The prevalence of dental caries and fluorosis among 5-7 year old children in Ga-Rankuwa, South Africa

A descriptive study
Sammanfattning

Prevalensen av karies och fluoros bland barn i åldrarna 5-7 år i Ga-Rankuwa, Sydafrika

En deskriptiv studie

Bakgrund: I Sydafrika har ca 60% av sexåringarna karies, 80% av dessa barn har obehandlad karies. Karies är en kronisk och multifaktoriell sjukdom som kan orsaka smärta och obehag för många barn. Fluoros är en hypomineralisation i tandens emalj som orsakas av en för stor mängd fluor i dricksvattnet. Syfte: Syftet med denna studie var att undersöka prevalensen av karies och fluoros bland 5-7 åringar i Ga-Rankuwa, Sydafrika. Metod: Studien var en kvantitativ tvärsnittsstudie baserad på kliniska screeningar på två grundskolor i Ga-Rankuwa, Sydafrika. Resultat: Av 470 deltog 424 barn i studien, varav 213 var flickor och 211 var pojkar. Prevalensen av karies var 67% bland barnen. Fler flickor hade karies jämfört med pojkarna (P=0,019). Förekomsten av fluoros var 11% hos barnen i studien. Det fanns ingen statistisk signifikant skillnad i fluorosförekomsten mellan könen. Slutsats: Kariesprevalensen är enligt studien hög bland både flickor och pojkar i Ga-Rankuwa, men majoriteten av barnen hade ingen fluoros enligt Dean’s Index. Determinanter för karies hos dessa barn bör kartläggas för att öka kunskapen och möjliggöra för ett orsaksinriktat preventionsarbete.

Nyckelord: förskole- och grundskolebarn, kön, outreach projekt
Summary

**Background:** In South Africa 60% of the 6-year-olds have dental caries, where 80 % are left untreated. Dental caries is a chronic and multifactorial disease that can cause both discomfort and pain. Dental fluorosis is a hypomineralization of the tooth enamel often caused by excessive amount of fluoride in drinking water. **Intention:** The aim of this study was to describe the prevalence of dental caries and fluorosis among 5-7 years old children in Ga-Rankuwa, South Africa. **Method:** The study was a quantitative cross-sectional study based on clinical dental screenings at two primary schools in Ga-Rankuwa, South Africa. **Result:** Of 424 children participated, 213 were girls and 211 were boys. The total prevalence of dental caries was 67% among the children. More girls had dental caries than boys (P=0.019). The prevalence of fluorosis was 11% among the children. There was no statistical significant difference regarding the prevalence of fluorosis when comparing the genders. **Conclusion:** The prevalence of caries is high among the children in Ga-Rankuwa, and the majority of the children had no fluorosis according to Dean’s Index. The determinants of caries amongst the children need to be elucidated to raise the awareness and develop an appropriate prevention programme.

**Keywords:** Pre- and primary school, gender, outreach project
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**Introduction**

The Sefako Makgatho Health Science University (SMU) is located in Ga-Rankuwa, in the province of Gauteng, South Africa. The Department of Oral Health sciences at the university have collaboration with nearby primary schools through outreach projects. In Ga-Rankuwa people live in peri-urban living conditions, determinants of which are based upon sanitary and infrastructures in the area, and the access to dental care is also affected by the living conditions in the community (G.T Malaka, personal communication, February 12, 2016). These conditions can engender risk factors both for the oral- and general health (World Health Organization, 2016). In a study conducted by Ayo-Yusuf, Okagbare and Ayo-Yusuf (2011), it is concluded that school-based programmes and school screenings are a cost-effective method to reduce inequalities in access to dental health care. This current descriptive study is a first step in future evaluation of dental caries and fluorosis in 5-7 year-olds who were screened through these school-based programmes.

**Background**

**South Africa**

South Africa is a republic located in the southern part of Africa. The country has a population of approximately 52 million living in the country’s nine provinces (WHO, 2016). South Africa is a developed middle-income country with abundant natural resources (van Wyk & van Wyk, 2004). Despite this, there are differences between the population’s prosperity and wealth. Therefore, some regions are considered as a developing country (Singh, 2011). Geographically the country extends over a vast area, which results in natural differences in the drinking water’s fluoride concentration and climate variations (Grobler, Louw & Kotze, 2001).

Powerful historical and social forces such as poverty, income inequalities and discrimination have shaped the health- and dental health services in South Africa. This has been a weakness in the whole health care system and this includes the oral health. To reduce inequality and to eliminate poverty, South Africa’s government developed The National Development Plan (2012) with national goals to the year of 2030. South Africa’s health challenges consist of
more than just ill-health. Both lifestyle and behaviour do impact the health. The plan builds on a report from WHO, who noted three major recommendations relevant for South Africa:

- Improve the conditions for daily life
- Tackle the inequitable distribution of power, money and resources
- Measure the problem, evaluate actions, expand the knowledge base, develop a trained workforce in the social determinants of health, and raise public awareness

In The National Development Plan, a number of goals and priorities have been set up to achieve the recommendations, in order to promote development. This includes both the general health and health services on a national level. One important priority is to improve the quality by using evidence-based knowledge for improving the quality of planning. This could result in a more cost-effective health care for the whole population (National Development Plan 2030, 2012). In a study by Gupta, Robinson, Marya and Baker (2015), sense of coherence (SOC) is described as a person’s possibility to handle stress and find their own solutions for their health. It is concluded that environmental factors such as socioeconomic status affect the individual SOC. This may influence the oral health outcome. Oral health inequalities are described as a consequence of differential resources causing individual and societal variances in health.

