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School-Based Oral Health Promotion: A Thorough Review

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Objectives Schools are considered as important platforms for oral health promotion worldwide. Oral diseases are preventable and any focus on schoolchildren can minimize suffering, reduce inequity, and create productive years of healthy adulthood later on. Hence, we need to explore oral health promotion methods conducted within the school systems in different countries. This is especially required for developing countries with limited resources.
Methods The PubMed database was searched for English peer-reviewed articles published from January 2000 to June 2017 with available abstracts, specifically focusing on primary school children aged between 7 and 12 years. “Oral health”, “health promotion” and “school” were used as keywords in our search strategy. Relevant papers were selected and reviewed by two independent readers using predefined exclusion criteria, firstly on the basis of abstracts, secondly by assessing full-text papers.
Results From a total of 257 articles, 22 were eligible for analysis. Of all oral health related activities implemented in schools, oral health education was mentioned in most studies (n=15) followed by supervised tooth brushing program in schools with fluoride toothpaste (n=5), administration of fluoride (varnish/gel) (n=3), provision of nutritious food (n=3), multimedia game or campaign (n=3), and tooth examination with screening (n=3).
Conclusion Improvement of children’s oral health related to school-based oral health programs is the result of a combination of several interventions. The governments and other policy makers should consider implementing some appropriate health promotion schemes in schools, which take local needs and resources into account.
Keywords Oral Health, Health Promotion, Schools

Introduction

The Ottawa Charter for Health Promotion[1] outlined five health-promotion action areas: Build healthy public policy, create supportive environments, strengthen community action, develop personal skills and reorient health services. School is one of the best settings to effectively implement these actions.[2] School years are the most important times of children’s lives where unchanging beliefs, attitudes and skills are developed; thus it would be wise to reinforce oral health messages during this period.[3]

Dental caries and gingivitis are the most common oral diseases among children. Dental caries is progressive and cumulative in nature and becomes more complex over time. If left untreated, it can affect children’s quality of life, e.g. the ability to eat and chew, the food they choose, how they look and the way they communicate. Toothache or oral pain can compromise their concentration and participation in school activities, thereby, compromising their personal development, making them uncomfortable, but also denying them the full benefit of schooling.[3]

Despite great achievements in oral health of populations globally, problems still remain in many communities all over the world, particularly among under-privileged groups in developed and developing countries.[4] The decrease in dental caries of children is most likely the result of a combination of factors such as improvement of living conditions, optimum use of fluoride, better oral health behavior and implementation of prevention oriented school health programs.[5]

Many oral health problems are preventable and reversible at the beginning. Besides, many risky behaviors stem from the school age years; this means that school has a strong influence on a child’s development and wellbeing. Clearly, the need to promote good oral health in schools is important and can be easily integrated into the curriculum, school activities and also general health promotion. Healthy behaviors and lifestyles that are established at a young age are more sustainable; thus, schoolchildren should be provided the skills that enable them to adopt a healthy lifestyle, make healthy decisions and learn to manage controversies.[6]

The aim of this study was to identify the applied strategies and approaches in school-based oral health promotion in different countries with varying level of income and finally to determine the appropriate school-based strategies local needs and resources.

Materials and Methods

The present comprehensive review was conducted using PubMed database to find studies related to school-based oral health promotion programs.

The PubMed database was searched for titles or abstracts containing the following: Keywords: (oral*[Title] OR mouth*[Title] OR teeth*[Title] OR tooth*[Title] OR dent*[Title]) AND (health*[Title] OR hygiene*[Title]) AND (promote*[Title] OR improve*[Title]) OR program*[Title]) AND school*[Title/Abstract]. Furthermore, we combined MeSH term for “oral health”

with the MeSH term for the "health promotion" AND school*[Title/Abstract].

To remove studies beyond the scope of this review, an initial screening of titles and abstracts were conducted. Studies were included if they assessed school-based oral health promotion programs.

The inclusion criteria included peer-reviewed articles published from January 2000 to June 2017 in English with available abstracts, on primary school between ages 7 and 12 years. The exclusion criteria were dissertations and theses (graduate level, not published), symposia/congress/ conference materials, bulletin, theoretical and purely descriptive papers, and studies that did not measure oral health promotion in primary schools for children between 7 and 12 years.

