Root caries experience among older adults in a country with long term systemic water fluoridation

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Research article

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Abstract

Objective

The objective of this study was to explore dental caries experience in older Singaporeans (60-90 years old), a country with over 60 years of water fluoridation, and to examine what risk factors contribute to prevalence of oral disease, in particular root caries, and to assess the impact of service utilisation on treatment of root caries.

Methodology

500 community dwelling older adults, aged 60 years and above were invited to participate in this cross-sectional study. Participants completed a survey which included questions related to demographics (e.g. age, gender, ethnicity, education level) self-rated oral health, oral health attitudes and frequency of dental visits. A clinical examination recorded details of decayed, missing and filled teeth; stimulated saliva flow was also measured. The main outcome of this study was prevalence of decayed and filled root surfaces (DFRS) of older adults, categorised as “low” [DFRS ≤3] and “high” [DFRS >3]. The regression models were controlled for age, gender, ethnicity, education, marital status, housing type, oral health related factors and salivary parameters.

Results

84.2% of the participants ethnicity was Chinese and 15.2% were Non-Chinese. The mean DFRS score was [Mean (SD), 3(3.5)], decayed [Total (Mean), 68(13.6)] and filled [Total (Mean), 287 (57.4)]. In bivariate analysis, age, ethnicity, education, dental visits, recession, restored coronal surfaces and oral health attitude were found to be significantly associated with DFRS. In final multivariate model it was found that age, ethnicity, education, pattern of dental visits, gingival recession/periodontal attachment loss and number of restored coronal surfaces are independent predictors of root caries experience in older adults. The selected risk factors in the final model explained about 20% of the variation.

Conclusion

Higher education and awareness increase dental care utilization which corresponds to a high filled (F) component of DFRS. Previous coronal caries experience and gingival recession/attachment loss are risk indicators of higher root caries experience.

Introduction

The phenomenon of population aging is a major challenge for social and economic development and sustainability worldwide (1). In Singapore, life expectancy has risen to 84.79 years, from 76.1 years in 1990 (2). By 2030, one in four Singaporeans will be aged 65 years and above (3). According to WHO, oral health is an important component of “active aging” (4). During the past several decades, the percentage of older adults who have retained their natural teeth has increased steadily (5). This may lead to overall
improvement in oral health quality of life (6), but tooth retention during later stage of life poses greater risk for root caries (7).

Older adults (i.e., those over 65 years of age) are at great risk for dental caries because of age-related salivary changes, deterioration of dental restorations, exposure of root surfaces through gingival recession and cumulative effects of periodontal disease (8). The mean number of decayed and filled root surfaces in older adults lies between 2.2 and 5.3 in developed countries (9–11). The initiation, progression and reversal of dental caries depend upon the balance between demineralization and remineralisation of available tooth surfaces. This balance can be shifted to remineralisation with the use of topical fluoride on regular basis (12). The role of systematic water fluoridation in dental caries has been well recognised, but its impact on caries in adults over 65 years is not so well known. Few countries have benefitted from prolonged water fluoridation with full penetration to its entire population. Singapore is fortunate to have enjoyed universal coverage of water fluoridation for over 50 years, having fluoridated its public water supplies in 1956 (13). According to the latest data, the level of fluoride in community water supplies is 0.7 mg/l (14). Previous studies done in Singapore, have reported steady decline in dental caries experience in school children aged between 6 and 18 years (15, 16). However, there are no studies which have examined the effect of long-term exposure of water fluoridation on oral health status of community dwelling older Singaporeans.

Beside, water fluoridation other factors which are known to be associated with root caries experience are social and behavioural factors (17, 18). The pattern is mostly that persons of low income (19), those who do not visit a dentist regularly (20), have poor oral hygiene (20), tend to experience high levels of coronal and root surface caries (21). The aim of this study was to explore dental caries experience in older Singaporeans (60–90 years old), a country with over 60 years of water fluoridation, and to examine what risk factors contribute to prevalence of oral disease, in particular root caries, and to assess the impact of service utilisation on treatment of root caries.

