Doctoral School of Interdisciplinary Medicine

Health risk behaviors among adolescents in Mongolia: cross-sectional national school-based surveys from 2013 and 2019

PhD Thesis

Javzan Badarch

Supervisor:
Prof. Edit Paulik MD, PhD

Department of Public Health

Albert Szent-Györgyi Medical School

University of Szeged

Szeged, Hungary

2022

LIST OF PUBLICATIONS

Publications related to the subject of the thesis

I. **Badarch, J.**; Batbaatar, S.; Paulik, E. Prevalence and Correlates of Poor Oral Hygiene among School-Going Students in Mongolia. *Dentistry. Journal*. **2021**, *9*, 12. doi: 10.3390/dj9020012

   Impact factor: -; Q2

II. **Badarch, J.**; Chuluunbaatar, B.; Batbaatar, S.; Paulik, E. Suicide Attempts among School-Attending Adolescents in Mongolia: Associated Factors and Gender Differences. *International Journal of Environmental Research and Public Health*. **2022**, *19*(5):2991. https://doi.org/10.3390/ijerph19052991.

   Impact factor: 3.390; Q2

III. **Badarch, J.**; Batbaatar, S.; Paulik, E. Risk and Protective Factors of Smoking among Adolescents: Results from the Mongolian Global School-Based Student Health Survey. Singapore Medical Journal (*the article is in progress*)

Presentations related to the subject of the thesis

1. **Badarch, J.**; Paulik, E. (2019). Factors influencing smoking behavior of adolescents in Mongolia. 21st Danube-Kris-Mures-Tisza (DKMT) Euro-Regional Conference On Environmental And Health. Novi Sad, Serbia. 2019.06.06-2019.6.08. In: Škrbić, B (szerk.) *Book of Abstracts.* University of Novi Sad, Faculty of Technology (2019) pp. 98-98., 1 p.
2. **Badarch, J.**; Paulik, E. (2019). Factors associated with poor oral hygiene among school-aged students in Mongolia. 24th Congress of the European Association of Dental Public Health. Ghent, Belgium. 2019.09.12-2019.09.14.
3. **Badarch, J.**; Batbaatar, S.; Paulik, E. (2021). Factors associated with smoking and alcohol consumption among adolescents in Mongolia. Népegészségügyi Képző- és Kutatóhelyek Országos Egyesülete XIV. Konferencia. Szeged, Hungary 2021.08.26–2021.08.27. *Népegészségügy,* 98:2:280.

4. **Badarch, J.**; Paulik, E. (2021). Determinants of fruit and vegetable consumption among in-school students in Mongolia. 2nd EUGLOH Annual Student Research Conference in virtual edition. 2021.09.29-2021.10.01.
5. **Badarch, J.**, Paulik E. (2021). Changing pattern of cigarette smoking among adolescents in Mongolia: Results from the GYTSs (2003-2019). 14th European Public Health Conference in virtual edition. 2021.11.10-2021.11.12. *European Journal of Public Health, 31*:Supplement 3, p. 545

Table of Content

Abbreviations

AA-HA	Accelerated Action for the Health of Adolescents
ACS	American Cancer Society
CDC	Center for Disease Control and Prevention
FAO	Food and Agricultural Organization
FCTC	Framework Convention on Tobacco Control
HBSC	Health Behavior in School-aged Children
GBD	Global Burden of Disease
GSHS	Global School-based Health Survey
G-YRBS	Global Youth Risk Behavior Survey
GYTS	Global Youth Tobacco Survey
IUHPE	International Union of Health Promotion Education
LMICs	Low- and Middle-Income Countries
MMEC	Mongolian Ministry of Education and Culture
MMH	Mongolian Ministry of Health
MNUMS	Mongolian National University of Medical Sciences
NCDs	Non-Communicable Diseases
NCHD	National Center for Health Development
NCPH	National Center for Public Health
NSOM	National Statistics Office of Mongolia
SHS	Second-Hand Smoke
SPSS	Statistical Package for the Social Sciences
STEPS	STEPwise Approach to NCD Risk Factor Surveillance
YRBS	Youth Risk Behavior Survey
UN	United Nations
UNAIDS	Joint United Nations Program on HIV/AIDS
UNESCO	United Nations Educational, Scientific and Cultural Organization

UNFPA	United Nations Population Fund
UNICEF	United Nations International Children's Emergency Fund
US	United States
WDF	World Dental Federation
WHO	World Health Organization

1. Introduction

1.1 Health transition in Mongolia

Mongolia is located in East Asia. Its size of population is 3.2 million, and its territory is 1.564 million km². Today, Mongolia is the l9th largest, and the least densely populated, country in the world (Chimed-Ochir et al., 2022; NSOM, 2020). In 2020, approximately 31 percent of the population in Mongolia were residing in rural areas and had a traditional semi-nomadic lifestyle (Statista, 2022). Mongolia has experienced an epidemiological transition regarding Non-Communicable Diseases (NCDs) since the 1990s. As a result, diseases related to lifestyle and health behavior, such as cardiovascular diseases and cancers are growing steadily and have become the leading causes of morbidity and mortality (WHO, 2018).

In 2019, cardiovascular diseases (33.3%), cancers (25.6%), as well as injury, poisoning and certain other consequences of external causes (15%) were the leading causes of death in Mongolia. The number of deaths related to NCDs accounted for 85.4% of the total mortality (NCPH, 2020). Annually, more than 5500 deaths (one in three) were due to cardiovascular diseases which remain the number one cause of mortality. Deaths due to injuries, poisoning and certain other consequences of external causes (including traffic and other accidents, suicides and homicide) are the third leading cause of death in Mongolia, but account for more than 50% of deaths among children and youth aged 10-35 years (NCHD, 2020).

Young people between 10 and 19 years of age are defined as adolescents. Adolescence is a period of human growth and development that occurs after childhood and before adulthood (WHO, 2013d). During this period, young people undergo rapid changes in body structure and physiological, psychological, and social functioning. Hormones govern this development agenda, together with social influences that foster the transition from childhood to adulthood (Abbott & Vlasses, 2011). According to the statistical data in 2019, there are 503.8 thousand 10–19 years old adolescents in Mongolia, which accounts for 15.3% of the total population. Altogether, the population of 0–19 years make up the largest proportion with almost 36% (NCHD, 2020). This suggests an urgent need to prioritize a life-course approach for the young children who will become adolescents and young adults within the next two decades. In 2018, an increased prevalence of high blood pressure was observed among the 15–24 years old, with 15% having to take medication

(NCPH, 2020). With a shift away from labor intensive nomadic activities to sedentary urban lifestyles, changes in diet, and increased use of tobacco and alcohol from young age on, has led to increasing prevalence of NCDs. Adolescents in Mongolia are not considered a distinct group with specific needs in the population, and there is a lack of independent and comprehensive adolescent health and development policy focusing on common behavioral risk factors including tobacco use, unhealthy diet, physical inactivity, etc. to reduce the risk of NCDs (WHO, 2013b).

1.2 Health risk behavior and its associated factors

1.2.1 Smoking

Smoking is the form of tobacco use with inhalation of its smoke. Smoking behavior refers to an addiction to tobacco products that may lead to serious health consequences (Dorland, 2012). Globally, cigarette smoking is one of the leading causes of cancers, and several lung and heart diseases. Every year, approximately 8 million patients die of tobacco-related diseases in the world (WHO, 2017b).

According to the Tobacco Atlas, 22.8% of men's and 7.7% of women's deaths were due to tobacco-related diseases in Mongolia in 2016, which is higher on average than in the middle-income countries. Concerning the daily use of tobacco, 40.7% of male adults and 4.1% of female adults consume tobacco each day in 2015 (ACS, 2016). The Fourth Mongolian STEPS Survey on the Prevalence of NCD and Injury Risk Factors showed that the prevalence of current smoking in 2019 was 24.2% in people aged 15–69 years (43.7% in males, and 5.0% in females). In people aged 15–24 years the total prevalence was 14.2%; the rate was significantly higher in males (25.4%) than females (2.6%). The mean age of initiation was 17.2 years among 15–24 years old (no difference was found between males and females) (NCPH, 2020).

In 2003, the prevalence of cigarette smoking in Mongolian adolescents was 9.2% (15.4% males and 4.4% females); and being male, parental and peer influence were significant predictors of smoking (Rudatsikira et al., 2008). In 2010, the same data (for the age group 13 to 15 years) were 5.4% (9.2% in boys and 2.0% in girls) and the age of smoking initiation was between 12 and 15 years in Mongolia (WHO, 2010). According to the data from Global School-based Health Surveys (GSHS) conducted in Asian countries between 2012–2015, the prevalence of current smoking ranged from 2.4% to 13.3% (***Table 1***).

Table 1. GSHS data regarding the prevalence of cigarette smoking in the 13–17 years old

Country	Year	Total (n)	Current smoking		
			Total (%)	Boys (%)	Girls (%)
Malaysia[1]	2012	25507	11.5	20.5	2.1
Cambodia[2]	2013	3806	2.4	3.4	1.4
Vietnam[3]	2013	3331	4.1	7.5	1.2
Brunei[4]	2014	2599	11.4	17.8	4.8
Laos[5]	2015	3683	5.8	9.8	1.4
Philippines[6]	2015	8761	13.3	18.4	8.5

Sources: ([1]WHO, 2012); ([2]WHO, 2013a); ([3]WHO, 2013e); ([4]WHO, 2014a); ([5]WHO, 2015a); ([6]WHO, 2015c)

Several international studies showed that current smoking of adolescents was associated with the following factors: being male and older age (Wang et al., 2016), exposed to second-hand smoke (SHS) (Bhaskar et al., 2016), current alcohol consumption and illicit marijuana use (Senanayake et al., 2018), having had sexual intercourse (Aliza Lodz et al., 2019), consumption of soft drinks (Bailey et al., 2015) and fast food (Larson et al., 2007), having psychological distress and suicidal ideation (Davaasambuu et al., 2017), sedentary behavior (Pengpid & Peltzer, 2019a), truancy (Seidu, 2019), inadequate parental monitoring, and parental smoking (Vasilopoulos et al., 2015).

1.2.2 Alcohol and illicit drug use

Nowadays, more than two billion people are current drinkers globally. Harmful alcohol drinking is an important public health problem and a risk factor for a broad spectrum of diseases, causing substantial health damage (GBD 2016 Alcohol Collaborators, 2018). According to the Global Burden of Disease Study, alcohol use was the seventh leading risk factor for premature death and disability, with three million deaths attributed to alcohol use worldwide (GBD 2017 Risk Factor Collaborators, 2019). A recent study reported that adolescents who drank alcohol before the age of 15 were four times more likely to develop alcohol dependence than those who were 21 years or older at alcohol initiation (Murphy et al., 2016). Dashpuntsag et al. reported that more than half of adolescents and youths in Mongolia started consuming alcoholic beverages at age of 16 (Dashpuntsag et al., 2021). The combined use of alcohol and tobacco may produce a multiplicative or synergistic increase of risk of negative health outcomes (de Leon et al., 2007).

Faeh et al. found that the use of tobacco, alcohol, and illicit drugs tended to cluster together among adolescents in the Seychelles (particularly smoking and alcohol drinking; and smoking and illicit drug use) (Faeh et al., 2006).

1.2.3 Nutritional habits

Healthy diet is important during adolescence because it has a long-term impact on health and lifestyle. The recent Joint Food and Agriculture Organization (FAO)/World Health Organization (WHO) Expert Consultation on diet, nutrition and the prevention of chronic diseases, recommended the intake of a minimum of 400 grams of fruits and vegetables per day (excluding potatoes and other starchy tubers) for the prevention of chronic diseases (WHO-FAO, 2004). Diets limited in sugary drinks and snacks can improve the adolescents' health. Within that, boys need more nutrients to fuel greater gains in bone and muscle mass and girls need more iron, especially at onset of menstruation (UNICEF, 2019).

According to the GSHS, most adolescents worldwide consume less than the recommended amount of fruits and vegetables, but more carbonated beverages and lipid-rich ready-to-eat processed foods (Beal et al., 2019). Based on a systematic review about school-aged adolescent girls living in low- and middle-income countries (LMICs), 44% of the girls consumed fruit and 37% vegetables and it was likely far below the minimum amount recommended by the WHO. In contrast, 49% consumed sugar sweetened beverages and 23% fast food 4–6 times a week (Keats et al., 2018).

The 5th National Nutrition Survey in Mongolia stated that the prevalence of overweight and obesity was 48.8% in men aged 15–49 year; 46.2% in reproductive aged women; and 22.2% among children aged 6–11 year in 2017 (NCPH, 2017). The lack of adequate nutrition in the formative years remains a barrier to child and adolescent well-being in Mongolia.

1.2.4 Physical activity

As declared by the WHO, "Children and adolescents should do at least an average of 60 minutes per day of moderate to vigorous-intensity, mostly aerobic, physical exercise per day, across the week. Vigorous-intensity aerobic activities, as well as those that strengthen muscle and bone, should be incorporated at least 3 days a week" (WHO, 2020). The GSHS data analyzed from fifty-four countries showed that only 15.2% of adolescents were physically active at least one hour

per day and one in three adolescents (34.6%) spent 3 or more hours per day sitting (sedentary behavior) (G. Xu et al., 2020).

In Mongolia, the physical activity deficit among children has become a serious problem in the recent years – especially in Ulaanbaatar, the capital city, where the average temperature is below freezing for more than five months per year, and shortage of outdoor play spaces caused by rapid urbanization, and spread of television and video games have reduced the physical activity levels of children. This fact has contributed greatly to increasing physical inactivity and sedentary behavior among young people. The fourth national STEPS Survey identified that one in five (21.9%) of Mongolian people aged 15–69 year had insufficient physical activity in 2019 (NCPH, 2020).

1.2.5 Oral hygiene

Oral health is an essential component of well-being during the whole lifetime (Jargaltsogt et al., 2018). Good oral hygiene (brushing tooth twice a day with fluoride toothpaste) is one of the most effective methods for the prevention of dental caries and other oral diseases. The World Dental Federation (WDF) and WHO have indicated that more than 200 diseases can be the consequence of dental caries (Glick et al., 2012).

In Mongolia, the first National Survey of Oral Health Status of children aged 5, 12, 15, and 18 years and adults aged 35–44 and 65–74 years in Mongolia (2013) and the Dental Survey in Mongolia (2014) showed a dramatic increase of caries among children as well as complications in adults in both urban and rural areas of the country compared to the previous study, which was conducted by the School of Dentistry, Mongolian National University of Medical Sciences (MNUMS) in 2008 (Ulamnemekh Kh et al., 2013). The prevalence of caries in Mongolian children is still high and has not significantly changed since 1993 (Chinzorig et al., 2019). According to the survey performed by Ser-Od et al., 90% of the population suffers from dental diseases nationwide, dental caries in children is the highest among all age groups (Ser-Od et al., 2017). The fourth national STEPS survey showed that only 59.4% (51.6% males and 67.5% females) of 15–24 years old young people cleaned teeth regularly at least twice a day (NCPH, 2020). Recommended tooth-brushing prevalence among school children was found to be 22.45% in four South-East Asian countries (Peltzer & Pengpid, 2014). According to the data of GSHS conducted in Asian countries

between 2007 and 2015, the prevalence of poor oral hygiene ranged from 54.8% to 88.7% (***Table 2***).

Table 2. GSHS data regarding the prevalence of poor oral hygiene in 13–17 years old

Country	**Year**	**Total (n)**	**Poor Oral Hygiene (%)**
India[1]	2007	6751	54.8
Myanmar[1]	2007	1983	72.4
Indonesia[1]	2008	2867	88.7
Thailand[1]	2008	2223	87.2
Bangladesh[2]	2014	2989	63.6
Philippines[2]	2015	8761	85.6

Source: ([1]Peltzer & Pengpid, 2014); ([2]Pengpid & Peltzer, 2021b)

According to international studies, poor oral hygiene among adolescents has been associated with being male (McKittrick & Jacobsen, 2014), older age (Pengpid & Peltzer, 2011), sweets intake (including sweetened drinks) (Jigjid et al., 2009), infrequent fruits and/or vegetables consumption (Pengpid & Peltzer, 2011), smoking behavior (Rudatsikira et al., 2011), lack of protective factors including poor parental supervision (Park et al., 2010), and unhealthy lifestyles such as inadequate exercise and sedentary leisure time (Pengpid & Peltzer, 2021b).

1.2.6 Suicide attempts

A suicide attempt is when someone harms themselves with an intent to end their life, but they do not die as a result of their actions (Crosby et al., 2011). Suicide and suicide-related behavior in young people have become serious and urgent global public health problems. More than 700,000 people in the world lose their life as a consequence of suicide each year (WHO, 2021c). In 2016, more than one in every 100 deaths (1.3%) was the consequence of committing suicide, and among individuals aged between 15 to 19 years, it was the third leading cause of mortality. In addition, most of the world's suicides occurred in LMICs (79%) (WHO, 2019b); globally, more than 62,000 youths committed suicide in 2016. (WHO, 2021a).

Data on the prevalence of suicide attempts are available from various countries. Asia is the continent with the largest population size, and more than 60% of the world's suicides occur in Asia, with China, India and Japan being the most significant contributors to global suicide counts

(Beautrais, 2006). In Mongolia, mental health is the second among the top five challenges that children are facing. The average suicide rate of Mongolian adolescents is five times as high as in East Asia and the Pacific region. Moreover, in Mongolia, the suicide mortality among the young aged 10–14 years increased from 3.3 % in 2003 to 11.4 % in 2019 (UNICEF, 2021).

According to the statistical data, suicide rates among the young are alarming. For instance, the standardized suicide rates increased from 3.5 to 5.3 per 100,000 between 2001 and 2010 in South Korea (G. M. Kim et al., 2019), and from 9.1% to 11.3% between 2004 (T.-C. Tang et al., 2009) and 2012 (Chen et al., 2020) in Taiwan, respectively. On the average, 450 suicides occurred each year in Mongolia (Жендэрийн Үндэсний Хороо, 2020) and with 23.3 suicides per 100,000 inhabitants in 2016, the country ranked third in the world. A significant increase in suicide rates among adolescents (15–19 years) was found in Mongolia. In the 2010 Mongolian GSHS, the prevalence of suicide attempts was 8.7% (Altangerel et al., 2014). Davaasambuu et al. found in 2013 that about 10% of the students had attempted suicide in the past 12 months, and students who lived in urban areas were more likely to have had a suicide attempt (11.8% vs 8.6%) (Davaasambuu et al., 2017). According to the data of GSHS conducted in Asian countries between 2013 and 2016, the prevalence of suicide attempts ranged from 6.8% to 16.9% (***Table 3***).

Table 3. GSHS data regarding the prevalence of suicide attempts in 13–17 years old

Country	**Year**	**Total (n)**	**Suicide Attempts (%)**
Vietnam[1]	2013	3331	16.9
Philippines[2]	2015	8761	16.8
Thailand[3]	2015	5894	13.3
Nepal[4]	2015	6529	10.0
Sri Lanka[5]	2016	3262	6.8
Myanmar[6]	2016	2838	8.8

Source: ([1]WHO, 2013e); ([2]WHO, 2015c); ([3]WHO, 2015d); ([4]WHO, 2015b); ([5]WHO, 2016b); ([6]WHO, 2016a)

Suicide and suicide-related behaviors are multifactorial and complex. Many studies have shown that demographic variables, mental distress, violence, and risky behaviors including substance use are associated with increased risk of suicidal behavior in youths. Demographic factors connected with a suicide attempt may include being a female (Putra et al., 2021), older age (Biswas et al., 2020) and urban locations (Oliveira et al., 2020). Mental distress, including lack of close friends (Pengpid & Peltzer, 2021a), anxiety-induced sleep disturbance (Li et al., 2021), feeling lonely, exposure to bullying/interpersonal violence (Koyanagi et al., 2019), including suffering a physical attack (W. Kim et al., 2021), as well as a serious injury (Campisi et al., 2020) have been found in a number of studies to be associated with adolescent suicide attempts. Risky behaviors associated with suicide attempts included substance use such as smoking (Lange et al., 2020) or alcohol drinking (Sharma et al., 2015), as well as sexual intercourse (Smith et al., 2020).

Gender differences seem to play a crucial role in suicidal behavior of young people. Female adolescents are more prone to show internalizing disorders (e.g., anxiety) which may mediate the connection with suicidal behaviors (Mars et al., 2014), and females tend to have more suicide attempts than males (Chau et al., 2014). In contrast, completed suicide was more frequent in males (Miranda-Mendizabal et al., 2019), which may be associated with a higher prevalence of externalizing disorders (e.g., substance abuse disorder) (Mergl et al., 2015).

1.3 Global health strategies for adolescents

The purpose of the Health Behavior in School-Aged Children (HBSC) survey is to provide an overview of adolescent health and well-being in Europe and North America, and its data are used at national/regional and international levels to gain new insights into adolescent health and well-being, to understand the social determinants of health, and to influence policy and practice to improve young people's lives. The 'Spotlight on adolescent health and well-being' report presents findings from 227,441 young people aged 11, 13 and 15 years in 45 countries/regions who participated in the 2017/2018 HBSC survey. Overall prevalence of cigarette smoking was similar in boys and girls: 7% of them had smoked in the last 30 days. Totally, two thirds of the adolescents (65%) brushed their teeth at least twice a day (Inchley et al., 2018).

HBSC drives improvements in making children's and adolescents' lives visible and supports progress towards achieving the United Nations Sustainable Development Goals and recommendations of the WHO Accelerated Action for the Health of Adolescents (AA-HA)

guidance. AA-HA is an initiative of seven United Nations (UN) agencies – WHO, UNAIDS, UNESCO, UNFPA, UNICEF, United Nations Women, and the World Bank – and it helps governments respond to the health needs of adolescents in their countries (WHO, 2017a).

The UN Secretary-General's Global Strategy for Women's, Children's and Adolescents' Health, initiated in September 2015, not only offers a framework to drive and coordinate investment, capacity building, research, and evaluation for adolescent health and wellbeing but also extends education to reduce gender inequalities, to improve food security and nutrition, and to promote vocational skills and opportunities for employment; all likely to benefit adolescents and young adults (UN Secretory-General, 2015).

It is generally accepted that adolescent years are crucial in establishing lifestyle habits that will affect health during adulthood. Many unhealthy habits driving the NCDs epidemic begin in adolescence. For instance, the majority of smokers start consuming tobacco before the age of 18 years (Bundhamcharoen et al., 2016). Nearly a half of those who start smoking in adolescence (90%, before the age of 20) continue doing so for more than 15 years (Sawyer et al., 2012).

Schools, where adolescents spend a large proportion of their time, should be an important place to support adolescent health and development. Schools have the potential to reach the majority of adolescents, and school health education is cost-effective and improves the effectiveness also of general education (Jimba et al., 2005). For these reasons, school-based health interventions became a major area of focus for the WHO. Since its launch in 1995, the WHO's Global School Health Initiative has sought to mobilize and strengthen school health programs globally. In effect, school health programs should strive to formulate health policies and provide safe and healthy environments, health education, and health services including screening for various conditions and behaviors (T. Xu et al., 2020).

1.4 Health promoting strategies in Mongolia

The first document on tobacco control policy, the Law of Mongolia to Combat Tobacco Hazards, was issued by the Mongolian government with the support of the WHO in 1993 (Baasanjav et al., 2006). Nearly ten years later, the WHO Framework Convention on Tobacco Control (WHO FCTC) was signed and approved by Mongolia (WHO, 2014b). This document contained a number of broad statements concerning the promotion of research and the exchange of information on tobacco control and included a provision on the establishment of an integrated

system of tobacco surveillance. In spite of the national and international tobacco control policies, smoking remains a major behavior problem in the Mongolian population.

The Mongolian Government approved the “National Oral Health” program in 2006. Based on the recommendation of the WHO, implementing the program was expected to reduce caries prevalence by up to 78% to 80.1% among 5–6-year-old; 60% to 62% among 12-year-old; and 70% to 71.6% in the adult population (MMH, 2006). Based on the results, the prevalence of dental caries and mean DMFT (decayed, missing, filled tooth) were decreased by 24.4% and 2.7%, respectively; and the number of 18-year-old who have intact teeth was increased by 5% (MMH, 2018).