Consequently, the remaining articles were assessed by two independent qualified investigators who were trained and calibrated to achieve a desirable level of agreement in selection of articles. They included studies in which, age range of participants generally met the inclusion criteria. Also, studies assessing the state of dental health of school children in special ages like five year olds for early childhood caries and 15-year olds were excluded. However, studies where the age range of participants generally met the inclusion criteria on one end of the range were included. Therefore, if the range of ages in the study was 5-12, we included the study, as a large portion of the participants would have met the inclusion criteria of 7-12.

According to the WHO, the reason that many epidemiological studies around the world focus specifically on 12-year-old children is because the indices related to oral health status of this age group are considered as an international index at the time of leaving the primary school.

Results

As seen in Table 1, electronic search of PubMed database yielded 257 studies. From a total of 257 articles, 22 were eligible for analysis (Figure 1). Each study was reviewed and critically appraised by two independent researchers. The summarized of findings were shown in Table 2.

Of all oral health related activities implemented in schools, oral health education was mentioned in most studies (*n*=15) followed by supervised tooth brushing program in schools with fluoride toothpaste (*n*=5), administration of fluoride (varnish/gel) (*n*=3), provision of nutritious food (*n*=3), multimedia game or campaign (*n*=3), and tooth examination with screening (*n*=3) (Table 3).

Then identified interventions were grouped and summarized with consideration of "policy development" and applied "preventive oral health care services."

Table 1- PubMed search strategy

Search step	Query	Items found
#1	Search (oral*[Title]) OR mouth*[Title]) OR teeth*[Title]) OR tooth*[Title]) OR dent*[Title]	420190
#2	Search (health*[Title]) OR hygiene*[Title]	648352
#3	Search ((promote*[Title]) OR improve*[Title]) OR program*[Title]	540067
#4	Search school*[Title/Abstract]	239219
#5	#1 AND #2 AND #3 AND #4	420
#6	Search (("Oral Health"[MeSH Terms]) AND "Health Promotion"[MeSH Terms]) AND school*[Title/Abstract]	137
#7	#5 OR #6	502
#8	Search #7 Filters: Abstract; Publication date from 01/01/2000 to 06/31/2017; English	257

Table 2- Studies included in the review of literature

No	First Author, Country	Year	Intervention	Conclusion
1	Simmer-Beck M., US	2017	To allow registered dental hygienists to provide preventive oral health services such as sealants, fluoride varnish applications, cleanings, and dental referrals based on screenings with limited dentist supervision	- Greater access to screening and preventive services - Increased scope of services - Expanded public health delivery opportunities - Decreased dentist supervision
2	Niederman R., US	2017	Twice yearly, and universal school based prekindergarten-to-grade-8 caries prevention program: screening; silver diamine fluoride treatment of all caries, pits, and fissures; fluoride varnish; oral hygiene instruction; and provision of a toothbrush and fluoride toothpaste delivered by a dental hygienist or nurse	- Increase the rate of access - Improve health by reducing untreated and new caries - Reduce direct and indirect short- and long-term costs for children, families, and society - Could be tested immediately with the current workforce
3	Silveira Schuch H., Taiwan	2017	During the oral hygiene education program, the children practiced flossing and brushing after lunch on every school day, under the detailed instruction of school nurses, for 1 semester (20 weeks). They also attended an annual national conference to demonstrate oral health hygiene techniques and tooth cleanliness.	Positive long-term effect on their dental knowledge, oral hygiene habits, plaque accumulation, periodontal status, and caries experience
4	Petersen P.E., Thailand	2015	-- Supervised tooth brushing program in schools, using toothpaste containing 1,450 ppm F and 1.5% arginine -- Oral hygiene program and classroom-based health education	The positive effect from use of fluoridated toothpaste (1,450 ppm F- and 1.5% arginine) administered by schoolteachers and undertaken via an enhanced school oral

