

Prevalence and Correlates of Dental Service Utilization among Adults in Solomon Islands

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Received : 22-10-20
Revised : 27-11-20
Accepted : 30-11-20
Published : 15-04-21

ABSTRACT **Aims and Objectives:** The aim of this study was to assess dental service utilization (DSU) among adults in a Pacific Island country. **Materials and Methods:** In a cross-sectional nationally representative survey in Solomon Islands, 2,533 individuals (18–69 years) responded to questions on DSU, sociodemographic and health information in 2015. **Results:** More than half of the participants (55.3%) never had DSU, 36.4% had more than 12 months DSU, and 8.3% had past 12 months DSU. In adjusted multinomial logistic regression analysis, older age, ever screened for blood pressure, using toothpaste, and having had pain in teeth, gum, or mouth in the past year were associated with both >12 months and past 12 months DSU. Higher education, ever screened for cholesterol, being divorced, separated, or widowed, poor self-rated oral health (SROH), and experienced difficulty in chewing foods in the past 12 months were associated with >12 months or past 12 months DSU. High physical activity was negatively associated with >12 months DSU. **Conclusion:** Less than one in ten participants had past 12 months DSU and several factors were found, which can be targeted in interventions.

KEYWORDS: Adults, correlates, dental service utilization, prevalence, Solomon Islands

INTRODUCTION

Oral diseases pose a major health burden globally and are increasing in low- and middle-income countries.^[1] According to data from the World Health Survey,^[2] adults expressing a need for oral health services range from 35% in low-income countries to 60% in lower-middle-income countries. Prompt DSU is needed for the prevention and treatment of oral diseases, and it is therefore important to determine the facilitators and barriers of DSU.^[3] However, no study has been conducted on the prevalence and correlates of DSU in Pacific Island countries in Oceania, such as the lower middle-income country Solomon Islands.

Solomon Islands has a population of 685,097 people, life expectancy at birth is 76.2 years, 24.7% live in urban areas, and there are 0.19 physicians per 1,000

population.^[4] In Solomon Islands, “dental care is provided by a cadre of health workers, with dental services identified in the role delineation guidelines for provision at rural health clinic level and above.”^[5] Area health centers and “hospitals have dental health clinics, with dental services integrated into overall facility services.”^[5] Dental health services are integrated into the primary care system, and rural health clinics provide dental care in terms of extraction and area health centers extraction, fillings, and dentures.^[5] At the start of 2012, there were 1687 health workers in the public sector, including 57 dental practitioners.^[6]

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Access this article online	
Quick Response Code: 	Website: www.jispcd.org
	DOI: 10.4103/jispcd.JISPCD_400_20

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How to cite this article: Pengpid S, Peltzer K. Prevalence and correlates of dental service utilization among adults in solomon islands. J Int Soc Prevent Communit Dent 2021;11:166-72.

In a review including studies from 28 countries, it was found that a global mean “proportion of individuals regularly/preventively utilizing dental services was 54%.”^[7] In specific countries, the past 12-month DSU was 21.4% in 35–44 year-olds and 20.7% in 65–74 year-olds in China,^[8] in adults in Beijing, 11.3% per year,^[9] in Iran 56% (15–64 years),^[10] in Bosnia and Herzegovina 20.1% (adults),^[3] in Greece 39.6%–47% (adults),^[11,12] in Finland 57%,^[13] and in the United States in 2010 ranging from 39.7% to 67.5% depending on the survey type.^[14] Some studies have reported the prevalence of never-DSU among the general adult population, ranging from 3.3% in Brazil^[15] to 73.6% in Nigeria,^[16] and 86.4% in Indonesia.^[17] Further, the national study in Nigeria^[16] showed the prevalence of the self-reported reasons for DSU, namely 54.9% for treatment, 24.9% for checkup only, and the remainder for both treatment and checkup; however, in two studies in Greece, the reasons were for regular dental checkup (31.7%),^[11] and for prevention (32.6%).^[12]

Predisposing factors of DSU include female sex,^[3,7,8,10,17] inequality in older age,^[10,17,18] decreasing age,^[3,9] no age differences,^[7] higher educational level,^[8,10,17-19] and higher household income/wealth.^[8,10-12,17-19] Enabling factors of DSU include having medical insurance,^[8,9,18,19] urban residence,^[3,17,19] short distance to see dentist,^[9] oral health literacy,^[7,9] meeting health-care needs,^[17] supportive family structure,^[7] and living in communities with high structural social capital.^[17]

