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## DENTAL PRACTICE DURING A WORLD CRUISE: CHARACTERISATION OF ORAL HEALTH AT SEA

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### ABSTRACT

**Aims:** To describe oral health of passengers and crew attending the dental service aboard during a two months world cruise.

**Methods:** In a retrospective, descriptive epidemiologic study design the routine documentation of all dental treatment provided at sea was analysed after the voyage.

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Subjects were n = 57 passengers (3.5 % of 1619) with a mean age of 71 ( $\pm$  9.8) years and n =56 crew (5.6 % of 999) with a mean age of 37 ( $\pm$  12.0) years. Age, gender, nationality, number of natural teeth and implants were extracted. The prosthetic status was described by recording the number of teeth replaced by fixed prosthesis and number of teeth replaced by removable prosthesis. Oral health-related quality of life (OHRQoL) was measured using the 14-item Oral Health Impact Profile (OHIP-14) and characterised by the OHIP sum score.

**Results:** Women attended for treatment more often than men. Passengers had a mean number of 20 natural teeth plus substantial fixed and removable prosthodontics. Crew had a mean of 26 teeth. British crew and Australian passengers attended the dental service above average. Crew tended to have a higher average OHIP-14 sum score than passengers indicating an increased rate of perceived problems. Emergency patients from both crew and passengers have a higher sum score than patients attending for routine treatment.

**Conclusion:** In passengers the average number of teeth appears to be higher than that of an age matched population of industrialized countries. However, the passengers' socioeconomic status was higher which has an effect on this finding. Socioeconomic factors also serve to explain the high standard of prosthetic care in passengers. Crew in general present with less sophisticated prosthetic devices. This is in line with their different socioeconomic status and origin from developing countries. The level of dental fees aboard in comparison to treatment costs in home countries may explain some of the differences in attendance. Passengers have enjoyed high standards of prosthetic care in the past and will expect a similarly high standard from ship based facilities. The ease of access to quality dental care may explain the relatively low level of perceived problems as characterised by oral health-related quality of life scores. The dental officer aboard has to be prepared to care for very varied diagnostic and treatment needs.

**Key words:** Oral health, Maritime medicine, OHIP, Gerodontology

## INTRODUCTION

The Cruise Lines International Association, representing all major cruise lines with a total of 192 vessels offering 245,755 berths, reported that 11.5 million people worldwide took a cruise in 2005. No other form of vacation is regarded as satisfying and projections indicate that up to 50 million US Americans alone show an intent to cruise within the next three years making cruising the fastest growing sector of the travel market [1]. Cruising offers best-agers a relaxed, safe and comfortable way of travelling the world. Even mild physical challenges, aboard, do not form a mobility

handicap or impede with long distance travel any longer. Cruise ship care as a proposed alternative to assisted living facilities would attract even more travellers with increased health needs [2]. With the number of ships growing, numbers of crew have naturally increased too. The American College of Emergency Physicians has developed standards describing medical equipment, personnel and procedures for cruise ship medicine. For the dental care of passengers and crew no such standards exist [3].

Oral health is an important aspect of general health, particularly in an older population, that has a high lifetime experience of caries, periodontal disease and their sequelae. For the crew, seafaring may pose a particular risk for oral health [4].

While medical practice on cruise ships has been described in the literature there is no study providing information on the epidemiology of oral health on cruise ships at sea. Naval forces of NATO frequently deploy dentists to vessels at sea keeping detailed records of diagnosis and treatment provided. However, these data are of little value to the management of cruise lines as the population differs vastly on military and merchant navy ships.

Therefore, it was aim of this study to describe oral health of the two distinctly different groups of passengers and crew members attending the dental service on board of a cruise ship.

## MATERIAL AND METHODS

### *Subjects and setting*

Data were collected on a cruise ship during a world cruise between 15 February and 15 April 2006 sailing from Sydney to Athens. Longest time at sea was 5 days and longest time in port three days. At midpoint of the observation period the vessel carried 1619 passengers from 23 nations and 999 crew members from 57 nations. At the same time the mean age of all passengers was calculated and nationality and sex of all passengers and crew noted. The data from all passengers and crew were then compared to those of patients seen (Table 1).

Approximately half of the passengers had booked the whole world cruise living aboard for more than three months. Some crew and some passengers changed in every major port. The data regarding all crew and passengers would have been influenced by such changes. However, these changes did not affect the general composition of passengers and crew and thus a single survey was felt to be sufficient.