			-- Two comprehensive workshops for the school teachers	health program.
5	Blake, H., UK	2015	Children received a 60 minute theory-driven classroom-based interactive educational session delivered by a dental care professional and received take-home literature on oral health	short-term improvements in children's knowledge of oral health and some aspects of oral hygiene behavior
6	Vozza, I., Italy	2014	An originally designed multimedia game on oral health was administered in the computer class rooms, before and after an educational stage	Access to health promotion for all socio-economic classes. The multimedia educational approach: A valuable and updated tool to attract the attention of digital native children
7	Halonen, H., Finland	2013	Total number of school children received dental education and some of the 7-12-year-old schoolchildren received individual tooth brushing instructions by a dental nurse in 2009-2010. Parents were present at the instruction sessions	Oral health intervention can be beneficial on health behavior especially for children at low grades. All children, 11 to 12 years of age, especially boys, need continuous health promotion.
8	Gauba, A., India	2013	Oral health education (delivered through lecture and demonstrations by an undergraduate dental student) and topical antibacterial therapy (fluoride varnish and povidone iodine)	This small economical school oral health program positively influenced oral health related practices and parameters of oral health such as oral cleanliness, gingival health and caries activity.
9	Macnab, A. and A. Kasangaki, Uganda	2012	The intervention had three elements: inclusion of health topics by teachers in regular classroom activities; health education delivered by the university team to reinforce key educational concepts; and daily in-school tooth brushing to develop healthy practices	Addressing oral health through HP schools is novel in Africa, and several lessons learned are of potential value for similar health promotion initiatives in sub-Saharan Africa.
10	Agrawal, N. Bangalore City	2011	APF gel application and oral health education to both groups	Biannual APF gel application is an effective preventive measure in reversing incipient carious lesions
11	Muirhead, V. E., Ontario	2011	Ontario's "Healthy Schools" program included healthy eating, physical activity, personal safety and injury prevention, substance use and abuse.	Schools participating in Ontario's "Healthy Schools" program had better school oral health outcomes than non-participating schools.
12	Macnab AJ., Radziminski N., Uganda	2010	Brighter Smiles intervention model (daily at school tooth brushing; in-class education), and recruited a cohort to receive additional biannual topical fluoride. Each month three university students went to the participating communities to repeat the health education concepts and reinforce brushing practices.	teachers, children, and families were engaged in the initiative; community-based learning was adopted for the university students; quarterly team education; evaluation; service delivery; visits to schools were initiated; oral health improved; new knowledge and practices were evident
13	Han D. H., Korea (Rep.)	2010	the introduction of the nationwide public oral health program: A fluoride mouth-rinsing program and a free fissure sealant program that was implemented by the government for primary school children every year by public health centers.	The oral health of Korean children improved considerably between 2000 and 2006 through improvement in lifestyle and the strong public oral health program
14	Tai, B. J., China (Yichang City)	2009	World Health Organization Health Promoting Schools Project was applied to primary schoolchildren	The school-based oral health promotion was an effective way to reduce new caries incidence, improve oral hygiene and establish positive oral health behavioral practices in the targeted schoolchildren
15	Hietasalo, P., Finland	2009	The children in the experimental group (n = 250) were offered an individually designed patient-centered regimen for caries control. The children in the control group (n = 247) received standard dental care (randomized clinical trial)	The experimental regimen would probably have been more cost-effective than standard dental care if the follow-up period had been longer, the regimen less comprehensive, and/or if dental nurses had conducted the preventive procedures.
16	Macnab AJ., Rozmus J., Canada	2008	The intervention consisted of a school-based program with daily brush-ins, fluoride application, educational presentations, and a recognition/incentive scheme.	A community- and university-supported, school-based, collaborative oral health program improved oral health and knowledge among children in a remote First Nations community.
17	Amit K., Nepal	2008	Educating the school teachers regarding basic oral health topics(caries, its causes, plaque& periodontal disease, brushing, fluoride mouth rinsing and training for dental examination)	Improvements in the level of oral health care in school children
18	Antonio, A. G., Brazil	2007	Oral health education program: About 1 week after the clinical examination and questionnaire application, the dentist commenced the 4-month (two sessions per month) dental health education program, conducted in a classroom with the experimental group, totaling eight 1-hour lessons. Participatory, descriptive classes using chalk and blackboard, illustrative and educational drawings, dental mannequins, and dynamic competitive games were featured at these meetings.	Analysis indicated that the duration of the program favorably influenced its outcome.