**Pretoria and Ga-Rankuwa**

Pretoria is the capital city of South Africa and is one of the biggest cities in the Gauteng province (Statistics South Africa, 2011). Gauteng is the smallest of the nine provinces, and it has the highest population density in the country. About 97 % of the population lives in urban areas and the province is highly industrialised (SouthAfrica.info, 2016). The population consists of approximately 42 % black Africans, but the majority of the people living in Pretoria are white, just over 50 %. Other groups living in Pretoria are Indian/Asian, coloured and others, they together stand for 5,6 %. As there are different population groups living in Pretoria, there are several languages spoken in the area. Afrikaans and English are the most common, used by 48 % respective 16 % of the citizens. Of those living in Pretoria, 99 % are living in the city. The remaining one percent lives outside the city in farming households (Statistics South Africa, 2011).
Ga-Rankuwa is a region near to Pretoria, where Sefako Makgatho Health Science University is located. Even though Ga-Rankuwa is close to Pretoria, the population groups and their living conditions differ from Pretoria. In Ga-Rankuwa 99% of the population is black Africans and the remaining one percent comes from other population groups. In Ga-Rankuwa the most common language is Setswana, but English is also spoken. When it comes to the average household income, 17% of the population in Ga-Rankuwa has no income. The rest of the population earn less when compared to the population in Pretoria (Statistics South Africa, 2011).

Outreach project

To reach out to the children in need for dental care, school-based programs including dental screenings and preventive work is performed by SMU, so called outreach projects. The two primary schools that SMU include in their outreach project are located in Ga-Rankuwa. The Reabetswe- and Shalom primary schools together have approximately 400 pupils in the 5-7 age group. According to SMU, there was a need for the outreach project, both for the community and for the SMU students attending the oral health sciences classes. The collaboration has taken place for several years and the primary schools now expect SMU to perform screenings every year on 5-7 year old children, i.e. preschool, first and second graders. The students at SMU starts with the outreach project during their second year, and they are the ones that first carry out the screenings. The screenings are the first part of further visits to the primary schools. Subsequently, a plaque index is established and, oral hygiene instructions are given. Because SMU now has access to a mobile dental clinic, the option to provide fissure sealants for the children is now available during the later visits at the primary schools (G.T Malaka, personal communication, February 12, 2016). In a study of Ayo-Yusuf, Okagbare & Ayo-Yusuf (2011), fissure sealants are more common among those seeking preventive dental care compared with those who only seek help when in acute pain in South Africa. The difference of fissure sealant prevalence differs between the various ethnic groups, and the presence is lower amongst the blacks. In total there were 3,5% of the 12 year-olds included in the study who had a fissure sealant.
Oral health

According to World Health Organization, the definition of oral health is to be free from oro-facial sickness, pain and birth defects. This is a general view that includes all humans, and to have a dentition without lost and defect teeth. Oral health concerns more than solely the dental health; it is an essential part of the general health and the well-being of humans (WHO, 2016). Socio-cultural determinants and living conditions influence the accessibility to health care, oral hygiene practices, healthy lifestyle and life choices to achieve a good oral health (WHO, 2016). In a study by Lukacs (2011) the gender affects the oral health due to cultural aspects. Children who suffer from dental pain and discomfort have manifested difficulty with eating, sleeping, playing and attending school. A poor oral health affects the daily quality of life (Edelstein, Vargas, Candelaria & Vemuri, 2006).

Oral health in developing countries

In many developing countries there is limited access to dental care, which can results in untreated or extracted teeth. The patient then has to live with pain and discomfort. Those who are most affected by this are often already disadvantaged and social marginalized. To reduce inequalities in the prevalence of disease, WHO (2016) highlights the importance to include the oral- and general health among both the high- and low- income groups.

In developing countries, such as in some rural areas in South Africa, the major risk factors to the oral health are unhealthy lifestyles (Statistics South Africa, 2011; WHO, 2016). This includes poor nutrition, diet and oral hygiene practice. Overall this is affected by the limited access to oral health services and by poor living conditions (Petersen, Bourgeois, Ogawa, Estupinan-Day & Ndiaye, 2005). Understanding the patterns of risk factors is fundamental for the planning of preventive work, where the greater aim is to achieve a good oral health (WHO, 2016).

Dental caries

Dental caries is a chronic and multifactorial disease that causes dissolution of the tooth surfaces. Due to bacterial occurrence and dental plaque, the carious process can proceed. When providing saccharose, the bacteria’s can establish acid that lowers the pH-value, which results in a demineralisation of tooth substance (Fejerskov & Kidd, 2008). External environmental factors affect the dental caries occurrence indirectly through the economy,
demography and access to health services (Jürgensen & Petersen, 2013). A method to measure the prevalence of dental caries experience is to count the number of teeth that are decayed, are missing due to caries, or have filled surfaces, which result in the so-called dmft/s-index (Baelum & Fejerskov, 2015).

