Prevalence and Correlates of Health Risk Behaviors among High School Adolescents in Iran

With focus on Water-pipe Smoking, Suicide Ideation, Physical Activity and Nutrition

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Dedicated to my beloved wife Mahsa
for her patience & unwavering support
To my Family
for their lifelong support
Acknowledgment

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Abstract

Background: Adolescence is a transitional stage from childhood into adulthood and many habits, with long-term implications for health, from this period of life can continue into adulthood. Identifying risk factors related to health risk behaviors is therefore an important part of health promotion. The main aim of this thesis was to analyze the prevalence and correlates of health risk behaviors among 15-17 year old high school adolescents in Iran. The risk behaviors explored in Papers I–IV include waterpipe smoking, suicide ideation, physical inactivity and sedentary behavior, and nutritional habits.

Methods: Two-stage cluster sampling was used to select representative high schools and classes in the Iranian city of Tabriz. At the first stage, high schools were selected with a probability proportional to the enrollment size. At the second stage, classes were randomly selected, and all students in these selected classes were eligible to participate in the study. Overall, thirty high schools, including sixteen girls’ and fourteen boys’ high schools, ninety classes (grades 9 to 11) and 1,517 students, including 727 boys (47.9%) and 790 (52.1 %) girls participated in the study. The participants’ (students’) response rate was 84.27 %. A reliable, valid and anonymous self-administered Persian Version of the Global School-Based Student Health Survey (GSHS) questionnaire was used for data collection. Statistical methods used were Chi-square test, Fisher exact and multivariate logistic regression analyses.

Results:

Water pipe smoking: Overall, 21.6 % of students were classified as ever WP smokers and 9.7% as current smokers. Ten percent of students had started WP
smoking when younger than 12. Ninety-one percent of current WP smokers smoked one session per day, 49% smoked at a café (Ghahvekhaneh). Ninety-five percent of students reported that their age did not prevent them from being served a WP. Ninety-one students out of 147 reported that they did not notice any health warning on the WP tobacco packages. Seven percent of students out of 1,517 participants reported that they would accept a WP if offered by their friends. Being in the third grade of high school, having experienced cigarette smoking, even one or two puffs, and accepting a WP offered by close friends showed significant odds ratios for ‘ever WP smokers’. Accepting a WP offered by close friends and gender (female) showed significant odds ratios for current WP smokers.

**Suicide ideation:** Four percent of students had seriously considered attempting suicide in the past 12 months. Thirteen point two percent of students reported that they wanted to use alcohol or other drugs when they were worried. The results also revealed that 8.8% of students had been sexually abused. Also, 20.6% declared that they had been bullied in the past 30 days.

Being worried, being a current cigarette smoker, consuming alcohol or other drugs and being sexually abused were significantly associated with suicide ideation.

**Physical activity/inactivity and sedentary behavior:** The prevalence of physical inactivity (<5 days/Weeks) was 72.2% and sedentary behavior (sitting ≥3 h or more) 71.4%. Being female, having a higher BMI (being overweight or obese), walking/cycling to or from school on 1-4 days, sedentary behavior, low vegetable intake, being the victim of bullying, lack of parental support, peer support, and parental connectivity (protective factors)
were directly associated with physical inactivity. Walking/cycling to or from school on 5-7 days was negatively associated with physical inactivity. Walking/cycling to or from school on 1-4 days, being physically inactive, inadequate fruit intake, and being bullied were positively associated with sedentary behavior.

**Fruit and vegetable intake:** The prevalence of fruit intake was 76.1% (≥ 2 times/daily) and vegetable intake 23% (≥ 3 times/d). Low fruit consumption was associated with being an 11th grade student, sedentary behavior (sitting ≥3h/d), low intake of vegetables (intake < 3 daily), low or lack of parental support, low or lack of peer support, and the lack of enough food (hunger) at home. Low vegetable consumption was associated with higher BMI (overweight or obese), low consumption of fruit (< 2 daily), lack of peer support, and physical inactivity.

**Conclusion:** Identified correlated factors (risk factors) should be taken into consideration by public health authorities in the development and implementation of interventions aimed at promoting health among students in the related areas.

**Keywords:** Global Youth Tobacco Survey, High school students, Iran, Waterpipe/hookah smoking, Student health, Suicide ideation, Global School-Based Student Health Survey, Physical activity, Physical inactivity, Sedentary behavior, Fruit intake, Vegetable intake.
List of Papers

This thesis is based on the following four papers, herein referred to by their Roman numerals:


All papers are reprinted with the permission of the copyright holders:
Paper I under license number: 4463160686328 from SPRINGER NATURE in the form of, “final accepted manuscript version”, Paper II reprinted under an open access agreement from SPRINGER NATURE, and Paper III by permission of the Iranian Journal of Public Health’s editor in chief.
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## Abbreviations and Terms

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AORs</td>
<td>Adjusted odds ratios</td>
</tr>
<tr>
<td>CDC</td>
<td>Center for Disease Control and Prevention</td>
</tr>
<tr>
<td>CI</td>
<td>Confidence intervals</td>
</tr>
<tr>
<td>EMRO</td>
<td>Eastern Mediterranean Region Office</td>
</tr>
<tr>
<td>FAO</td>
<td>Food and Agriculture Organization</td>
</tr>
<tr>
<td>F&amp;V</td>
<td>Fruit and Vegetables</td>
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<tr>
<td>GSHS</td>
<td>Global School Based Student Health Survey</td>
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<tr>
<td>GYTS</td>
<td>Global Youth Tobacco Survey</td>
</tr>
<tr>
<td>HBSC</td>
<td>Health Behaviour in School aged Children</td>
</tr>
<tr>
<td>NMUPD</td>
<td>Non-medical use of prescription drugs</td>
</tr>
<tr>
<td>PA</td>
<td>Physical activity</td>
</tr>
<tr>
<td>PIA</td>
<td>Physical inactivity</td>
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<td>STD</td>
<td>Sexually transmitted diseases</td>
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<tr>
<td>WHO</td>
<td>World Health Organization</td>
</tr>
<tr>
<td>WP</td>
<td>Water pipe</td>
</tr>
<tr>
<td>UAORs</td>
<td>Unadjusted odds ratios</td>
</tr>
</tbody>
</table>
Age groups and populations definitions according to WHO

The following definitions for adults, adolescents, children and infants are used by WHO. It is recognized that other agencies may use different definitions [206].