Health and lifestyle factors of DSU include better general health status,^[7] having normal weight,^[11] having noncommunicable diseases,^[3] not having psychological distress,^[20] never smoking,^[17] low alcohol consumption,^[21] being physically active,^[11] and having a healthier diet.^[11] Perceived need factors of DSU include poor SROH,^[7-10,18] pain in teeth or gum,^[17,22] self-reported mouth ulcers,^[17] more permanent teeth,^[22] not edentulous, nor severe tooth loss,^[7] and eating difficulties due to oral problems.^[23] The aim of this study was to assess DSU among adults in a Pacific Island country.

MATERIALS AND METHODS

STUDY DESIGN AND PROCEDURE

In a cross-sectional nationally representative STEPS survey in Solomon Islands, individuals (18–69 years) responded to a structured questionnaire in 2015; the overall response rate was 58.4%, and more details on the sampling are found on the WHO website.^[24] The questionnaire was administered face-to-face by a trained survey team in English or Pidgin English through a personal digital assistant (PDA), after having previously been piloted.^[24] Overall, the STEPS

survey questionnaire provides “aggregate data for valid between-population comparisons.”^[25] The study protocol was approved by the Solomon Islands’ Ministry of Health and Medical Services Ethics Committee, and participants provided written informed consent.^[24]

MEASURES

DSU was assessed with the question, “How long has it been since you last saw a dentist?” Response options were: <6 months, 6–12 months, >1 year and <2 years, >2 years and <5 years, ≥5 years, and never received dental care.^[24] Further, participants were asked, “What was the main reason for your last visit to the dentist?” (Response options ranged from 1 = consultation/advice to 4 = other; see more details in Table 2).^[24]

Predisposing factors included age, sex, and highest educational level.^[24]

Enabling factors included 1) health-care workers advised to “quit using tobacco or don’t start” in the past three years, 2) ever had blood pressure measured by a health-care worker? 3) ever had blood sugar measured? 4) ever had cholesterol (fat levels in blood) measured), and 5) marital status.^[24]

HEALTH AND LIFESTYLE FACTORS

Psychological distress (defined as ≥20 score) was assessed with the Kessler Psychological Distress Scale (K10).^[26] High internal consistency ($\alpha = 0.85$) was found for the K10 in this study.

Oral health-related behaviors were sourced from two items: (1) “How often do you clean your teeth?” (“1 = never to 7 = twice or more a day”), and (2) “Do you use toothpaste?”^[24]

Other health behaviors included current tobacco use, daily fruit and vegetable intake,^[24] high, moderate, or low physical activity measured with the “Global Physical Activity Questionnaire (GPAQ),”^[27] and alcohol dependence (defined as ≥4 scores on items 4–6 of the “Alcohol Use Disorder Identification Test = AUDIT.”)^[28]

NEED FACTORS

SROH was sourced from two items, 1) “How would you describe the state of your teeth, and 2) How would you describe the state of your gums?”^[24] Poor SROH was defined as “having poor or very poor status of teeth and/or gums, and good oral health as having average, good, very good or excellent status of teeth and/or gums,” in line with previous research.^[29]

Oral health impact (OHI) was sourced from two items, “Difficulty in chewing foods in the past 12 months?” and embarrassment about the appearance of teeth in the past 12 months (“Yes/No”).^[24]

Physical symptoms were sourced from the item, “During the past 12 months, did your teeth or mouth cause any pain or discomfort?” (“Yes/No”).^[24]

Self-reported number of teeth was measured with the question “How many natural teeth do you have?” Response options were: no natural teeth, 1–9, 10–19, and ≥ 20 teeth.^[24]

DATA ANALYSIS

“STATA software version 15.0 (Stata Corporation, College Station, Texas, USA)” was used for the analysis, by taking weighting of the data and multistage sampling design into account.^[24] Multinomial logistic regression was conducted to estimate the predictors of DSU (>12 months and past 12 months, with never DSU as the reference category). Only complete cases formed part of the analysis, and $p < 0.05$ was considered significant.