Bulletin of the World Health Organization (2015), estimates that 60-90% of all schoolchildren worldwide are affected by tooth decay. In the developing country Nepal, a study presents the prevalence of dental caries as 45% in 5-13 year old children. In the same study, the prevalence differs between the genders. The prevalence among boys was 11% higher compared to the girls (Dixit, Shakya, Shrestha & Shrestha, 2013). Another study from China presented the result of dental caries experience in preschool children. The prevalence was 89%, and the difference between the genders was 2%, with the girls having the higher scores with 51% (Zhang, Liu, Lo & Chu, 2013). The prevalence of dental caries amongst children in South Africa varies between different groups depending on their origin and if they grew up in a city or countryside. Over time a decrease of the dental caries prevalence in South African children has been noticed, including both in the primary and the permanent dentition (Cleaton-Jones & Fatti, 2009). According to Moynihan and Kelly (2014), there is a significant link between sugar intakes and levels of dental caries. Van Wyk, Louw and du Plessis (2004) compiled the result of a survey included children in South Africa, which showed that the percentage of 6-year-olds with dental caries was 60.3 % and among the children with dental caries, 80 % were left untreated. According to WHO (2016) the concern is the high level of untreated dental caries in that age group.

**Fluorosis**

Fluorosis is a hypomineralization of the tooth enamel due to an excessive amount of fluoride during the development stages of the primary- and permanent teeth. There is a clear correlation between high levels of fluoride in the drinking water and various grades in the prevalence of fluorosis. Although, it has been shown that low- and middle levels of fluoride in the drinking water does not give the same prevalence of fluorosis (Grobler, Louw & Kotze, 2001). Dean’s Index classifies fluorosis through a stepwise gradation, from very mild, mild, moderate and severe (Fejerskov, Cury, Tenuta & Marinho, 2015). Van Wyk and van Wyk (2004) noted that more than 20% of South African 12-year-olds had definitive grades of fluorosis according to Dean’s Index.
In summary, even if the dental caries prevalence in children in South Africa has decreased, it is still high and also unequal within the population (Cleaton-Jones & Fatti, 2009; WHO, 2016). Therefore, knowledge about oral health and oral health prevention is needed. The purpose of the collaboration between SMU and the primary schools is to reach the population that expressly is in a need of oral health care and provide the needed care. This descriptive study will be the basis for forthcoming research by investigating the prevalence of dental caries and fluorosis. To achieve effective measurements, it is important to evaluate the existing prevalence (Ayo-Yusuf, Okagbare & Ayo-Yusuf, 2011). The achievements from this study and the collaboration between SMU and the primary schools can later on be deployed and evaluated with further research. Hopefully, the results from this collaboration will lead to improved knowledge that will affect the oral health and general health among the children in Ga-Rankuwa.

**Intention**

The aim of this study was to describe the prevalence of dental caries and fluorosis among 5-7 year old children in Ga-Rankuwa, South Africa.

Research questions:

- Is there any difference in the prevalence of dental caries and fluorosis between the Reabetswe- and Shalom primary school?
- Is there any difference in the prevalence of dental caries and fluorosis between the genders?
Method

Design
This bachelor thesis is based on an already existing on-going oral health prevention project between SMU and the primary schools. The study had a quantitative approach with a cross-sectional design (Ejlertsson, 2012) based on clinical dental screenings at two primary schools in the community Ga-Rankuwa, South Africa.

Population
The population consisted of children in ages 5-7 years. The two primary schools included in the SMU outreach project are Reabetswe- and Shalom. Both the primary schools were located in the countryside of Pretoria, in Ga-Rankuwa. During the time for the study, the Reabetswe- and Shalom primary schools had approximately 200 pupils each in the ages of 5-7 years. Due to the number of pupils of the both primary schools, it was decided that all the children in the age group should be included. The children from the schools had a similar socioeconomic background, but pupils at the Reabetswe primary school were located in a more peri-urban area. The distances between the two schools were about two kilometers. Thus, both areas were classified as peri-urban (G.T Malaka, personal communication, February 12, 2016). The differences of the areas were noticed by the improved living conditions and the availability of infrastructure (Kok & Collinson, 2006). The fluoride level in the drinking water in Ga-Rankuwa was 0.7 ppm (G.T Malaka, personal communication, February 12, 2016).

Sample
The inclusion criterion for the sample selection was all the children registered in the age group 5-7 years at the Reabetswe- and Shalom primary school, attending the days when the screenings were performed during SMU’s outreach project. Out of 470 gathered epidemiological assessment forms, 424 were included in the study. The 46 remaining epidemiological assessment forms were excluded due to incomplete registration about gender or level of fluorosis.