- An adult is a person older than 19 years of age unless national law defines a person as being an adult at an earlier age.
- An adolescent is a person aged 10 to 19 years inclusive.
- A child is a person 19 years or younger unless national law defines a person to be an adult at an earlier age. However, in these guidelines when a person falls into the 10 to 19 age category they are referred to as an adolescent (see adolescent definition).
- An infant is a child younger than one year of age.
Preface

Adolescents are an important sector of the population and their health and behaviors can affect the society’s future health and norms. Adolescents should therefore be the main target group for health promotion and risk prevention; through teaching life skills and related interventions rooted in evidence-based studies. After receiving my Master of Public Health degree from the Karolinska Institute I returned to Iran and started to research in collaboration with the Province Health Center in Tabriz. Adolescent health is an area prioritized by the Tabriz University of Medical Sciences. I found that there was a lack of reliable and valid data as well as few studies based on standard global surveys. My first step was to choose a standardized instrument for data collection among adolescents, secondly to identify the risk factors, correlated to the ill health behaviour, and thirdly, based on these data, to design much needed interventions. After many discussions with the Iranian authorities, I chose the World Health Organization (WHO) Survey, i.e. the Global School Based Student Health Survey (GSHS), specially designed to identify health risk factors among school adolescents. Adopting a WHO, GSHS perspective, my intention was to investigate and identify the prevalence and correlates of health risk behaviors (water pipe smoking, suicide ideation, physical inactivity & fruit & vegetable intake) among high school students in the city of Tabriz in order to stimulate future research and health promotion interventions.
1 Introduction

1.1 Adolescence

The period between childhood and adulthood is called adolescence. Young people aged between 10 and 19 years old are defined as adolescents [1]. Adolescence is a transitional stage from childhood into adulthood, and many habits with long-term implications for health from this period of life, such as tobacco use, nutritional habits, and sexual behavior can continue into adulthood. These can lead to premature death [2]. In 2012, the number of adolescents worldwide was 721 million, and in each country, depending on its population, approximately 10% or more of the population consisted of adolescents [3]. In 2014, according to the Eurostat statistics from 507 million inhabitants in the EU-28 countries, approximately 170 million were under 30; with children (aged 0-14) accounting for 15.6% and young people for (15-29) 17.7% [4]. According to Statistics Sweden, in 2016, 20.8% of Swedish population consisted of 0-17 year olds. Developing countries in particular, have large populations in this age group. The adolescent period can be categorized into three stages: early adolescence (10-13), middle adolescence (14-16) and late adolescence (17-20) [5]. This period of life is concurrent with puberty that entails major physiological changes. During these changes, health risk behaviors with potentially life-threatening consequences, such as eating disorders, less physical activity, can become prominent [6]. During this period, the values of parental relationships can also be reduced, and conflicts can become more prevalent [5].
1.2 Adolescent health

According to the World Health Organization (WHO): “Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity” [7]. Over the past 60 years, this definition has been criticized and never been adapted. By changing the disease pattern from infectious diseases to chronic disease and population age, the definition can be counterproductive. The state of “complete” in relation to wellbeing has sparked many controversial discussions. At that time (1948), this definition seemed to encapsulate the physical, mental and social aspects of health, but as this definition was unattainable and considered almost everybody ill, so the new definition of health in 2011 was introduced: “Health as the ability to adapt and to self-manage, in the face of social, physical and emotional challenges” [7,8]. In epidemiological research, the biomedical model of health, which is the freedom from disease, pain, or defect, is commonly applied [9]. In this thesis, because of the nature of the project, the WHO definition of health was adopted. Adolescent health is defined as the “range of approaches to prevent, detect or treat young people’s health and wellbeing” (WHO, 2001) [10]. This age group is thought to be the healthiest group among the population [1]. Adolescence is a crucial period of life with regard to healthy lifestyle factors [11]. As mentioned above, the number of adolescents worldwide in 2012 was 721 million, of which 1.3 million adolescents died [12] due to road traffic injuries, HIV, suicide, violence and other preventable or curable diseases [1]. In developing counties, the higher risks of morbidity and mortality are early pregnancy and childbearing among female adolescents, and injuries among male adolescents. The risk of injuries among males is
increasing because they are more often involved in traffic accidents and war or violence than females [12]. Adolescents’ health can have various aspects that can be considered as upstream determinants or downstream determinants (Figure 1).

![Figure 1. The determinants of adolescent health and development: an ecological model [15]](image)

### 1.3 Reasons for paying attention to adolescent’s health

If healthy, skilled and educated, this age group is not only a main asset of their country but is also important for the present and the future due to the potential of adolescents to contribute to society as the main actors [13]. Better understanding of adolescent health helps us to improve our comprehension of the developmental processes during the second decade of life. Research has shown that the adolescent brain continues to develop until early adulthood.
and is therefore open to learning and being active in promoting healthy choices. This makes the age group suitable for interventions to improve their health situation.

1.4 New attention to adolescent health

“The world has not paid enough attention to the health of adolescents,” says Dr. Flavia Bustreo, Assistant Director-General for Family, Women and Children’s Health, WHO [15]. Adolescent health is a neglected area, especially in developing countries. During the past 20 years, we have seen many academic publications, documents, reports and conferences about adolescent health. However, this increased concern has frequently not been transformed into action [15, 16]. Neglected adolescent health areas include sexual health problems and HIV/AIDS, which remain the main causes of death. These problems are preventable but, because of neglect, remain a major cause of death. Mental health problems, violence and intentional and unintentional injuries are examples of neglected areas. Other health risk issues include tobacco use, alcohol and drug use, obesity and malnutrition, physical inactivity, infectious diseases and injuries [15].

1.5 Health related behaviors and risk-taking theories

As mentioned, many health-related behaviors that appear during adolescence can affect the health of the adolescent both in the present and future. Some of these risk behaviors, such as suicide and injuries, are the main causes of death among adolescents. Others, such as tobacco and alcohol use, can continue
from adolescence into adulthood. Adolescents’ behaviors thus can play both a positive and negative role in their present and future life. Positive behaviors, such as healthy eating habits and adequate physical activity may prevent health problems. According to research carried out in the United States of America on the actual causes of death among adolescents [17], physical inactivity, poor diet, alcohol consumption, microbial agents, toxic agents, traffic accidents, gun violence, sexually transmitted diseases, tobacco use and drug use were identified as being preventable and modifiable in half of the cases.

The emotional, cognitive and physical changes during adolescence can also lead to increasing independence, changes in family relationships, and identity formation. An important change is increased exploration and risk-taking behavior. The definition of risk is: a “chance of loss”, and the definition of risk taking is: “engaging in risky behavior that may be have harmful consequences” [18]. Risk-taking behaviors are a part of adolescence, but these behaviors can cause concern among parents, teachers, researchers and society because they may jeopardize the adolescent’s health and wellbeing. Examples of such behaviors are: tobacco use, alcohol consumption, drug misuse, unsafe sex, and unhealthy dietary habits [19, 20].

