To facilitate data entry, the responses were recorded numerically. Then, it was analyzed using Statistical Package for the Social Sciences software (SPSS V.23, IBM SPSS, Chicago, IL, USA). Frequency and percentage distributions were calculated for the type of institution (private or public), the number of students segregated by sex, and the number of responses received. The association between sex and their satisfaction level with education activities was tested using an independent *t*-test. The association between sex and knowledge on ICDAS and ICCMS knowledge, type of institution and their satisfaction level with education activities, type of institution, and their knowledge on ICDAS and ICCMS was tested using an independent *t*-test. Mean with confidence interval (CI) was calculated between sex and type of institution *vs* satisfaction level with educational activities, and knowledge on ICDAS and ICCMS. The relationship between the satisfaction level with education activities and knowledge of ICDAS and ICCMS among dental students was evaluated using Spearman's correlation analysis. All statistical tests were analyzed to a significance level of <0.05 and a CI set at 95%. All values were rounded up to one decimal point. Any blank answers were treated as missing values, only single unequivocal replies were included in calculating frequencies and percentages.

Results

A total of 616 final-year pre-doctoral dental students were identified across accredited dental schools all over Malaysia. A total of 440 questionnaires were received from 5 private and 6 public schools. The respondents' age ranged between 22 years and 35 years old out of which 384 respondents (87.3%) were 23 years and 24 years old. There was a total of 312 (70.9%) female respondents and 128 (28.6%) male respondents and two did not indicate sex. For the institution type, there was an almost equal distribution of respondents with 231 (52.5%) from the private institution and 209 (47.5%) from the government institution (Table 1). Two out of 13 dental institutions did not participate in the study. Overall satisfaction level showed that all the respondents felt adequate, satisfied, and very satisfied with the educational activities conducted (Table 2). Most students agreed or strongly agreed that they were aware of ICDAS, had adequate ICDAS training, were satisfied with their ICDAS training, were confident in using the ICDAS, and were able to communicate about ICDAS. The ICDAS items that most students felt they were unsure with the satisfaction of training and confidence in using ICDAS (Table 3).

Most students reported that they were unsure about the ICCMS. Around 27.5–30.7% of the students disagree or strongly disagree with the adequacy of training received, unsatisfied with the training given to them in school, unable to understand the ICCMS codes and effectively communicate using ICCMS, and did not have the confidence in formulating a treatment plan based on ICCMS

(Table 4). Male students had statistically significantly higher scores than female students on satisfaction with the pediatric dentistry lectures given during their preclinical studies and satisfaction with preparation for treating pediatric patients ($p < 0.05$) (Table 5). Females were more satisfied with the ICDAS and ICCMS training in school as compared to males. The mean score for males on the awareness of ICDAS, training received in ICDAS, training satisfaction, confidence in classifying caries, and communicate effectively with ICDAS were lower in general compared to females. The awareness of ICCMS for females was highest among the other ICCMS items. At a mean score of 3.0, female respondents felt unsure of the adequacy of training received, a satisfaction of training received, understanding of codes corresponding to the lesion, communicating effectively using ICCMS, making a treatment plan, and treating a patient based on ICCMS (Table 6).

The satisfaction level toward the number of clinical hours allocated to treat pediatric patients was statistically significantly higher among students from private institutions than from public institutions ($p < 0.05$). Students from public institutions, however, felt more prepared to treat patients independently upon graduation than students from the private institution (Table 7). No difference was observed between the private and public institutions on the satisfaction based on the number of pediatric patients allocated and pediatric dentistry lectures were given during preclinical studies ($p > 0.05$). The students' knowledge did not seem to be affected by the type of institution and the knowledge on ICDAS or ICCMS. There was a unanimous uncertainty of the awareness of what ICCMS is, satisfaction with the training received in school, having confidence in making a treatment plan, and treating a patient confidently using the ICCMS (Table 8). No correlation was observed between the satisfaction level of educational activities and knowledge of dental students in ICDAS, however, a high correlation was observed between the satisfaction level of educational activities and ICCMS