Clinical screening
The clinical screenings performed the function of a baseline. The children that took part had no previous information about oral health and the self-care of the teeth. The authors together with 25 second-year students attending oral health science at SMU were performing the
clinical screenings. Supervising teachers from SMU were present on every occasion for the clinical screenings. The screenings took place during the period from February 16 to March 8, 2016, distributed on four occasions. The time available for the clinical screenings were two hours per week, distributed in one of the schools every week. Clinical instrument available when performing the screenings were a wooden spatula for each individual. The screening method was only visual to detect oral manifestations; no probing, mirror, lights or x-ray machines were available. The clinical screenings took place in different rooms at the primary schools, either in the classroom, library or in the courtyard of the school. When performing the screenings it differed if the children and students were sitting on a common chair or if they were standing. After the clinical screening had ended, the used material was discarded. Hygienic equipment as gloves, mask and hand disinfection were provided by SMU and personal clinical coats were used.

The clinical findings were documented on an already existing epidemiological assessment form, developed by SMU, Appendix 1. Before the start of the outreach project, a review of the form had been completed together with the involved students and teacher as a calibration. This study included data of dental caries and fluorosis prevalence collected on the epidemiological assessment form. However, the oral mucosa was also documented as either normal or abnormal. Moreover, other conditions such as eruption interference or need of fissure sealants and treatment suggestions were documented on the epidemiological assessment form at the same time, but not included in the analysis for this study. Before starting with the clinical screenings, the teacher from SMU and the second year students gave a short presentation and explanation of the screenings to the children. The SMU students gave the introduction in Setswana and other South African languages to the children.

**Teeth and surfaces**

Numbers of both primary and permanent teeth were documented on all children participating. Dentition status was noted on the epidemiological assessment form together with suggestion of possible need of treatment and care. Missing teeth were documented as either “missing as a result of caries” or “missing any other reason”. Buccal, Lingual, Mesial, Distal and Occlusal were the surfaces that were noticed.
**Dental caries**

During the clinical screenings, merely visual diagnostic of dental caries on each tooth was registered. When detecting dental caries, the number of necessary filling therapy was documented as one or two surfaces in need of filling on the tooth or the assessment of an extraction. On the epidemiological assessment form only the decayed teeth due to dental caries were registered and used in the study analysis, and not the surfaces in need of treatment. The dmft/s-index was used to register dental caries (Baelum & Fejerskov, 2015). The definition of decayed teeth due to dental caries has been described as cavities on the tooth surface, and if probing a manifest caries lesion with a light pressure the probe would stick, Appendix 2 (Hugoson, Koch, Nydell Helkimo & Lundin, 2008; WHO, 2016). However, in this study, no probe was available and only a wooden spatula was used when observing caries lesions.

**Fluorosis**

The level of fluorosis was documented according to Dean’s Index on a scale from 0-5 (Fejerskov, Cury, Tenuta & Marinho, 2015). The gradual steps were defined as normal, questionable, very mild, mild, moderate and severe, Appendix 3 (WHO, 2016).

**Statistical method**

The collected data from the clinical screenings were analyzed by Statistical Package for the Social Science version 21.0 (SPSS) (IBM corp, Armonk, New York, USA). The outcome was presented through text, number, percent, mean, standard deviation (SD) and median in tables and figures. The level of statistical significant was determined to 5 % ($P \leq 0.05$). The prevalence of the total number of decayed teeth due to dental caries were analyzed with T-tests when comparing Reabetswe- and Shalom primary school, the genders and the genders within the primary schools separately. The collected data were later on categorized in “Caries anterior” (canine to canine), “Caries posterior” (premolars and molars) and “Caries total” (the total number of decayed teeth due to dental caries) before analyzing the data with Chi-square tests. Chi-square tests were used when comparing all the girls to all the boys, and as well Reabetswe- and Shalom primary school concerning the prevalence of “Caries” and “No caries”. The fluorosis was divided in categorizes according to Dean’s Index. The levels “normal” and “questionable” were chosen to be grouped in to “No fluorosis”. While the levels
“very mild”, “mild”, “moderate” and “severe” together were grouped as “Fluorosis”. The data concerning fluorosis was analyzed with Chi-square tests, comparing the primary schools and the genders.

**Ethical aspects**

The lecturer and Head of Department, Community Dentistry, at Sefako Makgato Health Science University approved the study. Senior Lecturer at School of Health and Welfare at Jönköping University, Sweden, approved the ethical own review of the School of Health and Welfare, Jönköping University.

The study involved humans and, therefore, The Declaration of Helsinki was used as a guideline (World Medical Association, 2016). The United Nations Convention on the Rights of the Child was also considered because the study was performed on children (United Nations, 1990).

When the screening and collecting of the data were performed, it was important that before, during and after, having the four basic ethical principles of Medical Ethics in consideration. The principle of autonomy was considered when giving the children tailored information adjusted to their age and the participation was optional. By conducting this study the children’s right to good oral health was pursued and, therefore, in accordance with the principle of beneficence. At the time for screenings, it was important to have the principle of nonmaleficence in mind. It was crucial not to harm the children in any way or subject them to unnecessary pain. The principle of justice was the last of the four ethical principles. This principle implied to treat the children equally and provide the same opportunities for participation (Henriksson, 2015).