These behaviors (health risk behaviors) established during adolescence can persist into adulthood [2]. Understanding adolescent risk taking has therefore become a public health priority. Some factors have been identified as being associated with adolescent risk-taking behaviors, such as biological, psychological and environmental. Many theories of risk-taking behavior among adolescents focus mostly on one main factor, such as biological or environmental and consider the behavior (risk behavior) to be
unidimensional. However, to make a comprehensive analysis of risk behaviors we need a framework or theory that examines simultaneously the factors that cause adolescents to engage in risky behaviors. The roles of biology, psychology and environment also need to be considered. The National Institute of Health (NIH) stresses the need for better understanding of the interaction between these three factors (biology, environment and psychology) and the behaviors which place one at risk [21]. The framework that contains both social and environmental factors, and simultaneously examines the biological and psychological predispositions, is the “biopsychosocial” model of risk-taking behavior [22]. A brief presentation of each theory of adolescent risk-taking behavior follows.

1.5.1 BIOLOGICALL BASED THEORIES

This theory suggests that adolescents engage in risky behaviors for four reasons:

1. Genetic predisposition
2. Direct hormonal influence
3. Influence of asynchronous pubertal timing
4. Brain and central nervous system development

1.5.1.1 Genetic predispositions

The role of genetic disorders in health risk behaviors is familial in nature. The conducted research among families has shown that risk-taking behaviors tend to aggregate within certain families. For example, some families have a greater tendency for injury-related behaviors [23]. Many studies have
demonstrated that children of alcoholic parents are more prone to abuse alcohol than the children of nonalcoholic parents [24, 25].

1.5.1.2 Direct Hormonal Influences

Studies have shown that hormones directly, and indirectly, play an important role in the onset of adolescent risk-taking behavior through pubertal development. A systematic review demonstrated that the rise in testosterone levels during adolescence was related to male coital debut [26].

1.5.1.3 Influence of asynchronous pubertal timing

The fluctuation of hormones and genetic factors plays an important role in the timing of pubertal maturation. Earlier or later maturation than peers (asynchronous) is hypothesized to be a factor in risk taking [22]. Early maturation in adolescents make them more prone to engage in adult behaviors such as alcohol drinking, tobacco smoking and sexual intercourse [27]. According to research, the initiation of sexual intercourse at younger ages is seen among early maturing females [28]. Being sexually active at younger ages increases the risk of unwanted/early pregnancies, different sex partners and STDs [29, 30].

1.5.1.4 Brain and Central Nervous System Development

According to Steinberg in 2004 [31], the maturation of the cognitive control system in the brain, which plays an important role in impulse control, is slow, thus increasing the vulnerability of adolescents for risk-taking behavior. Psychosocial factors and logical reasoning are the two important causes of
adolescents’ risk-taking behavior [32]. By the age of fifteen, logical reasoning abilities fully develop, but psychosocial abilities (impulse control, emotion regulation and resistance to peer influence) that facilitate decision making and control risk-taking behaviors in the brain, develop well into young adulthood [31, 32].

1.5.2 PSYCHOLOGICALLY BASED THEORIES

Related theories consider the roles of the following factors in risk-taking behavior.

1. Cognition
2. Personality
3. Dispositional characteristics

1.5.2.1 Cognition

The theories of cognition in risk-taking behavior consider the way in which adolescents perceive risk and make decisions. Risk perception theory suggests that adolescents believe themselves to be invulnerable and are thus optimistically biased in their risk perception [33]. A study by Fischoff [34] identified five important components of decision making in risk taking:

1. Identifying alternative options
2. Identifying possible consequences
3. Evaluation of the desirability of the potential consequences
4. Evaluation of the likelihood of those consequences
5. Combination of the information to make a decision
Some evidence suggests that adolescents give more priority to less severe, than potentially more severe, possible consequences during decision making. For instance, condom use among a group of 14-16 year old adolescents was not related to their beliefs about the degree to which condoms prevent STDs, but with the degree to which the condoms were easy to use, popular with friends and facilitate sex [35].

1.5.2.2 The Role of Personality

Jessor’s problem behavior theory links unconventionality in personality with an increased probability of participating in risky behaviors, such as drug use, and risky sexual activity [36].

In explaining risk-taking behaviors, “sensation seeking” as a personality trait was used. Sensation seeking is defined as the “need for varied, novel and complex sensations and experiences and willingness to take physical and social risks for the sake of such experiences” [37]. The Sensation Seeking Scale was developed by Zuckerman to evaluate the person’s differences in level of arousal. Persons with a high level of sensation seeking perceive less risks in many health risk behaviors than persons with low sensation seeking [38].

1.5.2.3 The Role of Dispositional Characteristics

Some psychological personal factors, such as self-esteem, depression and locus of control are considered to be predictors of risk-taking behavior [33]. Locus of control defined as, “the degree to which people believe that they have control over the outcome of events in their lives, as opposed to external
forces beyond their control” [39]. One study found that lower self-esteem in females was correlated with early sexual debut [40], and initiation and intensity of tobacco smoking and risky sexual behaviors were associated with depressive mood and stress in both males and female adolescents [41]. Also, a significant correlation has been found between risk taking and gender, and locus of control [42].

1.5.3 SOCIAL AND ENVIRONMENTAL THEORIES

This model considers the role of parents, peers, family structure and schools in risk-taking behaviors. These theories describe how social and environmental factors can lead adolescents to engage in risk-taking behaviors.

1. The role of family
2. The role of peers
3. The role of society

1.5.3.1 The role of family

The role of parents in risk-taking behaviors among adolescents is prominent. Adolescents, by observing their parents’ behaviors, can learn to participate in risk taking behaviors. Research has shown that early initiation of drug misuse in early adolescence was more prevalent among adolescents if their parents were drug users. [43]. Also, research has shown that parental emotional support and having a close relationship between parents and children resulted in adolescents being less inclined to misuse drugs or initiate early sexual activity [44].
Another important issue is the association between risk-taking behavior among adolescents and family structure. Adolescents with single parents are more likely to use illegal substances [45]. Also, the female adolescents from single parent families have their sexual intercourse debut in early adolescence and are less inclined to use contraceptives [46]. One reason for this correlation could be a lower level of supervision. One of the main important correlates of adolescents’ risk-taking behavior is parental monitoring [47]. Supervision and monitoring of adolescents can increase communication between parents and adolescents. Such monitoring, together with trust can serve as a protective factor against drug use, tobacco smoking, and sexual activity for both genders [48]. In contrast, low level of supervision and monitoring are associated with health risk behaviors such as sexual activity, and drug misuse [49].

1.5.3.2 The role of peers

When adolescents feel themselves to be independent from their families, i.e. individuation, peer influence increases and, as a result, parental influence wanes [50].

The role of peer influence, as the main correlate of adolescents’ risk-taking behavior has been demonstrated in many studies. Substance use [50], alcohol consumption [51], delinquency [52], sexual behaviors and water pipe smoking [53] are examples of risky behaviors that adolescents engage in under peer influence. How peers exert their influence on adolescents is very important, and one study has demonstrated that older adolescents participate in risky
behaviors to avoid feeling isolated, and inadequate in the eyes of their peers [54].