Table 1: Sociodemographic characteristics of respondents

Characteristics	*Number*
Sex	
Female	312 (70.9)
Male	126 (28.6)
Missing	2 (0.5)
Type of institution	
Private	231 (52.5)
Government	209 (47.5)
Year of treatment commencement for pediatric patients	
Year 2	5 (1.1)
Year 3	169 (38.4)
Year 4	117 (26.6)
Year 5	146 (33.2)
Missing	3 (0.7)
Total	440

Table 2: Dental students' satisfaction toward education activities in pediatric dentistry module

	n (%)					
	1	*2*	*3*	*4*	*5*	
	Very unsatisfied	*Unsatisfied*	*Adequate*	*Satisfied*	*Very satisfied*	*Total*
(1) How satisfied are you with the number of clinical hours/sessions that are allocated for you to treat pediatric patients?	7 (1.6)	70 (15.9)	141 (32.0)	169 (38.4)	51 (11.6)	438 (99.5)
(2) Are you satisfied with the number of pediatric patients that you treat during your allocated clinical sessions?	14 (3.2)	122 (27.7)	150 (34.1)	119 (27.0)	33 (7.5)	438 (99.5)
(3) Are you satisfied with the pediatric dentistry lectures that are given during your preclinical studies?	1 (0.2)	10 (2.3)	108 (24.5)	229 (52.0)	89 (20.2)	437 (99.3)
(4) How satisfied are you in the aspect of the pediatric dentistry module in the preparation for you to treat pediatric patients independently when you graduate?	1 (0.2)	19 (4.3)	140 (31.8)	211 (48.0)	67 (15.2)	438 (99.5)

Table 3: Dental students' knowledge on international caries detection and assessment system (ICDAS)

	n (%), n = 440				
	1	*2*	*3*	*4*	*5*
	Strongly disagree	*Disagree*	*Unsure*	*Agree*	*Strongly agree*
(1) I am aware of what the ICDAS is	13 (3.0)	1 (0.2)	7 (1.6)	131 (29.8)	288 (65.5)
(2) I have adequate training received in the area of ICDAS	11 (2.5)	10 (2.3)	33 (7.5)	181 (41.1)	205 (46.6)
(3) I am satisfied with the ICDAS training given to me in school	15 (3.4)	9 (2.0)	54 (12.3)	162 (36.8)	200 (45.5)
(4) I am confident in classifying caries using ICDAS in clinics	11 (2.5)	11 (2.5)	56 (12.7)	176 (40.0)	186 (42.30)
(5) I am able to communicate effectively with my colleagues using ICDAS	14 (3.2)	6 (1.4)	46 (10.5)	163 (37.0)	211 (48.0)

Table 4: Dental students' knowledge on international caries classification and management system (ICCMS)

	n (%), n = 440					
	1	*2*	*3*	*4*	*5*	
	Strongly disagree	*Disagree*	*Unsure*	*Agree*	*Strongly agree*	*Total*
(1) I am aware of ICCMS	58 (13.2)	50 (11.4)	176 (40.0)	88 (20.0)	68 (15.5)	440 (100.0)
(2) I have adequate training received in the area of ICCMS	69 (15.7)	52 (11.8)	196 (44.5)	65 (14.8)	57 (13.0)	439 (99.8)
(3) I am satisfied with the ICCMS training given to me in school	70 (15.9)	62 (14.1)	179 (40.7)	73 (16.6)	56 (12.7)	440 (100.0)
(4) I am able to understand the codes corresponding to the lesion in ICCMS	71 (16.1)	63 (14.3)	176 (40.0)	71 (16.1)	59 (13.4)	440 (100.0)
(5) I am able to communicate effectively with my colleagues using ICCMS	73 (16.6)	62 (14.1)	178 (40.5)	68 (15.5)	59 (13.4)	440 (100.0)
(6) I have confidence in making a treatment plan based on the ICCMS	76 (17.3)	58 (13.2)	182 (41.4)	69 (15.7)	55 (12.5)	440 (100.0)
(7) I am able to treat a patient confidently using the ICCMS	75 (17.0)	59 (13.4)	183 (41.6)	66 (15.0)	57 (13.0)	440 (100.0)