There is an already long-term existing ethical approval of the clinical screenings conducted by the SMU and the primary schools. Both of the primary schools expect the yearly outreach project from SMU. The responsible teacher from SMU calls the principal of the primary school for a verbal update of the approval before attending the first clinical screening each year. Within the ethical approval, the primary schools have the responsibility to communicate with the parents/guardians about the clinical screenings being performed during school hours. The primary schools also hold the responsibility to inform the parents/guardians about the
outreach project that include a screening, information and eventually placements of fissure sealants on the child if it is considered to be necessary. The ethical approval of the clinical screenings included an approval of the study and thereby publication of the result in Sweden. The result of the collected data was handled with confidentiality and only the children’s age and gender were presented in the result of the study. When detecting dental caries or other conditions in need of treatment, SMU offers treatment at a later visit with a mobile dental clinic. Setswana was the mother tongue of the children in both of the primary schools, and therefore involved students from SMU speaking Setswana were giving the information and interpret if necessary (G.T Malaka, personal communication, February 12, 2016). All the collected epidemiological assessment forms was given to the responsible teacher at SMU after the data was processed.

Result

The final number of participating children in the study were 424 (90%) out of a total 470 collected epidemiological assessment forms. Table 1 describes the number of 5-, 6- and 7-year olds. The number in relation to age of the children differed between the schools. Reabetswe primary school had more 6- and 7- year olds and Shalom primary school had more 5-year old children. Out of the 424 children, there were an equal total number of girls and boys, 213 and 211 respectively. In Reabetswe primary school there were 83 girls and 88 boys. In Shalom primary school there were 130 girls and 123 boys.

Table 1: The frequency of number and age for the included children in the Reabetswe- and Shalom primary school (n, %)

<table>
<thead>
<tr>
<th>Age</th>
<th>Reabetswe</th>
<th>Shalom</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>%</td>
</tr>
<tr>
<td>5</td>
<td>28</td>
<td>17</td>
</tr>
<tr>
<td>6</td>
<td>91</td>
<td>53</td>
</tr>
<tr>
<td>7</td>
<td>52</td>
<td>30</td>
</tr>
<tr>
<td>Total</td>
<td>171</td>
<td>100</td>
</tr>
</tbody>
</table>

Dental caries

The total prevalence of dental caries was 67%, for both genders and in both of the primary schools. The number of decayed teeth due to dental caries for girls and boys are presented in
Figure 1 (Reabetswe primary school) and Figure 2 (Shalom primary school). There was no statistical significant difference when comparing the prevalence of decayed teeth due to dental caries between Reabetswe- and Shalom primary school. The p-value was 0.735. When comparing the genders and the number of decayed teeth due to dental caries, not considering the primary school, no statistical significant difference was found. The p-value was 0.677. The mean value for decayed teeth due to dental caries for all the girls was 3.04 (SD=3.06) and for all the boys, the mean value was 3.17 (SD=3.51).

In Reabetswe primary school the prevalence of dental caries varied from the frequency of 0 to 14 decayed teeth. The mean value of number of decayed teeth due to dental caries among girls was 3.24 (SD=3.10). For the boys, the mean value of decayed teeth due to dental caries was 3.10 (SD=3.57). There was no statistical significant difference (p-value 0.787) between the genders in Reabetswe primary school when comparing the number of decayed teeth due to dental caries.

Figure 1: The number of decayed teeth due to dental caries for girls and boys in Reabetswe primary school (n=171).
In the Shalom primary school the prevalence of dental caries varied from the frequency of 0 to 15 decayed teeth. The mean value of decayed teeth due to dental caries among the girls was 2.91 (SD=3.03). For the boys the mean value was 3.22 (SD=3.49). There was no statistical significant difference (p-value 0.448) between the genders in Shalom primary school when comparing the number of decayed teeth due to dental caries.

**Figure 2:** The number of decayed teeth due to dental caries for girls and boys in Shalom primary school (n=253).

Dental caries was categorised in “Caries anterior”, “Caries posterior” and “Caries total” for respectively primary school and the number of children in each group of localisation of dental caries, is presented in Table 2. When comparing the Reabetswe primary school with Shalom primary school, concerning the prevalence of “Dental caries” and “No dental caries”, there was a higher percentage of number of children with dental caries in the three categories in Shalom primary school. However, no statistical significant difference was showed between Reabetswe- and Shalom primary school. The p-value in “Caries anterior” was 0.918, in “Caries posterior” it was 0.827 and in “Caries total” the p-value was 0.593.
Table 2: The number and percentage of children in Reabetswe- and Shalom primary school with dental caries. The mean, SD and median of decayed teeth due to dental caries among the children in localisation of “Caries anterior”, “Caries posterior” and “Caries total”.