1.5.3.3 The role of society

The norms of the society and mass media can play a role in adolescents’ risk-taking behavior. In societies where vending machines are used to sell cigarettes or tobacco products, adolescents are provided with opportunities to buy tobacco products at any age. In Sweden, the mass media, such as TV, advertises alcoholic beverages. However, there is a lack of evidence about the influence of TV on risk-taking behavior among adolescents. According to a systematic review [55], the exposure of adolescents to the media and commercials on alcohol was associated with starting alcohol drinking and increasing drinking among baseline drinkers.

The culture of the society also plays an important role in the initiation of risk-taking behaviors. For instance, the US has the highest rate of childbearing and abortion in the developed world, but different ethnic groups in the US have their own attitudes to adolescents’ sexual behavior [56], for example contraception usage varying significantly among different ethnic groups [57].

1.5.4 THE BIOPSYCHOSOCIAL MODEL OF RISK TAKING

As mentioned earlier, a model or theory that aims to provide a comprehensive framework for social, biological and psychological factors of risk-taking behavior among adolescents is the biopsychosocial model. This model combines the two areas that often are considered separately:
1. The association between biological development and psychosocial processing
2. The association between risk-taking behaviors and psychosocial correlates of risk-taking behavior.

According to this model, biological maturation affects the four areas of psychosocial functioning (Figure 2):

1. Cognition
2. Self-perception
3. Social and environment perceptions
4. Personal values

![Diagram](image)

**Figure 2.** The biopsychosocial model of risk-taking behavior

*Source: Adapted from Irwin and Millstein (1986) [22]*

The four areas are mediated by risk perception and peer group characteristics, and ultimately lead adolescents to risk-taking behavior. The above framework
was developed by Irwin [22, 58] and his colleagues to include factors that may increase the chance of participating in risk-taking behaviors by adolescents (Figure 2).

Some biological factors make adolescents susceptible to risk-taking behaviors, such as being male, genetic predisposition and hormonal disorders as well as psychological factors such as depression, low self-esteem, sensation seeking. Other factors are: socio-environmental, such as family and peer behaviours, socio-economic status and finally adolescents susceptibility to risk-taking behaviour in general. Risk-taking behavior can also be accelerated by other factors, such as family disruption, changing school and substance use (Figure 3) [33].
Figur 3. Factors contributing to the onset of risk-taking behaviors during adolescence

Source: Irwin and Ryan (1989); Irwin and Millstein (1986) [22, 59]
1.6 Iran

Iran is a country situated in the Middle East, with a population of around 80 million. Compared with other Eastern Mediterranean Regional Office (EMRO) countries, it has the largest youth (15-29 years old) population of approximately 35.5 % [60]. According to the most recent census, 35.5 % of Iran’s population is between 15-29 years old [61]. The Statistics Centre of Iran categorized the population into the following age groups: under 15 years as children and adolescents - 23.4%, 15-29 years as youths - 31.5%, 30-64 years as middle-aged - 39.4%, and 65 and above years as elderly - 5.7% [62]. The adolescent population, according to this category, thus overlaps two categories, because according to WHO, adolescents are 10-19 years old. The reported percentages of various age groups differ between various organizations in Iran.

1.7 Adolescent health in Iran

The Organization for Civil Registration in Iran, in its annual report (2015), stated that 2,500 adolescents, aged 10-19 years old, had died due to various causes of death, but mainly due to unintentional injuries. The same report stated that road traffic injuries are the main killer but a preventable problem in Iran [63]. According to WHO, road traffic injuries are the number one cause of death globally and second most common cause of illness and disability among adolescents [64]. In the “Global status report on road safety 2015” [65] the number of deaths among 15-29 year olds in 2012, due to road traffic injuries, was more than 300,000. In a recent report by the Organization for Civil Registration (2017) in Iran, about common causes of death among the
15-19 year old age group, unintentional injuries 40.5%, cardiovascular diseases 10.1%, cancer 4.7%, respiratory diseases 4.2%, and infectious disease 4.1% were identified as the main causes [66].

According to the WHO “Country cooperation strategy”, the major risk factors among Iranian adolescents are risky sexual behaviors, violence, illicit drug use, tobacco use, mental health problems (e.g. anxiety, depression, and stress), unhealthy dietary behaviors and physical inactivity [61]. The sale of alcohol and alcohol consumption are forbidden in Iran and has major consequences for both sellers and consumers, with repeated offences carrying the death penalty. Despite different reports and data from various organizations about the consumption of alcoholic beverages, there is no reliable data, or funding for the collection of data, about alcohol consumption among the population. Alcoholic beverages are imported illegally to Iran by smugglers and organized crime controls the black market. It was not possible therefore to address this issue in my thesis; the questionnaire relating to alcohol was heavily edited by the responsible authorities and rendered useless as a scientific instrument. According to the WHO “Country cooperation strategy” report, despite extensive health promotion during the past decades, there is still an urgent need in these areas for health promotion and development for this important population sector (adolescents). Health promotion among adolescents can include: increasing knowledge and information, promotion of physical and social environment, and provision of youth-friendly health services. In Iran, adolescents still face barriers to obtaining health services, for example, regarding sexual and reproductive health. No information or help (abortion, contraceptives) is available to adolescents in these areas. These barriers relate to the availability, accessibility, and acceptability of health
services where cultural and legal barriers also play an important role. For successful health policy, not only physical aspects but also social, economic and mental development should be taken into consideration [61]. The Ministry of Health Education in Iran put “adolescent health” on its agenda and made all medical universities all over the country responsible authorities for this area. Consequently, these universities prioritized their research on adolescent health, for instance, in the areas of physical activity, nutrition and tobacco.

1.8 Tobacco smoking

One of the important public health challenges is the tobacco epidemic. Annually, approximately seven million people globally die because of tobacco smoking. According to WHO, six million deaths are due to direct tobacco use and approximately one million due to passive smoking [67]. In the US, 440,000 people lose their lives every year because of tobacco smoking-related diseases [68]. Most of the tobacco-related deaths occur after the age of 35, but most of the adults who smoke started during adolescence. Eighty-two percent of the adults stated that they started smoking before the age of 18 [69]. Both smoked and non-smoked tobacco use among adolescents increases the risk of non-communicable diseases in adulthood [15]. According to global data, one in every ten girls aged 13–15 years, and one in every five boys of the same age, are current tobacco users [70].