RESULTS

SAMPLE AND DSU CHARACTERISTICS

The final sample included in the study was 2,533 people (18–69 years, median: 38, interquartile range: 29–48), 47.0% were male, and 39.0% had secondary or more education. One in four of the participants (25.3%) had been advised not to smoke, 41% had ever their blood pressure, 26.2% glucose, and 2.3% their cholesterol measured, and 73.0% were married or cohabiting. Regarding health and lifestyle factors, 18.9% had psychological distress, 12.3% cleaned their teeth twice or more times a day, 46.3% used toothpaste, 38.6% were currently using tobacco, 13.3% were dependent on alcohol, 12.1% had five or more servings of vegetables and fruits per day, and 55.7% had high physical activity. In terms of need factors, 15.0% had poor SROH, 23.0% had pain in teeth or mouth, 10.6% had less than 20 teeth, 12.6% experienced difficulty in chewing foods in the past 12 months, and 8.8% were embarrassed about the appearance of their teeth in the past 12 months. More than half of the participants (55.3%) had never DSU, 36.4% had more than 12 months DSU, and 8.3% had past 12 months DSU [see Table 1].

Among those who had ever DSU, the main reason for the last DSU was pain or trouble with teeth, gums, or mouth (74.4%), treatment or follow-up treatment (14.5%), and routine checkup treatment (5.3%) [see Table 2].

MULTINOMIAL LOGISTIC REGRESSION WITH DSU

In adjusted multinomial logistic regression analysis, older age, ever screened for blood pressure, using toothpaste, and having had pain in teeth, gums, or mouth in the past year were associated with both

>12 months and past 12 months DSU. Higher education, ever screened for cholesterol, being divorced, separated, or widowed, poor SROH, and experienced difficulty in chewing foods in the past 12 months were associated with >12 months or past 12 months DSU. High physical activity was negatively associated with >12 months DSU. In addition, in unadjusted analysis, having been advised not to smoke, ever screened for glucose, being married or cohabiting, <twice or >twice a day teeth cleaning, and embarrassed about the appearance of their teeth in the past 12 months were positively associated with >12 months and/ or past 12 months DSU; male sex, current tobacco use, and alcohol dependence were negatively associated with >12 months and/ or past 12 months DSU [see Table 3].

DISCUSSION

In this nationally representative general adult population in Solomon Islands, past 12 months DSU (8.5%) was lower than in a global study in 28 countries (54%),^[7] in China (<22%),^[8] in Beijing (11.3%),^[9] in Iran (56%),^[10] in Bosnia and Herzegovina (20.1%),^[3] in Greece (39.6%–47%),^[11,12] in Finland (57%),^[13] and in the United States (39.7%–67.5%).^[14] The prevalence of never DSU in this study (55.3%) was higher than in Brazil (3.3%),^[15] but lower than in Nigeria (73.6%)^[16] and Indonesia (86.4%).^[17] Consistent with some studies in Greece and Nigeria,^[11,12,16] the main reason for DSU was treatment rather than dental checkup. This result highlights the lack of awareness about the importance of preventive DSU and possibly the lack of physical access to dental care services. By all means, DSU needs to be improved in Solomon Islands.

In terms of predisposing factors, DSU increased with increasing age, higher education, and in unadjusted analysis among women. Similar results were found in some previous studies.^[3,7,8,10,17,19] Older people tend to have more dental problems, and since most DSU were sequel to pain or trouble with teeth, gums, or mouth, it may explain the higher proportion of older adults using DSU.^[16] Individuals with higher education may have greater awareness of oral health risks and the importance of DSU.^[3,10]

Regarding enabling factors, this study showed that previous health screening (for blood pressure, glucose, and/or cholesterol) and being divorced, separated, or widowed increased the odds for DSU. In addition, in unadjusted analysis, being married or cohabiting increased the odds for DSU. Previous research has shown that a supportive family structure, such as being married, was associated with DSU.^[7] In case of being married, it could mean that a dental visit could be easier to arrange.^[7]

Table 1: Sample and dental service utilization characteristics among adults in Solomon Islands, 2015