The findings of the Mongolian GSHS 2010 and 2013 revealed that suicide attempts had increased significantly. Between 2003 and 2019, suicide mortality among the young aged 10–14 years increased (UNICEF, 2021). However, Mongolia has taken an important and successful step of institutionalizing a nationwide “24/7 Child Helpline 108” in 2014, to create a safe space for minors to communicate freely and without fear of consequence. Children, adolescents and related adults can call confidentially and anonymously for information, advice and support. It has been pivotal for those seeking emotional support, counselling and even in identifying adolescents considering suicide, and providing necessary support (WHO, 2019a).

2. Aims

The overall aim of the study was to determine the prevalence of health risk behaviors among Mongolian adolescents, and to characterize the relevant risk and protective factors, based on the data of the Mongolian GSHS 2013 and 2019.

Our specific aims were:

1. to determine the prevalence of current smoking and its association with demographic factors (sex and age), other behavioral factors (dietary behaviors such as soft drink, fast food, fruit and vegetable intake; oral hygiene; alcohol and drug use; sexual activity; physical activity; sedentary behavior; parental smoking and exposure to second-hand smoke); psychological factors (loneliness, anxiety, presence or absence of close friend); and parental factors (truancy, parental supervision, connectedness and bonding) among school-going adolescents in Mongolia.
2. to determine the prevalence of poor oral hygiene and its association with demographic factors (sex and age), other behavioral factors (dietary behaviors such as soft drink, fast food, fruit and vegetable intake; smoking, alcohol and drug use; sexual activity; physical activity; sedentary behavior, parental smoking and exposure to second-hand smoke), psychological factors (loneliness, anxiety and close friend), and parental factors (truancy, parental supervision, connectedness and bonding) among school-going adolescents in Mongolia.
3. to determine the prevalence of self-reported suicide attempts and to identify the gender specific predictors including age, mental distress, injury and violence, and other risky behaviors among school-attending adolescents in Mongolia.

Finally, the information gathered and processed in this thesis on health risk behaviors including smoking behavior, poor oral hygiene and suicide attempts and the associated factors among adolescents in Mongolia, may be a starting point of the development of a comprehensive, school-based health promotion intervention for this population, and our results can be useful for the government, other policy makers and future researchers, too.

3. Materials and Methods

3.1 The WHO GSHS Datasets

The WHO GSHS is a collaborative surveillance project developed by the United States (US) Center for Disease Control and Prevention (CDC) and WHO together with UNICEF, UNESCO and UNAIDS. The GSHS also known as the country-specific version of the Global Youth Risk Behavior Survey (G-YRBS) because it applied many of the features of YRBS developed by US CDC (Brener et al., 2013).

As stated in the original document: "The purpose of the GSHS is to provide accurate data on health behaviors and protective factors among students to help countries develop priorities, establish programs, and advocate for resources for school health and youth health programs and policies; allow international agencies, countries, and others to make comparisons across countries regarding the prevalence of health behaviors and protective factors; and establish trends in the prevalence of health behaviors and protective factors by country for use in evaluation of school health and youth health promotion." (WHO, 2013c).

The WHO GSHS measured the behavioral risk factors and protective factors among young people aged 12–17 years. It used a two-stage cluster sampling design: in the first stage, schools were selected with probability proportional to enrollment size; in the second stage, classes were randomly selected and all students in the classes chosen were eligible to participate. The participants filled in a self-reported questionnaire including core questionnaire modules, core expanded questions, and country-specific questions. The key topics were alcohol use, dietary behaviors, drug use, hygiene, mental health, physical activity, protective factors, sexual behaviors, tobacco use, violence and unintentional injury (WHO, 2013c).

3.1.1 The Mongolian GSHS

In 2013 and 2019, the Mongolian Ministry of Health (MMH) and National Center for Public Health (NCPH) conducted the second and third nationwide GSHS in Mongolia. The GSHS methodology was approved by the Scientific Council Meeting of the Public Health School, MNUMS and the Committee on Ethics, under the MMH (WHO, 2010).

The central objectives for the Mongolian GSHS, defined in the 2010 report, were the following:

1. "Assess health behaviors and protective factors of adolescent students
2. Identify priority areas for increased programming, changes in school policy and collaboration with community agencies
3. Provide teachers with a basis for allocating instructional time in the health and physical education curriculum
4. Provide teens with peer norms rather than inflated perceptions of what their peers are doing
5. Establish benchmarks for and monitor the impact of national initiatives to improve adolescent health" (WHO, 2010).

3.1.2 GSHS Questionnaire

The Mongolian GSHS questionnaire contained 84 questions addressing the following topics: demographics, dietary behaviors, hygiene, violence and unintentional injury, mental health, tobacco use, alcohol use, drug use, sexual behaviors, physical activity and protective factors. Of the 84 questions, 58 questions were from the core questionnaire modules and 26 questions were expanded GSHS and country-specific questions. GSHS questions had been formulated by a group of experts including members from WHO, UNAIDS, UNICEF, UNESCO and US CDC.

3.1.3 Sampling

The 2013 and 2019 Mongolian GSHS employed a two-stage cluster sample design to produce a representative sample of all students in grades 6–12, aged 12–17 years old in Mongolia. The survey was organized nationwide with financial and technical assistance from the WHO and US CDC. The Mongolian GSHS surveyed students in grades 6-12 in nine districts of Ulaanbaatar and 21 provinces. The first-stage sampling frame involved the selection of schools. All schools in Mongolia having any of grades 6-12 were included in the sampling. The first-stage sampling frame consisted of 59 schools (urban, rural, public, or private) containing any of grades 6-12. Schools were selected systematically with probability proportional to school enrollment size. The second-stage sampling frame consisted of randomly selecting 202 full classes (using a random start) from each school to participate. All relevant classes in each selected school were included in the sampling frame. The survey questionnaire was answered by 5393 students in 2013 and 4514 students in 2019 in grades 6–12. In 2019, two types of questionnaires were applied, depending on

the age of the target population (10–12-year-old and 13–18-year-old). From the point of the study presented in this thesis, an important difference was in connection with the question about attempted suicide. This question was asked only from the 13–18-year-old students, and this question was answered by 2850 students, so in the suicide related analysis, these students were considered as total.

3.2 Variables and measurements

3.2.1 Dependent variables

In the study presented in this thesis, adolescent smoking behavior, poor oral hygiene and suicide attempts were used as the dependent variables. The dependent variables were assessed using the data from the WHO GSHS questionnaire.

Smoking

The dependent variable of smoking related analysis was “current smoking”, with the question as follows:

“During the past 30 days, on how many days did you smoke cigarette?” Response options were 1=0 day, 2=1 or 2 days, 3=3 to 5 days, 4=6 to 9 days, 5= 10 to 19 days, 6=20 to 29 days and 7=all 30 days. The answers were then dichotomized into 1=never smoking and 2-7=current smoking.

Oral hygiene

The dependent variable of oral hygiene related analysis was “poor oral hygiene”, with the question as follows:

“During the past 30 days, how many times per day did you usually clean or brush your teeth?” Response options were 1==Did not brush my teeth, 2=less than 1 time per day, 3=1 time per day, 4=2 times per day, 5= 3 times per day and 6=4 or more times per day. Poor oral hygiene was defined as brushing teeth less than two times per day (response codes 1 to 3) and good oral hygiene when brushing 2 or more times per day (response codes 4 to 6).

Suicide attempts

The dependent variable of attempted suicide related analysis was “suicide attempts”, with the question as follows:

“During the past 12 months, how many times did you actually attempt suicide?” Response options were 1=0 times, 2=1 time, 3=2 or 3 times, 4=4 or 5 times and 5=6 times. The answers were dichotomized into 1=no and 2-5=yes.

3.2.2 Independent variables

The independent variables were demographic factors, dietary behaviors, health risk factors, psychological factors, injury and violence and parental factors.

3.2.2.1 Demographic factors

Gender: “What is your sex?” (Response options were 1=male and 2=female).

Age: “How old are you?” (Response options were 1=11 years old or younger, 2=12 years old, 3=13 years old, 4=14 years old, 5=15 years old, 6=16 years old, 7=17 years old and 8=18 years old, recoded as 1-2=12 years old or younger, 3=13 years old, 4=14 years old, 5=15 years old and 6-8=16 years old or older).

3.2.2.2 Dietary behaviors

Carbonated soft drink intake: “During the past 30 days, how many times per day did you usually drink carbonated soft drinks, such as Coca, Pepsi Cola, or National Tereij?” [Response options were 1=I did not drink carbonated soft drinks during the past 30 days, 2=Less than one time per day, 3=1 time per day, 4=2 times per day, 5=3 times per day, 6=4 times per day and 7=5 or more times per day; recoded as 0=yes (2-7) and 1=no (1)].

Fast food intake: “During the past 7 days, on how many days did you eat food from a fast-food restaurant, such as pizza or burger places?” [(Response options were 1=0 days, 2=1 day, 3=2 days, 4=3 days, 5=4 days, 6=5 days 7=6 days and 8=7 days; recoded as 0=yes (2-8) and 1=no (1)].

Fruit intake: “During the past 30 days, how many times per day did you usually eat fruit, such as apples, grapefruit, bananas, or kiwi?” [Response options were 1=I did not eat fruit during the past 30 days, 2=Less than one time a day, 3=1 time per day, 4=2 times per day, 5=3

times per day, 6=4 times per day and 7=5 or more times per day; recoded as 0=inadequate (1–4) and 1=adequate (5–7)].

Vegetable intake: "During the past 30 days, how many times per day did you usually eat vegetables, such as carrots, cabbage, or green vegetables?" [Response options were 1=I did not eat vegetables during the past 30 days, 2=Less than one time a day, 3=1 time per day, 4=2 times per day, 5=3 times per day, 6=4 times per day and 7=5 or more times per day; recoded as 0=inadequate (1–4) and 1=adequate (5–7)].

3.2.2.3 Health risk factors

Smoking (used also as dependent variable; see the question and codes in 3.2.1 point)

Other tobacco use: "During the last month, on how many days did you use any other form of tobacco such as cigars, water pipe, cigarillos, pipe, chewing tobacco, or snuff?" [Response options were 1=0day, 2=1 or 2 days, 3=3 to 5 days, 4=6 to 9 days, 5= 10 to 19 days, 6= 20 to 29 days and 7=all 30 days; recoded as 0=no (1) and 1=yes (2–7)]].

Exposed to SHS: "During the past 7 days, on how many days did people smoke in your presence?" [Response options were 1=0 days, 2=1 or 2 days, 3=3 or 4 days, 4=5 or 6 days and 5=all 7 days; recoded as 0=no (1) and 1=yes (2–5)].

Parental smoking: "Which of your parents or guardians use any form of tobacco?" [Responses options were 1=neither, 2=my father, 3=my mother, 4=both and 5=I do not know; recoded as 0=none of them (1) and 1=yes, one or both (2–4)].

Alcohol use: "During the past 30 days, on how many days did you have at least one drink containing alcohol?" [Response options were 1=0 day, 2=1 or 2 days, 3=3 to 5 days, 4=6 to 9 days, 5= 10 to 19 days, 6= 20 to 29 days and 7=all 30 days; recoded as 0=never drinks alcohol (1); 1=drinks alcohol (2–7)].

Marijuana use: "During your life, how many times have you used marijuana?" [Response options were 1=0 time, 2=1 or 2 times, 3=3 to 9 times, 4=10 to 19 times and 5=20 or more times; recoded as 0=never uses drug (1) and 1=uses drug (2–5)].

Oral hygiene (used also as dependent variable; see the question and codes in 3.2.1 point)

Sedentary behavior: "How much time do you spend during a typical or usual day sitting and watching television, playing computer games, talking with friends, or doing other sitting

activities?" [Response options were 1=Less than 1 h per day, 2=1 to 2 h per day, 3=3 to 4 h per day, 4=5 to 6 h per day, 5=7 to 8 h per day and 6=more than 8 h per day; recoded as 0=not sedentary (1–2) and 1=sedentary (3–6)].

Physical activity: "During the past 7 days, on how many days were you physically active for a total of at least 60 min per day?" [Response options were 1=0 days, 2=1 day, 3=2 days, 4=3 days, 5=4 days, 6=5 days, 7=6 days and 8=7 days; recoded as 1=physically inactive (1) and 0=physically active (2–8)].

Sexual intercourse: "Have you ever had a sexual intercourse?" (Response options were 1=yes and 2=no).

3.2.2.4 Psychological factors

Loneliness: "During the past 12 months, how often have you felt lonely?" [Response option were from 1=never, 2=rarely, 3=sometimes, 4=most of the time and 5=always; recoded 0=no loneliness (1–2) and 1=feeling lonely (3–5)].

Anxiety-induced sleep disturbance: "During the past 12 months, how often have you been so worried about something that you could not sleep at night?" [Response option were from 1=never, 2=rarely, 3=sometimes, 4=most of the time and 5=always; recoded as 0=no anxiety (1–2) and 1=anxiety (3–5)].

Close friend: "How many close friends do you have?" [Response option were from 1=0 to 4=3 or more; recoded as 1=no close friend and 0=having close friend (2–4)].

Suicidal ideation: "During the past 12 months, did you ever seriously consider attempting suicide?" (Response options were 1=yes and 2=no)

Suicide attempts (used also as dependent variable; see the question and codes in 3.2.1 point)

3.2.2.5 Injury and violence

Being bullied: "During the past 30 days, on how many days have you been bullied?" [Response options were 1=0 day, 2=1 or 2 days, 3=3 to 5 days, 4=6 to 9 days, 5= 10 to 19 days, 6= 20 to 29 days and 7=all 30 days; recoded as 0=no (1) and 1=yes (2–7)]. *Description provided in the questionnaire*: Bullying occurs when one or more students or someone else about your age teases, threatens, ignores, spreads rumors about, hits, shoves, or hurts another person over and over again.

Physically attacked: "During the past 12 months, how many times have you been physically attacked?" [Response options were 1=0 time, 2=1 time, 3=2 or 3 times, 4=5 or 6 times, 6=8 or 9 times, 7=10 or 11 times and 8=12 or more times; recoded as 0=no (1) and 1=yes (2–8)]. *Description provided in the questionnaire:* A physical attack occurs when one or more people hit or strike someone, or when one or more people hurt another person with a weapon (such as, a stick, knife, or gun).

Injury: "During the past 12 months, how many times have you been seriously injured?" [Response options were 1=0 time, 2=1 time, 3=2 or 3 times, 4=5 or 6 times, 6=8 or 9 times, 7=10 or 11 times and 8=12 or more times; recoded as 0=no (1) and 1=yes (2–8)]. *Description provided in the questionnaire:* An injury is serious when it makes you miss at least one full day of usual activities (such as, school, sports, or a job) or requires treatment by a doctor or nurse.

3.2.2.6 Parental factors

Truancy: "During the past 30 days, on how many days did you miss classes or school without permission?" [Response options were 1=0 day, 2=1 or 2 days, 3=3 to 5 days, 4=6 to 9 days and 5=10 or more days; recoded as 0=no (1); 1=yes (2–5)].

Parental supervision: "During the past 30 days, how often did your parents or guardians check to see if your homework was done?" [Response options were 1=never, 2=rarely, 3=sometimes, 4=most of the times and 5=always; recoded as 0=no or poor (1–2) and 1=yes or good (3–5)].

Parental connectedness: "During the past 30 days, how often did your parents or guardians understand your problems and worries?" [Response options were 1=never, 2=rarely, 3=sometimes, 4=most of the times and 5=always; recoded as 0=no or "poor" (1–2) and 1=yes or "good" (3–5)].

Parental bonding: "During the past 30 days, how often did your parents or guardians really know what you were doing in your free time?" [Response options were 1=never, 2=rarely, 3=sometimes, 4=most of the times and 5=always; recoded as 0=no or "poor" (1–2) and 0=yes or "good" (3–5)].

3.3 Statistical analysis

Statistical analysis was carried out with IBM SPSS version 24.0 and 27.0 (SPSS Inc., Chicago, IL, USA). We used simple descriptive statistics including frequency, percentage, median, interquartile range (IQR) and chi-square tests to describe the overall characteristics of the sample.

Univariable logistic regression analyses were conducted to examine unadjusted associations between dependent (smoking behavior, poor oral hygiene and suicide attempts) and independent variables one by one.

Multivariable logistic regression analyses were conducted to examine the associations of smoking behavior and poor oral hygiene with all independent variables.

Multivariable forward stepwise logistic regression analysis was used to assess the independent contribution of demographic factors (age and residence location), mental distress (loneliness, anxiety, having close friend), injury and violence (being bullied, physically attacked and injured), and risky behaviors (cigarette smoking, alcohol drinking and sexual intercourse) to suicide attempts.

Odds ratio (OR), adjusted odds ratio (AOR) and 95% confidence interval (CI) of OR (AOR) were used to indicate the association between the health risk behaviors including smoking behavior, poor oral hygiene and suicide attempts and the selected list of independent variables. Statistical significance was defined at $p < 0.05$. Nagelkerke R^2 values were used to evaluate the explanatory power of the stepwise model.

3.4 Ethics Statements

The Mongolia GSHS study was approved by the Ethical Committee of the NCPH (Ethical committee approval codes 18 in 2013 and 88 in 2019). All students and their parents in each selected class were given a written consent form and asked to participate voluntarily in the survey.

4. Results

4.1 Description of the study sample

The Mongolian GSHS 2013 was conducted with a total sample size of 5393 students, while the GSHS 2019 involved 4514 participants. In 2019 the question about attempted suicide was asked only from the older students (mainly 13–18-year-old), so the sample in the present analysis involved only 2850 students. The main demographic characteristics of the samples in 2013 and 2019 are shown in ***Table 4***.

Table 4. Main demographic characteristics of samples

Variables	GSHS 2013 (n=5393)		GSHS 2019 (n=2850)	
	n	**%**	**n**	**%**
Gender				
Male	2529	46.9	1254	44.0
Female	2864	53.1	1596	56.0
Age				
12 years old or younger	353	12.1	116	4.0
13 years old	1099	20.5	494	17.3
14 years old	992	18.5	439	15.4
15 years old	1013	18.9	473	16.6
16 years old or older	1607	30.0	1328	46.7

The behavioral and parental characteristics of the sample in 2013 are shown in ***Table 5***. Of the responders, 46.9% were males. There were significant differences in the characteristics of males and females. Substance use and unhealthy dietary behaviors were more prevalent in males than females, but prevalence of feeling lonely and having suicidal ideation was higher among females compared to the males. Conversely, being bullied, having sexual intercourse, and school truancy were more common among male adolescents.

Table 5. Behavioral and parental **c**haracteristics of Mongolian adolescents included in the GSHS 2013 by sex

Variables	Total n (%)	Male n (%)	Female n (%)
Substance use			
Current smoking***	451 (8.5)	310 (12.5)	141 (5.0)
Alcohol use***	422 (8.0)	240 (9.7)	182 (6.5)
Marijuana use**	65 (1.2)	43 (1.7)	22 (0.8)
Other tobacco use***	324 (6.0)	236 (9.4)	88 (3.1)
Dietary behaviors			
Carbonated soft drink consumption***	1773 (33.1)	935 (37.3)	838 (29.4)
Fast food consumption	2924 (54.9)	1393 (55.8)	1531 (54.1)
Inadequate fruit intake	4918 (91.7)	2277 (91.0)	2622 (92.3)
Inadequate vegetable intake	4047 (75.7)	1840 (73.7)	2192 (77.4)
Psychological factors			
Felt lonely***	2180 (40.7)	850 (33.9)	1330 (46.7)
Being bullied***	1429 (27.6)	816 (33.5)	613 (22.3)
Having ideation of suicide***	1227 (23.1)	432 (17.4)	795 (28.1)
Risky behaviors			
Sexual intercourse***	734 (14.3)	472 (19.9)	262 (9.5)
Physically inactive	1657 (31.0)	715 (28.7)	932 (32.9)
Sedentary behavior***	2334 (43.7)	1010 (40.3)	1324 (46.6)
Poor oral hygiene***	1767 (33.0)	928 (37.0)	839 (29.5)
One or both parents smoking***	2387 (45.3)	1066 (43.3)	1321 (47.1)
Exposed to SHS***	3226 (60.5)	1584 (63.5)	1642 (57.9)
Parental factors			
Truancy***	1256 (23.5)	753 (30.1)	503 (17.7)
Poor parental supervision*	1703 (31.9)	763 (30.5)	940 (33.1)
Poor parental connectedness*	2699 (50.6)	1301 (52.1)	1398 (49.3)
Poor (no) parental bonding	1709 (32.3)	796 (32.0)	913 (32.5)

Results from chi-square tests: *p<0.05; **p<0.01; ***p<0.001

SHS: second-hand smoke

The percentages are calculated according to the number of the actual responders (missing data are not considered).

4.2 Prevalence and factors associated with smoking in Mongolian adolescents

Nearly one-tenth of the students (8.5%) reported current smoking in the previous 30 days of the survey. According to the univariable logistic regression analyses, male sex, older age, alcohol consumption, marijuana use, other tobacco use, carbonated soft drink and fast food consumption, feeling lonely, being bullied, having suicidal ideation, having poor oral hygiene, exposed to SHS, having had sexual intercourse, spending more than 3 hours a day sitting, being absent from school without permission, parents not controlling children's homework, poor parental connectedness, and parents not knowing what their children do were in significant relationship with current smoking among school-aged adolescents in Mongolia (***Table 6***).

Multivariable logistic regression analysis showed that males were more likely (AOR: 2.23, 95% CI 1.57–3.16) to smoke than females. The increase in age by each one year (from 12 years old and younger as the first age group) increased the odds of smoking (AOR: 1.89, 95% Cl 1.61–2.23). Concerning substance use, students who consumed alcohol (AOR: 5.05, 95% CI 3.56–7.15), and other tobacco product (AOR: 18.34, 95% CI 12.00–28.03) were more likely to report current smoking in the last 30 days. Similarly, students who consumed carbonated soft drinks (AOR: 1.44, 95% CI 1.06–1.97), and fast food (AOR: 1.71, 95% CI 1.23–2.38) were more likely to smoke than students who did not consume these foodstuffs. For the health risk factors, students who were exposed to SHS (AOR: 2.56, 95% CI 1.70–3.86), and who have had sexual intercourse (AOR: 3.05; 95% CI 2.19–4.26) had also higher chance to report current smoking; similarly to those who had sedentary behavior (spent sitting more than 3 hours a day) (AOR: 1.51, 95% CI 1.10–2.08), and ideation of suicide (AOR: 1.83, 95% CI 1.29–2.61), compared to students free of these risk factors. Students who missed class without permission (truancy) (AOR: 2.29, 95% CI 1.68–3.13), and students whose parents did not know what they do (AOR: 1.55, 95% CI 1.10–2.19) were also more likely to report current smoking compared to participants without these risk factors (***Table 6***).