19	Peng, B., China	2004	Oral health education group, sugar-free chewing gum in addition to OHE	The school-based OHE programs had some positive effect improving children's oral hygiene; in certain circumstances children may benefit from using polyol-containing chewing gum in terms of reduced dental caries.
20	Moyses, S. T., Brazil	2003	Health Promoting Schools with a comprehensive curriculum included particular policies such as: food policy; smoking policy; the inclusion of health topics in the formal curriculum; use of participative educational approaches; the involvement of the school's community on curriculum issues	Children in supportive schools had better oral health than those in non-supportive schools
21	Friel, S., Ireland	2002	Television campaign: The key oral hygiene messages were: to brush with fluoride toothpaste and use a pea size amount of it, to brush for 3 min at least twice a day, and also to replace toothbrush "when bristles start to get out of shape". The program consisted of a school dental nurse intervention simultaneously given against the backdrop of a national television campaign through a mainstream children's afternoon program. The intervention took place at the start of the school year and finished after the 6 weeks.	Mass media campaigns work to supplement the one-to-one activities of health professionals in order to effect knowledge and behavioral change.
22	Tai, B., China (Wuhan City)	2001	1) One hour of oral health education instruction for children & teachers once each year 2) one hour session of oral health education for parents when their children entered the school 3) production of oral health education booklets for all children and teachers, 4) presentation of oral health education posters in the classroom and the school yard annually 5)examination of teeth for all children once a year and information to the teachers and parents about the dental health status and treatment need of the children 6) provision of preventive and curative care to the children, partly free of charge in the nearby dental hospital	The school-based oral health promotion program should be expanded

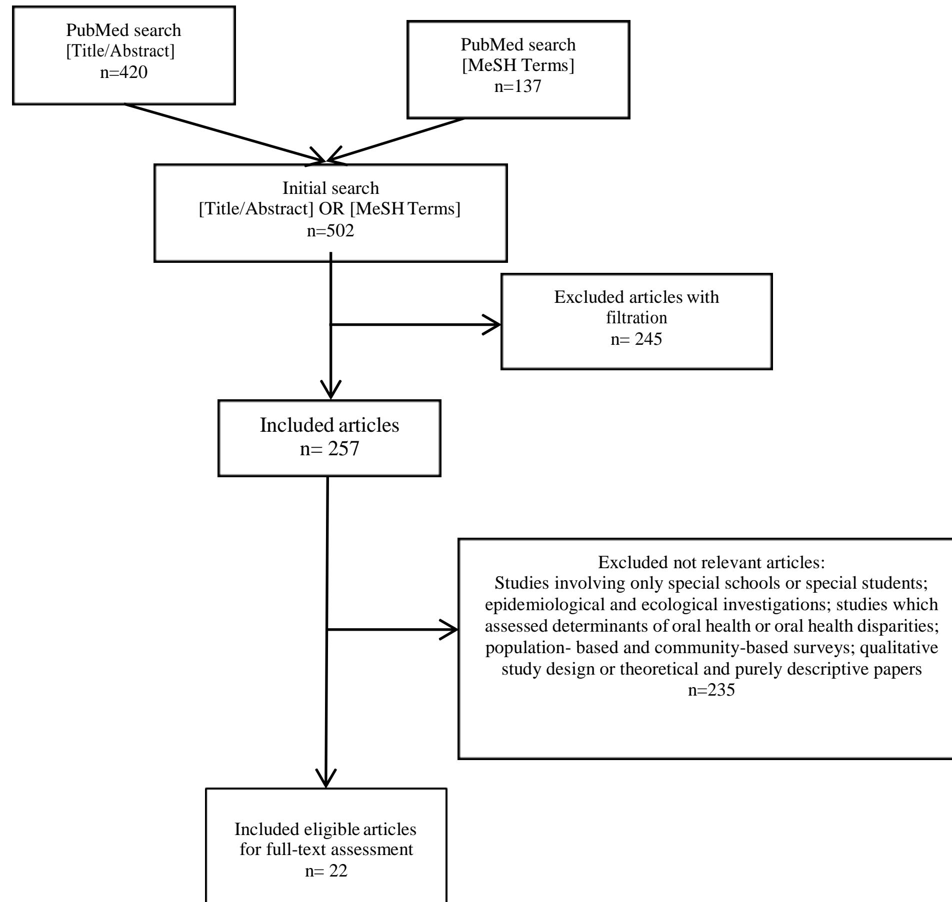

Figure 1- Flow chart showing search strategy and number of included and excluded articles