Table 5: Dental students' satisfaction level of education activities by sex

	Mean (CI)		
	Female n = 312	*Male n = 125*	*p value*
(1) How satisfied are you with the number of clinical hours/sessions that are allocated for you to treat pediatric patients?	3.4 (3.3–3.5)	3.4 (3.3–3.6)	0.955
(2) Are you satisfied with the number of pediatric patients that you treat during your allocated clinical sessions?	3.0 (2.9–3.1)	3.2 (3.1–4.0)	0.054
(3) Are you satisfied with the pediatric dentistry lectures that are given during your preclinical studies?	3.9 (3.8–3.9)	4.0 (4.0–4.2)	0.017*
(4) How satisfied are you in the aspect of the pediatric dentistry module in the preparation for you to treat pediatric patients independently when you graduate?	3.7 (3.6–3.8)	3.9 (3.7–4.0)	0.033*

*Indicates *p* value lower than 0.05, CI, confidence interval at 95%

Table 6: Dental students' knowledge of international caries detection and assessment system (ICDAS) and international caries classification and management system (ICCMS) by sex

	Mean (CI)		
	Female n = 312	*Male n = 126*	*p value*
(1) I am aware of ICDAS	4.6 (4.5–4.7)	4.5 (4.3–4.7)	0.356
(2) I have adequate training received in the area of ICDAS	4.3 (4.2–4.4)	4.1 (4.0–4.3)	0.053
(3) I am satisfied with the ICDAS training given to me in school	4.3 (4.2–4.4)	4.0 (3.8–4.2)	0.039*
(4) I am confident in classifying caries using ICDAS in clinics	4.2 (4.1–4.3)	4.1(3.9–4.3)	0.451
(5) I am able to communicate effectively with my colleagues using ICDAS	4.3 (4.2–4.4)	4.2 (4.0–4.3)	0.259
(1) I am aware of ICCMS	3.2 (3.0–3.3)	3.0 (2.8–3.3)	0.376
(2) I have adequate training received in the area of ICCMS	3.0 (2.9–3.1)	2.9 (2.7–3.1)	0.580
(3) I am satisfied with the ICCMS training given to me in school	3.0 (2.8–3.1)	2.8 (2.6–3.1)	0.204
(4) I am able to understand the codes corresponding to the lesion in ICCMS	3.0 (2.8–3.1)	2.9 (2.7–3.1)	0.556
(5) I am able to communicate effectively with my colleagues using ICCMS	3.0 (2.8–3.1)	2.9 (2.7–3.1)	0.661
(6) I have confidence in making a treatment plan based on the ICCMS	3.0 (2.8–3.1)	2.8 (2.6–3.1)	0.423
(7) I am able to treat a patient confidently using the ICCMS	3.0 (2.8–3.1)	2.8 (2.6–3.1)	0.296

*Indicates *p* value <0.05, CI, confidence interval set at 95%

knowledge ($p < 0.05$). The number of pediatric patients allocated to dental students and their preparedness to treat upon graduation had a strong correlation (Table 9).

Discussion

This study was aimed to measure the association that sex, type of institution, and satisfaction of education activities had with dental

Table 7: Dental students' satisfaction level of education activities by institution type

	Mean (CI)		
	Private, n = 231	*Government, n = 207*	*p value*
(1) Are you satisfied with the number of clinical hours/sessions that are allocated for you to treat pediatric patients?	3.6 (3.5–3.8)	3.2 (3.1–3.3)	0.000*
(2) Are you satisfied with the number of pediatric patients that you treat during your allocated clinical sessions?	3.0 (2.9–3.2)	3.1 (3.2–3.0)	0.228
(3) Are you satisfied with the pediatric dentistry lectures that are given during your preclinical studies?	4.0 (3.8–4.0)	3.9 (3.8–4.0)	0.681
(4) How satisfied are you in the aspect of the pediatric dentistry module in the preparation for you to treat pediatric patients independently when you graduate?	3.7 (3.5–3.8)	3.8 (3.7–3.9)	0.014*

*Indicates *p* value lower than 0.05, CI, confidence interval set at 95%

Table 8: Dental students' international caries detection and assessment system (ICDAS) and international caries classification and management system (ICCMS) knowledge by institution type