Table 6. Results of univariable and multivariable logistic regression analysis for current smoking, GSHS, 2013

Variables	Current smoking					
	UAOR	**95%CI**	***p* value**	**AOR**	**95%CI**	***p* value**
Demographic factors						
Male gender	2.73	2.22-3.36	<0.001	2.23	1.57-3.16	<0.001
Age (years)	1.88	1.72-2.06	<0.001	1.89	1.61-2.23	<0.001
Substance use						
Alcohol use	17.16	13.69-21.52	<0.001	5.05	3.56-7.15	<0.001
Marijuana use	13.38	8.04-22.26	<0.001	2.05	0.64-6.55	N.S.
Other tobacco use	24.61	19.06-31.79	<0.001	18.34	12.00-28.03	<0.001
Dietary behaviors						
Carbonated soft drink intake	2.13	1.75-2.58	<0.001	1.44	1.06-1.97	0.037
Fast food consumption	2.36	1.90-2.92	<0.001	1.71	1.23-2.38	0.001
Psychological factors						
Loneliness	1.54	1.19-2.01	0.001	1.16	0.74-1.82	N.S.
Being bullied	1.36	1.03-1.78	0.002	0.94	0.61-1.44	N.S.
Suicidal ideation	2.51	2.05-3.07	<0.001	1.83	1.29-2.61	<0.001
Risky behaviors						
Poor oral hygiene	1.49	1.22-1.81	<0.001	1.11	0.81-1.52	N.S.
Exposed to SHS	5.25	3.93-7.02	<0.001	2.56	1.70-3.86	<0.001
One or both parents smoking	1.61	1.32-1.96	<0.001	0.90	0.66-1.23	N.S.
Sexual intercourse	7.97	6.46-9.85	<0.001	3.05	2.19-4.26	<0.001
Sedentary behavior	2.26	1.86-2.76	<0.001	1.51	1.10-2.08	0.017
Parental factors						
Truancy	5.24	4.30-6.40	<0.001	2.29	1.68-3.12	<0.001
Poor parental supervision	1.49	1.23-1.82	<0.001	0.78	0.55-1.09	N.S.
Poor parental connectedness	1.59	1.30-1.94	<0.001	0.98	0.70-1.37	N.S.
Poor parental bonding	1.71	1.41-2.09	<0.001	1.55	1.10-2.19	0.010

SHS: second-hand smoke; UAOR: unadjusted odds ratio; AOR: adjusted odds ratio; CI: confidence interval; N.S.: p>0.05

Reference categories: female, no alcohol use, no marijuana use, no other tobacco use, no carbonated soft drink intake, no fast-food consumption, no loneliness, no being bullied, no suicidal ideation, good oral hygiene, no second-hand smoke exposure, no parental smoking, no sexual intercourse, no sedentary behavior, no truancy, parental supervision, parental connectedness, parental bonding

4.3 Prevalence and factors associated with poor oral hygiene in Mongolian adolescents

One-third of the students (1773, 33%) reported to have had poor oral hygiene in the 30 days preceding the survey in 2013. The main characteristics of poor oral hygiene are shown in ***Table 7***. All analyzed factors were in a significant relationship with poor oral hygiene among Mongolian school-going students.

Table 7. Sample characteristics associated with poor oral hygiene among school going students in Mongolia (GSHS 2013)

Variables	***Poor oral hygiene***	
	n	**%**
Demographic factors		
Gender		
Male (n=2516)	928	37.0
Female (n=2854)	839	29.5
Age (increase 1 year of age)		
12 years old or younger (n=652)	196	30.1
13 years old (n=1102)	340	30.9
14 years old (n=994)	315	31.9
15 years old (n=1017)	359	35.3
16 years old or older (n=1615)	559	34.7
Dietary behaviors		
Carbonated soft drink consumption		
Yes (n=1785)	529	29.9
No (n=3594)	1240	34.5
Fast food consumption		
Yes (n=2936)	876	30.0
No (n=2416)	878	36.4
Fruit intake		
Inadequate intake (n=4918)	1677	34.2
Adequate intake (n=447)	85	19.2
Vegetable intake		
Inadequate intake (n=4047)	1484	36.7
Adequate intake (n=1302)	274	21.2

Table 7. (Continued)

Variables	*Poor oral hygiene*	
	n	**%**
Smoking behavior		
Cigarette smoking		
Current smoking (n=456)	187	41.5
Never smoke (n=4888)	1571	32.2
Parental smoking		
One or both (n=2397)	875	36.6
None (n=2889)	861	29.9
Exposed to SHS		
Yes (n=3237)	1153	35.8
No (n=2113)	599	28.4
Parental factors		
Parental supervision		
Poor (n=1710)	661	38.8
Good (n=3653)	1096	30.1
Parental connectedness		
Poor (n=2709)	1015	37.6
Good (n=2642)	739	28.1
Parental bonding		
Poor (n=1718)	644	37.6
Good (n=3599)	1102	30.7
Physical activity		
Inactive (n=1657)	650	39.3
Active (n=3687)	1103	30.0
Sedentary behavior		
Yes (n=2342)	831	35.6
No (n=3026)	930	30.8

SHS: second-hand smoke

According to the univariable analysis (**Table 8**), students who reported poor oral hygiene tended to be males and be in age group older than 12 years. They consumed carbonated soft drinks

and fast food, had inadequate fruit and vegetable intake, smoked cigarettes, one or both parents were smokers, were exposed to second-hand smoke at home, and suffered from poor parental supervision and disconnectedness. Parents of these students typically did not know what their children did, and the students were physically inactive and spent more than 3 hours per day sitting. All the listed factors were in a significant relationship with poor oral hygiene among Mongolian school-going students.

Table 8. Factors associated with poor oral hygiene (results of univariable and multivariable logistic regression analysis, GSHS, 2013)

	Poor Oral Hygiene					
Variables	**UAOR**	**95% CI**	***p* value**	**AOR**	**95% CI**	***p* value**
Demographic factors						
Male gender	1.40	1.25–1.57	<0.001	1.54	1.36–1.75	<0.001
Age (increase 1 year of age)	1.06	1.02–1.10	0.003	1.00	0.96–1.05	0.813
Dietary behaviors						
Carbonated soft drink	0.80	0.71–0.91	<0.001	0.85	0.74–0.97	0.023
Fast food intake	0.74	0.66–0.84	<0.001	0.74	0.65–0.84	<0.001
Inadequate fruit intake	2.18	1.70–2.78	<0.001	1.80	1.36–2.37	<0.001
Inadequate vegetable intake	2.15	1.86–2.50	<0.001	1.80	1.59–2.21	<0.001
Smoking behaviors						
Current smoking	1.49	1.22–1.81	<0.001	1.20	0.96–1.51	0.106
One or both parents smoking	1.35	1.20–1.52	<0.001	1.23	1.08–1.40	0.002
Exposed to SHS	1.40	1.24–1.58	<0.001	1.22	1.06–1.40	0.005
Parental factors						
Poor parental supervision	1.47	1.30–1.66	<0.001	1.17	1.02–1.35	0.023
Poor parental connectedness	1.54	1.37–1.73	<0.001	1.30	1.13–1.49	<0.001
Poor parental bonding	1.36	1.20–1.53	<0.001	1.03	0.89–1.20	0.609
Physically inactive	1.51	1.34–1.70	<0.001	1.51	1.32–1.73	<0.001
Sedentary behavior	1.23	1.10–1.38	<0.001	1.39	1.22–1.58	<0.001

SHS: second-hand smoke; UAOR: unadjusted odds ratio; AOR: adjusted odds ratio; CI: confidence interval

Multivariable analysis showed that males were 1.54 times (AOR: 1.54; 95% CI 1.36–1.75) as likely as females to have poor oral hygiene (***Table 8***). Concerning dietary behaviors, students who

consumed carbonated soft drinks and fast food were 15% (AOR: 0.85; 95% CI [0.74–0.97]) and 26% (AOR: 0.74; 95% CI [0.65–0.84]) less likely to be associated with insufficient tooth brushing. Moreover, students who had inadequate fruit and vegetable intake were 80% (AOR: 1.80; 95% CI [1.36–2.37]) and (AOR: 1.80; 95% CI [1.59–2.21]) more likely to have poor oral health than students who ate adequate amounts of fruits and vegetables. As to smoking behaviors, students whose parents (one or both) were smokers were 1.23 times more likely to report poor tooth brushing (AOR: 1.23; 95% CI [1.08–1.40]), and those being exposed second-hand smoke were 1.22 times (AOR: 1.22; 95% CI [1.06–1.40]) more likely to report poor tooth brushing. Regarding protective factors, students whose parents did not check homework were 17% more likely to report poor dental hygiene compared to fellow students (AOR: 1.17; 95% CI [1.02–1.35]), and those whose parents did not understand trouble were 30% (AOR: 1.30; 95% CI [1.13–1.49]) more likely to report poor dental hygiene compared to fellow students. Students who were physically inactive were 1.51 times (AOR: 1.51; 95% CI [1.32–1.73]) as likely to report brushing tooth less than 2 times a day. Furthermore, students who spent sitting more than 3 h per day were 1.39 times (AOR: 1.39; 95% CI [1.22–1.58)]) as likely to have poor oral hygiene. These results are presented in ***Table 8***.

4.4 Prevalence and factors associated with suicide attempts in Mongolian adolescents

A total of 2850 subjects were eligible for the analysis of suicide attempts in the GSHS 2019. The characteristics of the sample (total, male, and female) are shown in ***Table 9***. The sex distribution showed female dominance (56% women and 44% men). The prevalence rate of attempted suicide was 32.1% (n=916) in the total sample, 33.3% (n=417) in males, and 31.3% (n=499) in females.

Table 9. Sample characteristics of Mongolian adolescents aged 13–18 year included in the GSHS 2019 by sex

Variables	**Total (n=2850)**		**Male (n=1254)**		**Female (n=1596)**	
	n	**%**	**n**	**%**	**n**	**%**
Demographic factors						
Median age in year (IQR*)	15	-3	15	-2	15	-3
Place of residence						
Urban	916	32.1	412	32.9	504	31.6
Rural	1934	67.9	842	67.1	1092	68.4
Psychological factors						
No close friend	154	5.4	53	4.2	101	6.3
Anxiety	752	26.4	266	21.2	486	30.5
Loneliness	1254	44.0	433	34.5	821	51.4
Injury and violence						
Being bullied	1144	40.1	568	45.3	576	36.1
Being physically attacked	1145	40.2	598	47.7	547	34.3
Injury	1472	51.6	738	58.9	734	46
Risky behavior						
Cigarette smoking	894	31.4	469	37.4	425	26.6
Alcohol drinking	824	28.9	400	31.9	424	26.6
Sexual intercourse	349	12.2	238	19	111	7

*IQR: interquartile range.

According to the univariable analysis (***Table 10***), male suicide attempters were less likely to have older age; more likely to be bullied, physically attacked, injured, smoke cigarettes, and drink alcohol. Female suicide attempters were less likely to have older age; more likely to live in urban location, have anxiety, feel lonely, be bullied, be physically attacked, be injured, smoke cigarettes, and drink alcohol. In the total sample, all factors showed a significant relationship with suicide attempts except sexual intercourse. Female students who had no close friends were less likely to have suicidal behavior than female students who had 1 or more close friends. The highest odds were found in connection with the risky behaviors, and with the injury and violence factors, especially among females.

The last step of the stepwise logistic regression models is shown in ***Table 11***. Compared with the results of univariable analyses, the multiple models showed small differences in the predictors of attempted suicide in males and females. The living place and feeling lonely were no significant predictors in all models. Age remained significant in case of females; each one-year increase in age was associated with progressively fewer suicide attempts (AOR: 0.84). Anxiety and feeling lonely were not involved in the stepwise model in males, as it was expected from the univariable results ($p>0.05$), while in females, anxiety was a significant predictor (AOR: 2.02). In males, the attempted suicide was more likely among those having a sexual intercourse (AOR: 2.14). Altogether, male suicide attempters were less likely to have close friends, and more likely to having been bullied, physically attacked, injured, smoke cigarettes, and drink alcohol, and have had a sexual intercourse. Within the female subgroup, lack of close friends, anxiety, being bullied, being physically attacked or injured, cigarette smoking, and alcohol drinking significantly increased the odds of reporting a suicide attempt.

Table 10. Results of univariable logistic regression analysis for suicide attempts by sex (GSHS, 2019)

Variables	Total			Male			Female		
	UAOR	**95% CI**	***p* value**	**UAOR**	**95% CI**	***p* value**	**UAOR**	**95% CI**	***p* value**
Deomographic factors									
Age (year)	0.87	0.83-0.91	<0.001	0.89	0.82-0.95	0.002	0.85	0.80-0.91	<0.001
Urban location	1.41	1.19-1.66	<0.001	1.15	0.90-1.48	0.251	1.65	1.32-2.07	<0.001
Psychological factors									
No close friends	0.60	0.41-0.89	0.011	0.94	0.52-1.70	0.852	0.45	0.27-0.77	0.003
Anxiety	1.34	1.12-1.59	<0.001	1.19	0.90-1.58	0.214	1.47	1.18-1.85	0.001
Feeling lonely	1.17	1.00-1.38	0.042	1.11	0.87-1.43	0.369	1.26	1.02-1.56	0.028
Injury and violence									
Being bullied	31.93	25.42-40.11	<0.001	32.03	22.19-46.23	<0.001	34.41	25.52-46.40	<0.001
Physically attacked	33.03	26.27-41.53	<0.001	30.18	20.74-43.92	<0.001	42.57	31.34-57.81	<0.001
Injury	21.27	16.60-27.27	<0.001	20.21	13.36-30.56	<0.001	23.60	17.23-32.34	<0.001
Risky behavior									
Smoking	69.89	54.47-89.67	<0.001	43.02	30.39-60.89	<0.001	217.69	133.85-354.01	<0.001
Alcohol drinking	145.73	107.45-197.65	<0.001	125.84	82.43-192.10	<0.001	190.89	119.50-304.93	<0.001
Sexual intercourse	1.22	0.96-1.54	0.092	1.14	0.84-1.53	0.386	1.31	0.88-1.96	0.179

UAOR: unadjusted odds ratio

Table 11. Results of multivariable stepwise logistic regression analysis for suicide attempts by sex (GSHS, 2019)

Variables	Total			Male			Female		
	AOR	**95% CI**	***p* value**	**AOR**	**95% CI**	***p* value**	**AOR**	**95% CI**	***p* value**
Demographic factors									
Age (year)	0.89	0.80-0.99	0.036	-	-	-	0.84	0.73-0.97	0.017
Psychological factors									
No close friends	3.3	2.02-5.40	<0.001	5.68	2.55-12.63	<0.001	2.26	1.19-4.28	0.012
Anxiety	1.51	1.09-2.10	0.013	-	-	-	2.02	1.30-3.12	0.002
Injury and violence									
Being bullied	2.41	1.67-3.47	<0.001	2.88	1.65-4.99	<0.001	2.22	1.35-3.65	0.001
Physically attacked	2.59	1.80-3.73	<0.001	3.25	1.84-5.74	<0.001	2.76	1.67-4.54	<0.001
Injured	2.35	1.66-3.31	<0.001	2.78	1.59-4.87	<0.001	2.29	1.46-3.59	<0.001
Risky behaviors									
Cigarette smoking	5.02	3.17-7.95	<0.001	3.93	2.19-7.07	<0.001	13.62	5.55-33.45	<0.001
Alcohol drinking	12.83	8.00-20.58	<0.001	17.58	9.59-32.24	<0.001	5.17	2.07-12.90	<0.001
Sexual intercourse	1.86	1.17-2.95	0.008	2.14	1.16-3.95	0.014	-	-	-
Nagelkerke R^2		0.779			0.793			0.781	

AOR: adjusted odds ratio

Reference categories: rural location, had close friends, did not report anxiety, did not report loneliness, did not report being physically attacked, did not suffer any injury, did not report being bullied, no cigarette smoking, no alcohol drinking, and no sexual intercourse.

Variables not entered in the models: Total: living place and feeling lonely; Male: age, living place, anxiety, and feeling lonely; Female: living place, feeling lonely, and sexual intercourse

5. Discussion

The aim of our study was to determine the prevalence of health risk behaviors among Mongolian adolescents, and to characterize the relevant risk and protective factors, based on the data of the Mongolian GSHS 2013 and 2019.

Considering our specific aims, by assessing the relevant GSHS data of the Mongolian sample of school-going adolescents, we found that

- the prevalence of current smoking in 2013 was 8.5% (12.5% in males and 5% in females); the self-reported current smoking in Mongolian adolescents was in relation with being male, older age, alcohol use, other tobacco use, fast food and carbonated soft drink consumption, ideation of suicide, exposed to SHS, having had a sexual intercourse, spending more than 3 hours a day sitting, school truancy, and parental bonding in 2013.
- the prevalence of poor oral hygiene was 33% (including 37% of male students and 29.5% of female students); self-reported poor oral hygiene was in correlation with male gender, inadequate fruit and vegetable intake, one or both parents being smokers, exposure to SHS, poor parental supervision and disconnectedness, and physically inactive and sedentary behavior. In addition, fast food and carbonated soft drink consumption were protective factors for poor tooth brushing (i.e., less than 2 times a day) according to the 2013 data.
- the prevalence of the past 12-month suicide attempts was 32.1% (33.3% for the males and 31.3% for the females) in this study; adolescents who had sexual intercourse, alcohol drinking, anxiety-induced sleep disturbance, had no close friend, being bullied, physically attacked and injured were significantly higher risk of suicide attempts among Mongolian adolescents in 2019.

5.1 Factors associated with cigarette smoking among Mongolian adolescents

In our study the prevalence of current smoking was 8.5% in 2013. In the same year, the prevalence rate was higher (15.8%) in the Philippines, and lower (5.2%) in Vietnam (Peltzer & Pengpid, 2017); and the GSHS data of all three countries showed a male dominance in smoking. One year later, the 2014 Global Youth Tobacco Survey (GYTS) found that 14.3% of the students aged 13–15 years (20.3% of males and 8.3% of females) were cigarette smokers in Mongolia (WHO, 2014c).

As regards sex differences, smoking may in many Asian cultures be an accepted behavior for men but not for women, which tends to defame girls who smoke, whereas the society exerts higher tolerant attitude toward smoking males. Therefore, most of the female students may hesitate to confess their smoking status, which may distort the outcome of a survey (Oyewole et al., 2018).

Cigarette smoking and drinking alcohol share similar etiological factors, and generally the habits coexist (Bailey et al., 2015). The present study also confirmed an intense bond between the use of alcohol and tobacco among adolescents. The current study indicated that the current smoking of adolescents was also associated with the intake of carbonated soft drinks and fast food. Absence of both behavioral traits may reflect the person's "healthy choice": the young who chooses not to smoke is also likely to avoid carbonated soft drinks and fast food. Parental supervision/connectedness may also be linked to avoidance of carbonated soft drinks and junk food and tobacco use: it has been reported that in consequence of poor parental supervision, the prevalence of poor eating habits (sweetened beverages and fatty food) and smoking has increased (Terry-McElrath et al., 2014).

Furthermore, our study showed that adolescents who had current smoking were also more likely to have had engaged in sexual intercourse. Several studies have described that young people are interested in discovering the unknown, venturing a "cluster" of risk factors including sexual intercourse and substance uses (Shayo & Kalomo, 2019). Seidu has described that adolescent smokers spend more time using a computer than their counterparts (Seidu, 2019). Our findings proved that adolescent smokers were more likely to follow sedentary behavior (e.g., sitting and watching television, playing computer games) in contrast to non-smoking peers. In our study, SHS exposure was higher among current smokers, which is also supported by others' findings. Non-smokers tend to stay away from smokers in order to reduce their own environmental tobacco smoke exposure. Moreover, adolescents who do not smoke may have better awareness of the effects of SHS, and therefore, they might be more keen on avoiding SHS exposure than those who smoke, which may provide an explanation for why they are less likely to be exposed to SHS (Bhaskar et al., 2016).

Our results further indicated, in agreement with previous investigations, that current smoking was associated with truancy. It is possible that smoking adolescents have more unsupervised time as they are absent from school (Pengpid & Peltzer, 2017). Parent-child connectedness is one of the effective ways to reduce risky behaviors such as tobacco use. Due to the modern lifestyle and

socioeconomic changes, parents cannot spend enough time with their children during their secondary school years. Therefore, poor parental connectedness and supervision proved to be predictors of current smoking (Glozah et al., 2018). However, in our study, parental connectedness and parental supervision, together with marijuana use, loneliness, being bullied, poor oral hygiene, and parental smoking, were not significantly associated with current smoking in school-aged students in Mongolia (see ***Table 6***).

5.2 Factors associated with poor oral hygiene among Mongolian adolescents

The prevalence of poor oral hygiene was 33% in 2013. This result was lower than the data from the 2010 GSHS Mongolia, when almost one-third of the students (41.8% of boys and 31.6% of girls) were poor tooth brusher (WHO, 2010), and it was lower than the prevalence in Afghanistan adolescents (60.7%) (Pengpid & Peltzer, 2019b). However, the last Mongolian result was higher compared to the Cambodian adolescents (20.2%) (Peltzer et al., 2016).

In concordance with a previous study (McKittrick & Jacobsen, 2014), our work identified males as showing poor oral hygiene behavior (less frequent tooth brushing) more frequently. It is explained that girls were more considerate of their body and appearance, and thus for their oral health, than boys.

High consumption of soft drinks among both younger and older adolescents was described as a predictor of poorer oral health and unhealthier lifestyle compared to those with lower consumption (Hasselkvist et al., 2014). In contrast to that, findings of the current study showed that frequent carbonated soft drink and fast-food consumption was a protective factor for tooth brushing less than 2 times a day. Our study confirmed the association between inadequate fruit and vegetable intake and poor dental hygiene, indicating that among young people, the consumption of unhealthy foods (lacking fruits and vegetables) is a part of wrong oral and general health behavior. It is also possible that low parental control may result in a higher prevalence of inadequate fruit and vegetable intake and poor oral health (Pengpid & Peltzer, 2021b).

Some previous studies have highlighted the relationship between oral and general health behaviors. Regarding general health behaviors, this study found an association between being physically inactive, sedentary leisure time, and poor tooth brushing (Pengpid & Peltzer, 2019b). Unhealthy lifestyles may lead to worse poor oral and general hygiene.

Furthermore, in this study, smoking behaviors (parental smoking and second-hand smoke exposure) were higher among poor tooth brushers. Adolescents with good oral health behavior tend to avoid smokers, thus reducing their SHS exposure (Peltzer & Pengpid, 2014). Additionally, adolescents who have good oral and general hygiene behavior may have better knowledge of the hazardous effects of smoking and passive smoke and, therefore, they might tend to avoid SHS exposure compared to those who smoke.

Parental involvement appeared to be determinant in several health behaviors, including oral health among adolescents. Socio-economic changes also affect parental care, as modern parents need to work more, cannot supervise children, and sometimes, they do not know about their children's general and dental hygiene problems during the adolescent development. The results presented here indicate that a low level of parental bonding is associated with poor oral hygiene in adolescents, similarly to the findings of Hamilton et al. (Hamilton et al., 2018).

5.3 Factors associated suicide attempts among Mongolian adolescents

The prevalence of the past 12-month suicide attempts was 32.1% in this study, which is much higher than in previous studies based on the Mongolian GSHS of 2010 (8.7%) (Altangerel et al., 2014) and 2013 (10%) (Davaasambuu et al., 2017). Mongolia belongs to the Western Pacific (WPR) region, which exhibited the highest overall prevalence of suicide attempts (X. Liu et al., 2018). The prevalence of suicide attempts is a major concern in LMICs among young people aged 10–19 years. In addition, this result was also higher than the 12-month prevalence of suicide attempts in China (9.4%) (Z. Z. Liu et al., 2018), the Philippines (15.34%) (Lagman et al., 2021), Vietnam (21.2%) (Nguyen Thi Khanh et al., 2020), or Thailand (13.3%) (WHO, 2015d), but lower than in the Solomon Islands (36.9%) (Sharma et al., 2017).

In a previous study (Biswas et al., 2020) based on the GSHS data of 82 countries from 2003 to 2015, it has been found that the incidence of suicide attempts increases with age between 12 and 17 years. In contrast, our results show that older age students (between 13 and 18 years of age) were less likely to have suicidal behavior.

Considering the gender role, our findings show only small differences in the predictors of attempted suicide in males and females. Age and anxiety remained significant in case of females; while sexual intercourse was a significant predictor only in males.

This study found that having no close friends was a risk factor for suicide attempts among adolescents. It is well known that having no close friends is associated with poor mental health including suicide attempts (Quarshie et al., 2020). Conversely, school-going students who had support from their classmates were protected from experiencing suicide attempts (Seidu et al., 2020).