In Sweden, a cohort study [71] among adolescents 12-13-years old (grade 7), with follow-ups until they were 17-18 years old (grade 12), has shown that a smoking prevalence from 3.3% among 12-13-year olds increased to 25.1%
among 17-18-year olds. The predicting factors were: being female, low and medium self-esteem, less negative attitude towards smoking and having been a snus user. During the past decades, cigarette smoking has declined in Sweden, with smokeless, oral tobacco, in Sweden “snus”, gaining in popularity [72]. According to the data from the Health Behaviour in School aged Children (HBSC) survey in Sweden, at the age of 15, 7% of the boys and 2% of the girls have reported snus use at least once a week [73]. According to data on the WHO website from the 2009 HBSC database, cigarette smoking weekly among 15 year old boys in Sweden was 13% and among girls was 15% [74]. Figures for the 13 year old boys were 3% and for girls 4% during the same year (2009). However, according to the 2014 report of the Swedish Public Health Agency (Folkhälsomyndigheten), current cigarette smoking among 15 year old boys and girls is less than 10% and for 13 year old boys and girls less than 5% [75].

In Iran, water-pipe smoking is more popular and common than cigarette smoking among adolescents. The national fact sheets from the Global Youth Tobacco Survey (GYTS) among middle school (grades 6 and 7) and high school (grade 10) students in Iran in 2007, showed that 3.0% of students were current (smoked within the past 30 days) cigarette smokers and 16.5% were water-pipe smokers. Of these, 22.8% were boys and 9.4% were girls for water-pipe smoking and 5.1% and 0.9% were boys and girls respectively for cigarette smoking [76]. According to a recent published article by an Iranian national representative sample (Caspian-IV study-data collection 2012), among 14,880 students aged 6-18 years old, 2.6 % (3.5% of boys and 1.7% of girls) were current smokers, and 5.9% (7.5% of boys and 4.2% of girls) had been smokers [77] (see Table 1).
1.9 Mental health problems

Mental health is defined as a state of well-being in which every individual realizes his or her own potential, can cope with the normal stresses of life, can work productively and fruitfully, and is able to make a contribution to her or his community [78]. Mental health problems have an important impact on the wellbeing of all people, especially adolescents. Adolescence is a time for the onset of some mental disorders, and many adolescents have mentioned mental health as their main important health issue. Among this age group, the number one cause of illness and disability globally is depression, with
suicide being the third most common cause of death [64]. Research has shown that half of adolescents have experienced the symptoms of mental disorders for the first time by the age of 14, and that if they receive the help and care they need, this can subdue their suicidal behavior later in life [64]. Adolescents with mental disorders encounter tough challenges, such as isolation, discrimination and lack of access to health care despite their fundamental rights [79]. Ill (poor) mental health has also associations with alcohol consumption, tobacco smoking, illicit drug use, early pregnancy and school dropout [79]. In a survey, in the US among 18 year old adolescents, the most common mental health disorders were depressive disorder (16.6%), alcohol abuse (13.2), anxiety disorders (28.8) and mood disorders (20.8%) [80].

According to WHO, the prevalence of mental ill health has increased [78, 81] over the past decades. In Sweden, according to the Swedish National Board of Health and Welfare report, mental health problems among Swedish children and young people have increased [82]. The WHO Euro region data show a higher burden (30%) of mental health disease in this area among 15-29 year olds [83]. Depression and anxiety are included in the higher percentage of mental health problems. Between 1950 and 1990 in Europe, mental health problems increased. The cause is largely unknown and unexpected as improvements in living conditions are usually considered to be beneficial to good mental health [84].

A review study from 1985-2011 has shown the externalizing problem among adolescents and no time trend. In contrast, many studies have shown an increase in internalizing problems among adolescents [81,85,86]. Many studies investigated the individual determinants of mental health problems,
such as economic hardship, but could not find the reason for increasing mental ill health [87].

In a recent Swedish study, the prevalence of depressive symptoms among girls was 44.3% and 23.0% among boys [88]. A clear gender difference exists between boys and girls in Sweden regarding mental health problems [81,82,88], and the determinants of depressive symptoms were individual, psychological and structural [88]. The gender differences were found in self-efficacy, self-esteem, parental and peer support, being bullied and family affluence level [88].

Among Iranian adolescents, the various aspects of mental disorders have been studied, such as eating disorders. In a study among male high school adolescents in Kerman, 15% of male students had an eating disorder [89] and the risk factors were social pressure, body dissatisfaction and body mass index. According to another study, among 13-15-year high school students in Gorgan, a comparison with Finish high school students revealed that there is no gender difference among Iranian adolescents regarding self-esteem, body satisfaction, anxiety and depression. In contrast there were differences between boys and girls in the Finnish sample, with better mental health being found among boys [90].

1.9.1 Suicide

Each year, globally, approximately 800 000 deaths are due to suicide, with many suicide attempts for each death. The burden of suicide is high and affects the families of victims, society and countries [91]. Suicide behavior (suicide ideation, suicide planning & attempting suicide) is a public health
problem and a taboo subject in most religions, cultures and countries. Also, it is not widely monitored by the authorities. According to WHO, just one-third of the countries included suicide attempts in the GSHS survey. Other surveys in Europe [92] and the US, ask about this health risk behavior [92]. No country in South-East Asia asks the population about suicide attempts.

The prevalence of suicide attempts among 12-18 year old adolescents varies between countries. In high-income countries, it is about 5-10% and in low- and middle-income countries it is approximately 15%. In 2015, 78% of global suicides occurred in low- and middle-income countries. In Europe and the US, there is a gender difference in suicide attempts, with girls having twice as high an attempt rate. In Africa, the Eastern Mediterranean Region, and the Western Pacific Region, on the other hand, no gender differences have been reported [91]. The association between suicide and mental health problems, such as alcohol misuse and depression, has been demonstrated in many studies in high-income countries, and research has shown that people attempt suicide when they cannot cope with a situation, such as economic problems, relationship break-up or illness [91]. Also, other factors, such as conflicts, being the victim of violence and/or sexual abuse were associated with suicidal behavior. One of the main risk factors for suicide in the general population is a previous attempt [91, 92, 93].

Among 15-29 year old adolescents, the second leading cause of death is suicide [91, 93]. According to research, different risk factors are associated with suicide among adolescents, of which an important one is suicide ideation [94, 95]. Suicide ideation is defined as wishes, ideas, and the tendency to commit suicide [96]. As mentioned earlier, suicide behaviors are related to risk factors in terms of psychological disorders and social environmental
factors [97-99]. Psychological aspects, such as feeling lonely (loneliness), hopelessness, being worried and depressed; social-environmental aspects, such as smoking, alcohol consumption, drug misuse, low parental supervision, being bullied, sexually assaulted or abused are the main risk factors among adolescents for suicidal behavior [100-106]. One theory that provides a framework by which to understand suicidal behavior is the “interpersonal theory of suicide”. This theory suggests that people die by suicide because they have both the wish and capacity to take their own life. Two psychological components that lead people to having desire to die by suicide are perceived burdensomeness and sense of low belongingness. The presence of both components at the same time creates a desire for suicide. The third component that leads a person to commit suicide, without any fear of death, is the capability of doing so [107, 108] (see Figure 4).