Variable	Sample	DSU		
	N (%)	Never %	>12 months %	≤12 months %
All	2533	55.3	36.4	8.3
Predisposing factors				
Age (years)				
18–29	657 (33.3)	67.0	28.0	5.0
30–49	1292 (49.1)	52.3	37.6	10.0
50–69	584 (17.6)	41.6	48.8	9.6
Gender				
Women	1402 (53.0)	50.2	40.0	9.8
Men	1131 (47.0)	61.1	32.3	6.6
Education				
<Primary	686 (25.1)	61.5	30.1	8.4
Primary	929 (35.8)	54.0	38.5	7.5
≥Secondary	908 (39.0)	52.5	38.5	9.0
Enabling factors				
Advised to not smoke by health-care worker	612 (25.3)	67.0	23.7	9.3
Ever screened for blood pressure	1060 (41.3)	46.8	42.5	10.7
Ever screened for glucose	671 (26.2)	40.9	46.4	12.8
Ever screened for cholesterol	65 (2.3)	26.5	47.1	26.4
Marital status				
Never married	441 (21.4)	64.8	30.2	5.0
Married/cohabiting	1890 (73.0)	54.1	36.9	9.1
Divorced/separated/widowed	201 (5.6)	35.0	54.1	10.8
Health and lifestyle factors				
Psychological distress	484 (18.9)	53.9	38.3	7.8
Teeth cleaning				
Never	646 (24.4)	69.7	25.3	5.0
<Twice/day	1596 (63.4)	51.1	39.6	9.3
≥Twice/day	273 (12.3)	48.8	41.7	9.6
Uses toothpaste				
No	1402 (53.7)	66.9	27.3	5.7
Yes	1113 (46.3)	41.9	46.8	11.2
Current tobacco use	922 (38.6)	66.8	27.2	6.0
Alcohol dependence	302 (13.3)	67.5	28.9	3.5
Fruit/vegetable intake (servings/day)				
<3	1465 (57.1)	56.7	35.0	8.3
3–4	709 (30.8)	54.7	37.3	8.0
≥5	336 (12.1)	50.4	41.2	8.4
Physical activity				
Low	721 (27.0)	47.7	43.5	8.8
Moderate	448 (17.3)	49.4	41.4	9.2
High	1308 (55.7)	61.1	31.4	7.5
Need factors				
Poor SROH	435 (15.0)	35.5	50.2	14.3
Pain in teeth/mouth (past year)	584 (23.0)	39.6	37.4	23.0
Teeth (<20)	328 (10.6)	45.8	43.7	10.5
OHI chewing	368 (12.6)	37.2	42.2	20.6
OHI embarrassed	212 (8.8)	41.4	43.6	15.0

OHI = oral health impact

On the other hand, older people are more likely to be widowed or divorced and tend to have more oral health problems in more likely initiating DSU in this group. One possible way of increasing DSU is the integration of oral

health into other essential medical services, such as blood pressure or glucose screening, in Solomon Islands.

In terms of health and lifestyle factors and consistent with some studies,^[17,21] this study showed that some

Table 2: Main reason for last dental visit

Main reason for last dental visit	All %	Male %	Female %
Consultation/advice	2.2	2.3	2.1
Pain or trouble with teeth, gums, or mouth	74.4	72.3	75.8
Treatment/follow-up treatment	14.5	13.7	15.0
Routine checkup treatment	5.3	6.4	4.6
Other	3.7	5.3	1.6

positive health behaviors (tooth cleaning, using toothpaste, non-current tobacco users, and non-alcohol dependent people) were positively associated with DSU. It is possible that people who engage in tobacco use and harmful drinking have less concern for their health, including oral health, and thus do not access dental services.^[21] However, contrary to some previous studies,^[11,20] this study did not find a significant positive association between a healthier diet (fruit and vegetables intake), physical activity, nonpsychological distress, and DSU.