	Mean (CI)		
	Private n = 231	*Government n = 209*	*p value*
(1) I am aware of ICDAS	4.5 (4.5–4.6)	4.6 (4.5–4.7)	0.554
(2) I have adequate training received in the area of ICDAS	4.3 (4.2–4.4)	4.2 (4.1–4.3)	0.178
(3) I am satisfied with the ICDAS training given to me in school	4.2 (4.1–4.3)	4.2 (4.1–4.3)	0.811
(4) I am confident in classifying caries using ICDAS in clinics	4.2 (4.1–4.3)	4.1 (4.0–4.3)	0.560
(5) I am able to communicate effectively with my colleagues using ICDAS	4.3 (4.1–4.4)	4.3 (4.1–4.4)	0.977
(1) I am aware of ICCMS	3.1 (3.0–3.3)	3.1 (3.0–3.3)	0.972
(2) I have adequate training received in the area of ICCMS	3.0 (2.8–3.2)	2.9 (2.8–3.0)	0.588
(3) I am satisfied with the ICCMS training given to me in school	2.9 (2.8–3.1)	2.9 (2.8–3.1)	0.756
(4) I am able to understand the codes corresponding to the lesion in ICCMS	3.0 (2.8–3.2)	2.9 (2.8–3.1)	0.673
(5) I am able to communicate effectively with my colleagues using ICCMS	3.0 (2.8–3.1)	2.9 (2.8–3.1)	0.723
(6) I have confidence in making a treatment plan based on the ICCMS	2.9 (2.8–3.1)	2.9 (2.8–3.1)	0.797
(7) I am able to treat a patient confidently using the ICCMS	2.9 (2.8–3.1)	2.9 (2.8–3.1)	0.862

*Indicates *p* value < 0.05, CI, confidence interval set at 95%

students' knowledge of ICDAS and ICCMS on young children's (0–6) oral health. The findings showed that male dental students were more satisfied with the education activities than their female counterparts and were more prepared to treat pediatric patients independently when they graduate. This was in accordance with a previous study by Gilmour et al.[14] However, these findings were in contrast to what has been found in some literatures where females are usually more satisfied.[15] The differences in country, cultural background, and the setting of this study done may have attributed to this alongside the year where this study was conducted. There seemed to be no disparity in the knowledge of ICDAS and ICCMS among Malaysian dental students by sex or type of institution. Previous studies conducted among the dental students of other countries; which aimed to explore their ability to examine dental caries using the ICDAS system also showed similar results.[16,17] Even though ICDAS and ICCMS have only recently been developed in the last decade, after many workshops and meetings between many experts to refine these diagnostic criteria and its management, the implementation of this framework and accessibility of ICDAS and ICCMS could be widespread enough to negate any disparity.[18,19]

It is interesting to note that the students have higher knowledge in ICDAS in comparison to ICCMS. This might be due to ICCMS not being the only system available for promoting the staging of caries, risk assessment, and management.[11] Some schools may also be utilizing other systems to treat and manage their patients. There is the possibility of a national movement steering and comprehensively setting into motion of ICDAS within the context of the local curriculum and oral healthcare delivery arrangements, an initiative 5 years ago, launched by the Malaysian Dental Dean's Council (MDDC) in October 2013 on the integration of ICDAS into the dental school curricula.[20] Most schools would then have been actively educating and training their students in recognizing and diagnosing caries using ICDAS but may not necessarily have taught about ICCMS. However, the intervention using ICCMS, to ensure that caries does not progress further, is as paramount as ICDAS. Only a handful of students have heard of what ICCMS is, where only a few knew what it entails.

Dental students need to be well equipped in diagnosing and managing caries. The ICDAS e-learning program available on the Internet, developed by the ICDAS Foundation (distribution from Smile-On Limited), can be an effective tool in this regard.[21] Through this study, we also recommend for schools to educate, train and place emphasis on ICCMS alongside ICDAS in their study curricula. This would enable dental students to be able to properly

Table 9: Relationship between satisfaction toward education activities and knowledge of international caries detection and assessment system (ICDAS) and international caries classification and management system (ICCMS)