**Methodology**

**Participants and public involvement**

Community dwelling older adults aged between 60-90 years of age were recruited from a senior activity centre located in the central west district of Singapore and National University Polyclinic (NUP), Jurong. The inclusion criteria were: (1) aged between 60-90 years, (2) eligible for dental care benefits, (3) can understand/communicate in Mandarin/Hokkien, English and Malay.

**Informed Consent**

Written informed consent was obtained from all participants after the objectives and procedures of the research were fully explained to them by a member of the research team. Participants were informed that they could withdraw from the research at any time without giving any reasons. Participants with mild/moderate dementia were asked to invite their legally appointed representatives to the consent-taking
process and data collection. The research team ascertained that the person deciding on behalf of the participant with dementia, was acting in the best interest of the participant and considered the participant’s concerns and desires.

**Dental clinical examination**

The dental clinical examination was performed by calibrated examiners. The dental examination included recording details of: (1) oral pathology (if any), (2) periodontal status (calculus, probing depth, loss of attachment and bleeding), (3) coronal status (active decay, filled, missing due to decay), (4) root status (active decay, filled and missing), (5) tooth wear (loss of enamel, dentine, pulp exposure or exposure of secondary dentine), (6) number and distribution of occlusal contacts (specifically of posterior teeth) and (7) prosthodontic status (presence/absence of denture, denture fit, retention, stability, extension and hygiene).

**Collection of saliva sample**

Alongside the clinical examination of the subject's dentition, saliva samples were also collected to record stimulated salivary flow rate and buffering capacity of saliva. Subjects were instructed to chew on paraffin wax for five minutes and spit out their stimulated residual saliva into a sterilised container. The volume of stimulated saliva was recorded and the salivary flow per minute was subsequently calculated.

**Other data**

Data on potential covariates were obtained from in-person interviews and included age, gender, ethnicity, education, marital status, oral health related factors and oral health attitude. Housing type has been considered as a social determinant of health (22). In Singapore, there is a mixture of public rental housing together with owner-occupied public housing within each residential precinct. For the needy, heavily subsidized public rental housing is available from the Housing Development Board (HDB). In 2017/2018, Average monthly household expenditure by type of dwelling was S$3,956 for people staying in HDB, S$7,963 for those staying in condominium or apartments and S$10,500 for individuals residing in landed property (23). In our study, we have collected information related to ‘housing type’ of study participants as a proxy of socio-economic status (SES).

**Statistical analysis**

Decayed and filled root surfaces (DFRS) was calculated by adding the number of decayed and filled root surfaces from a maximum of 32 teeth. In addition, we computed pseudo-R-squared coefficients to summarize the predictive power of the regression models. This type of measure describes the power of the explanatory variables (oral health determinants) to predict the dependent variable (24). The main outcome of this study was DFRS of older adults which was categorised as DFRS ≤ 3 and DFRS > 3 (it was categorised based on Mean DFRS (SD) of sample population which was 3(3.5)). During statistical analysis DFRS ≤3 was considered as a reference group. To identify correlation between DFRS and other host factors including: age, gender, ethnicity, education, marital status, housing type (proxy of SES),
dental visits, self-perceived oral health, recession, coronal caries experience, denture wear, oral health attitude and volume of saliva, we first performed bivariate analysis. After bivariate analysis, we conducted multivariate analysis to predict potential factors associated with DFRS of study participants.

For final prediction model, we performed a backward stepwise model building approach that eliminates and includes variables into the model with p-value>0.09 and p-value<0.05 respectively. P-value <0.05 was considered significant. All statistical analyses were performed using SPSS version 24.

Results

In total, 500 independently living older Singaporeans were examined in this study. 405 (81.0%) were 60-75 years of age, 347 (69.4%) were females, 421 (84.2%) were Chinese, 417 (83.4%) were at least with primary education, 340 (68.0%) were married and 411 (82.2%) were staying in HDB more than 3 rooms or private property. Mean DFRS score was 3, 30.8% scored greater than 3. (Table 1).