Adolescents who had worry-induced sleep disturbance had higher odds of attempted suicide (Ahinkorah et al., 2021). In this case, sleep disturbance is likely to be a symptom of anxiety. It has been reported that adolescents showing high levels all characteristics of anxiety disorder, including low distress tolerance and uncontrolled emotion, tend to have suicide attempts (O'Neil Rodriguez & Kendall, 2014). Anxiety in itself was found to be correlated with attempted suicide in the present study.

Findings from this study suggest that being bullied was strongly associated with suicide attempts. Being bullied is known to increase the risk of mental health problems, including poor motivational control, which may lead to increased risk of adolescent suicide attempts (J. J. Tang et al., 2020). In order to prevent committing suicide in this population, it will also be crucial to improve anti-violence interventions.

The results of this study, namely that the social adversities of being physically attacked increased the odds of suicide attempts, were consistent with evidence from the GSHS in other South East Asian countries, including Indonesia, Laos, the Philippines, Thailand, and Timor-Leste (Pengpid & Peltzer, 2020). Evidence suggests that this relationship is often mediated by other factors. Students who are physically attacked by their peers are more likely to be depressed, have difficulty to win friends, have poorer relationships with classmates, and experience loneliness (Dema et al., 2019).

The present study found that injury contributed to the increased likelihood of high psychological distress including suicidal behavior among young people. Injury may have poorly affected the physical and psychological health of adolescents, making them vulnerable to mental distress (Aboagye et al., 2021).

This study confirmed previous findings (Pengpid & Peltzer, 2019a; Pengpid & Peltzer, 2019c) showing an association between substance use, including current smoking and alcohol consumption, and suicide attempts in the adolescent population. An association between substance use and poor mental health or suicide attempts may refer to a clustering of risky behaviors.

Our findings show that sexual intercourse was significantly associated with suicide attempts, which is in concordance with previous research (Smith et al., 2020). In that research, it has been concluded that adolescents who reported having their first sexual intercourse before 14 years of age were more likely to have several psychological problems compared to adolescence who had their first sexual intercourse after the age of 14 years.

Recent studies have described that urban location (Goldman-Mellor et al., 2018) and feeling lonely (Pengpid & Peltzer, 2020) were strongly associated with suicide attempts, whereas our present study did not find an association between locations, loneliness, and suicide attempts.

5.4 Preventive measures in Mongolia

In Mongolia, the tobacco control law issued in 2005 contained a number of broad statements concerning the promotion of research and the exchange of information on tobacco control, and included a provision on the establishment of an integrated system of tobacco surveillance. It prohibits the sale of tobacco products by vending machine and via internet, and the sale of cigarettes by the piece or in small packs. In addition, the law prohibits the sale of tobacco products in entertainment areas, bars, and within 500 meters of secondary schools and student dormitories. The sale of tobacco products is prohibited to persons under the age of 21 (Baasanjav et al., 2006). Additionally, the National Program on NCD Control was approved in 2005, and these documents were amended in 2012 and 2015, respectively (State Great Khural of Mongolia, 2012).

In 2006, the Mongolian Government approved the “National Oral Health” program to reduce caries prevalence (MMH, 2006). In 2018, the “Healthy Teeth-Healthy Child” national program to address dental diseases was ratified. This program, including dental checkup, counselling, fluoride varnish, caries treatment, root canal treatment, and tooth extraction in children aged 2 to 12, will be implemented by 2023 (MMH, 2018). A total of 121,000 children had been provided oral health services, examinations, and advice by June 2020 (MMH, 2020).

Information on the risk factors of suicide attempts is fundamental for formulating an effective suicide prevention program or intervention. Fostering socio-emotional life skills in adolescents is one of the four effective evidence-based interventions to prevent suicide, as stated in the LIVE LIFE implementation guideline (WHO, 2021b). In order to achieve that, school-based interventions in Mongolia should focus on strengthening general mental health, mitigating violence and bullying, as well as on controlling and preventing risky behaviors such as tobacco or alcohol

use. Improved sexual health education, e.g., teaching strategies for refusing unwanted sex, might also contribute to reducing the risk of attempted suicide. Better self-esteem and development of life skills (including proper habits and lifestyle for a good general and mental health, healthy eating behavior, and healthy decision making) have been proven to decrease the risk of suicide among young people.

Considering the above-mentioned, we can state that although population-based efforts have been done to improve the health of the general population of Mongolia, the availability of comprehensive health promoting programs for the adolescents is limited. Therefore, efficient and target-oriented programs for prevention of unhealthy behaviors need to be started among Mongolian youths.

5.4.1 Improving school-based health interventions for Mongolian youths

The life-course narrative of children and adolescents of the country demonstrates that while the government and its partners have made remarkable progress in achieving early childhood development outcomes, persistent gaps remain in programming for older children and adolescents. The children's and adolescents' invisibility in data and in decision making leaves them in a cycle of inter-generational inequality (UNICEF, 2020).

Schools can play a crucial role in health promotion mainly by improving schoolchildren's health literacy, changing their behaviors and promoting academic achievements. The WHO, UNICEF and UNESCO support various international initiatives such as the WHO's "Global School Health Initiative" (WHO, 1999) and the "Focusing Resources on Effective School Health Initiative" (Joerger & Hoffmann, 2002) which share the recognition of the importance of addressing school health in an integrated and comprehensive approach.

Mukamana and Johri demonstrated that school-based interventions have the potential to improve the health and well-being of students and their communities especially by focusing on both individual and environmental determinants of health (Mukamana & Johri, 2016).

In Mongolia, health education classes have been introduced at primary (with focus on hand and oral hygiene behaviors), secondary (with focus on nutritional habits, diet and physical activity) and high (focusing on reproductive health, and mental well-being/communication skills) level of education to improve adolescents' understanding of their body and health. However, key informants reported that the quality of these classes is very poor, and therefore little impact was

observed (MMEC, 2020). In absence of appropriate health specialists within the education system, these classes are taught by non-qualified biology teachers or physical education teachers. The Mongolian Ministry of Health (MMH) introduced a specialized program on adolescent health, which includes a two-and-half day training for medical doctors at rural area hospitals a few years ago. The two core focus areas are sexual and reproductive health, and mental health, which means that these appointed specialists remain ill-equipped to handle sensitive cases involving vulnerable and often traumatized adolescents (UNICEF, 2020).

Our study results showed that a remarkable proportion of school-attending adolescents were current smokers, had poor oral hygiene, and had a history of attempted suicide. Male adolescents were more likely to smoke and having poor oral hygiene than female ones, and increase in age was associated with progressively fewer suicide attempts among female adolescents. Between the health damaging behaviors, the following correlations were revealed in the present study. Adolescents who used substances (e.g. alcohol), or followed unhealthy diet (e.g. inadequate fruit and vegetable intake), had other risky behaviors (e.g. physical inactivity), and mental distress (loneliness, anxiety-induced sleep disturbance, etc.). Those being injured and/or bullied and not being controlled by their parents were more likely to smoke, having poor oral hygiene and attempting suicide. The findings of our research showed that on the one hand the unfavorable behavior of adolescents is related to the school as an important setting of health promotion, on the other hand it is influenced by the parents' behavior and attitude.

Based on our results we can conclude that a comprehensive health prevention program/intervention involving both schools and families is needed in order to improve the health and health behavior of Mongolian adolescents. A school-based health prevention program/intervention should include the following:

- Targeted prevention of substance use, especially smoking prevention, promotion of healthy nutrition, oral and mental health among school-attending adolescents such as to give information about harmful effects of substance use and how they damage their body in future life.
- Improving refusal skills and self-efficacy as it relates directly to tobacco or alcohol use or pressure to use.
- Distribution of materials on health risk behaviors and healthy lifestyle.

- Construction of hygienic facilities, supervised tooth brushing, to give information about "tooth-friendly food".
- Training for life-skills including self-esteem and stress management; small group discussion, student competitions and school-wide health promotion efforts and outreach to families and communities.
- Promotion of safe and healthy learning environment.
- Use of technological innovation and digital platforms to provide learning tools for adolescents with information and knowledge on healthy lifestyle, reproductive health and mental health/well-being.
- Improve knowledge and skills of school social workers and doctors to address adolescent health risk behaviors including substance use, nutritional habits, oral hygiene, mental health, and reproductive health.

These activities should be implemented by schoolteachers, students, school nurses or other community members. Interventions focusing on individual factors have to involve the training of teachers, the education of students on relevant health subjects, and the training or sensitization of students' parents or communities.

School-based learning activities have to be integrated in regular school curricula or provided through extracurricular activities. Moreover, interventions targeting environmental factors involve the establishment or improvement of school health policies, provision of health services, better hygienic facilities, partnerships between schools and communities. These interventions will not only focus on environmental factors but also include health education components to improve students' knowledge and attitude.

Parents have a strong influence on the lives of their children and can positively affect adolescents' mental and physical well-being through encouragement and facilitation. Recent studies indicated that a variety of parental involvement factors including parents' warmth, supportive parenting, parental encouragement, and overall parental engagement were associated with improved health outcomes and educational achievements among adolescents (Davids et al., 2017; Benner et al., 2016). Baig et al. reported that adolescents with higher parental involvement had significantly higher odds of good nutrition, good hygiene including oral hygiene and physical activity, and lower odds of physical harm, being bullied, poor mental health, and substance use

including tobacco use (Baig et al., 2021). These studies are in correlation with our results, so it can be stated that parents have a key role in the health promotion of children and adolescents, and this should be considered as an important aspect of capacity building in school-based health promotion programs.

The International Union of Health Promotion Education (IUHPE) guidelines state that a school program for health promotion should allow 3–4 years to achieve intermediate goals; and sustain them over a period of 5–7 years to achieve long term objectives (IUHPE, 2008). Thus, allowing enough time to monitor planned activities and to achieve anticipated outcomes is necessary.

5.5 Strengthens and limitations of study

GSHS was a large, nationally representative survey, the data of which were collected by the WHO and the CDC. The GSHS is globally recognized and implemented providing highly generalizable data and findings. Schools and students were randomly selected from both urban and rural areas. Nonetheless, the findings in our study should be interpreted as having several limitations. First, there are no reliability and validity studies examining GSHS items within the context of Mongolian culture. Second, the study was cross-sectional, which meant that at one point in time, the students who were absent on the day of survey could not be included. Also, cross-sectional studies do not prove causation, but they provide information on correlations. Third, a self-report questionnaire was applied, so the children might have provided invalid answers. Finally, although the involvement of parents/guardians may protect young people from risk factors, the GSHS 2019 in Mongolia has not assessed parental engagement.

6. Conclusions

Using a large and representative sample of adolescents in Mongolia, our study found that the prevalence of current smoking was 8.5%, poor oral hygiene was 33%, and a high prevalence (32.1%) of suicide attempts was observed. Several demographic factors, including male gender and older age; substance use including alcohol and other tobacco use; dietary behaviors including carbonated soft drinks, fast food, inadequate fruit and vegetable intake; risky behaviors including having had sexual intercourse, sitting more than 3 hours a day, being physically inactive, one or both parents smoking and exposure to SHS; psychological factors including anxiety-induced sleep disturbance and having no close friend; injury and violence including being bullied, having been frequently physically attacked or injured; and parental factors including truancy, poor parental supervision, connectedness and bonding were found to be significantly associated with health risk behaviors such as current cigarette smoking, poor oral hygiene, and suicide attempts.

This study was focused on health risk behaviors including smoking behavior, poor oral hygiene and suicide attempts and its relation to risky behaviors. A better understanding of these relationships will contribute to designing a better health promotion and wellness education program.

Young people aged between 10 and 19 years face many pressures and challenges, including increasing academic demands and expectations, changing social relationships with family and peers, and increasing exposure to online interactions. Adolescence is a period of rapid physical growth and brain development, bringing its own physical and emotional challenges. These years mark a period of increasing autonomy during which health-related behaviors develop, so independent decision-making may influence the young's current and future health. Behaviors established during this transition period can continue into adulthood, affecting issues such as substance use, general and oral health, mental health, as well as longer-term health outcomes. Exposure to alcohol or tobacco use, poor general and oral hygiene, poor mental health, for example, present risks not only to the adolescents' current health and well-being, but also to their future health. Association of adolescents' smoking behavior, poor oral hygiene, and suicide attempts with other risky behaviors is an important issue in adolescent health research, and such work could provide a better understanding of the characteristics of Mongolian teenagers in their risky behaviors.

Our results underline that the problem is increasing among adolescents, and the results may call the attention of the Mongolian government to the need to develop an independent and comprehensive adolescent school-based health promotion programs. Such programs should be combined with prevention of tobacco use, general, oral and mental health promotion, and lifestyle intervention programs for this young population as the future adult generation.

Strengthening the comprehensive health promotion and prevention program at schools means reduction and avoidance of unhealthy habits such as smoking and use of other substances; choosing healthy diet and food; increasing physical activity; reducing sitting long period of time at the computer or playing video games or during school classes; increasing awareness of personal general health including oral and mental health. It also includes providing information related to risk and protective factors in youth's health, especially for teachers and students at teacher's training schools, so that they can transfer the knowledge to their students. Important elements of that include mitigating violence and bullying, improving sexual health education, e.g., teaching strategies for refusing unwanted sex, which might also contribute to a reduced risk for attempted suicides among the Mongolian adolescents. These are the key components of how to handle the adolescent health risk behaviors.

Most of the school-based programs were developed and implemented in the western countries, and the availability of school-based intervention programs for adolescent health promotion in Asian countries, especially in Mongolia, is limited. Parallel with the implementation of a school-based program an indicator system has to be developed to measure the achievements of the program. The indicators based on the GSHS questionnaire are suitable to follow the changes, but some school and program specific indicators are also needed. The development of these specific indicators can be done in the framework of another study in parallel with the characterization of the school programs. These specific indicators are best developed parallel with shaping the school-based programs.

7. References

Abbott, M. B., & Vlasses, C. H. (2011). Nelson Textbook of Pediatrics. *JAMA*, *306*(21). https://doi.org/10.1001/jama.2011.1775

Aboagye, R. G., Seidu, A. A., Bosoka, S. A., Hagan, J. E., & Ahinkorah, B. O. (2021). Prevalence and correlates of unintentional injuries among in-school adolescents in Ghana. *International Journal of Environmental Research and Public Health*, *18*(13). https://doi.org/10.3390/ijerph18136800

ACS. (2016). *The Tobacco Atlas Mongolia Fact Sheet*. Available online: http://tobaccoatlas.org/country/mongolia/ Accessed on 08, April, 2022.

Ahinkorah, B. O., Aboagye, R. G., Arthur-Holmes, F., Hagan, J. E., Okyere, J., Budu, E., Dowou, R. K., Adu, C., & Seidu, A. A. (2021). A multi-country analysis of prevalence of anxiety-induced sleep disturbance and its associated factors among in-school adolescents in sub-Saharan Africa using the global school-based health survey. *Healthcare (Switzerland)*, *9*(2). https://doi.org/10.3390/healthcare9020234

Aliza Lodz, N., Abd Mutalip, M. H., Fikri Mahmud, M. A., Awaluddin S, M., Yoep, N., Paiwai, F., Hazrin Hashim, M., Omar, M., Mohamad Kasim, N., & Ani Ahmad, N. (2019). Risky Sexual Behaviours among School-going Adolescent in Malaysia-Findings from National Health and Morbidity Survey 2017. *Journal of Environmental Science and Public Health*, *03*(02). https://doi.org/10.26502/jesph.96120059

Altangerel, U., Liou, J. C., & Yeh, P. M. (2014). Prevalence and predictors of suicidal behavior among mongolian high school students. *Community Mental Health Journal*, *50*(3). https://doi.org/10.1007/s10597-013-9657-8

Baasanjav et al. (2006). *ASSESSMENT of the CONFORMITY of NATIONAL POLICIES with the FRAMEWORK CONVENTION on TOBACCO CONTROL in MONGOLIA*. Available online:https://assets.publishing.service.gov.uk/media/57a08c36e5274a31e0001084/Mongolia-Final_Report-Tobacco_report_Eng.pdf Accessed on 08, April, 2022.

Baig, T., Ganesan, G. S., Ibrahim, H., Yousuf, W., & Mahfoud, Z. R. (2021). The association of parental involvement with adolescents' well-being in Oman: evidence from the 2015 Global School Health Survey. *BMC Psychology*, *9*(1). https://doi.org/10.1186/s40359-021-00677-5

Bailey, A., Istre, G. R., Nie, C., Evans, J., Quinton, R., & Stephens-Stidham, S. (2015). Truancy and injury-related mortality. *Injury Prevention*, *21*(1). https://doi.org/10.1136/injuryprev-2014-041276

Beal, T., Morris, S. S., & Tumilowicz, A. (2019). Global Patterns of Adolescent Fruit, Vegetable, Carbonated Soft Drink, and Fast-Food Consumption: A Meta-Analysis of Global School-Based Student Health Surveys. *Food and Nutrition Bulletin*, *40*(4). https://doi.org/10.1177/0379572119848287

Beautrais, A. L. (2006). Suicide in Asia. In *Crisis* (Vol. 27, Issue 2). Available online: https://doi.org/10.1027/0227-5910.27.2.55

Benner, A. D., Boyle, A. E., & Sadler, S. (2016). Parental Involvement and Adolescents' Educational Success: The Roles of Prior Achievement and Socioeconomic Status. *Journal of Youth and Adolescence*, *45*(6). https://doi.org/10.1007/s10964-016-0431-4

Bhaskar, R. K., Sah, M. N., Gaurav, K., Bhaskar, S. C., Singh, R., Yadav, M. K., & Ojha, S. (2016). Prevalence and correlates of tobacco use among adolescents in the schools of Kalaiya, Nepal: A cross-sectional questionnaire based study. *Tobacco Induced Diseases*, *14*(1). https://doi.org/10.1186/s12971-016-0075-x

Biswas, T., Scott, J. G., Munir, K., Renzaho, A. M. N., Rawal, L. B., Baxter, J., & Mamun, A. A. (2020). Global variation in the prevalence of suicidal ideation, anxiety and their correlates among adolescents: A population based study of 82 countries. *EClinicalMedicine*, *24*. https://doi.org/10.1016/j.eclinm.2020.100395

Brener, N. D., Kann, L., Shanklin, S., Kinchen, S., Eaton, D. K., Hawkins, J., & Flint, K. H. (2013). Methodology of the youth risk behavior surveillance system - 2013. *MMWR Recommendations and Reports*, *62*(1).

Bundhamcharoen, K., Aungkulanon, S., Makka, N., & Shibuya, K. (2016). Economic burden from smoking-related diseases in Thailand. *Tobacco Control*, *25*(5). https://doi.org/10.1136/tobaccocontrol-2015-052319

Campisi, S. C., Carducci, B., Akseer, N., Zasowski, C., Szatmari, P., & Bhutta, Z. A. (2020). Suicidal behaviours among adolescents from 90 countries: A pooled analysis of the global school-based student health survey. In *BMC Public Health* (Vol. 20, Issue 1). https://doi.org/10.1186/s12889-020-09209-z

Chau, K., Kabuth, B., & Chau, N. (2014). Gender and family disparities in suicide attempt and role of socioeconomic, school, and health-related difficulties in early adolescence. *BioMed Research International*, *2014*. https://doi.org/10.1155/2014/314521

Chen, Y. L., Ho, H. Y., Hsiao, R. C., Lu, W. H., & Yen, C. F. (2020). Correlations between quality of life, school bullying, and suicide in adolescents with attention-deficit hyperactivity disorder. *International Journal of Environmental Research and Public Health*, *17*(9). https://doi.org/10.3390/ijerph17093262

Chimed-Ochir, O., Delgermaa, V., Takahashi, K., Purev, O., Sarankhuu, A., Fujino, Y., Bayarmagnai, N., Dugee, O., Erkhembayar, R., Lkhagvaa, B., Ochir, C., Sosorburam, T., & Naghavi, M. (2022). Mongolia health situation: based on the Global Burden of Disease Study 2019. *BMC Public Health*, *22*(1). https://doi.org/10.1186/s12889-021-12070-3

Chinzorig, T., Aida, J., Cooray, U., Nyamdorj, T., Mashbaljir, S., Osaka, K., & Garidkhuu, A. (2019). Inequalities in caries experience among mongolian children. *International Journal of Environmental Research and Public Health*, *16*(20). https://doi.org/10.3390/ijerph16203892

Crosby, A. E., Ortega, L., & Melanson, C. (2011). Self-directed Violence Surveillance: Uniform Definitions and Recommended Data Elements, Version 1.0. *Centers for Disease Control and Prevention, National Center for Injury Prevention and Control*, *1*.

Dashpuntsag, K., Chandaga, U., Tserennadmid, N., Bat-Ochir, U., Mukhtar, Y., Altankhuyag, G. E., Gombodorj, N., Dulamsuren, O., & Jaalkhorol, M. (2021). Awareness and Attitudes of Mongolian Adolescents and Youth toward Alcohol Consumption and Alcohol-related Harm. *Addict Health*, *Summer*, *13*(3). https://doi.org/10.22122/ahj.v13i3.1250

Davaasambuu, S., Batbaatar, S., Witte, S., Hamid, P., Oquendo, M. A., Kleinman, M., Olivares, M., & Gould, M. (2017). Suicidal plans and attempts among adolescents in Mongolia: Urban versus rural differences. *Crisis*, *38*(5). https://doi.org/10.1027/0227-5910/a000447

Davids, E. L., Roman, N. V., & Leach, L. (2017). The link between parenting approaches and health behavior: A systematic review. *Journal of Human Behavior in the Social Environment*, *27*(6), 589–608. https://doi.org/10.1080/10911359.2017.1311816

De Leon, J., Rendon, D. M., Baca-Garcia, E., Aizpuru, F., Gonzalez-Pinto, A., Anitua, C., & Diaz, F. J. (2007). Association between smoking and alcohol use in the general population:

Stable and unstable odds ratios across two years in two different countries. *Alcohol and Alcoholism*, *42*(3). https://doi.org/10.1093/alcalc/agm029

Dema, T., Tripathy, J. P., Thinley, S., Rani, M., Dhendup, T., Laxmeshwar, C., Tenzin, K., Gurung, M. S., Tshering, T., Subba, D. K., Penjore, T., & Lhazeen, K. (2019). Suicidal ideation and attempt among school going adolescents in bhutan- A secondary analysis of a global school-based student health survey in Bhutan 2016. In *BMC Public Health* (Vol. 19, Issue 1). https://doi.org/10.1186/s12889-019-7791-0

Dorland. (2012). Dorland's Illustrated Medical Dictionary 32nd edition. In *Philadelphia: Elsevier Saunders* (Vol. 32).

Faeh, D., Viswanathan, B., Chiolero, A., Warren, W., & Bovet, P. (2006). Clustering of smoking, alcohol drinking and cannabis use in adolescents in a rapidly developing country. *BMC Public Health*, *6*. https://doi.org/10.1186/1471-2458-6-169

GBD 2016 Alcohol Collaborators. (2018). Alcohol use and burden for 195 countries and territories, 1990–2016: a systematic analysis for the G. *The Lancet*, *392*(10152).