Figure 4. Interpersonal theory of suicide
I am a burden (perceived burdensomeness) is the idea that the person thinks his/her death is worth much more than his/her existence and that he/she is the burden on the family or society. Research has shown that there is association between perceived burdensomeness and suicide ideation [109]. The sense of thwarted belongingness causes the person to feel him/herself separate from other people, such as friends, family or other groups. According to research among adolescents, college students and the elderly, there is an association between suicide ideation and thwarted belongingness. Research also shows that suicide rates during celebrations (pulling together) and during hardship or tragedy decline [110, 111].

These two components create suicide ideation and are enough to spawn thoughts about suicide. However, without capability such thoughts do not lead to a suicide attempt. Suicide requires the ability to administer lethal self-injury and this can be enhanced by the experience of previous suicides attempts. Such experience can make it easier for the person to counteract feelings of self-preservation and fear of pain from death, thus facilitating committing suicide [112].

In Sweden, the suicide rate (per 100 000) among 15-24-year old adolescents between 1990-2010, has shown an annual increase of +0.04 units (p > 0.05) [81]. In Iran, according to the latest WHO Suicide Report, the suicide rate (per 100 000) in 2012, among 15-29 year olds of both sexes, was 7.8. Among boys it was 10.00, and among girls 5.5 [113]. In Sweden, among the same age group, it was 11.9 for both sexes and 5.2 among girls and 18.2 among boys [113]. The sensitivity of the topic and strict rules for gathering data among school students in Iran meant that no studies on the prevalence and correlates of
suicidal ideation could be published; and only a few studies have been carried out on community samples of adults [114, 115].

1.10 Physical activity

According to WHO, “Physical activity is defined as any bodily movement produced by skeletal muscles that require energy expenditure” [116]. These body movements can include movements while working, playing and carrying out household chores. All these physical activities (PA) have a health benefit. In contrast, physical inactivity (PIA), causing an estimated 3.2 million deaths globally, is regarded as the fourth leading risk factor for global mortality [116]. Among adolescents, physical activity levels lower than 60 minutes per day on at least 5 days per week are defined as physical inactivity [117].

As mentioned above, adolescence is a period when most behavioral habits form, such as nutritional and PA habits. These can persist from adolescence into adulthood [118]. Some research has shown the association of non-communicable diseases (NCDs) with lack of exercise and PIA (risk behaviors) [118]. According to the WHO recommendations for children and adolescents aged 5-17 years, at least 60 minutes of moderate to vigorous-intensity physical activity daily is needed, while amounts more than 60 minutes daily will provide additional health benefits.

Following the recommended PA level is very important to prevent NCDs, such as cardiovascular disease, diabetes, cancer and chronic respiratory problems. According to the GSHS and HBSC projects, most adolescents do not reach the recommended PA level [119]. Boys are more active than girls,
and adolescents in high income countries are less active than in low income countries. No country in the world has even half of its adolescents meeting the recommended daily activity level [119].

In the United States, according to a national survey, just 28% of the children aged 6-17 met the daily recommend PA [120]. In Malta 39% of the boys and 10% of the girls met the recommendations [121], and in Beijing 30-61% of the students (middle) did not meet the recommendations [122]. A GSHS study among 72,845 school students from 34 countries has shown that 23.8% of the boys and 15.4% of the girls only just met the recommendations [123].

PIA is associated with NCDs [124,125] and during adolescence it is associated with higher BMI and obesity, which can have psychological effects on adolescents’ moods [126]. Physical inactivity also can lead to mental health problems [126], whereas research has shown adequate PA can reduce symptoms of depression [127].

Various studies have been carried out to specify the correlates of PIA among adolescents. Some factors, such as being female [128], sedentary behavior [117], being overweight or obese [129], drug misuse [130], being bullied [131], passive transportation [132], inadequate fruit and vegetable intake [133], skipping breakfast and not attending at physical education class were associated with PIA [130].

In Iran, according to the national Caspian-III survey among school students, screen-time activities, such as playing games or watching TV is approximately 4 hours per day, which indicates sedentary behavior among adolescents [134]. Also, the same study has reported Metabolic Equivalent of Task (MET) [134] and not the PA level according to recommendations.
According to the WHO GHO 2010, 13.9% of Swedish adolescents (aged 11–17 years) reached the recommended physical activity levels for health (16.7% for boys and 11.1% for girls) [135].

1.11 Fruit and vegetable intake

Adequate fruit and vegetable (F&V) intake can promote health and prevent NCDs by improving micronutrient levels and preventing obesity [136]. In epidemiological studies, the benefits of adequate F &V intake have been observed and that is the reason for the recommended daily intake of 400 g per day [137].

Many behavioral habits form during adolescence, one of them being food preferences and nutritional habits. These can be healthy or unhealthy and tend to remain throughout life [138]. For this reason, a high F&V intake among adolescents is an important issue [139].

Adolescents in most European countries, despite of the importance of adequate F&V intake, consume less than the recommended daily level [140]. In the United States, and according to the CDC, only one in ten adolescents consumes the daily recommended intake [141]. In Asian [142-144] and African countries, the consumption is also under recommend levels [145]. According to WHO, in almost all the countries that have participated at GSHS survey, most of adolescents do not eat the recommended daily intake [146]. In the European HBSC survey of 33 countries, just under 50% of the adolescents consumed the recommended level of F &V [140,146].

The recommended daily intake according to the WHO and Food and Agriculture Organization (FAO) is 400g of fruit and vegetables (excluding
potatoes and other starchy tubers) i.e. an equivalent of ≥2 servings of fruit and ≥3 servings of vegetables/day [147]. Consuming fruit less than twice a day and vegetables less than 3 times a day is insufficient according to the WHO and CDC F &V [147-149].

Various factors have been identified as correlates of F &V intake among adolescents, such as family socio-economic status, maternal literacy, school performance [150], being male, being at high school, smoking [145], sedentary behavior, consuming soft drinks, being physically inactive, and overweight or obese [151,152,153].

In Iran, different studies have investigated F &V intake and its correlates among adolescents, but none have provided any data regarding F &V frequency of intake according to the recommendations [154, 155, 156, 157, 158,159]. They have also used questionnaires that are not comparable with other countries. The overall conclusion of these Iranian studies is that adolescent F &V intake should be improved.

According to the 2009 WHO adolescent health report, in Sweden, among 15 year old adolescents, 22% of boys consumed at least 1 serving of fruit per day and girls 26% [160].