64.8% of study population had routine visits, 61.0% had good self-perceived oral health, 67.0% had mild or no recession, 55.4% has calculus deposits. For root status, 13.6% had at least one carious surface, 97.2% had at least one tooth missing and 57.4% had at least one filled tooth. For coronal status, 10.8% had at least one tooth carious, 58.2% had at least one tooth missing due to decay and 84.0% had at least one filled tooth. 34.6% were wearing acrylic or Co/Cr removable partial dentures (RPDs). 84.0% agreed that they are afraid of losing teeth, 91.6% agreed that dental problems affect overall health and 63.4% agreed that dental treatment is more costly than medical treatment. 55.6% of participants had normal salivary flow (≥1ml/min of saliva).

Bivariate analysis showed that root DFRS is significantly associated with age, ethnicity, education, dental visits, recession, coronal fillings and oral health attitude, dental problems affects overall health (Table 2).

The multivariate logistic regression analyses revealed that the odds of having higher DFRS score is associated with individuals between 60-75 years old [0.30 (0.17 – 0.52)], Chinese [2.61 (1.17 – 5.81)], those who had at least primary education [2.69 (1.22 – 5.90)], non-routine visits [0.45 (0.27 – 0.76)], individuals with mild or no recession [0.41 (0.26 – 0.64)] and participants with coronal fillings [2.67 (1.21 – 5.88)] (Table 3).

Table 4 demonstrates the final prediction model. Age, ethnicity, education, dental visits, recession, and coronal fillings were associated with root DFT scores. Our final model classified correctly 73.1% of the cases. The Pearson Chi square value for the Goodness-of-fit test was 0.39 which is not significant therefore indicates model fits the data well. Full model statistically significantly predicts the dependent variable better than the intercept-only model alone (Likelihood ratio test, p<0.001).

Discussion
To the best of our knowledge, in Singapore, this is the first comprehensive study that attempts to explore the factors responsible for root caries experience among older adults who had long-term exposure to fluoride. Present study showed that age, ethnicity, education, dental visits, recession, and coronal fillings are potential factors associated with root caries in older adults. Our finding is similar to a previous study which has shown that root caries was more frequently observed with advancing age (25). Overall, our study participants had lower prevalence of active caries lesions compared to previous studies (26-28). The majority of our participants were below seventy-five years old, educated and in middle to upper SES category, so one might expect combined benefit of these factors on oral health status of our study population.

In our study, mean number of decayed and filled teeth were 0.23 and 2.54 respectively. In a study done in 2014, the reported mean decayed score was 2.21 and filled score 0.25 among independent-living Singaporean elderly (29). This decrease in number of untreated carious lesions and increase in restorations in our study can be explained by a variety of factors. Firstly, in 2014, the government introduced a dental care co-payment scheme, Community Health Assist Scheme (CHAS), and subsidised oral health care for adults was extended beyond government-funded polyclinics to the private sector. This enabled about half of all Singaporean households to benefit from the scheme (30). Furthermore, the Pioneer Generation (PG) scheme was launched in 2015, to honour and recognise pioneers (special generation of Singaporeans who were at least aged 16 years in 1965 or are aged ≥65 years by the end of 2014). Under this scheme, all Singaporean citizens over 65 years of age receive additional subsidies on top of existing services and medication at polyclinics, specialist outpatient clinics, general practitioners and dental clinics. Almost 97% of CHAS and PG cardholders island-wide have access to more than one CHAS clinic within a kilometre of their homes (31). It is still too early to conclude that increase in dental care utilization has increased due to enhancement of dental care subsidies (CHAS and PG). Future case control studies should be conducted to investigate the true impact of oral health benefits on dental care utilization among older Singaporeans. One could argue that increase in number of restorations in our study population corresponds to higher prevalence of dental caries. Unfortunately, we could not record whether restorations were due to the treatment of previous caries lesions or non-carious tooth wear [abrasion].