GBD 2017 Risk Factor Collaborators. (2019). Erratum: Global, regional, and national comparative risk assessment of 84 behavioral, environmental and occupational, and metabolic risks or clusters of risks for 195 countries and territories, 1990–2017: a systematic analysis for the Global Burden of Disease Study 2017 (The Lancet (2018) 392(10159) (1923–1994), (S0140673618322256) (10.1016/S0140-6736(18)32225-6)). In *The Lancet* (Vol. 393, Issue 10167). https://doi.org/10.1016/S0140-6736(18)33216-1

Glick, M., Monteiro Da Silva, O., Seeberger, G. K., Xu, T., Pucca, G., Williams, D. M., Kess, S., Eiselé, J. L., & Séverin, T. (2012). FDI Vision 2020: Shaping the future of oral health. In *International Dental Journal* (Vol. 62, Issue 6). https://doi.org/10.1111/idj.12009

Glozah, F. N., Asante, K. O., & Kugbey, N. (2018). Parental involvement could mitigate the effects of physical activity and dietary habits on mental distress in Ghanaian youth. *PLoS ONE*, *13*(5). https://doi.org/10.1371/journal.pone.0197551

Goldman-Mellor, S., Allen, K., & Kaplan, M. S. (2018). Rural/Urban Disparities in Adolescent Nonfatal Suicidal Ideation and Suicide Attempt: A Population-Based Study. *Suicide and Life-Threatening Behavior*, *48*(6). https://doi.org/10.1111/sltb.12390

Hamilton, K., Cornish, S., Kirkpatrick, A., Kroon, J., & Schwarzer, R. (2018). Parental supervision for their children's toothbrushing: Mediating effects of planning, self-efficacy, and action control. *British Journal of Health Psychology*, *23*(2). https://doi.org/10.1111/bjhp.12294

Hasselkvist, A., Johansson, A., & Johansson, A. K. (2014). Association between soft drink consumption, oral health and some lifestyle factors in Swedish adolescents. *Acta Odontologica Scandinavica*, *72*(8). https://doi.org/10.3109/00016357.2014.946964

Inchley, J., Currie, D., Budisavljevic, S., Torsheim, T., Jåstad, A., Cosma, A., Kelly, C., & Már Arnarsson, Á. (2018). Spotlight on adolescent health and well-being survey in Europe and Canada International report VOLUME 1. KEY FINDINGS. In *Health Behaviour in School-aged Children*. HBSC. Available online: http://apps.who.int/bookorders. Accessed on 08, April, 2022.

IUHPE. (2008). Achieving health promoting schools: guidelines for promoting health in schools. *Iuhpe*.

Jargaltsogt, D., Bazar, O., Sharkhuu, M.-O., Altansukh, S., & Bazar, A. (2018). The Results of National Oral Health Survey, Mongolia. *Central Asian Journal of medical Sciences*, *4*(1), 61-68.

Jigjid, B., Ueno, M., Shinada, K., & Kawaguchi, Y. (2009). Early childhood caries and related risk factors in Mongolian children. *Community Dental Health*, *26*(2). https://doi.org/10.1922/CDH_2298Jigjid08

Jimba, M., Poudel, K. C., Poudel-Tandukar, K., & Wakai, S. (2005). School health research in low-income countries in East Asia and the Pacific. *Japan Medical Association Journal*, *48*(4).

Joerger C, & Hoffmann A. (2002). *FRESH: A Comprehensive School Health Approach to Achieve EFA.*

Keats, E. C., Rappaport, A. I., Shah, S., Oh, C., Jain, R., & Bhutta, Z. A. (2018). The dietary intake and practices of adolescent girls in low-and middle-income countries: A systematic review. In *Nutrients* (Vol. 10, Issue 12). MDPI AG. https://doi.org/10.3390/nu10121978

Kim, G. M., Kim, J., Hyun, M. K., Choi, S., & Woo, J. M. (2019). Comparison of the risk factors of Korean adolescent suicide residing in high suicidal regions versus those in low suicidal regions. *Psychiatria Danubina*, *31*(4). https://doi.org/10.24869/psyd.2019.397

Kim, W., Chun, S., & Lee, S. A. (2021). Suicide attempt and violence victimization in Korean adolescents with migrant parents: A nationwide study. *Journal of Affective Disorders*, *290*. https://doi.org/10.1016/j.jad.2021.04.065

Koyanagi, A., Oh, H., Carvalho, A. F., Smith, L., Haro, J. M., Vancampfort, D., Stubbs, B., & DeVylder, J. E. (2019). Bullying Victimization and Suicide Attempt Among Adolescents Aged 12–15 Years From 48 Countries. *Journal of the American Academy of Child and Adolescent Psychiatry*, *58*(9). https://doi.org/10.1016/j.jaac.2018.10.018

Lagman, J. G., Gara, M., Baweja, R., & Kim, W. J. (2021). Correlates of Suicide Attempts in Filipino Youths: An Analysis Based on the 2015 Global School-Based Student Health Survey. *Cureus*. https://doi.org/10.7759/cureus.18100

Lange, S., Koyanagi, A., Rehm, J., Roerecke, M., & Carvalho, A. F. (2020). Association of Tobacco Use and Exposure to Secondhand Smoke with Suicide Attempts among Adolescents: Findings from 33 Countries. *Nicotine and Tobacco Research*, *22*(8). https://doi.org/10.1093/ntr/ntz172

Larson, N. I., Story, M., Perry, C. L., Neumark-Sztainer, D., & Hannan, P. J. (2007). Are diet and physical activity patterns related to cigarette smoking in adolescents? Findings from project EAT. *Preventing Chronic Disease*, *4*(3).

Li, L., You, D., Ruan, T., Xu, S., Mi, D., Cai, T., & Han, L. (2021). The prevalence of suicidal behaviors and their mental risk factors among young adolescents in 46 low- and middle-income countries. *Journal of Affective Disorders*, *281*. https://doi.org/10.1016/j.jad.2020.11.050

Liu, X., Huang, Y., & Liu, Y. (2018). Prevalence, distribution, and associated factors of suicide attempts in young adolescents: School-based data from 40 low-income and middle-income countries. *PLoS ONE*, *13*(12). https://doi.org/10.1371/journal.pone.0207823

Liu, Z. Z., Wang, Z. Y., Bo, Q. G., Qi, Z. B., Xu, R. J., Jia, C. X., & Liu, X. (2018). Suicidal behaviours among Chinese adolescents exposed to suicide attempt or death. *Epidemiology and Psychiatric Sciences*. https://doi.org/10.1017/S2045796018000756

Mars, B., Heron, J., Crane, C., Hawton, K., Kidger, J., Lewis, G., Macleod, J., Tilling, K., & Gunnell, D. (2014). Differences in risk factors for self-harm with and without suicidal intent: Findings from the ALSPAC cohort. *Journal of Affective Disorders, 168*. https://doi.org/10.1016/j.jad.2014.07.009

McKittrick, T. R., & Jacobsen, K. H. (2014). Oral hygiene practices among middle-school students in 44 low- and middle-income countries. *International Dental Journal*, *64*(3). https://doi.org/10.1111/idj.12094

Mergl, R., Koburger, N., Heinrichs, K., Székely, A., Tóth, M. D., Coyne, J., Quintão, S., Arensman, E., Coffey, C., Maxwell, M., Värnik, A., van Audenhove, C., McDaid, D., Sarchiapone, M., Schmidtke, A., Genz, A., Gusmão, R., & Hegerl, U. (2015). What are reasons for the large gender differences in the lethality of suicidal acts? An epidemiological analysis in four european countries. *PLoS ONE, 10*(7). https://doi.org/10.1371/journal.pone.0129062

Miranda-Mendizabal, A., Castellví, P., Parés-Badell, O., Alayo, I., Almenara, J., Alonso, I., Blasco, M. J., Cebrià, A., Gabilondo, A., Gili, M., Lagares, C., Piqueras, J. A., Rodríguez-Jiménez, T., Rodríguez-Marín, J., Roca, M., Soto-Sanz, V., Vilagut, G., & Alonso, J. (2019). Gender differences in suicidal behavior in adolescents and young adults: systematic review and meta-analysis of longitudinal studies. In *International Journal of Public Health* (Vol. 64, Issue 2). https://doi.org/10.1007/s00038-018-1196-1

ММЕС. (2020). Боловсрол, соёл шинжлэх ухааны яам. *Бага боловсролын эрүүл мэндийн хөтөлбөрийг хэрэгжүүлэх арга зүйн зөвлөмж (in Mongolian)*. Available online: www.meds.gov.mn/post/67588 Accessed on 08 April, 2022.

ММН. (2006). Амны Хөндийн Үндэсний Хөтөлбөр (in Mongolian). Available online: https://legalinfo.mn/mn/detail/1790?fbclid=IwAR3aPgMssyBoNNeK2LFMx7y3PK-1VM7ApAFJpfo-wmNxY6yufHIEeoTTsUk Accessed on 08 April, 2022.

ММН. (2018). Эрүүл Шүд-Эрүүл Хүүхэд Үндэсний Хөтөлбөр (in Mongolian). Available online: http://tushig.se.gov.mn/upload/files/2020-04-29_09-37-01.pdf?fbclid=IwAR2tWIpEbi3PcdiyD-6dT5Lha_SbryWQIAi-8pQ-vYBiEmT95ad7vtB_vFI Accessed on 08 April, 2022.

MMH. (2020). National Program for Healthy Tooth-Healthy Child. Available online: https://montsame.mn/mn/read/227540 Accessed on 08 April 2022.

Mukamana, O., & Johri, M. (2016). What is known about school-based interventions for health promotion and their impact in developing countries? A scoping review of the literature. *Health Education Research*, *31*(5). https://doi.org/10.1093/her/cyw040

Murphy, E., O'Sullivan, I., O'Donovan, D., Hope, A., & Davoren, M. P. (2016). The association between parental attitudes and alcohol consumption and adolescent alcohol consumption in Southern Ireland: A cross-sectional study. *BMC Public Health*, *16*(1). https://doi.org/10.1186/s12889-016-3504-0

NCHD. (2020). Health Indicator 2019. Available online: www.hdc.gov.mn Accessed on 08 April, 2022.

NCPH. (2017). NUTRITION STATUS OF THE POPULATION OF MONGOLIA NATIONAL CENTER FOR PUBLIC HEALTH MINISTRY OF HEALTH GOVERNMENT OF MONGOLIA. Available online: https://www.unicef.org/mongolia/media/1116/file/NNS_V_undsen_tailan_EN.pdf Accessed on 08 April, 2022.

NCPH. (2020). Fourth national STEPS Survey on the Prevalence of Non-Communicable Disease and Injury Risk Factors-2019. Brief Summary. Available online: https://cdn.who.int/media/docs/default-source/ncds/ncd-surveillance/data-reporting/mongolia/mongolia-steps-survey---2019_brief-summary_english.pdf?sfvrsn=5ba7a1d3_1&download=true Accessed on 08 April, 2022.

Nguyen Thi Khanh, H., Nguyen Thanh, L., Pham Quoc, T., Pham Viet, C., Duong Minh, D., & le Thi Kim, A. (2020). Suicidal behaviors and depression "among adolescents in Hanoi, Vietnam: A multilevel analysis of data from the Youth Risk Behavior Survey 2019. *Health Psychology Open*, *7*(2). https://doi.org/10.1177/2055102920954711

NSOM. (2020). Integrated statistical database of Mongolia. Available online: http://www.1212.mn/stat.aspx?LIST_ID=976_L03 Accessed on 08 April, 2022.

Oliveira, E. de C., Meucci, T. S., Rossato, L. M., Mendes-Castillo, A. M. C., & Silva, L. (2020). Prevalence of suicide attempts among adolescents and young people. *SMAD Revista*

Eletrônica Saúde Mental Álcool e Drogas (Edição Em Português), *16*(4), 85–91. https://doi.org/10.11606/issn.1806-6976.smad.2020.168441

O'Neil Rodriguez, K. A., & Kendall, P. C. (2014). Suicidal Ideation in Anxiety-Disordered Youth: Identifying Predictors of Risk. *Journal of Clinical Child and Adolescent Psychology*, *43*(1). https://doi.org/10.1080/15374416.2013.843463

Oyewole, B. K., Animasahun, V. J., & Chapman, H. J. (2018). Tobacco use in Nigerian youth: A systematic review. In *PLoS ONE* (Vol. 13, Issue 5). https://doi.org/10.1371/journal.pone.0196362

Park, Y. D., Patton, L. L., & Kim, H. Y. (2010). Clustering of oral and general health risk behaviors in korean adolescents: A national representative sample. *Journal of Adolescent Health*, *47*(3). https://doi.org/10.1016/j.jadohealth.2010.02.003

Peltzer, K., & Pengpid, S. (2014). Oral and hand hygiene behaviour and risk factors among in-school adolescents in four Southeast Asian countries. *International Journal of Environmental Research and Public Health*, *11*(3). https://doi.org/10.3390/ijerph110302780

Peltzer, K., & Pengpid, S. (2017). Prevalence and determinants of tobacco use among school going adolescents in Cambodia and Vietnam: A cross-sectional study. *Journal of the Pakistan Medical Association*, *67*(7).

Peltzer, K., Tepirou, C., & Pengpid, S. (2016). Prevalence and correlates of perceived teeth health status and oral health behavior among school-going adolescents in Cambodia. *Nagoya Journal of Medical Science*, *78*(4). https://doi.org/10.18999/nagjms.78.4.493

Pengpid, S., & Peltzer, K. (2011). Hygiene behaviour and associated factors among in-school adolescents in nine african countries. *International Journal of Behavioral Medicine*, *18*(2). https://doi.org/10.1007/s12529-010-9109-6

Pengpid, S., & Peltzer, K. (2017). Prevalence, demographic and psychosocial correlates for school truancy among students aged 13–15 in the Association of Southeast Asian Nations (ASEAN) member states. *Journal of Child and Adolescent Mental Health*, *29*(3).

Pengpid, S., & Peltzer, K. (2019a). Leisure-time sedentary behavior is associated with psychological distress and substance use among school-going adolescents in five southeast Asian countries: A cross-sectional study. *International Journal of Environmental Research and Public Health*, *16*(12). https://doi.org/10.3390/ijerph16122091

Pengpid, S., & Peltzer, K. (2019b). Prevalence and associated factors of oral and hand hygiene behavior among adolescents in Afghanistan. *Journal Public Health*, *11*(3), 295–301.

Pengpid, S., & Peltzer, K. (2019c). Prevalence and correlates of past 12-month suicide attempt among in-school adolescents in Guatemala. *Psychology Research and Behavior Management*, *12*, 523–529. https://doi.org/10.2147/PRBM.S212648

Pengpid, S., & Peltzer, K. (2020). Suicide Attempt and Associated Factors among Adolescents in Five Southeast Asian Countries in 2015. *Crisis*, *41*(4). https://doi.org/10.1027/0227-5910/a000642

Pengpid, S., & Peltzer, K. (2021a). Past 12-month history of single and multiple suicide attempts among a national sample of school-going adolescents in Tonga. *Asia-Pacific Psychiatry*, *13*(3). https://doi.org/10.1111/appy.12425

Pengpid, S., & Peltzer, K. (2021b). Prevalence and associated factors of oral and hand hygiene behaviour among adolescents in six Southeast Asian countries. *International Journal of Adolescent Medicine and Health*, *33*(6). https://doi.org/10.1515/ijamh-2019-0177

Putra, I. G. N. E., Karin, P. A. E. S., & Ariastuti, N. L. P. (2021). Suicidal ideation and suicide attempt among Indonesian adolescent students. *International Journal of Adolescent Medicine and Health*, *33*(5). https://doi.org/10.1515/ijamh-2019-0035

Quarshie, E. N. B., Onyeaka, H. K., & Oppong Asante, K. (2020). Suicidal behaviours among adolescents in Liberia. *BMC Psychiatry*, *20*(1). https://doi.org/10.1186/s12888-020-02985-3

Rudatsikira, E., Dondog, J., Siziya, S., & Muula, A. S. (2008). Prevalence and determinants of adolescent cigarette smoking in Mongolia. *Singapore Medical Journal*, *49*(1).

Rudatsikira, E., Muula, A. S., & Siziya, S. (2011). Tooth Brushing among Adolescents in Jordan. *International Journal of Child and Adolescent Health*, *4*, 403.

Sawyer, S. M., Afifi, R. A., Bearinger, L. H., Blakemore, S. J., Dick, B., Ezeh, A. C., & Patton, G. C. (2012). Adolescence: A foundation for future health. In *The Lancet* (Vol. 379, Issue 9826). https://doi.org/10.1016/S0140-6736(12)60072-5

Seidu, A. A. (2019). Prevalence and Correlates of Truancy among School-Going Adolescents in Mozambique: Evidence from the 2015 Global School-Based Health Survey. *Scientific World Journal*, *2019*. https://doi.org/10.1155/2019/9863890

Seidu, A. A., Amu, H., Dadzie, L. K., Amoah, A., Ahinkorah, B. O., Ameyaw, E. K., Acheampong, H. Y., & Kissah-Korsah, K. (2020). Suicidal behaviours among in-school adolescents in Mozambique: Cross-sectional evidence of the prevalence and predictors using the Global School-Based Health Survey data. In *PLoS ONE* (Vol. 15, Issue 7 July). https://doi.org/10.1371/journal.pone.0236448

Senanayake, S., Gunawardena, S., Kumbukage, M., Wickramasnghe, C., Gunawardena, N., Lokubalasooriya, A., & Peiris, R. (2018). Smoking, Alcohol Consumption, and Illegal Substance Abuse among Adolescents in Sri Lanka: Results from Sri Lankan Global School-Based Health Survey 2016. *Advances in Public Health, 2018*. https://doi.org/10.1155/2018/9724176

Ser-Od, T., Al-Wahabi, A., Sumi, M., Akashi, Y., Nakajima, K., Kokubun, K., Matsuzaka, K., & Inoue, T. (2017). Current situation of oral diseases in rural Mongolia. *The Bulletin of Tokyo Dental College,* 7(1):34-36

Sharma, B., Lee, T. H., & Nam, E. W. (2017). Loneliness, insomnia and suicidal behavior among school-going adolescents in Western Pacific Island countries: Role of violence and injury. *International Journal of Environmental Research and Public Health, 14*(7). https://doi.org/10.3390/ijerph14070791

Sharma, B., Nam, E. W., Kim, H. Y., & Kim, J. K. (2015). Factors associated with suicidal ideation and suicide attempt among school-going urban adolescents in Peru. *International Journal of Environmental Research and Public Health, 12*(11). https://doi.org/10.3390/ijerph121114842

Shayo, F. K., & Kalomo, M. H. (2019). Prevalence and correlates of sexual intercourse among sexually active in-school adolescents: An analysis of five sub-Sahara African countries for the adolescent's sexual health policy implications. *BMC Public Health, 19*(1). https://doi.org/10.1186/s12889-019-7632-1

Smith, L., Jackson, S. E., Vancampfort, D., Jacob, L., Firth, J., Grabovac, I., McDermott, D., Yang, L., López-Sánchez, G. F., Niederkrotenthaler, T., Veronese, N., & Koyanagi, A. (2020). Sexual behavior and suicide attempts among adolescents aged 12–15 years from 38 countries: A global perspective. *Psychiatry Research, 287*. https://doi.org/10.1016/j.psychres.2019.112564

State Great Khural of Mongolia. (2012). Law of Tobacco Control revised version. Available online: https://untobaccocontrol.org/impldb/wp-content/uploads/mongolia_2018_annex-9_tobacco_control_law_2012.pdf?fbclid=IwAR3fjRU1gQpSHRXjKYMoA8a5P4YDnIjKrN6rMI2ltkThhagCwYpSycqkt_s Accessed on 08 April, 2022.

Statista. (2022). Share of rural population in Mongolia from 2011 to 2020. Available online: https://www.statista.com/statistics/760999/mongolia-share-of-rural-population/ Accessed on 08 April, 2022.

Tang, J. J., Yu, Y., Wilcox, H. C., Kang, C., Wang, K., Wang, C., Wu, Y., & Chen, R. (2020). Global risks of suicidal behaviors and being bullied and their association in adolescents: School-based health survey in 83 countries. *EClinicalMedicine*, *19*. https://doi.org/10.1016/j.eclinm.2019.100253

Tang, T.-C., Ko, C.-H., Yen, J.-Y., Lin, H.-C., Liu, S.-C., Huang, C.-F., & Yen, C.-F. (2009). Suicide and Its Association with Individual, Family, Peer, and School Factors in an Adolescent Population in Southern Taiwan. *Suicide and Life-Threatening Behavior*, *39*(1). https://doi.org/10.1521/suli.2009.39.1.91

Terry-McElrath, Y. M., O'Malley, P. M., & Johnston, L. D. (2014). Energy drinks, soft drinks, and substance use among United States secondary school students. *Journal of Addiction Medicine*, *8*(1). https://doi.org/10.1097/01.ADM.0000435322.07020.53

Ulamnemekh Kh et al. (2013). The National Survey of Oral Health Status of Children and Adults in Mongolia.

UN Secretary-General. (2015). The Global Strategy for Women's Children's and Adolescents' Health 2016-2030: Survive Thrive Transform. Available online: https://www.who.int/life-course/partners/global-strategy/ewec-globalstrategyreport-200915.pdf Accessed on 08 April, 2022.

UNICEF. (2019). Children, food and nutrition: growing well in a changing world. Available online: www.unicef.org/media/106506/file/The%20State%20of%20the%20World's%20Children%202019.pdf. Accessed on 08 April, 2022.

UNICEF. (2020). Situational Analysis: UNDERSTANDING INTEGRATED ADOLESCENT DEVELOPMENT IN MONGOLIA. Available online: www.unicef.mn Accessed on 08 April, 2022.

UNICEF. (2021). Five priority issues facing Mongolian children. Available online: https://www.unicef.org/mongolia/mn/commitment-address-top-five-challenges-children-are-facing-mongolia Accessed on 08 April, 2022.

Vasilopoulos, A., Gourgoulianis, K., Hatzoglou, C., & Roupa, Z. (2015). Juvenile (age 13-18) smoking incidence determinants in Greece. *International Journal of Nursing Practice*, *21*(5). https://doi.org/10.1111/ijn.12233

Wang, M., Zhong, J. M., Fang, L., & Wang, H. (2016). Prevalence and associated factors of smoking in middle and high school students: A school-based cross-sectional study in Zhejiang Province, China. *BMJ Open*, *6*(1). https://doi.org/10.1136/bmjopen-2015-010379

WHO. (1999). Improving Health Through schools: National and International Strategies. Information series on School Health.

WHO. (2010). Mongolia Global School-based Student Health Survey (GSHS) Country Report 2010. Available online: https://www.who.int/ncds/surveillance/gshs/GSHS_Country_report_Mongolia2010.pdf Accessed on 08 April, 2022.

WHO. (2012). Malaysia Global School-based Student Health Survey (GSHS) Fact Sheet 2012. Available online: www.who.int/ncds/surveillance/gshs/Malaysia_2012_GSHS_FS_national.pdf Accessed on 08 April, 2022.

WHO. (2013a). Cambodia Global School-based Student Health Survey (GSHS) Fact Sheet 2013. http://www.who.int/chp/gshs/en/ Accessed on 06 April, 2022.

WHO. (2013b). Global action plan for the prevention and control of noncommunicable diseases 2013-2020. *World Health Organization*. Available online: https://apps.who.int/iris/bitstream/handle/10665/94384/9789241506236_eng.pdf?sequence=1&isAllowed=y Accessed on 08 April, 2022.

WHO. (2013c). Global School-based Student Health Survey. Available online: https://www.who.int/teams/noncommunicable-diseases/surveillance/systems-tools/global-school-based-student-health-survey/methodology Accessed on 08 April, 2022.

WHO. (2013d). Health Topics: Adolescent Health. Available online: https://www.who.int/health-topics/adolescent-health/#tab=tab_1 Accessed on 08, April, 2022.

WHO. (2013e). Vietnam Global School-based Student Health Survey (GSHS) Fact Sheet 2013. Available online: www.who.int/ncds/surveillance/gshs/2013_Viet_Nam_Fact_Sheet.pdf. Accessed on 08 April, 2022.

WHO. (2014a). Brunei Darussalam Global School-based Student Health Survey (GSHS) Fact Sheet 2014. Available online: www.who.int/ncds/surveillance/gshs/Brunei_Darussalam_2014_FactSheet.pdf Accessed on 08 April, 2022.

WHO. (2014b). How Mongolia ratified the protocol to Eliminate Illicit Trade in Tobacco Products 2014. Available online: https://www.who.int/fctc/protocol/about/Mongolia_Case_Study_Protocol_ratification.pdf?ua=1 Accessed on 08 April, 2022.

WHO. (2014c). Mongolia Global Youth Tobacco Survey (GYTS) Fact Sheet 2014. Available online: https://extranet.who.int/ncdsmicrodata/index.php/catalog/754/download/5254 Accessed on 08 April, 2022.

WHO. (2015a). Loas Global School-based Student Health Survey (GSHS) Fact Sheet 2015. Available online: www.who.int/ncds/surveillance/gshs/2015-Laos-GSHS-Fact-Sheet.pdf Accessed on 08, April, 2022.