Table 3- Oral health activities implemented in studies (n=22)

Oral health activities	Number of activities in studies
Oral health education (booklets, posters, lectures/ inclusion of health topics by teachers in regular classroom activities/ comprehensive curriculum)	15
Supervised tooth brushing program in schools with fluoride toothpaste	5
Fluoride application (fluoride varnish/ APF gel)	3
Provision of sugar-free meals and drinks at schools/patient-centered regimen for caries control	3
Multimedia game/television campaign/ dental health education campaign	3
Examination of teeth for all children once a year/ screening/ provision of preventive and curative care, partly free of charge in the nearby dental hospital	3

Discussion

The purpose of this study was to show the broad range of interventions in school-based oral health promotion programs used in different countries. Of all the oral health-related activities implemented in schools, oral health education was the most common activity, followed by supervised tooth brushing exercises, fluoride application, provision of nutritious food, using multimedia games, and examination of teeth/screening.

However, Cooper et al.[7] in their systematic review on Primary school-based behavioral interventions for preventing caries included studies with behavioral interventions addressing both tooth brushing and consumption of cariogenic foods or drinks and have a primary school as the focus for delivery of the intervention.

The exact processes vary across different countries due to many factors including organizing and financing the health and education sectors, the socioeconomic situation of the country, traditions, and focus of the oral and general health sector, health policies, and the burden of oral disease among the target population.

We summarized different school oral health promotion activities with consideration of “Policy development” and applied “preventive oral health care services.”

Policy Development

School Health Promoting School Program

A policy should be implemented by experts in order to make sure the oral health promotion school program continues over time, independent of the authorities in power. Given that the majority of children worldwide are not protected by comprehensive oral health services[8, 9]; schools are the best platform for oral health promotion especially in low and middle-income countries. In some countries, oral healthcare for children is provided in an organized way with full coverage of the entire population of children. Scandinavian countries, for example, have a long tradition for public delivery and financing of a thorough school oral health service for all children and adolescents up to the age of 18 years.

Family and Community Support

Better oral health can be achieved efficiently when both schools and families are working together on oral health promotion. Therefore, parents should be regularly educated about the importance of supervising their children’s daily personal oral health care. Likewise, oral health messages that are promoted at school need to be reinforced in families and the community. Halonen et al. showed that dental education and individual tooth brushing demonstrations in presence of parents can benefit the health behavior of younger children.[12] Also, Tai et al.[13] in their study showed improved attitudes towards dental care and oral health behavior after a 3-year period of oral health promotion school program that consisted of oral health education for children, their parents and teachers, as well as dental examinations at school and referrals to a dental clinic every year.[13]

Oral Health Promoting Schools

Schools are great places to create strong links between health and education. Therefore, supporting all schools in order to become “Oral Health Promoting Schools” can be very effective model to improve the overall health outcomes of students in developing countries. Thus, health education, including oral health, is in the curriculum for many primary schools as a “Health Promoting Schools” network that exists in few countries, which provides a structure for an integrated approach to oral health.[14, 15] Health promoting schools emerged from discussions during the 1980s under the support of WHO as “a school constantly strengthening its capacity as a healthy setting for living, learning and working”.[16]

Macnab et al.[17] in 2015 showed that HPS programs used the available human, financial, and community resources which are of particular relevance as a health intervention in schools in low and middle-income countries and it is for such reasons that the WHO realizes HPS programs as a particularly sound investment in global child health.[17]

Preventive oral Health Care Services

1) Supervised tooth brushing with fluoridated toothpaste

Along with a weekly supervised tooth brushing, and monthly oral health education program by teachers in Indonesia to their second-grade students; there was a moderate positive effect after 1.5 years. Improvements were noted in oral health knowledge, on plaque level and on the effectiveness of tooth brushing.[18]

2) Oral health education

Redmond and colleagues[19] investigated a school dental health education program among 12-year-old English children in 1999, which involved three lessons and

discussions in a 6 months period by a dental nurse with the support of parents. This intervention resulted in improvements in the knowledge of dental disease and in reported oral hygiene, as well as an increase in the reported duration of brushing.[19]