Interestingly, in our study, educated participants and those who had routine visits were shown to have higher odds of root caries experience compared to individuals with no formal education. Most of our study population had at least one restoration and few active carious lesions which explains that more oral health knowledge and awareness will be responsible for high ‘F’ component of DFRS. This could be possibly due to their relatively higher SES level, and thus more likely to have lower levels of untreated decay and higher levels of restored teeth. Furthermore, it has been proven that DT and MT components increased with decreasing income, while the FT component decreased (32).

Our study has shown that root caries experience is significantly associated with recession. Our findings correlate with findings of previous studies (33, 34). This is an expected correlation because having exposed root surfaces is a basic condition for root caries development and an increase in the amount of
exposed surface would increase the risk. As the amount of gingival recession increases with age among older adults (35) this can partly explain why age was consistently reported to be a predictor of root caries. Also, in present study, age was significantly correlated with DFRS similar to findings in other studies (36, 37).

It is unsurprising that coronal caries experience were identified as correlates for root caries experience and have been identified as risk indicators in previous studies (38). Past caries experience is an important factor when assessing risk (4), it has been shown that combined effect of coronal and root caries experience contributes to observed increments whereby coronal caries made the greater contribution to the overall increment (39). Clinical preventive measures related to geriatric care should account for both coronal and root caries, it is wrong to consider that root surface caries is the only problem during later age of life (39).

Surprisingly, despite of considerable proportion of respondents were in the hypo salivary volume range, this was not statistically significant predictor. It may be due to low caries susceptibility/high motivation of oral health care.

Care must be exercised when comparing the results of this study to previous studies with respect to definition, calculation and reporting methods of root caries. Some studies calculate Root Caries Index (RCI) (40), other studies classified a lesion as active if it was softened or leathery on moderate probing with a sharp explorer probe (40, 41). In literature, there has been considerable variation while assessing root caries in older adults. In our study, we didn’t record number of surfaces which were decayed or restored and hence unable to calculate root caries index (RCI). In this scenario, it is not possible to compare DFRS within available literature.

**Conclusion**

Findings of our study showed that root caries is a disease influenced by various factors, it is a preventable disease which if identified at an early stage, can be controlled and treated. Besides, oral health benefits for treatment procedures Government interventions should be targeted to spread oral health awareness as well.

Factors like recession, restorations and frequency of dental visits are the common causes of dental caries in geriatric population. Hence, in research studies involving older adults, measurement of caries index whether DFRS or DMFT should be interpreted with caution. The DMF index is perhaps the most valuable measure we have in dental epidemiology. However, it has inherent problems (42). Calculation and interpretation of each component of index separately avoids over or under estimation of factors associated with caries risk.

**Declarations**

*Ethics approval and consent to participate*
Ethical approval for this study was granted by the National University of Singapore – Institutional Review Board (NUS-IRB Reference code: H-17-047) and Domain Specific Review Board (DSRB Reference Number: 2017/00223).

Written informed consent was obtained from all participants after the objectives and procedures of the research were fully explained to them by a member of the research team. Participants were informed that they could withdraw from the research at any time without giving any reasons. Participants with dementia were asked to invite their legally acceptable representatives to the consent-taking process and data collection. The research team ascertained that the person making a decision on behalf of the participant with dementia, was acting in the best interest of the participant and took into account the participant’s concerns and desires.

**Competing interests**

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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**Availability of data and materials**

The data of this study may not be publicly available due to confidentiality agreements with the participants.

**Author’s contributions**

PF Allen conceived the study (PI of the study). PF Allen, WML and RM designed the methods. RM collected the data. RM analysed the data and wrote the first draft of the report. All authors interpreted results, commented on drafts and approved the final version of the report.