WHO. (2015b). Nepal Global School-based Student Health Survey (GSHS) Fact Sheet 2015. Available online: www.who.int/ncds/surveillance/gshs/gshs_fs_nepal_2015.pdf Accessed on 08, April, 2022.

WHO. (2015c). Philippines Global School-based Student Health Survey (GSHS) Fact Sheet 2015. Available online: www.who.int/ncds/surveillance/gshs/PIH2015_fact_sheet.pdf?ua=1 Accessed on 08 April, 2022.

WHO. (2015d). Thailand Global School-based Student Health Survey (GSHS) Fact Sheet 2015. Available online: https://www.who.int/ncds/surveillance/gshs/2015-Thailand-GSHS-Fact-Sheet.pdf Accessed on 08 April, 2022.

WHO. (2016a). Myanmar Global School-based Student Health Survey (GSHS) Fact Sheet 2016. Available online: http://www.who.int/ncds/surveillance/gshs/Myanmar_2016_GSHS_FactSheet.pdf Accessed on 08 April, 2022.

WHO. (2016b). Sri Lanka Global School-based Student Health Survey (GSHS) Fact Sheet 2016. Available online: www.who.int/ncds/surveillance/gshs/SRH2016_fact_sheet.pdf Accessed on 08 April, 2022.

WHO. (2017a). Global Accelerated Action for the Health of Adolescents (AA-HA!) Guidance to Support Country Implementation. In *Who*. Available online: https://www.who.int/publications/i/item/9789241512343 Accessed on 08 April, 2022.

WHO. (2017b). WHO Report on the Global Tobacco Epidemic 2017. Monitoring Tobacco use and Prevention Policies. Available online: https://apps.who.int/iris/bitstream/handle/10665/255874/9789241512824-eng.pdf?sequence=1&isAllowed=y. Accessed on 08 April, 2022.

WHO. (2018). Noncommunicable Disease Country Profiles 2018. In *WHO*. Available online: https://doi.org/10.1002/9781119097136.part5 Accessed on 08, April, 2022.

WHO. (2019a). Calling for stronger efforts to prevent suicide. Available online: http://www.who.int/mongolia/news/detail/09-10-2019-press-conference-on-suicide-prevention Accessed on 08 April, 2022.

WHO. (2019b). Suicide in the world Global Health Estimates. Available online: http://apps.who.int/bookorders. Accessed on 08 April, 2022.

WHO. (2020). WHO Guidelines on physical activity and sedentary behavior, Web Annex, Evidence Profiles. *World Health Organization*. Available online: https://apps.who.int/iris/bitstream/handle/10665/336657/9789240015111-eng.pdf?sequence=1&isAllowed=y Accessed on 08 April, 2022.

WHO. (2021a). Health Topics: Adolescent Mental Health. Available online: https://www.who.int/news-room/fact-sheets/detail/adolescent-mental-health Accessed on 08 April, 2022.

WHO. (2021b). LIVE LIFE: An Implementation guide for Suicide Prevention in Countries. Available online: https://apps.who.int/iris/handle/10665/341726 Accessed on 08 April, 2022.

WHO. (2021c). Suicide Key Facts. Available online: https://www.who.int/news-room/fact-sheets/detail/suicide Accessed on 08 April, 2022.

WHO-FAO. (2004). Fruit and vegetable for health: report of a joint FAO/WHO workshop, 1-3 September 2004, Kobe, Japan. *Handbook of Plant Food Phytochemicals*, *September*. Available online: https://apps.who.int/iris/bitstream/handle/10665/43143/9241592818_eng.pdf?sequence=1&isAllowed=y Accessed on 08 April, 2022.

Xu, G., Sun, N., Li, L., Qi, W., Li, C., Zhou, M., Chen, Z., & Han, L. (2020). Physical behaviors of 12-15 year-old adolescents in 54 low-and middle-income countries: Results from the Global School-based Student Health Survey. *Journal of Global Health*, *10*(1). https://doi.org/10.7189/jogh.10.010423

Xu, T., Tomokawa, Gregorio, R., Mannava, P., Nagai, M., & Sobel, H. (2020). School-based interventions to promote adolescent health: A systematic review in low- And middle-income countries of WHO Western Pacific Region. *PLoS ONE*, *15*(3). https://doi.org/10.1371/journal.pone.0230046

Жендэрийн Үндэсний Хороо. (2020). Суурь Судалгааны Тайлан 2020. Available online: https://1212.mn/BookLibraryDownload.ashx?url=GenderBasicSurveyReport_2019.pdf&ln=Mn Accessed on 08 April, 2022.

ACKNOWLEDGEMENT

I would like to give my utmost respect and appreciation to my supervisor, Prof. Edit Paulik for her guidance and continuous support for the completion of my study. Her endless care and kindness for this past four years has left me with lot of good memories to treasure for the years to come.

Furthermore, I would like to thank all the colleagues of the Department of Public Health, University of Szeged for their contribution to my professional development during my PhD work.

I am especially thankful to my parents for their endless perseverance with they brought me up, and to my precious Mother for always taking care of me from heaven. This thesis is dedicated to my beloved Mother who lives forever in my heart.

Last but not least I want to express my big thanks and love to my husband Bayar Chuluunbaatar and my beloved sons Bat-Ulzii Bayar, Batsarai Bayar and Batgun Bayar for their encouragement, support and faith in me.

APPENDICES

I.

dentistry journal

MDPI

Article

Prevalence and Correlates of Poor Oral Hygiene among School-Going Students in Mongolia

Javzan Badarch [1,*], Suvd Batbaatar [2] and Edit Paulik [1]

[1] Department of Public Health, Faculty of Medicine, University of Szeged, 6720 Szeged, Hungary; paulik.edit@med.u-szeged.hu
[2] Department of Environmental Health, National Center for Public Health, Ulaanbaatar 210349, Mongolia; suvd552001@gmail.com
* Correspondence: javzan.badarch@med.u-szeged.hu

Abstract: Brushing at least twice a day is one of the most effective methods for the prevention of dental caries and oral diseases. The aim of the present study was to determine the prevalence and correlates of poor oral hygiene in Mongolian school-going students. A secondary analysis of nationally representative data from the 2013 Mongolian Global School-based Health Survey (GSHS) was performed. In the survey, a questionnaire was completed by 5393 students aged 12–16 years old. The prevalence of poor oral hygiene and its association with some independent variables were analyzed by frequency distribution, chi-squared test, and logistic regression. The overall prevalence of poor oral hygiene was 33%. In the multivariate analysis, male students, inadequate fruit and vegetable intake, parents' smoking, being exposed to second-hand smoke, poor parental supervision and connectedness, physical inactivity, and sedentary behavior were significantly associated with poor oral hygiene. Meanwhile, students who ate fast food and drank carbonated soft drink were found to be less likely to be poor tooth-brushers in 2013. Various determinants were identified in connection with poor oral hygiene. Based on these findings, it is recommended that an oral health promotion program should be combined with general health promotion and lifestyle intervention programs for this target population.

Keywords: oral hygiene; prevalence; health survey; risk factors; Mongolia; school going students

check for updates

Citation: Badarch, J.; Batbaatar, S.; Paulik, E. Prevalence and Correlates of Poor Oral Hygiene among School-Going Students in Mongolia. *Dent. J.* **2021**, *9*, 12. https://doi.org/10.3390/dj9020012

Received: 29 December 2020
Accepted: 16 January 2021
Published: 20 January 2021

1. Introduction

Oral health is an essential component of well-being during the whole lifetime [1]. Good oral hygiene (brushing tooth twice a day) is one of the most effective methods for the prevention of dental caries and other oral diseases [2]. The World Dental Federation and World Health Organization (WHO) have indicated that more than 200 diseases can be the consequence of dental caries [3].

In Mongolia, the first National Survey of Oral Health Status of children aged 5, 12, 15, and 18 years and adults aged 35–44 and 65–74 years in Mongolia (2013) and the Dental Survey in Mongolia (2014) showed a dramatic increase of caries among children as well as complications in adults in both urban and rural areas of the country compared to the previous study, which was conducted by the School of Dentistry, Mongolian National University of Medical Sciences in 2008 [4]. The prevalence of caries in Mongolian children is still high and has not significantly changed since 1993 [5]. According to the survey performed by Tungalag et al., 90% of the population suffers from dental diseases nationwide, and dental caries in children is the highest among all age groups [6].

The Mongolian Government approved the "National Oral Health" program in 2006. Based on the recommendation of the WHO, implementing the program was expected to reduce caries prevalence by up to 78.0% to 80.1% among 5 to 6 year olds, 60.0% to 62.0% among 12 year olds, and 70% to 71.6% in the adult population, [7].

Recommended tooth-brushing prevalence among school children was found to be 22.45% in four South-East Asian countries [8]. Poor oral hygiene among adolescents has been associated with being male [9], older age [10], sweets intake (including soft drink) [11], infrequent fruits and/or vegetables consumption [10], smoking behaviors [12], lack of protective factors including poor parental supervision [13], and unhealthy lifestyles such as inadequate exercise and sedentary leisure time [14].

Until now, no studies have investigated poor oral hygiene among Mongolian adolescents. Therefore, we aimed to investigate the prevalence and correlates of poor oral hygiene in Mongolian school-going students.

2. Materials and Methods

2.1. Participants and Procedures

In 2013, the Mongolian Ministry of Health and the Public Health Institute conducted the second nationwide Global School Based Health Survey (GSHS) in Mongolia. We carried out a secondary analysis using existing data obtained from the Mongolian GSHS 2013. The GSHS uses a standardized sampling strategy in all participating countries worldwide. The Mongolian GSHS surveyed students aged 12–16 years old (attending school grades 7–12) in nine districts of Ulaanbaatar and 21 provinces. The first-stage sampling frame involved the selection of schools. The second-stage sampling frame involved the selection of classes within the selected schools. Classes were selected randomly from all eligible classes (grades 7–12). All 59 selected schools as well as all 202 selected classes participated in the survey. All students in each selected class were given a consent form (to be signed by the student) and asked to participate voluntarily in the survey. The survey questionnaire was answered by 5393 students in grades 7–12. The school response rate was 98%, the student response rate was 89%, and the overall response rate was 88% [15].

2.2. Measures

The dependent variable of this analysis was poor oral hygiene. It was measured on the basis of the following question: "During the past 30 days, how many times per day did you usually clean or brush your teeth?" Response options were 1 = Did not brush my teeth, 2 = Less than 1 time per day, 3 = 1 time per day, 4 = 2 times per day, 5 = 3 times per day, and 6 = 4 or more times per day; poor oral hygiene was defined as brushing teeth less than two times per day (response codes 1 to 3) and good oral hygiene when brushing 2 or more times per day (response codes 4 to 6).

The independent variables were demographic factors, dietary behaviors, smoking habits and exposure, protective factors, physical activity, and sedentary behavior-related factors. All variables were recoded to dichotomous variables except age, which was analyzed as a continuous variable.

2.2.1. Demographic Factors

Sex: "What is your sex?" (response option was 1 = male and 2 = female; recoded 0 = male (1) and 1 = female (2)).

Age: "How old are you?" (response options were 1 = 11 years old or younger, 2 = 12 years old, 3 = 13 years old, 4 = 14 years old, 5 = 15 years old, 6 = 16 years old, 7 = 17 years old and 8 = 18 years old; recoded 0 = 12 years old or younger (1–2), 1 = 13 years old (3), 2 = 13 years old, 3 = 14 years old (4), 4 = 15 years old (5) and 5 = 16 years old or older (6–8)).

2.2.2. Dietary Behaviors

Carbonated soft drink intake: "During the past 30 days, how many times per day did you usually drink carbonated soft drinks, such as Coca, Pepsi Cola?" (response options were 1 = Did not drink soft drinks, 2 = Less than one time per day, 3 = 1 time per day, 4 = 2 times per day, 5 = 3 times per day, 6 = 4 times per day and 7 = 5 or more times per day; recoded 0 = yes (2–7) and 1 = no (1)).

Fast food intake: "During the past 7 days, on how many days did you eat food from a fast food restaurant, such as pizza or burger places?" (response options were 1 = 0 days, 2 = 1 day, 3 = 2 days, 4 = 3 days, 5 = 4 days, 6 = 5 days 7 = 6 days and 8 = 7 days; recoded 0 = yes (2–8) and 1 = no (1)).

Fruit intake: "During the past 30 days, how many times per day did you usually eat fruit, such as apples, grapefruit, bananas, or kiwi?" (response options were 1 = I did not eat fruit during the past 30 days, 2 = Less than one time a day, 3 = 1 time per day, 4 = 2 times per day, 5 = 3 times per day, 6 = 4 times per day and 7 = 5 or more times per day; recoded 0 = inadequate (1–4) and 1 = adequate (5–7)).

Vegetable intake: "During the past 30 days, how many times per day did you usually eat vegetables, such as carrots, cabbage, or green vegetables?" (response options were 1 = I did not eat vegetables during the past 30 days, 2 = Less than one time a day, 3 = 1 time per day, 4 = 2 times per day, 5 = 3 times per day, 6 = 4 times per day and 7 = 5 or more times per day; recoded 0 = inadequate (1–4) and 1 = adequate (5–7)).

2.2.3. Smoking Behaviors

Cigarette smoking: "During the past 30 days, on how many days did you smoke a cigarette?" (response options were 1 = 0 days, 2 = 1 or 2 days, 3 = 3 to 5 days, 4 = 6 to 9 days, 5 = 10 to 19 days, 6 = 20 to 29 days and 7 = All 30 days; recoded 0 = currently smoking (2–7) and 1 = never smoking (1)).

Parental smoking: "Which of your parents or guardians use any form of tobacco?" (responses options were 1 = neither, 2 = my father, 3 = my mother, 4 = both and 5 = I do not know; recoded 0 = one or both (2–4) and 1 = none (1)).

Second-hand smoke: "During the past 7 days, on how many days did people smoke in your presence?" (response options were 1 = 0 days, 2 = 1 or 2 days, 3 = 3 or 4 days, 4 = 5 or 6 days and 5 = all 7 days; recoded 0 = yes (2–5) and 1 = no (1)).

2.2.4. Protective Factors

Parental supervision: "During the past 30 days, how often did your parents or guardians check to see if your homework was done?" (response options were 1 = never, 2 = rarely, 3 = sometimes, 4 = most of the times and 5 = always; recoded 0 = no (1–2) and 1 = yes (3–5)).

Parental connectedness: "During the past 30 days, how often did your parents or guardians understand your problems and worries?" (response options were 1 = never, 2 = rarely, 3 = sometimes, 4 = most of the times and 5 = always; recoded 0 = no (1–2) and 1 = yes (3–5)).

Parental bonding: "During the past 30 days, how often did your parents or guardians really know what you were doing in your free time?" (response options were 1 = never, 2 = rarely, 3 = sometimes, 4 = most of the times and 5 = always; recoded 0 = no (1–2) and 1 = yes (3–5)).

2.2.5. Physical Activity

Leisure time physical activity was assessed by asking participants: "During the past 7 days, on how many days were you physically active for a total of at least 60 min per day?" (response options were 1 = 0 days, 2 = 1 day, 3 = 2 days, 4 = 3 days, 5 = 4 days, 6 = 5 days, 7 = 6 days and 8 = 7 days; recoded 0 = physically inactive (1) and 1 = physically active (2–8)).

2.2.6. Leisure Time Sedentary Behavior

This was assessed by asking participants about the time they spend mostly sitting when not in school or doing homework: "How much time do you spend during a typical or usual day sitting and watching television, playing computer games, talking with friends, or doing other sitting activities?" (response options were 1 = Less than 1 h per day, 2 = 1 to

2 h per day, 3 = 3 to 4 h per day, 4 = 5 to 6 h per day, 5 = 7 to 8 h per day and 6 = more than 8 h per day; recoded 0 = yes (3–6) and 1 = no (1–2)).

2.3. Data Analysis

Data analysis was performed by using IBM SPSS version 24 software. Frequency distributions were used to describe demographic characteristics of the sample. Univariable and multivariable logistic regression analyses were applied to reveal the associations between poor oral hygiene and selected independent variables.

3. Results

3.1. Description of the Study Sample

The Mongolian GSHS 2013 was conducted with a total sample size of 5393 students. One-third of the students (33%) reported to have had poor oral hygiene in the 30 days preceding the survey. The main characteristics of the sample are shown in Table 1.

Table 1. Sample characteristics associated with poor oral hygiene among school going students in Mongolia (univariable logistic regression).

Variables	Poor Oral Hygiene		UAOR	95% CI	*p* Value
	N	%			
Demographic factors					
Gender					
Male (n = 2516)	928	37	1.40	1.25–1.57	<0.001
Female (n = 2854)	839	29.5	1.00		
Age* (increase 1 year of age)			1.06	1.02–1.10	0.003
12 y.o or younger (n = 652)	196	30.1			
13 years old (n = 1102)	340	30.9			
14 years old (n = 994)	315	31.9			
15 years old (n = 1017)	359	35.3			
16 y.o or older (n = 1615)	559	34.7			
Dietary behaviors					
Carbonated soft drink					
Yes (n = 1785)	529	29.9	0.80	0.71–0.91	<0.001
No (n = 3594)	1240	34.5	1.00		
Fast food intake					
Yes (n = 2936)	876	30	0.74	0.66–0.84	<0.001
No (n = 2416)	878	36.4	1.00		
Fruit intake					
Inadequate intake (n = 4918)	1677	34.2	2.18	1.70–2.78	<0.001
Adequate intake (n = 447)	85	19.2	1.00		
Vegetable intake					
Inadequate intake (n = 4047)	1484	36.7	2.15	1.86–2.50	<0.001
Adequate intake (n = 1302)	274	21.2	1.00		
Smoking behaviors					
Cigarette smoking					
Currently smoking (n = 456)	187	41.5	1.49	1.22–1.81	<0.001
Never smoke (n = 4888)	1571	32.2	1.00		
Parental smoking					
One or both (n = 2397)	875	36.6	1.35	1.20–1.52	<0.001
None (n = 2889)	861	29.9	1.00		
Passive smoking					
Yes (n = 3237)	1153	35.8	1.40	1.24–1.58	<0.001
No (n = 2113)	599	28.4	1.00		
Protective factors					
Parental supervision					
No (n = 1710)	661	38.8	1.47	1.30–1.66	<0.001
Yes (n = 3653)	1096	30.1	1.00		
Parental connectedness					
No (n = 2709)	1015	37.6	1.54	1.37–1.73	<0.001
Yes (n = 2642)	739	28.1	1.00		
Parental bonding					
No (n = 1718)	644	37.6	1.36	1.20–1.53	<0.001
Yes (n = 3599)	1102	30.7	1.00		
Physical activity					
Inactive (n = 1657)	650	39.3	1.51	1.34–1.70	<0.001
Active (n = 3687)	1103	30	1.00		
Sedentary behavior					
Yes (n = 2342)	831	35.6	1.23	1.10–1.38	<0.001
No (n = 3026)	930	30.8	1.00		

* Age: continuous variable in logistic regression analysis. UAOR: UnAdjusted Odds Ratio. 95% CI: 95% Confidence Interval. yo: years old.

3.2. Factors Associated with Poor Oral Hygiene

According to the univariate analysis, students who reported poor oral hygiene tended to be males and be in age group older than 12 years. They consumed carbonated soft drinks and fast food, had inadequate fruit and vegetable intake, smoked cigarettes, one or both parents were smokers, were exposed to second-hand smoke at home, and suffered from poor parental supervision and disconnectedness. Parents of these students typically did not know what their children did, and the students were physically inactive and spent more than 3 h per day sitting. All the listed factors were in a significant relationship with poor oral hygiene among Mongolian school-going students.

Multivariable analysis showed that males were 1.54 times (Adjusted Odds Ratio; (AOR) = 1.54; 95% Confidence Interval (CI) [1.36–1.75]) as likely as females to have poor oral hygiene. Concerning dietary behaviors, students who consumed carbonated soft drinks and fast food were 15% (AOR = 0.85; 95% CI [0.74–0.97]) and 26% (AOR = 0.74; 95% CI [0.65–0.84]) less likely to be associated with insufficient tooth brushing. Moreover, students who had inadequate fruit and vegetable intake were 80% (AOR = 1.80; 95% CI [1.36–2.37]) and (AOR = 1.80; 95% CI [1.59–2.21]) more likely to have poor oral health than students who ate adequate amounts of fruits and vegetables. As to smoking behaviors, students whose parents (one or both) were smokers were 1.23 times more likely to report poor tooth brushing (AOR = 1.23; 95% CI [1.08–1.40]), and those being exposed second-hand smoke were 1.22 times (AOR = 1.22; 95% CI [1.06–1.40]) more likely to report poor tooth brushing. Regarding protective factors, students whose parents did not check homework were 17% more likely to report poor dental hygiene compared to fellow students (AOR = 1.17; 95% CI [1.02–1.35]), and those whose parents did not understand trouble were 30% (AOR = 1.30; 95% CI [1.13–1.49]) more likely to report poor dental hygiene compared to fellow students. Students who were physically inactive were 1.51 times (AOR = 1.51; 95% CI [1.32–1.73]) as likely to report brushing tooth less than 2 times a day. Furthermore, students who spent sitting more than 3 h per day were 1.39 times (AOR = 1.39; 95% CI [1.22–1.58)]) as likely to have poor oral hygiene. These results are presented in Table 2.

Table 2. Sample characteristics associated with poor oral hygiene among school-going students in Mongolia (multivariable logistic regression).

Variables	AOR	95% CI	*p* Value
Demographic factors			
Male gender	1.54	1.36–1.75	**<0.001**
Increase one year of age *	1.00	0.96–1.05	0.813
Dietary behaviors			
Carbonated soft drink intake	0.85	0.74–0.97	**0.023**
Fast food intake	0.74	0.65–0.84	**<0.001**
Inadequate fruit intake	1.80	1.36–2.37	**<0.001**
Inadequate vegetable intake	1.80	1.59–2.21	**<0.001**
Smoking behaviors			
Currently smoking	1.20	0.96–1.51	0.106
One or both parents smoking	1.23	1.08–1.40	**0.002**
Exposed second-hand smoke	1.22	1.06–1.40	**0.005**
Protective factors			
Poor parental supervision	1.17	1.02–1.35	**0.023**
Parental disconnectedness	1.30	1.13–1.49	**<0.001**
Poor parental bonding	1.03	0.89–1.20	0.609
Physically inactive	1.51	1.32–1.73	**<0.001**
Sedentary behavior	1.39	1.22–1.58	**<0.001**

* Age: continuous variable; AOR: Adjusted Odds Ratio; 95% CI: 95% Confidence Interval.

4. Discussion

By assessing a national sample of school-going students in Mongolia, we found that the prevalence of poor oral hygiene was 33% (including 37% of male students and 29.5% of female students) in 2013. This result was lower than the data from the 2010 GSHS Mongolia,

when almost one-third of the students (41.8% of boys and 31.6% of girls) were poor tooth brushers [16], and it was lower than the prevalence in Afghanistan adolescents (60.7%) [17]. However, the last Mongolian result was higher compared to the Cambodian adolescents (20.2%) [18].

We revealed that self-reported poor oral hygiene was in correlation with male gender, inadequate fruit and vegetable intake, one or both parents being smokers, exposure to second-hand smoke, poor parental supervision and disconnectedness, and physically inactive and sedentary behavior. In addition, fast food and carbonated soft drink consumption were protective factors for poor tooth brushing (i.e., less than 2 times a day) according to the 2013 data.

In concordance with a previous study [19], our work identified males as showing poor oral hygiene behavior (less frequent tooth brushing) more frequently. It is explained that girls were more considerate of their body and appearance, and thus for their oral health, than boys.

High consumption of soft drinks among both younger and older adolescents was described as a predictor of poorer oral health and unhealthier lifestyle compared to those with lower consumption [20]. In contrast to that, findings of the current study showed that frequent carbonated soft drink and fast food consumption was a protective factor for tooth brushing less than 2 times a day.