<table>
<thead>
<tr>
<th>Localisation of dental caries</th>
<th>Reabetswe</th>
<th>Shalom</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n (%)</td>
<td>Mean (SD): median</td>
</tr>
<tr>
<td>Caries anterior</td>
<td>60 (35.1)</td>
<td>1.04 (1.77): 0</td>
</tr>
<tr>
<td>Caries posterior</td>
<td>105 (61.4)</td>
<td>2.13 (2.21): 2</td>
</tr>
<tr>
<td>Caries total</td>
<td>112 (65.5)</td>
<td>3.17 (3.34): 3</td>
</tr>
</tbody>
</table>

When caries were divided in “Dental caries” and ”No dental caries” in the different categories of localisation of dental caries, there was a statistical significant difference when comparing the total amount of dental caries in girls and boys. The “Caries total” p-value was 0.019. Girls had a higher prevalence of dental caries, Table 3.

Table 3: The prevalence of “Dental caries” and “No dental caries” when comparing girls (n=213) and boys (n=211) of all participating children in Reabetswe- and Shalom primary school.

<table>
<thead>
<tr>
<th>Caries</th>
<th>Girls</th>
<th>Boys</th>
<th>p-value a,</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Caries anterior</td>
<td>76</td>
<td>137</td>
<td>74</td>
</tr>
<tr>
<td>Caries posterior</td>
<td>139</td>
<td>74</td>
<td>124</td>
</tr>
<tr>
<td>Caries total</td>
<td>154</td>
<td>59</td>
<td>130</td>
</tr>
</tbody>
</table>

a, P<0.05 $\chi^2$

Fluorosis

Of all children (n=424), about 11% (n=46) of the children had fluorosis in both genders and primary schools. The stepwise levels of fluorosis according to Dean’s Index, and also the division of “No Fluorosis” and “Fluorosis” are indicated in Table 4. In Reabetswe primary school 8% (n=14) of the children had fluorosis. The level of fluorosis varied from normal (n=148) to mild (n=6). In Shalom primary school 13% (n=32) of the children had fluorosis. The prevalence of different level of fluorosis in Shalom primary school varied in all stages according to Dean’s Index, from normal (n=211) to severe (n=1). The result showed that it was no statistical significance when comparing the prevalence of fluorosis in Reabetswe- and Shalom primary school, p-value 0.147.
When comparing the prevalence of fluorosis between girls and boys, of all participating children, the prevalence of fluorosis among the girls was 10% (n=22). Of all boys, 11% (n=24) had fluorosis. The p-value 0.729 indicates that it was no statistical significant difference when comparing the genders.

Table 4: The number of children with fluorosis divided in Reabetswe- and Shalom primary school and gender. The prevalence is presented in categorizes of “No Fluorosis”, “Fluorosis” and the stepwise levels of fluorosis according to Dean’s Index.

<table>
<thead>
<tr>
<th>Level of fluorosis</th>
<th>Reabetswe n=171</th>
<th>Shalom n=253</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Girls: n (%)</td>
<td>Boys: n (%)</td>
</tr>
<tr>
<td>No Fluorosis</td>
<td>75 (43.8)</td>
<td>82 (47.9)</td>
</tr>
<tr>
<td>Normal</td>
<td>70 (40.9)</td>
<td>78 (45.6)</td>
</tr>
<tr>
<td>Questionable</td>
<td>5 (2.9)</td>
<td>4 (2.3)</td>
</tr>
<tr>
<td>Fluorosis</td>
<td>8 (4.7)</td>
<td>6 (3.6)</td>
</tr>
<tr>
<td>Very mild</td>
<td>5 (2.9)</td>
<td>3 (1.8)</td>
</tr>
<tr>
<td>Mild</td>
<td>3 (1.8)</td>
<td>3 (1.8)</td>
</tr>
<tr>
<td>Moderate</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Severe</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
</tr>
</tbody>
</table>
Discussion

The result of this study indicates that there are differences in the prevalence of the total number of decayed teeth due to dental caries. More girls had a higher score of decayed teeth due to dental caries compared to the boys. Regarding the prevalence of fluorosis there was no difference when comparing the genders or the two primary schools. However, in Shalom all the six different levels of fluorosis were noted. In Reabetswe, the children were distributed in the first four levels of fluorosis according to Dean’s Index.

Method

This bachelor thesis was based on an already existing on-going outreach project between Reabetswe- and Shalom primary school and SMU. The method was therefore predetermined and the authors did not affect any changes in the practical performance. The authors chose to follow the already existing method for the outreach project and clinical screenings. This enabled a larger amount of collected data for the study. If the method or/and the epidemiological assessment form would be changed, the result of the collected data would not reflect how the collaboration functions. The number of 46 epidemiological assessment forms was excluded due to incomplete information about either gender or level of fluorosis. Sources of error regarding gender and age could have occurred when the children answered the questions because the teachers in the primary school weren’t available for every individual screening. Considering the high number of participating children, the excluded data may not influence or impact the result of the study. Before the outreach project started, a calibration was done with all the attending students and a responsible teacher from SMU, although some misunderstandings did occur during the clinical screenings. The fact that it was the first outreach sessions for all students attending, and that the conditions of the screenings varied from time to time was probably the reason for the uncompleted epidemiological assessment forms. Since both dental caries and fluorosis can be interpreted in different ways by different examiners, it would have been more reliable if only the authors and a smaller group of students were collecting the data for this study. This would have enabled better opportunities to calibrate when doubts occurred while performing the clinical screenings. Before the start of the outreach project, a verbal update of the ethical approval was done (G.T Malaka, personal
communication, February 12, 2016). When performing the clinical screenings no individual approval existed to confirm every child’s participation consented by parents or legal guardians. The participation was optional, but in this case this can be discussed because the children attended the clinical screenings as their teacher told them to. Therefore, ethical considerations can be discussed (World Medical Association, 2016). This study had to rely on accurate information being given to the parents and guardians through responsible teachers at the primary schools.