1.12 Monitoring health related problems

The World Health Organization (WHO) has different health surveys for monitoring adolescents’ health-related behaviors:

- Global School-based Student Health Survey (GSHS) (ages 13–17) [161].
• Health Behavior of School-Age Children: WHO Collaborative Cross-National Study (HBSC) (ages 11, 13 and 15) [162].
• Global Youth Tobacco Survey (GYTS) (ages 13–15) [163].

The GSHS covers adolescents up to the age of 17 who are still in school. For older adolescents (15–19 years), who may be in or out of school, the Demographic and Health Surveys (DHS), [164] the STEP wise approach to surveillance (STEPS), [165] are used to collect information.

1.13 Global School Based Student Health Survey

The GSHS has been designed by WHO and the Center for Disease Control and Prevention of US(CDC) in collaboration with UNICEF, UNESCO, and UNAIDS as a global, youth health monitoring surveillance system to provide accurate data on health behaviors and protective factors among students aged 13-17 years [166]. As its name suggests, it uses a “survey research method” for data collection, which is the systematic collection of people’s self-reported information at a particular point in time [167]. The aim of the GSHS project is to identify the risk and protective factors related to the 10 leading causes of morbidity and mortality (Alcohol use, dietary behaviors, drug use, hygiene, mental health, physical activity, protective factors, sexual behaviors that contribute to HIV infection, other sexually-transmitted infections, and unintended pregnancy, tobacco use, violence and unintentional injury) among 13-17 year old school students.
1.14 GSHS globally and in Iran

As of December 2013, representatives from more than 120 countries have been trained, and 94 countries have completed a GSHS. Insufficient funds, staff turnover, or other in-country barriers have caused limited participation in some countries. More than 450,000 students have participated in a GSHS survey [168].

In the Eastern Mediterranean Region, with the exception of Iran and Bahrain, 19 countries implement GSHS. Finally, in December 2012, the full version of GSHS was ratified as a pilot study for the first time in Tabriz, Iran, by the Tabriz Medical University Research Committee.

1.15 GSHS’significance in Iran

As already mentioned, many countries use reliable, valid and comprehensive standardized health monitoring surveys to maintain awareness of their adolescents’ health risk and protective behaviors. The HBSC survey in Europe and the GSHS in the rest of the world have been implemented for this purpose. These surveys give countries the opportunity to make comparisons with others regarding the prevalence of health and protective factors, their school health and health promotion and the development and prioritizing of programs and policies to promote health.

For school going adolescents in Iran, there is a lack in health monitoring and surveillance in terms of a reliable, valid, standardized, comprehensive and international questionnaire. In Iran, every institute, research center or university conducting research among adolescents has used a different
questionnaire. It proved difficult to find the origin of these instruments or evaluations of their reliability and validity. Also, because different questionnaires with various purposes make it very difficult to assess the adolescent’s health according to the WHO criteria and to make a comparison with other countries. The GSHS has been implemented in all EMRO countries except Bahrain and Iran. In Iran, the problem with the GSHS questionnaire is the frank questions about risk behaviors, such as sexual behavior etc. Some sections of the GSHS ask about personal behaviors in order to assess the student’s health behavior. The GSHS project has to be ratified by the ministry of health in the country concerned and implemented at a national level. As Iran will not give its approval for the reasons mentioned above, the Caspian survey has been implemented instead. This survey avoids asking sensitive questions and is not comparable with the GSHS in several respects.

The epidemiology team at Tabriz University of Medical Sciences, in line with the 2013 policy of prioritizing research on adolescents’ health, decided to ratify the GSHS survey in the form of a replication, pilot study among the city’s school adolescents. Ethical approval was sought and received. The first step was to translate the material and test the reliability and validity of this new Persian version of the WHO GSHS questionnaire. This work was carried out and was published in 2014 [169]. This survey started for the following reasons:

- The lack of comprehensive and reliable data on health issues in schools
- Recognition of behavioral risk and protective factors
- The need to design effective interventions for the prevention and promotion of health issues
• The wish to set proper polices in schools that lead to safer environments

1.16 Rationale and motives for the present study

As mentioned above, there is lack of reliable and comprehensive data on students’ health risk and protective factors and their correlates in Iran. In certain areas of Iranian research there is gap between health risk behaviors and their correlates among students. Recognition of behavioral risk and protective factors can help the authorities to identify the risk and protective factors of health risk behavior and design effective interventions for prevention and promotion of health among adolescents. In some research areas there a few, and in others no (e.g. suicide ideation), Iranian studies investigating the prevalence and correlates of risk behavior. This thesis focuses therefore on the prevalence and correlates of health risk behavior in selected areas in order to identify the risk and protective factors that may help the authorities design future interventions for health promotion among adolescents in Iran.

2 Aim of the thesis

The main aim of this thesis was to investigate the prevalence and correlates of health risk behaviors and protective factors among high school adolescents (15-17 year olds) in the Iranian city of Tabriz, based on the WHO GSHS questionnaire.
2.1 The Specific objectives

- To determine the prevalence, attitudes, and correlates of water-pipe smoking among high school students in Tabriz, Iran (Paper I).

- To determine the prevalence and correlates of suicidal ideation among high school students in Tabriz, Iran (Paper II).

- To determine the prevalence and correlates of physical activity/inactivity and sedentary behavior among high school students in Iran: A Cross-Sectional Study (Paper III).

- To determine the prevalence of fruit and vegetables intake and its correlates among high school students in Iran (Paper IV).

3 Material and Methods

3.1 Study site

Iran is a middle-income country in the Eastern Mediterranean Region (EMRO), with a population of approximately 80 million. Tabriz city, where the present study was conducted, is the center of the East Azarbaijan province, located in northwest Iran and has approximately 2 million inhabitants. During the 2013-14 academic year, there were 62,714 high school students (9th to 11th grade), of whom 29,935 were female and 32,779 male. The general school attendance rate in the city of Tabriz is above 99%. The formal language
for reading and writing is Persian, which is used in schools, by the authorities and other governmental organs. However, the spoken language is Turkish (Azari). Tabriz is one of the Iran’s most important cities and is the country’s second or third largest metropolitan area.

3.2 Sampling

According to the common international protocol for GSHS, two-stage cluster sampling was used to select representative high schools and classes. At the first stage, high schools were selected with a probability proportional to the
enrollment size. At the second stage, classes were randomly selected, and all students in the selected classes were then eligible to participate in the study. Overall, thirty high-schools, including sixteen girls’ and fourteen boys’ high schools, and ninety classes (grades 9 to 11th) including 1,800 (max) students, were chosen to participate in the study. The full details and formulas of the two-stage cluster sampling procedure as well as the selection of the sample size are available in Appendix 1. [see Appendix 1].

3.3 Response rate

The participants’ (students’) response rate for the present study was 84.27 %. The participants school’s response rate was 100 %.