The vessel is equipped with a standard single-chair dental surgery with chairside intra-oral radiographic facilities integrated into the ships medical facility. All tasks related to dental treatment (documentation, clinical procedures, instrument preparation

and sterilisation etc) are performed by one dental officer. For occasional complex surgical procedures chairside assistance is available upon request from the ships medical centre. The ships nurses assist in making appointments. Subjects were all passengers and all crew attending the dental clinic aboard.

Table 1 Gender and nationality of passengers and crew

	Passengers n (%)				Crew n (%)			
	All		Patients		All		Patients	
	n	%	n	%	n	%	n	%
Total	1619	100	57	3.5	999	100	56	5.6
Female	868	54	33	58	207	21	15	27
Nationality	USA 757	47	USA22	38	FIL 427	43	UK 32	57
	UK 501	31	UK 14	25	UK 151	15	CAN 3	5
	AUS 99	6	AUS 13	23	INDIA 92	9	FIL 5	9
	DEU 91	5	IT 2	4	RSA 31	3	RUS 2	4
	CAN 66	4	Holl 1	2	ROM 22	2	CHIN 2	4
	Others 105	7	Others 5	8	Others 276	28	Others 12	21

This report describes the subjects' oral health status characterized by key indicators for physical oral health and oral health-related quality of life as a summary measure for perceived oral health. A second article presenting the dental treatment needs and demands of the subjects will be published subsequently in this journal.

***Physical indicators of oral health***

Number of natural teeth and prosthetic status including the presence of implants, fixed and removable prosthesis were recorded. The following oral conditions were

diagnosed: Trauma, Pericoronitis, Pulpal disease, Periodontal disease, Caries, Defective restoration, Defective prosthesis, and Temporomandibular disorders. Trauma relates to dental injuries caused by accidents. Inflammation of the gum tissue around the crown of a tooth, usually the third molar, is referred to as pericoronitis. Temporomandibular disorders are conditions affecting the jaw muscles and the temporomandibular joint.

***Perceived oral health assessed as oral health-related quality of life***

Oral health-related quality of life (OHRQoL, Table 2) was measured using the 14-item Oral Health Impact Profile [5]. For each OHIP question, subjects were asked how frequently they had experienced the impact in the last month. Responses were made on a scale 0-never, 1-hardly ever, 2-occasionally, 3-fairly often, and 4-very often. OHRQoL impairment was characterized by the OHIP summary score (OHIP-14) – the sum of all 14 item frequencies (Table 2). The score ranges from 0-56 (0-4\*14) OHIP units. “0” indicates the absence of any problem, higher OHIP scores represent more impaired OHRQoL, i.e., the total instrument score is a “problem index”.

***Table 2 OHIP-E-14 items***

Have you had trouble pronouncing any words because of problems with your teeth, mouth or dentures?

Have you felt that your sense of taste has worsened because of problems with your teeth, mouth or dentures?

Have you had painful aching in your mouth?

Have you found it uncomfortable to eat any foods because of problems with your teeth, mouth or dentures?

Have you felt self conscious because of problems with your teeth, mouth or dentures?

Have you felt tense because of problems with your teeth, mouth or dentures?

Has your diet been unsatisfactory because of problems with your teeth, mouth or dentures?

Have you had to interrupt meals because of problems with your teeth, mouth or dentures?

Have you found it difficult to relax because of problems with your teeth, mouth or dentures?

Have you been a bit embarrassed because of problems with your teeth, mouth or dentures?

Have you been a bit irritable with other people because of problems with your teeth, mouth or dentures?

Have you had difficulty doing your usual jobs because of problems with your teeth, mouth or dentures?

Have you felt that life in general was less satisfying because of problems with your

teeth, mouth or dentures?

Have you been totally unable to function because of problems with your teeth, mouth or dentures?