The method of the clinical screenings was visual, and only a wooden spatula was used to detect oral manifestations. Recommendations by WHO states that a minimum of instruments when performing screenings is to use a probe and a mirror to detect oral manifestations. In the same manual, only using plane mouth mirrors to conduct the examination for dental caries is mentioned (Petersen & Baez, 2013). Reddy and Singh (2015) presented a scientific study where only a wooden spatula was used in their clinical screenings. The absence of a probe, mirror and x-ray may lead to underestimations of manifest dental caries. In this study only decayed teeth due to manifest dental caries were registered. The visual method did not enable detection of initial caries, even though the children probably also had these lesions, as they are required for a manifest caries lesion to occur (Fejerskov, Nyvad & Kidd, 2015). Probably a higher percentage of dental caries would be presented in the result if initial dental caries would be included in the study. Another reason that may have affected the diagnostics of dental caries and fluorosis was the lack of proper light when conducting the screenings. Plaque on the children’s teeth made it problematic to diagnose the lower levels of fluorosis according to Dean’s Index. The screenings took place in different locations at the primary schools, and the access to ceiling lights or sunlight differed. The screenings were performed without any external lights. At the time of the screenings, it also differed if the students and children were able to sit on a common chair or if they were standing. Under these circumstances, the use of plane mouth mirrors would have enabled indirect light and facilitated seeing all tooth surfaces. This reinforces WHO’s guidelines and recommendations of using plane mouth mirrors when detecting oral manifestations, such as dental caries.

To achieve more accurate information about the prevalence of decayed teeth due to dental caries, the epidemiological assessment form could have been adapted to register all decayed tooth surfaces instead of the only the teeth with a decay due to dental caries. Sources of error regarding missing teeth did occur. If teeth were missing, the children were asked about the
reason for the missing tooth/teeth. The examiner had to consider the children’s age when documenting reason for missing teeth on the epidemiological assessment form. More precise information in the epidemiological assessment form could simplify the further treatment.

**Result**

The prevalence of children with dental caries was 67%. This result is in line with the estimation of the prevalence of dental caries in school children according to WHO (2015). The total number is also similar to the Van Wyk, Louw and du Plessis survey completed in 2004, were 60.3% of 6-year olds were affected by tooth decay, with 80 % of the children left with untreated dental caries. Economical disparities and struggles to access dental health care are one reason why children are left untreated (Van Wyk, Louw & du Plessis, 2004). An outreach project like this could enable treatment of these children. Thus, difficulties to get written permission from parents/guardians to perform dental caries treatment and the lack of enough time and resources complicates the possibilities to give treatments in the extent that is necessary.

There was no statistical significant difference regarding the prevalence of dental caries or fluorosis when comparing the Reabetswe and Shalom primary school. Both primary schools are located in the same community, with only a couple of kilometres apart, this might explain the equivalent result. The living conditions and infrastructure differ in some ways though (G.T Malaka, personal communication, February 12, 2016). In the Ga-Rankuwa, a low economical income is common (Statistics South Africa, 2011). Poverty and social determinants influence the possibilities to access dental care and living conditions that affect the oral health (Petersen, Bourgeois, Ogawa, Estupinan-Day & Ndiaye, 2005). Circumstances in life, and life conditions affect the priorities made for the family. The basic needs come first, and the oral health considerations are secondary. This might be the fundamental cause that could explain the children’s oral health. Therefore, including the oral health in the general health services could enable better opportunities for communicating accurate information and basic knowledge about the children’s oral health (WHO, 2016). When the clinical screenings were conducted, the authors together with the other attending students sometimes observed big differences in the oral health in children of the two primary schools. In the same class of pupils, children with no oral manifestations were noted, at the same time as other children
were assessed with multiple decayed teeth due to dental caries. Children at this young age are depending on their parents or guardians for help to achieve a good oral health (WHO, 2016). In a qualitative study of Duijster, de Jong-Lenters, Verrips and van Loveren (2015) many influences on children’s oral health behaviours were identified in both levels of the child, family and community. Family environments such as parental knowledge, locus of control and habits were detected to affect tooth brushing routines and dietary consumption. In the conclusion of the same study, the parents of the children suggested that provision of accurate information and a multidisciplinary approach from professionals would enable support to promote oral health. In the preventive measurements to decrease the prevalence of dental caries among the children in Ga-Rankuwa it is important to highlight the importance of the parental responsibilities. It is crucial to include the parents and teachers in the preventive work to enable opportunities for a good oral health for the children (WHO, 2016). By giving the parents and the teachers accurate information by using booklets and pictures, basic knowledge is provided. With practical instructions of tooth brushing techniques from dental health care professionals, or in this outreach project, students from SMU, the parents will become more involved in the oral health care of their child. As a further suggestion, collaboration with nearby health care centres could enable more effective preventive oral health work, through cooperation between health care professionals. In the framework of this outreach project, fissure sealants can be placed as a preventive measurement if so is deemed. Treating the occlusal surface of the first permanent molar with a fissure sealant is considered to be a caries preventing measure. Fissure sealants applied to children’s teeth have a durable and prolonged caries preventive effect (Wendt, Koch, Birkhed, 2001; Liu, Lo, Chu & Lin, 2012).