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Tables
| Potential Predictors                        | N (%) |
|--------------------------------------------|-------|
| Sociodemographic factors                   |       |
| Age                                        |       |
| 60–75 years                                | 405 (81.0) |
| More than 75 years                         | 95 (19.0) |
| Gender                                     |       |
| Male                                       | 153 (30.6) |
| Female                                     | 347 (69.4) |
| Ethnicity                                  |       |
| Chinese                                    | 421 (84.2) |
| Non-Chinese                                | 79 (15.8) |
| Education                                  |       |
| Primary passed or above                    | 417 (83.4) |
| No formal education                        | 83 (16.6) |
| Marital status                             |       |
| Married                                    | 340 (68.0) |
| Single/Divorced/Widowed                    | 160 (32.0) |
| Housing type                               |       |
| HDB more than 3 rooms/condominium          | 411 (82.2) |
| HDB 1–3 room                               | 89 (17.8) |
| Oral Health related factors                |       |
| Dental visits                              | 176 (35.2) |
| Non-routine visits                         | 324 (64.8) |
| Routine visits                             |       |
| Self-perceived oral health                 |       |
| Good                                       | 305 (61.0) |
| Fair/Poor                                  | 195 (39.0) |
| Potential Predictors               | N (%)    |
|-----------------------------------|----------|
| Recession                         | 335 (67.0) |
| Mild or no                        | 165 (33.0) |
| Moderate to severe                | 276 (55.2) |
| Presence of calculus              | 224 (44.8) |
| Yes                               |           |
| No                                |           |
| Root caries experience            | 68 (13.6) |
| Decayed                           | 486 (97.2) |
| Missing                           | 287 (57.4) |
| Filled                            | 346 (69.2) |
| DFRS                              | 154 (30.8) |
| \( \leq 3 \)                      | 14.26 (7.96) |
| > 3                               |           |
| DMFT Mean (SD)                    |           |
| Coronal caries experience         | 54 (10.8) |
| Decayed                           | 291 (58.2) |
| Missing due to decay              | 420 (84.0) |
| Filled                            | 10.77 (7.38) |
| DMFT Mean (SD)                    | 173 (34.6) |
| Denture wear                      | 327 (65.4) |
| Acrylic or Co/Cr RPD              |           |
| No denture                        |           |
| Potential Predictors                                      | N (%)  |
|----------------------------------------------------------|--------|
| Oral Health attitude                                     | 420 (84.0) |
| Afraid of losing teeth                                   | 80 (16.0) |
| Agree                                                    | 458 (91.6) |
| Disagree/Unsure                                          | 42 (8.4) |
| Dental problem affects overall health                    | 317 (63.4) |
| Agree                                                    | 183 (36.6) |
| Disagree/Unsure                                          | 278 (55.6) |
| Dental treatment is costly than medical treatment        | 222 (44.4) |
| Agree                                                    |        |
| Disagree/Unsure                                          |        |
| Salivary parameters                                      |        |
| Salivary flow                                            |        |
| Normal (greater than equal to 5 ml)                      |        |
| Hypo (1-4.5 ml)                                          |        |
Table 2
Bivariate correlation between potential predictors and root caries experience (DFRS)