Regarding perceived need factors, consistent with a number of previous research studies,^[8-10,17,18,22] this study found a positive association between poor SROH, pain in teeth or mouth, oral health impact (difficulty chewing, and embarrassment with appearance of teeth), and DSU. Unlike some previous research,^[7] this study did not find a significant association between non-tooth loss and DSU. The identification of determinants and potential barriers of DSU in the general population in Solomon Islands has dental public health implications. Oral health promotion activities can be targeted at identified barriers of DSU. New and current activities should be reinforced for the active inclusion of groups with less access to DSU, including younger age groups, those with lower education, those who have never screened for blood pressure or cholesterol, those not using toothpaste, and those not experiencing poor oral health. Study findings suggest to improve oral health awareness, in particular stressing the relevance of regular dental checkups, by using different modalities of oral health promotion.^[8]

The study limitations included that some relevant variables for DSU, such as oral examination, medical insurance coverage, oral health literacy, unmet treatment needs, supportive family structure, and residence status, were not assessed in the 2015 STEPS Solomon Islands, and should be incorporated in the future. The moderate response rate (58.4%) in this study may have biased the estimates and may have weakened the external validity of the results. Due to the lack of detailed information about the non-responders, a comparison with responders could not be made. Some variables, such as anthropometric measurements and household income, were not included in the analysis

due to large number of missing values. Due to the self-report of the data, responses may have been biased. The cross-sectional study design hinders us from drawing causative conclusions.

CONCLUSION

In this nationally representative general adult population in Solomon Islands, less than one in ten participants had past 12 months DSU. Several associated factors for >12 months and/ or past 12 months DSU were identified, including older age, higher education, being divorced, separated, or widowed, ever screened for blood pressure, ever screened for cholesterol, using toothpaste, having had pain in teeth, gum, or mouth in the past year, poor SROH, and experienced difficulty in chewing foods in the past 12 months, which can be targeted in improving DSU. Oral health care should be strengthened, including both dental and other care provision, to increase access to dental care. Moreover, oral health promotion should stress the importance of preventive DSU.

ACKNOWLEDGMENTS

The data source, the World Health Organization NCD Microdata Repository (URL: <https://extranet.who.int/ncdsmicrodata/index.php/catalog>), is hereby acknowledged.

FINANCIAL SUPPORT AND SPONSORSHIP

Not applicable.

CONFLICTS OF INTEREST

The authors declare that they have no competing interests.

AUTHORS' CONTRIBUTIONS

All authors fulfill the criteria for authorship. SP and KP conceived and designed the research, performed statistical analysis, drafted the article, and made a critical revision of the article for key intellectual content. All authors read and approved the final version of the article and have agreed to authorship and order of authorship for this article.

ETHICAL POLICY AND INSTITUTIONAL REVIEW BOARD STATEMENT

The Solomon Islands National Health Ethics Review Committee provided ethics approval of the study, and

Table 3: Associations with >12 months and past 12 months DSU (with never DSU as reference category)