### Statistical analyses

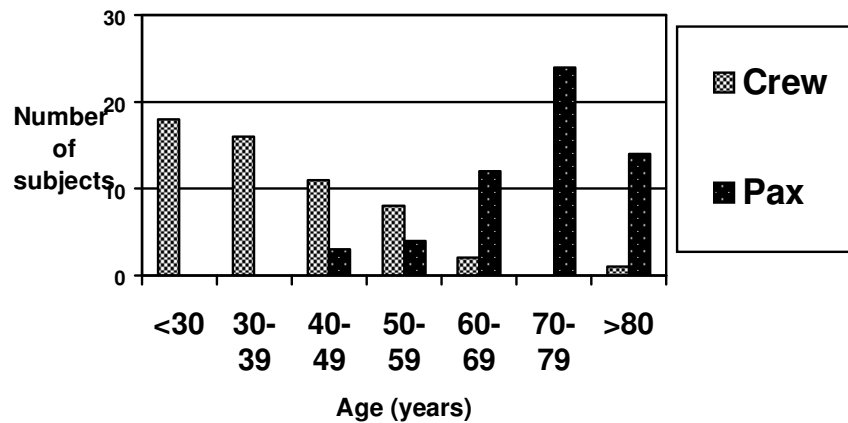
Physical health indicators are described as the mean ( $\pm$  standard deviation) number of subjects' natural teeth. In addition, the prevalence of several types of prostheses is presented. Mean OHIP-14 summary scores ( $\pm$ standard deviation) characterise the subjects' perceived oral health. All oral health indicators are shown for passengers and crew members. The difference in proportions between passengers and crew seeking treatment and the difference between the proportions of care seeking women among passengers or crew were tested using Fisher's exact test. Differences in OHIP mean summary scores between passengers and crew were tested using a regression analysis with robust standard errors to incorporate the dependence of the observations in the analysis.

All analyses were performed using the statistical software package STATA, Release 9 (StataCorp. 2005. Stata Statistical Software, College Station, TX), with the probability of a type I error set at the 0.05 level.

## RESULTS

Age, gender, and nationality of passengers and crew members attending the dental service

Figure 1 Patients' age distribution of crew (n = 56) and passengers (n = 57)



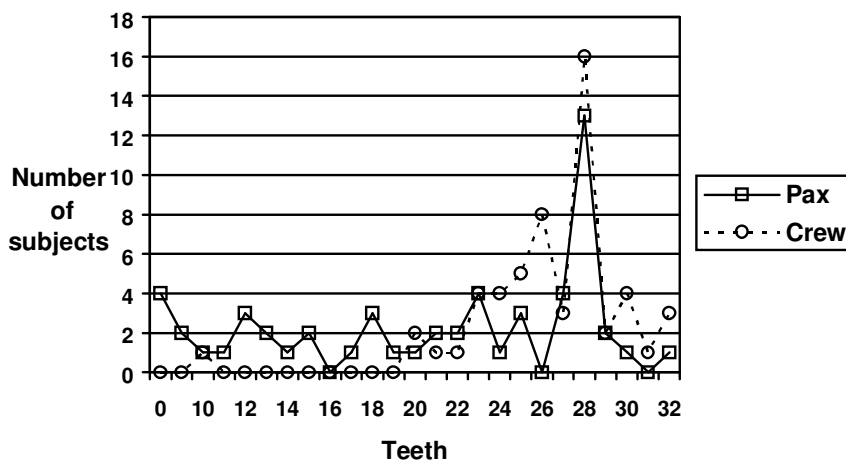
The mean age of all passengers was 67 years ( $\pm 11.5$ ) with a mean age of patients from this group of 71 ( $\pm 9.8$ ) years. The mean age of crew patients was 37 ( $\pm 12.0$ ) years. Data on the mean age of all crew were not available. The age distribution of patients from crew and passengers is presented in Figure 1.

The number of passengers and crew members attending the dental clinic was similar (57 passengers and 56 crew). However, the proportion of passengers (3.5 % of 1619) was statistically different ( $p=0.01$ ) from the proportion of crew (5.6% of 999). The proportion of women attending the dental service was higher for both crew and passengers than their respective proportions among all passengers and crew (Table 1), however the differences were not statistically significant ( $p=0.52$  for passengers,  $p=0.28$  for crew members). Whereas American and British citizens were underrepresented as patients, the 6 % of Australian passengers on board made up 23 % of passenger patients seen. It is noteworthy that out of the 9 % of Indian crew only one person (0.1 %) attended for dental treatment. Canadians, who only made up 1 % of crew, were third representing 5 % of patients seen. The 15 % British nationals among the crew accounted for 57 % of patients (Table 1).

***Prosthetic status of passengers and crew attending the dental service***

The mean number of natural teeth was 26 ( $\pm 3.6$ ) for crew patients and 20 ( $\pm 8.6$ ) for passengers (Figure 2).