		(1) How satisfied are you with the number of clinical hours/sessions that are allocated for you to treat pediatric patients?	*(2) Are you satisfied with the number of pediatric patients that you treat during your allocated clinical sessions?*	*(3) Are you satisfied with the pediatric dentistry lectures that are given during your preclinical studies?*	*(4) How satisfied are you in the aspect of the pediatric dentistry module in the preparation for you to treat pediatric patients independently when you graduate?*
(1) I am aware of what the ICDAS is	Pearson correlation	0.041	0.008	0.054	−0.031
	Sig. (two-tailed)	0.395	0.865	0.261	0.513
	N	438	438	437	438
(2) I have adequate training received in the area of ICDAS	Pearson correlation	0.121	0.051	0.127	0.080
	Sig. (two-tailed)	0.011*	0.287	0.008*	0.095
	N	438	438	437	438
(3) I am satisfied with the ICDAS training given to me in school	Pearson correlation	0.122	0.109	0.156	0.179
	Sig. (two-tailed)	0.011*	0.023*	0.001*	0.000*
	N	438	438	437	438
(4) I am confident in classifying caries using ICDAS in clinics	Pearson correlation	0.081	0.106	0.114	0.140
	Sig. (two-tailed)	0.089	0.027*	0.017*	0.003*
	N	438	438	437	438
(5) I am able to communicate effectively with my colleagues using ICDAS	Pearson correlation	0.059	0.090	0.095	0.082
	Sig. (two-tailed)	0.219	0.059	0.047*	0.085
	N	438	438	437	438
(1) I am aware of what the ICCMS is	Pearson correlation	0.050	0.164	0.078	0.142
	Sig. (two-tailed)	0.301	0.001*	0.103	0.003*
	N	438	438	437	438
(2) I have adequate training received in the area of ICCMS	Pearson correlation	0.061	0.158	0.080	0.158
	Sig. (two-tailed)	0.202	0.001*	0.095	0.001*
	N	437	437	436	437
(3) I am satisfied with the ICCMS training given to me in school	Pearson correlation	0.092	0.166	0.113	0.182
	Sig. (two-tailed)	0.056	0.000*	0.018*	0.000*
	N	438	438	437	438
(4) I am able to understand the codes corresponding to the lesion in ICCMS	Pearson correlation	0.034	0.149	0.084	0.144
	Sig. (two-tailed)	0.476	0.002*	0.078	0.003*
	N	438	438	437	438

Contd…

Contd…

		(1) How satisfied are you with the number of clinical hours/sessions that are allocated for you to treat pediatric patients?	*(2) Are you satisfied with the number of pediatric patients that you treat during your allocated clinical sessions?*	*(3) Are you satisfied with the pediatric dentistry lectures that are given during your preclinical studies?*	*(4) How satisfied are you in the aspect of the pediatric dentistry module in the preparation for you to treat pediatric patients independently when you graduate?*
(5) I am able to communicate effectively with my colleagues using ICCMS	Pearson correlation	0.059	0.166	0.085	0.145
	Sig. (two-tailed)	0.219	0.000*	0.075	0.002*
	N	438	438	437	438
(6) I have confidence in making a treatment plan based on the ICCMS	Pearson correlation	0.069	0.163	0.086	0.159
	Sig. (two-tailed)	0.150	0.001*	0.073	0.001*
	N	438	438	437	438
(7) I am able to treat a patient confidently using the ICCMS	Pearson correlation	0.063	0.157	0.076	0.153
	Sig. (two-tailed)	0.188	0.001*	0.112	0.001*
	N	438	438	437	438

*Indicates *p* value lower than 0.05, CI, confidence interval set at 95%

diagnose and subsequently formulate a thorough treatment plan for their pediatric patients. We have attempted to report all the contents appropriate for cross-sectional study and have followed the reporting guidelines as indicated in the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement.[22] This study evaluated the knowledge of ICDAS and ICCMS only on final year pre-doctoral students in Malaysian dental schools and this limits the possibilities of generalizing the outcomes to dental students in other countries. In addition, the respondents were grouped within a generalized category by private and public schools. It is not clear if the dental practitioners use any of the caries detection and management system in their practice and future studies could be conducted to assess and compare the dental practitioner's knowledge in the area of ICDAS and ICCMS.

Conclusion

Male dental students felt more satisfied with pediatric lectures conducted during preclinical years and were more prepared to treat patients independently upon graduation. Sex and type of institution do not play a role in the ICDAS and ICCMS knowledge of dental students. Dental students were more knowledgeable in ICDAS compared to ICCMS. The number of patients treated during their clinical sessions and their preparedness to treat patients was independently related to their knowledge in ICCMS.

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