Also, in Ireland, an oral health program was developed via a 6-week television campaign which showed video clips promoting key oral health messages targeted at 7-12 years old. Concurrently, an oral health education program was delivered to the children by a dental nurse. After the dental nurse's intervention, positive changes occurred in the dental health knowledge and behavior of these children. More developments were seen amongst those who reported to have seen the TV program, but the campaign itself had little obvious impact on the children. These results confirm that the activities of health professionals can be enhanced by mass media campaigns to provide knowledge and promote behavioral change.[20] In this manner, Vozza et al.[21] in Italy showed that an educational approach using multimedia has proven a valuable and updated tool to attract the attention of digital native children. Furthermore, Jürgensen and Petersen[6] in 2013 used purposive sampling across 100 countries and showed the important role of oral health education in promoting oral health of school age children. However, Blake et al.[22] determined that school-based preventative oral health education delivered by primary care dental practices can generate short-term improvements in children's knowledge of oral health and some aspects of oral hygiene behavior.

3) Fluoride application (varnish/gel)

A small economical oral health school program in India positively influenced oral health. This program consisted of oral health education (delivered through lecture and demonstrations by an undergraduate dental student) and topical antibacterial therapy (fluoride varnish and povidone iodine).[23]

4) Healthier eating advices

Healthy eating choices are important lifestyle behaviors that should be learned at an early age and it should be an inevitable part of health promoting schools. Schou et al. provided sugar-free meals and drinks in all primary schools throughout the campaign week. Consequently, a positive correlation was found between free meals and the proportion of children who claimed to have received new information during the campaign and ate healthier food because of it.[24]

5) Training programs for teachers, school nurses and oral health care providers

All individuals involved in school oral health promotion are required to have proper on job training. Macnab and Kasangaki investigated on health promotion using a model with three elements: The inclusion of health subjects by teachers in regular classroom activities, health education delivered by the university team to emphasize key educational concepts, and daily in school tooth brushing to improve healthy practices. They concluded that this model was instantly accepted, implemented, sustained and evaluated; all the communities involved took ownership and the schools still continue their programs.[25]

Silveria Schuch and Giang Do in 2017 showed that a school based OHE program based on brushing and flossing instructions and dental concepts had lasting positive influences on oral health behaviors and disease prevention. During the OHE program, the children practiced flossing and brushing after lunch on every school day, under the complete instruction of school nurses, for one semester (20 weeks). They also attended an annual national conference to demonstrate oral health hygiene techniques and tooth cleanliness.[26]

Niederman et Al. in 2017 proposes a simple effective bundle of preventive services defined as follows: screening; silver diamine fluoride treatment of all caries, pits, and fissures; fluoride varnish; oral hygiene instruction; and provision of a toothbrush and fluoride toothpaste. A dental hygienist or nurse could deliver these simple preventive measures.[27]

Changes to dental practice acts at the state level allowing registered dental hygienists to practice with limited supervision in community settings, such as schools, may provide vulnerable populations with greater access to screening and preventive services. We derive our recommendations from expert opinion.[28]

Also, the Brighter Smiles program has proved to be an excellent approach for the improvement of a cooperative relationship between developed and developing world university students (Makerere University in Kampala, Uganda and University of British Columbia) and between universities and rural communities. It has shown the practicality and significance of health-promoting schools in Uganda. Health-promoting schools provide a practical and effective health intervention at low cost, with measurable outcomes of success over a short timeframe. A significant reduction in caries rates and improvement in quantitative measures such as the decayed, missing, and filled teeth scores have been proven in several child populations including Canadian native children and rural primary school pupils in Africa.[14]

Conclusion

This review is an important step in mapping out a broad range of intervention programs used for school-based oral health promotion. On the other hand, the selected interventions should be evidence based and follow clear implementation plan especially in developing countries with limited resources.

Of course, the governments and policy makers should consider a combination of complementary interventions for school-based oral health programs.

Ultimately use of "Oral Health Promoting Schools" offered as a practical, cost-effective, and evidence-based suggestion to make the school a healthy environment, and implement policies and practices. Also, practitioners of oral health promotion should look wider abroad to integrate oral health

promotion into general health promotion.

Moreover, the results of our literature review showed that a key to success of a health program is the participation of stakeholders in it. The health sector is responsible for training of teachers, parents and school children to reinforce the oral health messages.

Conflict of Interests

None Declared ■

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