**Figure 2** Number of natural teeth



Note: Pax is for Passenger

Fixed prostheses, i.e., crowns and bridges, were present in 26 % of passengers replacing a mean of 2.6 teeth and 5 % of crew replacing 1.7 teeth. About a quarter of passengers and 13 % of crew used removable dentures (Table 3). Both, complete dentures and implants were present in 7 % of the passengers but not in crew. There were fewer passengers than crew with the “natural” number of 28 teeth.

**Table 3 Prosthetic status**

	<b>Passengers n (%)</b>	<b>Crew n (%)</b>
Removable dentures	13 (23)	7 (13)
Fixed partial dentures	15 (26)	3 (5)
Patients with implants	4 (7)	-

**Table 4. Mean OHIP summary scores ( $\bar{x}$ ) by diagnosis and number of appointments (n)**

<b>Diagnosis</b>	<b>Emergency</b>		<b>Routine</b>					
	<b>Passengers</b>		<b>Crew</b>		<b>Passengers</b>		<b>Crew</b>	
	n	$\bar{x}$ ( $\sigma$ )	n	$\bar{x}$ ( $\sigma$ )	n	$\bar{x}$ ( $\sigma$ )	n	$\bar{x}$ ( $\sigma$ )
Trauma	7	3.3 (4.3)	-	-	-	-	-	-
Pericoronitis	-	-	1	5.0 (-)	-	-	-	-
Pulpal disease	14	9.3 (10.2)	7	22.3 (4.8)	-	-	2	0.0
Periodontal disease	3	7.0 (6.2)	3	8.0 (5.3)	2	1.5 (0.7)	20	3.3 (6.2)
Caries	8	12.4 (12.7)	10	20.9 (19.5)	-	-	16	3.0 (5.9)
Defective restoration	25	4.6 (5.7)	5	3.4 (5.5)	1	0.0	4	3.0 (2.5)
Defective prosthesis	8	11.8 (14.7)	-	-	-	-	-	-
Temporomandibular disorders	-	-	-	-	-	-	-	-
Others	5	5.6 (0.9)	1	8.0 (-)	1	5.0 (-)	30	1.1 (1.5)
<b>Mean</b>		<b>7.6 (9.1)</b>		<b>12.3 (11.1)</b>		<b>2.0 (1.9)</b>		<b>3.3 (5.9)</b>

**Oral health-related quality of life of passengers and crew members**

Crew members perceived more oral health problems than passengers in both, routine and emergency care ( $p < 0.05$ , however, the differences were not statistically significant when tested in routine and emergency separately). Subjects demanding emergency care showed, not unexpectedly, more problems, i.e., higher OHIP-14 sum



scores, than subjects attending for routine therapy (4). When OHIP-14 sum scores were examined by diagnosis, highest scores were observed for pulpal disease, caries and defective prosthesis.

## DISCUSSION

This is the first survey of oral health among passengers and crew members onboard a cruise ship at sea. The study does not attempt to describe oral health of all crew and passengers. As much as it would be desirable to gather detailed data with standard parameters like CPI and DMFT for the two distinct subgroups on a cruise ship, a representative study appears impractical. It could potentially cause disruptions to the operations of the ship and might impair the enjoyment of the voyage for passengers. However, passengers and crew seeking dental care are those relevant for planning purposes. The analysis of their treatment records provides valuable information to this end.

### *Profile of Subjects - Passengers*

Cruise statistics indicate that the mean duration of a cruise is 7 days with a mean age of cruisers of 49 years. Only 0.3 % of cruises sold worldwide last 18 days or more [6]. Passengers on this cruise were a fairly homogenous group, largely coming from industrialised countries. With a mean age of 71 years most can be assumed to be retired. For the 2005 world cruise more than 850 passengers booked the whole cruise effectively living on the ship for periods in excess of 90 days. The subjects are older and they stay aboard much longer than the average cruiser. The increased attendance of females is consistent with findings in other epidemiological studies.[7].

Cruise passengers have a mean annual household income of 104,000 US\$ [6]. With the much longer duration of the voyages on a world cruise it can be assumed, that world cruise passengers have a higher than average income. High socio-economic status coincides with more natural teeth being retained into old age. and is also correlated to more advanced prosthetic care [7]. In this study 2.6 missing teeth were replaced by fixed partial dentures (bridges). They offer a well established, reliable, predictable and comfortable treatment option but are costly to make. Their use appears high compared with data recorded in Germany [7] where only one missing tooth in the age group 65 – 74 years was replaced by a bridge. Cost is even more relevant in implant supported prosthetics. These were only seen in 0.73 % in the same large German study published in 1999 and are represented here in 2.7 % of patients. The popularity of such restorations in all age groups has greatly increased since 1999 which could, in

conjunction with the above average socioeconomic background, explain their growing presence. Removable prostheses in turn, which are regarded as less comfortable, were seen less frequently in passengers.