This study confirmed the association between inadequate fruit and vegetable intake and poor dental hygiene, indicating that among young people, the consumption of unhealthy foods (lacking fruits and vegetables) is a part of wrong oral and general health behavior. It is also possible that low parental control may result in a higher prevalence of inadequate fruit and vegetable intake and poor oral health [14].

Furthermore, in this study, smoking behaviors (parental smoking and second-hand smoke exposure) were higher among poor tooth brushers. Adolescents with good oral health behavior tend to avoid smokers, thus reducing their second-hand smoke (SHS) exposure [8]. Additionally, adolescents who have good oral and general hygiene behavior may have better knowledge of the hazardous effects of smoking and passive smoke and, therefore, they might tend to avoid SHS exposure compared to those who smoke.

Parental involvement appeared to be determinant in several health behaviors, including oral health among adolescents. Socio-economic changes also affect parental care, as modern parents need to work more, cannot supervise children, and sometimes, they do not know about their children's general and dental hygiene problems during the adolescent development. The results presented here indicate that a low level of parental bonding is associated with poor oral hygiene in adolescents, similarly to the findings of Hamilton et al. [21].

Some previous studies have highlighted the relationship between oral and general health behaviors. Regarding general health behaviors, this study found an association between being physically inactive, sedentary leisure time, and poor tooth brushing [17]. Unhealthy lifestyles may lead to worse poor oral and general hygiene.

The Government of Mongolia ratified "Healthy Teeth-Healthy Child" national program in 2018 to address dental diseases. This program will be implemented until 2023: including dental checkup, giving advice, caries treatment, root canal treatment, fluoride varnish, and tooth extraction to children ages 2 to 12. A total of 121,000 children had been provided oral health services, examinations, and advice by June 2020 [22].

Many countries have introduced effective school-based programs to improve the oral health of children. School policies and practices on healthy diet, particularly policies on sugar intake, that ensure healthy foods and drinks are provided in all areas (urban and rural), serving to promote healthy dietary behaviors from an early age [23].

5. Strengths and Limitations

GSHS was a large, nationally representative survey, the data of which were collected by the WHO and the Centers for Disease Control and Prevention (CDC). The GSHS is

globally recognized and implemented providing highly generalizable data and findings. Schools and students were randomly selected from both urban and rural areas. Nonetheless, the findings in our study should be interpreted as having several limitations. First, there are no reliability and validity studies examining GSHS items within the context of Mongolian culture. Second, the cross-sectional nature of the study means that at one point in time, we could not assess the characteristics (e.g., oral hygiene) of students who were absent that day. Third, data were collected based on self-report, which may have biased the results.

6. Conclusions

Using a large and representative sample of school-going students in Mongolia, this study found the prevalence of poor oral hygiene among school-going students in Mongolia to be 33%. Factors such as male gender, inadequate fruit and vegetable intake, parents smoking, exposed second hand-smoke, poor parental supervision and disconnectedness, being physically inactive, and sitting more than 3 h a day are risk factors; meanwhile, carbonated soft drink and fast food intake are protective factors of poor oral hygiene among school-going students in Mongolia. Based on these findings, it is recommended that oral health promotion programs should be combined with general health promotion lifestyle intervention programs for this target population.

Author Contributions: Formal analysis, J.B.; Methodology, S.B.; Supervision, E.P.; Writing—original draft, J.B.; Writing—review & editing, E.P. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no funding from any governmental agency, commercial enterprise, or non-profit organization.

Institutional Review Board Statement: Patient consent was waived due to that this study was carried out using publicly available data from the Mongolian GSHS 2013, a WHO/CDC collaborative surveillance project.

Informed Consent Statement: Patient consent was waived due to the secondary data analysis.

Data Availability Statement: This study used the Mongolian GSHS 2013 dataset publicly available on the website of CDC and WHO https://www.who.int/ncds/surveillance/gshs/mongoliadataset/en/ (accessed on 24 September 2018).

Acknowledgments: We thank the World Health Organization and the Centers for Disease Control and Prevention for making the data for this analysis publicly available. This research received no funding from any governmental agency, commercial enterprise, or non-profit organization.

Conflicts of Interest: The authors declared no potential conflicts of interest with respect to the research, authorship, and publication of this article.

References

1. Delgertsetseg, J.; Oyuntsetseg, B.; Munkh-Od, S.; Suvdanchimeg, A.; Amarsaikhan, B. The results of national oral health survey, Mongolia. *Cent. Asian J. Med. Sci.* **2018**, *4*, 61–68. [CrossRef]
2. FDI. World Dental Federation. Annual Report 2019. Available online: https://www.fdiworlddental.org/sites/default/files/media/website/2019-fdi_annual_report.pdf (accessed on 15 December 2020).
3. Glick, M.; Monteiro da Silva, O.; Seeberger, G.K.; Xu, T.; Pucca, G.; Williams, D.M.; Kess, S.; Eisele, J.L.; Severin, T. FDI vision 2020: Shaping the future of oral health. *Int. Dent. J.* **2012**, *62*, 278–291. [CrossRef] [PubMed]
4. Ulamnemeh, H.; Batbayar, B.; Mashbajir, S.; Puntsag, O.-E.; Jagdag, U.; Bold, O.; Khishigdorj, O.; Nyamdorj, T.; Javkhlan, P.; Baatarjav, T.; et al. The national survey of oral health status of children and adults in Mongolia. *Cent. Asian J. Med. Sci.* **2018**, *4*, 61–68.
5. Chinzorig, T.; Aida, J.; Cooray, U.; Nyamdorj, T.; Mashbaljir, S.; Osaka, K.; Garidkhuu, A. Inequalities in caries experience among Mongolian children. *Int. J. Environ. Res. Public Health* **2019**, *16*, 3892. [CrossRef] [PubMed]
6. Tungalag, S.-O.; Akram, A.-W.; Masami, S.; Yoshihiko, A.; Kei, N.; Katsutoshi, K.; Kenichi, M.; Takashi, I. Current situation of oral diseases in rural Mongolia. *J. Jpn. Soc. Evid. Dent. Prof. JJSEDP* **2017**, *9*, 34–36.
7. Government of Mongolia. *Mongolia National Oral Health Program*; Government Report; Government of Mongolia: Ulaanbaatar, Mongolia, 2006; Volume 150, pp. 1–13.

8. Peltzer, K.; Pengpid, S. Oral and hand hygiene behaviour and risk factors among in-school adolescents in four Southeast Asian countries. *Int. J. Environ. Res. Public Health* **2014**, *11*, 2780–2792. [CrossRef]
9. McKittrick, T.R.; Jacobsen, K.H. Oral hygiene practices among middle-school students in 44 low- and middle-income countries. *Int. Dent. J.* **2014**, *64*, 164–170. [CrossRef]
10. Pengpid, S.; Peltzer, K. Hygiene behaviour and associated factors among in-school adolescents in nine African countries. *Int. J. Behav. Med.* **2011**, *18*, 150–159. [CrossRef] [PubMed]
11. Jigjid, B.; Ueno, M.; Shinada, K.; Kawaguchi, Y. Early childhood caries and related risk factors in Mongolian children. *Community Dent. Health* **2009**, *26*, 121–128. [PubMed]
12. Rudatsikira, E.; Muula, A.S.; Siziya, S. Tooth brushing among adolescents in Jordan. *Int. J. Child. Adolesc. Health* **2011**, *4*, 403–405.
13. Park, Y.D.; Patton, L.L.; Kim, H.Y. Clustering of oral and general health risk behaviors in Korean adolescents: A national representative sample. *J. Adolesc. Health* **2010**, *47*, 277–281. [CrossRef]
14. Pengpid, S.; Peltzer, K. Prevalence and associated factors of oral and hand hygiene behaviour among adolescents in six Southeast Asian countries. *Int. J. Adolesc. Med. Health* **2020**, 20190177. [CrossRef]
15. CDC. Global School-Based Health Survey (GSHS). Available online: https://www.who.int/ncds/surveillance/gshs/2013_Mongolia_GSHS_Fact_Sheet.pdf (accessed on 10 December 2020).
16. CDC. Global School-Based Health Survey (GSHS). Available online: https://www.who.int/ncds/surveillance/gshs/GSHS_Country_report_Mongolia2010.pdf (accessed on 12 December 2020).
17. Pengpid, S.; Peltzer, K. Prevalence and associated factors of oral and hand hygiene behavior among adolescents in Afghanistan. *Int. Public Health J.* **2019**, *11*, 295–301.
18. Peltzer, K.; Tepirou, C.; Pengpid, S. Prevalence and correlates of perceived teeth health status and oral health behavior among school-going adolescents in Cambodia. *Nagoya J. Med. Sci.* **2016**, *78*, 493–500. [CrossRef] [PubMed]
19. McKittrick, T.R.; Jacobsen, K.H. Oral hygiene and handwashing practices among middle school students in 15 Latin American and Caribbean countries. *West. Indian Med. J.* **2015**, *64*, 266–268. [CrossRef]
20. Hasselkvist, A.; Johansson, A.; Johansson, A.K. Association between soft drink consumption, oral health and some lifestyle factors in Swedish adolescents. *Acta Odontol. Scand.* **2014**, *72*, 1039–1046. [CrossRef]
21. Hamilton, K.; Cornish, S.; Kirkpatrick, A.; Kroon, J.; Schwarzer, R. Parental supervision for their children's toothbrushing: Mediating effects of planning, self-efficacy, and action control. *Br. J. Health Psychol.* **2018**, *23*, 387–406. [CrossRef] [PubMed]
22. Mongolian Government. National Program for Healthy Tooth-Healthy Child. Available online: https://montsame.mn/mn/read/227540 (accessed on 10 August 2020).
23. World Health Organization. *Oral Health Promotio: An Essential Element of a Health-Promoting School*; World Health Organization: Geneva, Switzerland, 2003. Available online: https://apps.who.int/iris/bitstream/handle/10665/70207/WHO_NMH_NPH_ORH_School_03.3_eng.pdf?sequence=1&isAllowed=y&fbclid=IwAR3PM_i3qSEq2fnbsqIOIhwuCREaaXa0PRlx8nO-rXWuGQubQZsmA2ZCB_c (accessed on 1 December 2020).

II.

International Journal of
Environmental Research and Public Health

MDPI

Article

Suicide Attempts among School-Attending Adolescents in Mongolia: Associated Factors and Gender Differences

Javzan Badarch [1,*], Bayar Chuluunbaatar [2], Suvd Batbaatar [3] and Edit Paulik [1]

[1] Department of Public Health, Albert Szent-Györgyi Medical School, University of Szeged, 6720 Szeged, Hungary; paulik.edit@med.u-szeged.hu
[2] Medicine and Medical Devices Regulatory Agency, Ulaanbaatar 14210, Mongolia; bayar@mmra.gov.mn
[3] Department of Environmental Health, National Center for Public Health, Ulaanbaatar 13381, Mongolia; suvd552001@gmail.com
* Correspondence: javzan.badarch@med.u-szeged.hu

Abstract: Attempting suicide is an important risk factor that can lead to suicide death. The aim of the current study was to examine the prevalence of suicide attempts and to identify the gender-specific predictors of suicide among adolescents in Mongolia. We analyzed data from the 2019 Mongolian Global School-Based Health Survey (GSHS) conducted nationwide among 13–18-year-old students. Univariable and multivariable analyses were performed to assess the correlates of suicide attempts. Overall, 32.1% of the adolescents reported to have had suicide attempts. Multivariable analysis showed a significant association in the total sample of suicide attempts with lack of close friends, anxiety, injury and violence, smoking and alcohol drinking, and sexual intercourse. Male suicide attempters were less likely to have close friends and more likely to have injuries, been physically attacked, been bullied, smoke, drink alcohol, and have had sexual intercourse. Within the female subgroup, anxiety, injury and violence, smoking and alcohol drinking significantly increased the odds of reporting suicide attempts. Increase of the student's age by one year decreased the odds ratio of suicide attempts. Nearly one in three students had had a suicide attempt. Several factors, including mental distress, violence, and risky behaviors were found to be associated with suicide attempts. These can aid in designing intervention strategies for preventing suicidal behaviors among adolescents.

Keywords: prevalence; suicide; attempt; adolescents; health survey; Mongolia

check for updates

Citation: Badarch, J.; Chuluunbaatar, B.; Batbaatar, S.; Paulik, E. Suicide Attempts among School-Attending Adolescents in Mongolia: Associated Factors and Gender Differences. *Int. J. Environ. Res. Public Health* **2022**, *19*, 2991. https://doi.org/10.3390/ijerph19052991

Academic Editor: Paul B. Tchounwou

Received: 27 January 2022
Accepted: 3 March 2022
Published: 4 March 2022

1. Introduction

Suicide and suicide-related behavior in young people have become serious and urgent global public health problems. More than 700,000 people in the world lose their life each year as a consequence of suicide [1]. In 2016, more than one in every 100 deaths (1.3%) was the result of committing suicide, and among individuals aged between 15 to 19 years, it was the third-leading cause of mortality. In addition, most of the world's suicides occurred in low and middle-income countries (LMICs) (79%) [2], and in 2016, globally, more than 62,000 youths committed suicide [3].

Data on the prevalence of suicide attempts are available from various countries. Asia is the continent with the largest population size, and more than 60% of the world's suicides occur in Asia, with China, India, and Japan being the most significant contributors to global suicide counts [4]. In Mongolia, mental health is second among the top five challenges that children are facing. The average suicide rate of Mongolian adolescents is five times as high as that of East Asia or the Pacific region. Moreover, in Mongolia, the suicide mortality among the young aged 10–14 years increased from 3.3% in 2003 to 11.4% in 2019 [5].

According to the statistical data, suicide rates among the young are alarming. For instance, the standardized suicide rates increased from 3.5 to 5.3 per 100,000 between 2001 and 2010 in South Korea [6], and from 9.1% to 11.3% between 2004 [7] and 2012 [8]

in Taiwan, respectively. On average, 450 suicides occurred each year in Mongolia [9] and with 23.3 suicides per 100,000 inhabitants in 2016, the country ranked third in the world. A significant increase in suicide rates among adolescents (15–19 years) was found in Mongolia. In the 2010 Mongolian Global School-Based Health Survey (GSHS), the prevalence of suicide attempts was 8.7% [10]. Davaasambuu et al. found, in 2013, that about 10% of students had attempted suicide in the past 12 months, and students who lived in urban areas were more likely to have had a suicide attempt (11.8% vs. 8.6%) [11].

Suicide and suicide-related behaviors are multifactorial and complex. Many studies have shown that demographic variables, mental distress, violence, and risky behaviors, including substance use, are associated with increased risk of suicidal behavior in youth. Demographic factors connected with a suicide attempt may include being a female [12], older age [13], and urban locations [14]. Mental distress, including lack of close friends [15], anxiety-induced sleep disturbance [16], feeling lonely [17], and exposure to bullying/interpersonal violence [18] including suffering a physical attack [19], as well as a serious injury [20] have been found in a number of studies to be associated with adolescent suicide attempts. Risky behaviors associated with suicide attempts included substance use such as smoking [21] or alcohol drinking [22], as well as sexual intercourse [23].

Gender differences seem to play a crucial role in suicidal behavior of young people. Female adolescents are more prone to show internalizing disorders (e.g., anxiety) which may mediate the connection with suicidal behaviors [24], and females tend to have more suicide attempts than males [25]. In contrast, completed suicide was more frequent in males [26], which may be associated with a higher prevalence of externalizing disorders (e.g., substance-abuse disorder) [27].

Although findings of studies using the Mongolian GSHS 2010 and 2013 revealed that suicide attempts had increased significantly, no suicide-prevention program had been implemented in Mongolia in the previous decade. Considering this, the aim of the current study was to examine the prevalence of self-reported suicide attempts and to identify the gender specific predictors among school-attending adolescents in Mongolia using data from the GSHS 2019.

2. Materials and Methods

2.1. Participants and Procedures

The study involved data from the 2019 Mongolia GSHS. The Mongolian GSHS protocol was approved by Resolution No. 88 of the Ethical Committee of National Center for Public Health in November 2018. Students were asked to participate voluntarily in the survey, and a written informed consent was obtained from each student and parents/guardians. A two-stage cluster sample design was used to collect data to represent all students from 10 to 18 years of age in Mongolia. In the first stage of sampling, schools were selected with probability proportional to their reported enrolment size. In the second stage, classes in the selected schools were randomly chosen, and all students in the selected classes were eligible to participate. Altogether 4514 students participated in the 2019 Mongolian GSHS survey. Two types of questionnaires were applied, depending on the age of the target population (10–12-year-old or 13–18-year-old). The ten core GSHS questionnaire modules address the leading causes/risk factors of morbidity and mortality among children: tobacco, alcohol and other drug use; dietary behaviors; hygiene; mental health; physical activity; sexual behaviors that contribute to HIV infection, other sexually transmitted infections and unintended pregnancy; unintentional injuries and violence; and respondent demographics [28]. The question about attempted suicide was asked of the 13–18-year-old students. This question was answered by 2850 students, so in the present analysis, these students were considered as total.

2.2. Measures

With the exception of age, all variables were dichotomized as yes or no answers.

Suicide attempts: "During the past 12 months, how many times did you actually attempt suicide?" (Response options were from 1 = 0 times to 5 = 6 or more times; coded 1 = no and 2–5 = yes).

The independent variables were demographic factors, mental distress, injury and violence, and risky behaviors.

2.2.1. Demographic Factors

Gender: "What is your sex?" (Response options were 1 = male and 2 = female).

Age: "How old are you?" (Age in years).

2.2.2. Mental Distress

Close friend: "How many close friends do you have?" (Response options were from 1 = 0 to 4 = 3 or more; coded 1 = no and 2–4 = yes).

Anxiety-induced sleep disturbance: "During the past 12 months, how often have you been so worried about something that you could not sleep at night?" (Response option were from 1 = never to 5 = always; coded 1–2 = no and 3–5 = yes).

Loneliness: "During the past 12 months, how often have you felt lonely?" (Response option were from 1 = never to 5 = always; coded 1–2 = no and 3–5 = yes).

2.2.3. Injury and Violence

Being bullied: "During the past 30 days, on how many days have you been bullied?" (Response options were from 1 = 0 day to 7 = all 30 days; coded 1 = no and 2–7 = yes). (Description provided in the questionnaire: Bullying occurs when one or more students or someone else about your age teases, threatens, ignores, spreads rumors about, hits, shoves, or hurts another person over and over again).

Physically attacked: "During the past 12 months, how many times have you been physically attacked?" (Response options were from 1 = 0 time to 8 = 12 or more times; coded 1 = no and 2–8 = yes). (Description provided in the questionnaire: A physical attack occurs when one or more people hit or strike someone, or when one or more people hurt another person with a weapon (such as a stick, knife, or gun)).

Injury: "During the past 12 months, how many times have you been seriously injured?" (Response options were from 1 = 0 time to 8 = 12 or more times; coded 1 = no and 2–8 = yes). (Description provided in the questionnaire: An injury is serious when it makes you miss at least one full day of usual activities (such as, school, sports, or a job) or requires treatment by a doctor or nurse).

2.2.4. Risky Behaviors

Cigarette smoking: "During the past 30 days, on how many days have you smoked cigarettes?" (Response options were from 1 = 0 day to 7 = all 30 days; coded 1 = no and 2–7 = yes).

Alcohol drinking: "During the past 30 days, on how many days have you had at least one drink containing alcohol?" (Response options were from 1 = 0 day to 7 = All 30 days; coded 1 = no and 2–7 = yes).

Sexual intercourse: "Have you ever had a sexual intercourse?" (Response options were 1 = yes and 2 = no).

2.3. Data Analysis

Data analysis was carried out with IBM SPSS (Statistical Package for the Social Sciences) version 27 (SPSS Inc., Chicago, IL, USA). Descriptive statistics including frequency, percentage, median, and interquartile range (IQR) were done to describe the study sample. Univariable logistic regression analyses were conducted to examine unadjusted associations between suicide attempts and independent variables. Multivariable forward stepwise

logistic regression analysis was used to assess the independent contribution of demographic factors, mental distress, injury and violence, and risky behaviors to suicide attempts. The independent variables involved in the regression analysis were student age, place of residence, having close friends, anxiety, loneliness, being bullied, being physically attacked, injury, cigarette smoking, alcohol drinking, and sexual intercourse. Student age was considered as a continuous variable in the model. Odds ratio (OR) and 95% CI of OR were used to indicate the association between the suicide attempts and the selected list of independent variables. Statistical significance was defined at $p < 0.05$. Nagelkerke R^2 values were used to evaluate the explanatory power of the models.

3. Results

A total of 2850 subjects were eligible for the analysis. The sex distribution showed female dominance (56% women and 44% men). The characteristics of the sample (total, male, and female) are shown in Table 1. The prevalence rate of attempted suicide was 32.1% in the total sample, 33.3% in males, and 31.3% in females.

Table 1. Sample characteristics of school-attending adolescents included in the study by sex.

	Total (2850)		**Male (1254)**		**Female (1596)**	
	N	**%**	**N**	**%**	**N**	**%**
Suicide attempts						
Yes	916	32.1	417	33.3	499	31.3
No	1934	67.9	837	67.3	1097	68.7
Demographic factors						
Median age in year (IQR *)	15	−3	15	−2	15	−3
Place of residence						
Urban	916	32.1	412	32.9	504	31.6
Rural	1934	67.9	842	67.1	1092	68.4
Mental distress						
Close friend						
No	154	5.4	53	4.2	101	6.3
Yes	2683	94.1	1195	95.3	1488	93.2
Missing	13	0.5	6	0.5	7	0.4
Anxiety						
Yes	752	26.4	266	21.2	486	30.5
No	2094	73.5	987	78.7	1107	69.4
Missing	4	0.1	1	0.1	3	0.2
Feeling lonely						
Yes	1254	44	433	34.5	821	51.4
No	1594	55.9	819	65.3	775	48.6
Missing	2	0.1	2	0.2		
Injury and violence						
Being bullied						
Yes	1144	40.1	568	45.3	576	36.1
No	1699	59.6	682	54.4	1017	63.7
Missing	7	0.2	4	0.3	3	0.2
Being physically attacked						
Yes	1145	40.2	598	47.7	547	34.3
No	1703	59.8	655	52.2	1048	65.7
Missing	2	0.1	1	0.1	1	0.1
Injury						
Yes	1472	51.6	738	58.9	734	46
No	1375	48.2	514	41	861	53.9
Missing	3	0.1	2	0.2	1	0.1

Table 1. *Cont.*

	Total (2850)		Male (1254)		Female (1596)	
	N	%	N	%	N	%
Risky behaviors						
Cigarette smoking						
Yes	894	31.4	469	37.4	425	26.6
No	1950	68.4	780	62.2	1170	73.3
Missing	6	0.2	5	0.4	1	0.1
Alcohol drinking						
Yes	824	28.9	400	31.9	424	26.6
No	2025	71.1	854	68.1	1171	73.4
Missing	1	0	0	0	1	0.1
Sexual intercourse						
Yes	349	12.2	238	19	111	7
No	2491	87.4	1007	80.3	1484	93
Missing	10	0.4	9	0.7	1	0.1

* IQR: interquartile range. Missing: no answer was provided.

According to the univariable analysis (Table 2), male suicide attempters were less likely to have older age; more likely to be bullied, physically attacked, injured, smoke cigarettes, and drink alcohol. Female suicide attempters were less likely to have older age; more likely to live in urban location, have anxiety, feel lonely, be bullied, be physically attacked, be injured, smoke cigarettes, and drink alcohol. In the total sample, all factors showed a significant relationship with suicide attempts except sexual intercourse. Female students who had no close friends were less likely to have suicidal behavior than female students who had 1 or more close friends. The highest odds were found in connection with the risky behaviors, and with the injury and violence factors, especially among females.

Table 2. Results of univariable logistic regression analysis for suicide attempts by sex.