The T-test showed no difference in the prevalence of decayed teeth due to dental caries in girls and boys at the two primary schools. However, when the teeth were divided into categorizes of “Caries anterior”, “Caries posterior” and “Caries total”, a statistical significant difference was found when comparing the genders. A conclusion of this result indicates that more girls had dental caries but a less amount of decayed teeth. The boys, on the other hand, had a lower prevalence of dental caries than girls, but the boys with dental caries had a higher amount of decayed teeth. A similar result is shown in the study of Zhang, Liu, Lo and Chu (2013), were a group of children with the mean age of 5,3 years presents a result with girls having a slightly higher prevalence of dental caries. Dixit, Shkaya, Shrestha and Shrestha, 2013, present a similar result about gender differences in prevalence of dental caries. This
result argues that girls and boys may be raised in different ways even in this young age. The gender is impacted on the children in young ages due to cultural aspects (Lukacs, 2011).

Regarding the prevalence of fluorosis in the children, there was no statistical significant difference when comparing the gender or the two primary schools. The majority of the children had no fluorosis according to Dean’s Index, which might be explained by the low level of fluoride in the drinking water in Ga-Rankuwa (G.T Malaka, personal communication, February 12, 2016). According to Grobler, Louw and Kotze (2001), low levels of fluoride in the drinking water do not affect the prevalence of fluorosis and caries experience in children.

The result of this study presented a difference in the prevalence of dental caries when comparing the genders. Why the prevalence of dental caries differs between girls and boys needs to be evaluated in the forthcoming studies within the oral health prevention project between SMU and the primary schools. It would be interesting to evaluate in what way cultural aspects influence the oral health through gender implications. Problem of the existing prevalence of dental caries needs to be viewed from a broader perspective. The children’s living conditions and social determinants needs to be highlighted to raise awareness and to develop an appropriate prevention programme for these children. In the preventive measurements that are required, the parents/legal guardians and teachers needs to be involved to achieve a good oral health for the children. To use the toothpaste technique where a slurry rinse is carried out after brushing is a cost effective and caries preventive measure that can be suggested for the children and parents. This technique has been presented to increase the efficacy of the fluoride toothpaste (Sjögren, 1995). Dental hygienist has an important role in the collaboration with health care professionals and parents to these children. By communicating knowledge and implement the preventive measurements in outreach projects, such as school-based programs, the broader perspective of reaching a good oral health is achievable.
Conclusion

In the study, a significant difference was found in the prevalence of dental caries when comparing the genders. Still, the prevalence of dental caries is high in both girls and boys among children in Ga-Rankuwa. Regarding the prevalence of fluorosis among the children, no difference was found. The majority of the children had no fluorosis. Among the 46 children with fluorosis, only two of them had moderate or severe fluorosis according to Dean’s Index. The rest of the 46 children showed lower levels of fluorosis.

Acknowledgement

Thanks to Sefako Makgatho Health Science University and the School of Health and Welfare at Jönköping University for making this study possible. We would like to give our grateful thanks to Mr Malaka and Dr Motloba for the practical help with this study and the outreach project. We would also like to thank our tutor Ulrika Lindmark, Senior Lecturer, for all the help and guidance in the process of this bachelor thesis. Last but not least, a big thanks to the students at SMU participating in the outreach project and to all the wonderful children at the primary schools.

Evelina Blomquist and Emma Källner
References


Appendix 1

Epidemiological assessment form

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<tr>
<td>EPIDEMIOLOGICAL ASSESSMENT FORM</td>
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Name of School
Name of Pupil Age in years
Condition:
Ethnic group Gender M F
Location type: 1 = Urban 2 = Peri-urban 3 = Rural

DEFINITION STATUS AND TREATMENT NEEDS

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</tbody>
</table>

Status
0 = sound
1 = decayed
2 = filled decay
3 = filled no decay
4 = missing as a result of caries
5 = missing any other reason
6 = fissure sealant
7 = bridge
8 = unerupted tooth
9 = trauma

Oral mucosa
0 = normal
1 = abnormality

Dental fluorosis
0 = normal
1 = questionable
2 = very mild
3 = mild
4 = moderate
5 = severe

Other conditions (Please specify)
Appendix 2

Decayed primary- and permanent teeth due to dental caries
Appendix 3

Levels of fluorosis according to Dean’s Index

Normal/No sign of fluorosis

Questionable fluorosis

Very mild fluorosis

Mild fluorosis

Moderate fluorosis

Severe fluorosis