Complex dental prosthetic restorations as reported in this study do offer a high degree of comfort and are aesthetically pleasing. However, in case of a failure, the challenges of repairing such prosthesis can be daunting, particularly when the ship travels in remote parts of the world where shore based facilities are not geared to deal with complex cases. With function and aesthetics impaired, passengers in the absence of a dental officer aboard could be forced to abort a cruise.

#### ***Profile of Subjects - Crew***

Data on mean age of crew were not available. The mean age of crew reported by other authors appears lower than the mean age of crew patients in this study. Younger crew tend to work in hotel and restaurant positions as waiters and cabin stewards and frequently originate from less developed countries. Their wages are lower than that of qualified engineering and deck crew. Costs for private dental treatment in their home countries can be as low as 2 -3 US\$ for a dental extraction. It would be plausible to assume, that, even though treatments cost aboard are subsidised, more medium ranking to senior officers and crew with higher incomes make use of the service. This in turn leads to a higher than average age of patients seen. Low treatment costs in the country of origin would also explain the almost complete absence of Indian crew from the ships dental office.

Many of the British crew members have served for a long time on the vessel. They know therefore, that a dentist will be in attendance during the world cruise and routinely plan their annual dental examination during this period. Access to the state dental service in their home country is difficult, more so, when considering the frequent absence from home typical for sea going staff. Treatment costs aboard compare favourable to their country of origin. The high rate of attendance is therefore not unexpected.

The substantial number of removable prosthesis in crew is a function of their socioeconomic status. A mean number of 26 teeth for crew would allow the placement of fixed partial dentures in the majority of cases. However, as outlined before, this is a costly treatment option compared to a simple removable acrylic denture. Crew thus have a lower standard of prosthetic dental care than passengers.

#### ***Oral Health-Related Quality of Life***

Oral health as perceived by the subject is characterised by oral health-related quality of life (OHRQoL). The Oral Health Impact Profile [8] is a technically

sophisticated OHRQoL instrument with established reliability and validity. Several language versions are available, e.g., Chinese [9], German [10], Hungarian [11], Korean [12]. Its 14-item version [5] is frequently used in clinical and population-based research. More recently, the OHIP was introduced to routine clinical care in private dental practice [16] or university-based prosthodontic care. The OHIP served to assess key components of patients' complaints and was used to collect patients' problems in a standardized way complementing the usual comprehensive patient anamnesis. Therefore, we are able to compare the summary scores presented in this study with several patient populations in the literature. For example, patients attending a general dental practice had a mean OHIP-14 score of 6.5 [13]. OHIP scores of emergency patients were higher than this value, OHIP scores of routine patient were lower. In a German population-based study, OHIP-14 mean scores were around 4 units [14]. This level of impaired oral health-related quality of life in German subjects not seeking care, i.e., the "normal" level of OHRQoL in the general population, is higher than in subjects attending for routine care on this cruise. Of course, subject populations with special oral conditions such as burning mouth syndrome, temporomandibular disorders, or oral mucosa diseases have much higher OHIP-14 scores. For example, in patients diagnosed with Behçet's disease or recurrent aphthous stomatitis, OHIP-14 mean summary scores were 20.5 and 15.3, respectively [15]. Patients with dental anxiety presented a mean OHIP-14 score of 22.4 [16].

Therefore, we can conclude that passengers and crew on a cruise ship with a dental service suffer from a low level of impaired oral health-related quality of life in spite of substantial clinical problems. We attribute this situation to the fact that the immediate availability and the quality of dental care reduced the perceived impact from oral conditions.

## CONCLUSIONS

The great variety of age and socioeconomic factors of people vacationing and working on a cruise ship are reflected in wide variations of the physical parameters of oral health examined here. Perceived oral health, in spite of a high incidence of dental emergencies, appears to be good, provided that a dental service is available. Basic dental equipment and a broadly trained and experienced dentist can contribute to the wellbeing of passengers and crew at sea.

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