| Potential Predictors                  | OR (95% CI) | p value | Cox & Snell R² |
|---------------------------------------|-------------|---------|----------------|
| **Sociodemographic factors**          |             |         |                |
| Age                                   |             |         |                |
| 60–75 years                           | 2.19 (1.38–3.46) | < 0.01* | 0.02           |
| More than 75 years                    |             |         |                |
| **Gender**                            | 0.88 (0.58–1.32) | 0.54    | 0.001          |
| Male                                  |             |         |                |
| Female                                |             |         |                |
| **Ethnicity**                         | 0.24 (0.11–0.50) | < 0.001* | 0.03           |
| Chinese                               |             |         |                |
| Non-Chinese                           |             |         |                |
| **Education**                         | 0.36 (0.19–0.68) | < 0.01* | 0.02           |
| Primary passed or above               |             |         |                |
| No formal education                   |             |         |                |
| **Marital status**                    | 0.94 (0.62–1.42) | 0.79    | 0.000          |
| Married                               |             |         |                |
| Single/Divorced/Widowed               |             |         |                |
| **Housing type**                      | 0.64 (0.38–1.09) | 0.10    | 0.005          |
| HDB more than 3 rooms/condominium    |             |         |                |
| HDB 1–3 room                          |             |         |                |
| **Oral Health Habits**                | 2.58 (1.66–4.01) | < 0.001* | 0.03           |
| **Dental visits**                     |             |         |                |
| Non-routine visits                    |             |         |                |
| Routine visits                        |             |         |                |
| **Self-perceived oral health**        | 0.78 (0.52–1.16) | 0.22    | 0.003          |
| Good                                  |             |         |                |
| Fair/Poor                             |             |         |                |

DFRS: Decayed filled root surfaces
| Potential Predictors                          | OR (95% CI)           | p value | Cox & Snell R² |
|---------------------------------------------|-----------------------|---------|---------------|
| **Recession**                               |                       |         |               |
| Mild or no                                   | 1.87 (1.26–2.77)      | < 0.01* | 0.01          |
| Moderate to severe                           | 1.03 (0.70–1.52)      |         |               |
| **Presence of calculus**                     |                       |         |               |
| Yes                                         |                       |         |               |
| No                                          |                       | 0.25    | 0.003         |
| **Coronal caries experience**                | 1.45 (0.75–2.80)      | 0.30    | 0.002         |
| Decayed                                     | 1.22 (0.83–1.79)      | < 0.001*| 0.03          |
| Missing due to decay                        | 0.24 (0.11–0.49)      |         |               |
| Filled                                      |                       |         |               |
| **Denture wear**                             |                       |         |               |
| Acrylic or Co/Cr RPD                        | 1.30 (0.86–1.95)      | 0.20    | 0.003         |
| No denture                                  | -                     | 0.22    | 0.003         |
| Oral Health attitude                        | 0.71 (0.41–1.22)      | 0.04*   | 0.009         |
| Afraid of losing teeth                      | -                     | 0.89    | 0.000         |
| Agree                                       | 0.42 (0.18–0.97)      | 0.60    | 0.001         |
| Disagree/Unsure                             | -                     |         |               |
| **Dental problem affects overall health**    | 1.02 (0.69–1.52)      |         |               |
| Agree                                       | -                     |         |               |
| Disagree/Unsure                             | 1.10 (0.75–1.61)      |         |               |
| **Dental treatment is costly than medical treatment** | -                      |         |               |
| Agree                                       | -                     |         |               |
| Disagree/Unsure                             | -                     |         |               |
| Salivary parameters                         |                       |         |               |
| **Salivary flow**                           |                       |         |               |
| Normal (greater than equal to 5 ml)         |                       |         |               |
| Hypo (1–4.5 ml)                              |                       |         |               |
| DFRS: Decayed filled root surfaces          |                       |         |               |
### Table 3
Multivariate correlation between potential predictors and root caries experience (DFRS 0–3 as reference variable)