Variable	DSU		DSU	
	>12 months	≤12 months	>12 months	≤12 months
	CRRR (95% CI)	CRRR (95% CI)	ARRR (95% CI)	ARRR (95% CI)
Predisposing factors				
Age (years)				
18–29	1 (Reference)	1 (Reference)	1 (Reference)	1 (Reference)
30–49	1.73 (1.34, 2.25)***	2.61 (1.75, 3.88)***	1.94 (1.37, 2.74)***	1.88 (1.16, 3.05)*
50–69	2.99 (2.07, 4.32)***	3.27 (1.79, 5.97)***	3.37 (2.11, 5.37)***	2.20 (1.12, 4.20)*
Gender				
Women	1 (Reference)	1 (Reference)	1 (Reference)	1 (Reference)
Men	0.61 (0.49, 0.76)***	0.56 (0.41, 0.77)***	0.81 (0.60, 1.10)	0.93 (0.52, 1.66)
Education				
<Primary	1 (Reference)	1 (Reference)	1 (Reference)	1 (Reference)
Primary	1.49 (1.15, 1.93)**	1.02 (0.67, 1.57)	1.48 (1.12, 1.97)**	0.95 (0.54, 1.65)
≥Secondary	1.40 (1.04, 1.89)*	1.25 (0.81, 1.95)	1.49 (1.08, 2.05)*	1.49 (0.73, 3.03)
Enabling factors				
Advised to not smoke by health-care worker	1.04 (0.76, 1.41)	1.59 (1.10, 2.32)*	1.00 (0.73, 1.36)	1.44 (0.93, 2.23)
Ever screened for blood pressure	2.36 (1.79, 3.11)***	3.12 (2.19, 4.45)***	1.73 (1.33, 2.24)***	1.69 (1.13, 2.53)*
Ever screened for glucose	2.03 (1.44, 2.87)***	2.80 (1.81, 4.32)***	0.96 (0.70, 1.32)	1.12 (0.70, 1.78)
Ever screened for cholesterol	2.68 (1.36, 5.27)**	6.18 (2.69, 14.22)***	1.63 (0.79, 3.36)	3.34 (1.48, 7.51)**
Marital status				
Never married	1 (Reference)	1 (Reference)	1 (Reference)	1 (Reference)
Married/ cohabiting	1.50 (1.11, 2.02)**	2.44 (1.28, 4.65)**	0.90 (0.63, 1.29)	1.46 (0.70, 3.05)
Divorced/separated/widowed	3.20 (1.92, 5.34)***	4.81 (2.39, 9.96)***	1.42 (0.67, 3.02)	2.86 (1.28, 6.41)*
Health and lifestyle factors				
Psychological distress	1.15 (0.82, 1.61)	1.02 (0.64, 1.65)	---	---
Teeth cleaning				
Never	1 (Reference)	1 (Reference)	1 (Reference)	1 (Reference)
<Twice/day	2.03 (1.53, 2.69)***	2.37 (1.39, 4.04)**	1.40 (0.95, 2.06)	1.42 (0.74, 2.70)
≥Twice/day	2.42 (1.49, 3.93)***	2.60 (1.20, 5.66)*	1.23 (0.67, 2.26)	1.16 (0.48, 2.80)
Uses toothpaste				
No	1 (Reference)	1 (Reference)	1 (Reference)	1 (Reference)
Yes	2.62 (1.98, 3.47)***	2.90 (2.07, 4.05)***	2.35 (1.66, 3.33)***	2.96 (1.86, 4.71)***
Current tobacco use	0.47 (0.35, 0.62)***	0.45 (0.32, 0.63)***	0.77 (0.54, 1.08)	0.90 (0.61, 1.33)
Alcohol dependence	0.60 (0.41, 0.87)**	0.33 (0.18, 0.58)***	1.17 (0.72, 1.84)	0.51 (0.26, 1.01)
Fruit/vegetable intake (servings/day)			---	---
<3	1 (Reference)	1 (Reference)		
3–4	1.05 (0.79, 1.40)	0.96 (0.66, 1.38)		
≥5	1.30 (0.92, 1.83)	1.00 (0.60, 1.69)		
Physical activity				
Low	1 (Reference)	1 (Reference)	1 (Reference)	1 (Reference)
Moderate	0.94 (0.71, 1.25)	1.03 (0.66, 1.63)	0.81 (0.60, 1.10)	0.82 (0.48, 1.40)
High	0.58 (0.44, 0.76)***	0.72 (0.48, 1.07)	0.68 (0.52, 0.88)**	0.79 (0.51, 1.23)
Need factors				
Poor SROH	2.47 (1.53, 3.98)***	3.23 (1.85, 5.63)***	1.63 (1.02, 2.60)*	1.54 (0.94, 2.53)
Pain in teeth/mouth (past year)	1.59 (1.16, 2.18)**	10.05 (6.69, 15.10)***	1.44 (1.03, 2.01)*	8.63 (5.63, 13.21)***
Teeth (<20)	1.53 (0.95, 2.46)	1.71 (0.96, 3.04)	---	---
OHI chewing	1.92 (1.22, 3.02)**	5.29 (3.44, 8.12)***	1.23 (0.78, 1.95)	1.90 (1.18, 3.06)**
OHI embarrassed	1.87 (1.02, 3.45)*	2.81 (1.36, 5.81)**	1.53 (0.85, 2.75)	1.37 (0.66, 2.48)

OHI = Oral Health Impact; CRRR = Crude Relative Risk Ratios; ARRR = Adjusted Relative Risk Ratios; ****P* < 0.001, ***P* < 0.01, **P* < 0.05

written informed consent was obtained from the study participants.

PATIENT DECLARATION OF CONSENT

Not applicable.

DATA AVAILABILITY STATEMENT

The data for the current study are publicly available at the World Health Organization NCD Microdata Repository (URL: <https://extranet.who.int/ncdsmicrodata/index.php/catalog>).

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