	Total			Male			Female		
	UAOR	95% CI	*p* Value	UAOR	95% CI	*p* Value	UAOR	95% CI	*p* Value
Demographic factors									
Age * (year)	0.87	0.83–0.91	<0.001	0.89	0.82–0.95	0.002	0.85	0.80–0.91	<0.001
Urban location	1.41	1.19–1.66	<0.001	1.15	0.90–1.48	0.251	1.65	1.32–2.07	<0.001
Mental distress									
No close friends	0.60	0.41–0.89	0.011	0.94	0.52–1.70	0.852	0.45	0.27–0.77	0.003
Anxiety	1.34	1.12–1.59	<0.001	1.19	0.90–1.58	0.214	1.47	1.18–1.85	0.001
Feeling lonely	1.17	1.00–1.38	0.042	1.11	0.87–1.43	0.369	1.26	1.02–1.56	0.028
Injury and violence									
Being bullied	31.93	25.42–40.11	<0.001	32.03	22.19–46.23	<0.001	34.41	25.52–46.40	<0.001
Physically attacked	33.03	26.27–41.53	<0.001	30.18	20.74–43.92	<0.001	42.57	31.34–57.81	<0.001
Injury	21.27	16.60–27.27	<0.001	20.21	13.36–30.56	<0.001	23.60	17.23–32.34	<0.001
Risky behaviors									
Smoking	69.89	54.47–89.67	<0.001	43.02	30.39–60.89	<0.001	217.69	133.85–354.01	<0.001
Alcohol drinking	145.73	107.45–197.65	<0.001	125.84	82.43–192.10	<0.001	190.89	119.50–304.93	<0.001
Sexual intercourse	1.22	0.96–1.54	0.092	1.14	0.84–1.53	0.386	1.31	0.88–1.96	0.179

* Age: continuous variable. UAOR: unadjusted odds ratio. 95% CI: 95% confidence interval.

The last step of the stepwise logistic regression models is shown in Table 3. Compared with the results of univariable analyses, the multiple models showed small differences in the predictors of attempted suicide in males and females. The living place and feeling lonely were not significant predictors in all models. Age remained significant in the case of females; each one year increase in age was associated with progressively fewer suicide attempts (AOR: 0.84). Anxiety and feeling lonely were not involved in the stepwise model in males, as was expected from the univariable results ($p > 0.05$), while in females, anxiety was a significant predictor (AOR: 2.02). In males, attempted suicide was more likely among those having sexual intercourse (AOR: 2.14). Altogether, male suicide attempters were less

likely to have close friends, and more likely to having been bullied, physically attacked, injured, smoke cigarettes, and drink alcohol, and have had sexual intercourse. Within the female subgroup, lack of close friends, anxiety, being bullied, being physically attacked or injured, cigarette smoking, and alcohol drinking significantly increased the odds of reporting a suicide attempt.

Table 3. Results of multivariable stepwise logistic regression analysis for suicide attempts by sex.

	Total			Male			Female		
	* AOR	95% CI	*p* Value	AOR	95% CI	*p* Value	AOR	95% CI	*p* Value
Demographic factors									
Age (year)	0.89	0.80–0.99	0.036	-	-	-	0.84	0.73–0.97	0.017
Mental distress									
No close friends	3.3	2.02–5.40	<0.001	5.68	2.55–12.63	<0.001	2.26	1.19–4.28	0.012
Anxiety	1.51	1.09–2.10	0.013	-	-	-	2.02	1.30–3.12	0.002
Injury and violence									
Being bullied	2.41	1.67–3.47	<0.001	2.88	1.65–4.99	<0.001	2.22	1.35–3.65	0.001
Physically attacked	2.59	1.80–3.73	<0.001	3.25	1.84–5.74	<0.001	2.76	1.67–4.54	<0.001
Injured	2.35	1.66–3.31	<0.001	2.78	1.59–4.87	<0.001	2.29	1.46–3.59	<0.001
Risky behaviors									
Cigarette smoking	5.02	3.17–7.95	<0.001	3.93	2.19–7.07	<0.001	13.62	5.55–33.45	<0.001
Alcohol drinking	12.83	8.00–20.58	<0.001	17.58	9.59–32.24	<0.001	5.17	2.07–12.90	<0.001
Sexual intercourse	1.86	1.17–2.95	0.008	2.14	1.16–3.95	0.014	-	-	-
Nagelkerke R^2		0.779			0.793			0.781	

Reference categories: rural location, had close friends, did not report anxiety, did not report loneliness, did not report being physically attacked, did not suffer any injury, did not report being bullied, no cigarette smoking, no alcohol drinking, and no sexual intercourse. * AOR: adjusted odds ratio. Variables not entered in the models: Total: living place and feeling lonely; male: age, living place, anxiety, and feeling lonely; female: living place, feeling lonely, and sexual intercourse.

4. Discussion

This was a cross-sectional study among school-attending adolescents based on the 2019 Mongolian GSHS. Mongolia belongs to the Western Pacific (WPR) region, which exhibited the highest overall prevalence of suicide attempts [29]. The prevalence of suicide attempts is a major concern in LMICs among young people aged 10–19 years. In this study, the prevalence of suicide attempts during the previous 12 months was 32.1% (33.3% for the males and 31.3% for the females), which was much higher than in previous studies based on the Mongolian GSHS of 2010 (8.7%) [10] and 2013 (10%) [11]. In addition, this result was also higher than the 12-month prevalence of suicide attempts in China (9.4%) [30], the Philippines (15.34%) [31], Vietnam (21.2%) [32], or Thailand (13.3%) [33], but lower than in the Solomon Islands (36.9%) [34].

In a previous study [13] based on the GSHS data of 82 countries from 2003 to 2015, it was found that the incidence of suicide attempts increases with age between 12 and 17 years. In contrast, our results showed that older age students (between 13 and 18 years of age) were less likely to have suicidal behavior.

This study found that having no close friends was a risk factor for suicide attempts among adolescents. It is well-known that having no close friends is associated with poor mental health including suicide attempts [35]. Conversely, school-going students who had support from their classmates were protected from experiencing suicide attempts [36].

Adolescents who had worry-induced sleep disturbance had higher odds of attempted suicide [37]. In this case, sleep disturbance is likely to be a symptom of anxiety. It has been reported that adolescents showing high levels all characteristics of anxiety disorder, including low distress tolerance and uncontrolled emotion, tend to have suicide attempts [38]. Anxiety in itself was found to be correlated with attempted suicide in the present study.

Findings from this study suggest that being bullied was strongly associated with suicide attempts. Being bullied is known to increase the risk of mental health problems, including poor motivational control, which may lead to increased risk of adolescent suicide

attempts [39]. In order to prevent suicide in this population, it will also be crucial to improve anti-violence interventions.

The results of this study, namely that the social adversities of being physically attacked increased the odds of suicide attempts, were consistent with evidence from the GSHS in other South East Asian countries, including Indonesia, Laos, the Philippines, Thailand, and Timor-Leste [17]. Evidence suggests that this relationship is often mediated by other factors. Students who are physically attacked by their peers are more likely to be depressed, have difficulty winning friends, have poorer relationships with classmates, and experience loneliness [40].

The present study found that injury contributed to the increased likelihood of high psychological distress including suicidal behavior among young people. Injury may have poorly affected the physical and psychological health of adolescents, making them vulnerable to mental distress [41].

This study confirmed previous findings [42,43] showing an association between substance use, including current smoking and alcohol consumption, and suicide attempts in the adolescent population. An association between substance use and poor mental health or suicide attempts may refer to a clustering of risky behaviors.

Our findings showed that sexual intercourse was significantly associated with suicide attempts, which is in concordance with a previous research [23]. In that research, it was concluded that adolescents who reported having their first sexual intercourse before 14 years of age were more likely to have several psychological problems compared to adolescents who had their first sexual intercourse after the age of 14 years.

Recent studies have described that urban location [44] and feeling lonely [17] were strongly associated with suicide attempts, whereas our present study did not find an association between locations, loneliness, and suicide attempts.

Information on the risk factors of suicide attempts is fundamental for formulating an effective suicide-prevention program or intervention. Fostering socio-emotional life skills in adolescents is one of the four effective evidence-based interventions to prevent suicide, as stated in the LIVE LIFE implementation guideline [45]. In order to achieve that, school-based interventions in Mongolia should focus on strengthening general mental health, mitigating violence and bullying, and controlling and preventing risky behaviors, such as tobacco or alcohol use. Improved sexual health education, e.g., teaching strategies for refusing unwanted sex, might also contribute to reducing the risk of attempted suicide. Better self-esteem and development of life skills (including proper habits and lifestyle with good general and mental health, healthy eating behavior, and healthy decision-making) have been proven to decrease the risk of suicide among young people.

5. Limitations

The findings of this investigation must be viewed in light of its limitations. Firstly, the data were cross-sectional, so did not prove causation, but they did provide information on correlations. Secondly, a self-report questionnaire was applied, so it might be possible that the children provided invalid answers. Thirdly, this study focused on only in-school students meaning that the findings are not generalizable to all adolescents in the country. Fourthly, the involvement of parents/guardians may protect young people from risk factors, and the GSHS in Mongolia does not assess parental engagement. Finally, this questionnaire had no questions on sexual orientation, which could be the focus of further research.

6. Conclusions

High prevalence (32.1%) of suicide attempts was observed among school-attending adolescents in Mongolia, which remains a major public health problem. Several risk factors, including having no close friends, anxiety-induced sleep disturbance, frequent bullying, victimization, having been frequently physically attacked or injured, current tobacco use, alcohol drinking, and having had sexual intercourse were connected with students' suicide attempts, whereas an increase in a student's age by 1 year was a protective

factor. Our results reinforce that the problem is increasing among school-going students, and the results may call the attention of the Mongolian government to the need to develop an independent and comprehensive adolescent health policy covering physical, mental, and behavioral problems of the adolescents in Mongolia. Findings of our study suggest that suicide-prevention programs should focus on encouraging general mental health. Important elements of that include mitigating violence and bullying, as well as controlling and preventing risky behaviors such as substance use (smoking and alcohol). Improving sexual health education, e.g., teaching strategies for refusing unwanted sex, might also contribute to a reduced risk for attempted suicides in the Mongolian adolescent population.

Author Contributions: Conceptualization, J.B., B.C. and S.B.; methodology, J.B.; formal analysis, J.B. and E.P.; writing—original draft preparation, J.B. and B.C.; writing—review and editing, S.B. and E.P. All authors have read and agreed to the published version of the manuscript.

Funding: This research did not receive any funds from public or private funding agencies.

Institutional Review Board Statement: The Mongolia GSHS protocol was approved by the Ethical Committee (resolution No.88) of the National Center for Public Health, Mongolia in November 2018.

Informed Consent Statement: Written informed consent was obtained from each student who asked, voluntarily, to participate in the survey and from their parents/guardians.

Data Availability Statement: Datasets generated during the study can be obtained directly from the third author at suvd552001@gmail.com.

Acknowledgments: This research uses data from the Global School-Based Student Health Survey (GSHS). The authors would like to thank GSHS country coordinators and other staff members as well as adolescent participants in Mongolia.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. Suicide Key Facts. Available online: https://www.who.int/news-room/fact-sheets/detail/suicide (accessed on 19 January 2022).
2. World Health Organization. Suicide in the World: Global Health Estimates 2019. Available online: https://apps.who.int/iris/handle/10665/326948 (accessed on 19 January 2022).
3. Adolescent Mental Health. Available online: https://www.who.int/news-room/fact-sheets/detail/adolescent-mental-health (accessed on 19 January 2022).
4. Beautrais, A.L. *Suicide in Asia*; Hogrefe & Huber Publishers: Cambridge, MA, USA, 2006; pp. 55–57.
5. Five Priority Issues Facing Mongolian Children. Available online: https://www.unicef.org/mongolia/mn/commitment-address-top-five-challenges-children-are-facing-mongolia (accessed on 19 January 2022).
6. Kim, G.M.; Kim, J.M.; Kyung Hyun, M.; Mi Choi, S.; Woo, J.M. Comparison of the risk factors of Korean adolescent suicide residing in high suicidal regions versus those in low suicidal regions. *Psychiatr. Danub.* **2019**, *31*, 397–404. [CrossRef] [PubMed]
7. Tang, T.C.; Ko, C.H.; Yen, J.Y.; Lin, H.C.; Liu, S.C.; Huang, C.F.; Yen, C.F. Suicide and its association with individual, family, peer, and school factors in an adolescent population in southern Taiwan. *Suicide Life-Threat. Behav.* **2009**, *39*, 91–102. [CrossRef] [PubMed]
8. Chen, Y.L.; Ho, H.Y.; Hsiao, R.C.; Lu, W.H.; Yen, C.F. Correlations between quality of life, school bullying, and suicide in adolescents with attention-deficit hyperactivity disorder. *Int. J. Environ. Res. Public Health* **2020**, *17*, 3262. [CrossRef] [PubMed]
9. Жендэрийн Үндэсний Хороо. Суурь Судалгааны Тайлан 2020. Available online: https://1212.mn/BookLibraryDownload.ashx?url=GenderBasicSurveyReport_2019.pdf&ln=Mn (accessed on 19 January 2022).
10. Altangerel, U.; Liou, J.C.; Yeh, P.M. Prevalence and predictors of suicidal behavior among Mongolian high school students. *Community Ment. Health J.* **2014**, *50*, 362–372. [CrossRef]
11. Davaasambuu, S.; Batbaatar, S.; Witte, S.; Hamid, P.; Oquendo, M.A.; Kleinman, M.; Olivares, M.; Gould, M. Suicidal Plans and Attempts Among Adolescents in Mongolia. *Crisis* **2017**, *38*, 330–343. [CrossRef]
12. Putra, I.; Karin, P.; Ariastuti, N.L.P. Suicidal ideation and suicide attempt among Indonesian adolescent students. *Int. J. Adolesc. Med. Health.* **2019**, *33*. [CrossRef]
13. Biswas, T.; Scott, J.G.; Munir, K.; Renzaho, A.M.; Rawal, L.B.; Baxter, J.; Mamun, A.A. Global variation in the prevalence of suicidal ideation, anxiety and their correlates among adolescents: A population based study of 82 countries. *EClinicalMedicine* **2020**, *24*, 100395. [CrossRef]
14. Oliveira, E.D.C.; Meucci, T.S.; Rossato, L.M.; Mendes-Castillo, A.M.C.; Silva, L. Prevalence of suicide attempts among adolescents and young people. *SMAD. Rev. Eletrônica Saúde Ment. Álcool E Drog.* **2020**, *16*, 85–91. [CrossRef]

15. Pengpid, S.; Peltzer, K. Past 12-month history of single and multiple suicide attempts among a national sample of school-going adolescents in Tonga. *Asia-Pac. Psychiatry* **2021**, *13*, e12425. [CrossRef]
16. Li, L.; You, D.; Ruan, T.; Xu, S.; Mi, D.; Cai, T.; Han, L. The prevalence of suicidal behaviors and their mental risk factors among young adolescents in 46 low-and middle-income countries. *J. Affect. Disord.* **2021**, *281*, 847–855. [CrossRef]
17. Pengpid, S.; Peltzer, K. Suicide attempt and associated factors among adolescents in five Southeast Asian countries in 2015. *Crisis: J. Crisis Interv. Suicide Prev.* **2020**, *41*, 296. [CrossRef] [PubMed]
18. Koyanagi, A.; Oh, H.; Carvalho, A.F.; Smith, L.; Haro, J.M.; Vancampfort, D.; Stubbs, B.; DeVylder, J.E. Bullying victimization and suicide attempt among adolescents aged 12–15 years from 48 countries. *J. Am. Acad. Child Adolesc. Psychiatry* **2019**, *58*, 907–918. e4. [CrossRef] [PubMed]
19. Kim, W.; Chun, S.; Lee, S.A. Suicide attempt and violence victimization in Korean adolescents with migrant parents: A nationwide study. *J. Affect. Disord.* **2021**, *290*, 164–168. [CrossRef] [PubMed]
20. Campisi, S.C.; Carducci, B.; Akseer, N.; Zasowski, C.; Szatmari, P.; Bhutta, Z.A. Suicidal behaviours among adolescents from 90 countries: A pooled analysis of the global school-based student health survey. *BMC Public Health* **2020**, *20*, 1102. [CrossRef]
21. Lange, S.; Koyanagi, A.; Rehm, J.; Roerecke, M.; Carvalho, A.F. Association of tobacco use and exposure to secondhand smoke with suicide attempts among adolescents: Findings from 33 countries. *Nicotine Tob. Res.* **2020**, *22*, 1322–1329. [CrossRef]
22. Sharma, B.; Nam, E.W.; Kim, H.Y.; Kim, J.K. Factors associated with suicidal ideation and suicide attempt among school-going urban adolescents in Peru. *Int. J. Environ. Res. Public Health* **2015**, *12*, 14842–14856. [CrossRef]
23. Smith, L.; Jackson, S.E.; Vancampfort, D.; Jacob, L.; Firth, J.; Grabovac, I.; McDermott, D.; Yang, L.; López-Sánchez, G.F.; Niederkrotenthaler, T.; et al. Sexual behavior and suicide attempts among adolescents aged 12–15 years from 38 countries: A global perspective. *Psychiatry Res.* **2020**, *287*, 112564. [CrossRef]
24. Mars, B.; Heron, J.; Crane, C.; Hawton, K.; Kidger, J.; Lewis, G.; Macleod, J.; Tilling, K.; Gunnell, D. Differences in risk factors for self-harm with and without suicidal intent: Findings from the ALSPAC cohort. *J. Affect. Disord.* **2014**, *168*, 407–414. [CrossRef]
25. Chau, K.; Kabuth, B.; Chau, N. Gender and family disparities in suicide attempt and role of socioeconomic, school, and health-related difficulties in early adolescence. *Biomed Res. Int.* **2014**, *2014*, 314521. [CrossRef]
26. Miranda-Mendizabal, A.; Castellví, P.; Parés-Badell, O.; Alayo, I.; Almenara, J.; Alonso, I.; Blasco, M.J.; Cebrià, A.; Gabilondo, A.; Gili, M.; et al. Gender differences in suicidal behavior in adolescents and young adults: Systematic review and meta-analysis of longitudinal studies. *Int. J. Public Health* **2019**, *64*, 265–283. [CrossRef]
27. Mergl, R.; Koburger, N.; Heinrichs, K.; Székely, A.; Tóth, M.D.; Coyne, J.; Maxwell, M.; Värnik, A.; van Audenhove, C.; McDaid, D.; et al. What are reasons for the large gender differences in the lethality of suicidal acts? An epidemiological analysis in four European countries. *PLoS ONE* **2015**, *10*, e0129062. [CrossRef]
28. World Health Organization. Mongolia Global School-Based Health Survey Country Report 2010. Available online: https://www.who.int/ncds/surveillance/gshs/GSHS_Country_report_Mongolia2010.pdf (accessed on 19 January 2022).
29. Liu, X.; Huang, Y.; Liu, Y. Prevalence, distribution, and associated factors of suicide attempts in young adolescents: School-based data from 40 low-income and middle-income countries. *PLoS ONE* **2018**, *13*, e0207823. [CrossRef] [PubMed]
30. Liu, Z.Z.; Wang, Z.Y.; Bo, Q.G.; Qi, Z.B.; Xu, R.J.; Jia, C.X.; Liu, X. Suicidal behaviours among Chinese adolescents exposed to suicide attempt or death. *Epidemiol. Psychiatr. Sci.* **2018**, *29*, e12. [CrossRef] [PubMed]
31. Lagman, J.G.; Gara, M.; Baweja, R.; Kim, W.J. Correlates of Suicide Attempts in Filipino Youths: An Analysis Based on the 2015 Global School-Based Student Health Survey. *Cureus* **2021**, *13*, e18100. [CrossRef] [PubMed]
32. Nguyen Thi Khanh, H.; Nguyen Thanh, L.; Pham Quoc, T.; Pham Viet, C.; Duong Minh, D.; Le Thi Kim, A. Suicidal behaviors and depression "among adolescents in Hanoi, Vietnam: A multilevel analysis of data from the Youth Risk Behavior Survey 2019. *Health Psychol. Open* **2020**, *7*, 2055102920954711. [CrossRef]
33. World Health Organization. Thailand Global School-Based Health Survey 2015. Available online: https://www.who.int/ncds/surveillance/gshs/2015-Thailand-GSHS-Fact-Sheet.pdf (accessed on 19 January 2022).
34. Sharma, B.; Lee, T.H.; Nam, E.W. Loneliness, insomnia and suicidal behavior among school-going adolescents in Western Pacific Island countries: Role of violence and injury. *Int. J. Environ. Res. Public Health* **2017**, *14*, 791. [CrossRef]
35. Quarshie, E.N.-B.; Onyeaka, H.K.; Asante, K.O. Suicidal behaviours among adolescents in Liberia. *BMC Psychiatry* **2020**, *20*, 572. [CrossRef]
36. Seidu, A.A.; Amu, H.; Dadzie, L.K.; Amoah, A.; Ahinkorah, B.O.; Ameyaw, E.K.; Acheampong, H.Y.; Kissah-Korsah, K. Suicidal behaviours among in-school adolescents in Mozambique: Cross-sectional evidence of the prevalence and predictors using the Global School-Based Health Survey data. *PLoS ONE.* **2020**, *15*, e0236448.
37. Ahinkorah, B.O.; Aboagye, R.G.; Arthur-Holmes, F.; Hagan, J.E.; Okyere, J.; Budu, E.; Dowou, K.R.; Adu, C.; Seidu, A.-A. A Multi-Country Analysis of Prevalence of Anxiety-Induced Sleep Disturbance and Its Associated Factors among In-School Adolescents in Sub-Saharan Africa Using the Global School-Based Health Survey. *Healthcare* **2021**, *9*, 234. [CrossRef]
38. O'Neil Rodriguez, K.A.; Kendall, P.C. Suicidal ideation in anxiety-disordered youth: Identifying predictors of risk. *J. Clin. Child Adolesc. Psychol.* **2014**, *43*, 51–62. [CrossRef]
39. Tang, J.J.; Yu, Y.; Wilcox, H.C.; Kang, C.; Wang, K.; Wang, C.; Wu, Y.; Chen, R. Global risks of suicidal behaviours and being bullied and their association in adolescents: School-based health survey in 83 countries. *EClinicalMedicine* **2020**, *19*, 100253. [CrossRef] [PubMed]

40. Dema, T.; Tripathy, J.P.; Thinley, S.; Rani, M.; Dhendup, T.; Laxmeshwar, C.; Tenzin, K.; Gurung, M.S.; Tshering, T.; Subba, D.K.; et al. Suicidal ideation and attempt among school going adolescents in Bhutan—A secondary analysis of a global school-based student health survey in Bhutan 2016. *BMC Public Health* **2019**, *19*, 1605. [CrossRef] [PubMed]
41. Aboagye, R.G.; Seidu, A.A.; Bosoka, S.A.; Hagan, J.E.; Ahinkorah, B.O. Prevalence and correlates of unintentional injuries among in-school adolescents in Ghana. *Int. J. Environ. Res. Public Health* **2021**, *18*, 6800. [CrossRef]
42. Pengpid, S.; Peltzer, K. Prevalence and correlates of past 12-month suicide attempt among in-school adolescents in Guatemala. *Psychol. Res. Behav. Manag.* **2019**, *12*, 523. [CrossRef]
43. Pengpid, S.; Peltzer, K. Early substance use initiation and psychological distress among adolescents in five ASEAN countries: A cross-sectional study. *Psychol. Res. Behav. Manag.* **2019**, *12*, 1003. [CrossRef]
44. Goldman-Mellor, S.; Allen, K.; Kaplan, M.S. Rural/Urban Disparities in Adolescent Nonfatal Suicidal Ideation and Suicide Attempt: A Population-Based Study. *Suicide Life-Threat. Behav.* **2018**, *48*, 709–719. [CrossRef] [PubMed]
45. World Health Organization. Live Life: An Implementation Guide for Suicide Prevention in Countries 2021. Available online: https://apps.who.int/iris/handle/10665/341726 (accessed on 19 January 2022).