| Potential Predictors       | DFRS (Decayed and filled root surfaces) |
|----------------------------|----------------------------------------|
|                            | OR (95% CI)                             | p value |
| **Sociodemographic factors** |                                        |         |
| Age                        |                                        |         |
| 60–75 years                |                                        |         |
| More than 75 years         |                                        |         |
| **Gender**                 |                                        |         |
| Male                       | 1.07 (0.67–1.71)                       | 0.76    |
| Female                     | -                                      |         |
| **Ethnicity**              |                                        |         |
| Chinese                    | 2.61 (1.17–5.81)                       | 0.01*   |
| Non-Chinese                | -                                      |         |
| **Education**              |                                        |         |
| Primary passed or above    | 2.69 (1.22–5.90)                       | 0.01*   |
| No formal education        | -                                      |         |
| **Marital status**         |                                        |         |
| Married                    | 0.95 (0.59–1.52)                       | 0.83    |
| Single/Divorced/Widowed    | -                                      |         |
| **Housing type**           |                                        |         |
| HDB more than 3 rooms      | 0.88 (0.46–1.68)                       | 0.71    |
| HDB 1–3 room               | -                                      |         |
| **Oral Health Habits**     |                                        |         |
| Dental visits              | 0.45 (0.27–0.76)                       | < 0.01* |
| Non-routine visits         | -                                      |         |
| Routine visits             | -                                      |         |
| **Self-perceived oral health** | 0.99 (0.63–1.56) | 0.98    |
| Good                       | -                                      |         |
| Fair/Poor                  | -                                      |         |
| Potential Predictors                        | OR (95% CI)          | p value |
|--------------------------------------------|----------------------|---------|
| **Recession**                              |                      |         |
| Mild or no                                 | 0.41 (0.26–0.64)     | < 0.001*|
| Moderate to severe                         | 1.04 (0.67–1.60)     |         |
| **Presence of calculus**                   |                      |         |
| Yes                                        |                      |         |
| No                                         | -                    | 0.86    |
| **Coronal caries experience**              |                      |         |
| Decayed                                    | 0.80 (0.37–1.73)     | 0.57    |
| Missing due to decay                       | 2.67 (1.21–5.88)     | 0.01*   |
| Filled                                     | 0.85 (0.53–1.38)     | 0.53    |
| **Denture wear**                           |                      |         |
| Acrylic or Co/Cr RPD                       | 1.07 (0.57–2.006)    | 0.44    |
| No denture                                 | -                    | 0.87    |
| **Oral Health attitude**                   |                      |         |
| Afraid of losing teeth                     | 1.45 (0.56–3.72)     |         |
| Agree                                      | -                    |         |
| Disagree/Unsure                            | -                    |         |
| Dental problem affects overall health      |                      |         |
| Agree                                      | 1.03 (0.66–1.60)     |         |
| Disagree/Unsure                            | -                    |         |
| Dental treatment is costly than medical treatment |                      |         |
| Agree                                      | 0.86 (0.55–1.32)     | 0.49    |
| Salivary flow                              | -                    |         |
| Normal (greater than equal to 5 ml)        | -                    |         |
| Hypo (1-4.5 ml)                            | -                    |         |
Table 4
Final model for the correlates of root caries in older adults (Reference group is DFRS (0–3))

| Potential Predictors                  | DFRS                       |
|--------------------------------------|----------------------------|
|                                      | Standard Error | OR (95% CI) | p value |
| Sociodemographic factors             | 0.27           | 0.31        | < 0.001 |
| Age                                  |               | (0.18–0.53) |          |
| 60–75 years                          |               |             |          |
| More than 75 years                   |               |             |          |
| Ethnicity                            | 0.39           | 2.61        | 0.01     |
| Chinese                              |               | (1.19–5.71) |          |
| Non-Chinese                          |               |             |          |
| Education                            | 0.37           | 2.78        | < 0.01   |
| Primary passed or above              |               | (1.32–5.84) |          |
| No formal education                  |               |             |          |
| Oral Health Habits                   | 0.25           | 0.44        | < 0.01   |
| Dental visits                        |               | (0.27–0.72) |          |
| Non-routine visits                   |               |             |          |
| Routine visits                       |               |             |          |
| Recession                            | 0.22           | 0.42        | < 0.001  |
| Mild or no                           | 0.39           | (0.27–0.66) | 0.01     |
| Moderate to severe                   |               |             |          |
| Coronal caries experience            |               | 2.73        |          |
| Decayed                              |               | (1.25–5.96) |          |
| Missing due to decay                 |               |             |          |
| Filled                               |               |             |          |

Nagelkerke R2 = 0.20; Goodness of Fit: Pearson Chi Square p value = 0.39 (not significant means we can accept the model)