3.4 Participants

The participants in the present study were male and female high school students from the all five districts of Tabriz city. They were in grades 9-11 and between the ages of 15 to 17-years, with a mean of 16.1 ± 0.76 (SD). The data used for analysis came from 1517 students, including 727 boys (47.9%) and 790 (52.1 %) girls.

3.5 Data collection

A reliable, valid and anonymous self-administered Persian Version of the GSHS questionnaire was used [169]. This questionnaire (original English questionnaire) had been translated before starting the main study, and validated for data collection. The details of the whole procedure, i.e. the
translation and validation of the questionnaires have been published earlier by the research team involved in this study [169]. Data collection for the main survey took approximately three months, starting on 26 December 2013. Related questionnaires were administered to students during an ordinary school day in selected schools and classes by Province Health Center staff, who, one week prior to the survey date, had attended a workshop on GSHS methodology.

Before starting the main survey, special permission was required from various authorities. Some questions were subsequently deleted by these authorities leading us to focus upon, and choose health modules where we could retain all, or almost all, questions. This was the reason for choosing the related sub-studies in this thesis. Due to problems already discussed, that had occurred prior to data collection, some modules from important areas of research, such as sexual behaviors, alcohol use, drug use and etc. were not used.

3.6 Measures

Dependent variables (Outcome variables)

In Paper I we had two dependent outcome variables: a) “Have you ever tried, or experimented with, WP smoking, even just one or two puffs?” This question was used for “ever WP smokers”; and, b) “During the past 30 days, on how many days did you smoke a WP?” was used for “current WP smokers”. Current WP smoking was defined as students who had smoked a WP during the past 30 days. The answer options and dichotomized answers can be found in Table 2.
In **Paper II** the dependent outcome variable was suicide ideation and was derived from question, “During the past 12 months, have you ever seriously considered attempting suicide?” [Table 2].

In **Paper III** we had two dependent outcome variables: the first one being, “Leisure time physical activity” and second, “leisure time sedentary behavior”. Leisure time PA was defined as, “any activity that increases your heart rate and makes you breathe hard, such as playing with friends, walking to school, running, walking fast, cycling, dancing and playing football” and was derived from the question, “During the past 7 days, on how many days were you physically active for a total of at least 60 minutes per day?” The definition for the second outcome variable was, “the time that students spent sitting when they were not at school or doing their homework” and was derived from the question, “How much time do you spend during a typical or usual day sitting and watching television, playing computer games, talking with friends, or engaging in other sitting activities?”. [Table 2].

In **Paper IV** we also had two dependent outcome variables, “vegetable intake” and “fruit intake”. Fruit intake was derived from the question, “During the past 30 days, how many times per day did you eat fruit?” and vegetable intake was derived from the question, “During the past 30 days, how many times per day did you eat vegetables?” [Table 2].
Table 2. Description of dependent outcome variables

<table>
<thead>
<tr>
<th>Paper</th>
<th>Original Questions</th>
<th>Answer options</th>
<th>Dichotomizing reference = 0, at risk = 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Have you ever tried or experimented with WP smoking, even just one or two puffs?</td>
<td>“Yes”, “No”.</td>
<td>“No” = 0. “Yes” = 1.</td>
</tr>
<tr>
<td>I</td>
<td>During the past 30 days, on how many days did you smoke WP?</td>
<td>“0 days”, “1 or 2 days”, “3 to 5 days”, “6 to 9 days”, “10 to 19 days”, “20 to 29 days”, “all 30 days”.</td>
<td>“0 days” = 0. “1 or 2”, “3 to 5”, “6 to 9”, “10 to 19”, “20 to 29”, “all 30 days” = 1.</td>
</tr>
<tr>
<td>II</td>
<td>During the past 12 months, have you ever seriously considered attempting suicide?</td>
<td>“Yes”, “No”.</td>
<td>“No” = 0. “Yes” = 1.</td>
</tr>
<tr>
<td>III</td>
<td>During the past 7 days, on how many days were you physically active for a total of at least 60 minutes per day?</td>
<td>“0 days”, “1 day”, “2 days”, “3 days”, “4 days”, “5 days”, “6 days”, “7 days”.</td>
<td>“5, 6 &amp; 7 days” = 0. “0 days, 1 day, 2, &amp; 3 days” = 1</td>
</tr>
<tr>
<td>III</td>
<td>How much time do you spend during a typical or usual day sitting and watching television, playing computer games, talking with friends, or engaging in other sitting activities?</td>
<td>“Less than 1 hour per day”, “1 to 2 h/d”, “3 to 4 h/d”, “5 to 6 h/d”, “7 to 8 h/d”, “more than 8 h/d”.</td>
<td>“Less than 1 hour per day”, “1 to 2 h/d” = 0. “3 to 4 h/d”, “5 to 6 h/d”, “7 to 8 h/d” = 1.</td>
</tr>
<tr>
<td>IV</td>
<td>During the past 30 days, how many times per day did you usually eat fruits?</td>
<td>“I did not eat fruit during the past 30 days”, “Less than one time per day”, “1 time p/d”, “2 times p/d”, “3 times p/d”, “4 times p/d”, “5 or more times p/d” = 0.</td>
<td></td>
</tr>
<tr>
<td>IV</td>
<td>During the past 30 days, how many times per day did you usually eat vegetables?</td>
<td>“I did not eat vegetables during the past 30 days”, “Less than one time per day”, “1 time p/d”, “2 times p/d”, “3 times p/d”, “4 times p/d”, “5 or more times p/d” = 0.</td>
<td>“I did not eat vegetables during the past 30 days”, “Less than one time per day”, “1 time p/d” = 1.</td>
</tr>
</tbody>
</table>
3.7 Statistical analysis

SPSS version 24 was used for data entries and analysis. Descriptive statistics were used to analyze categorical and continuous scales. The Chi square and Fisher exact tests were used to assess associations among categorical variables. A multivariate logistic regression was used to assess the association between relevant independent variables and the dependent outcome variable. Reporting of adjusted odds ratios (AORs) and unadjusted odds ratios (UAORs) was done after controlling for factors identified as significant in the bivariate analysis. AORs and UAORs with 95% confidence intervals (CI) were reported. Through the pre-modeling bivariate analysis, associations with p-value < 0.1 were considered for further investigation by an independent role through multivariate analysis. A p-value of less than 0.05 was considered statistically significant for other statistical tests.

3.8 Inclusion and exclusion criteria

To be eligible to participate in this study, the participants had to meet the following inclusion criteria: school student aged between 15 -17, resident of Tabriz and completed and signed a consent form to participate in the study. Exclusion criteria: Students without signed parental consent form or not willing to participate in the survey.
3.9 Ethical consideration

The Ethics Committee of Tabriz University of Medical Sciences granted approval for the study [5/4/7180, 1391/08/10]. One week prior to the survey, consent forms were distributed to all parents of students in the participating classes through the school authorities and these were collected from students on the day of administration. All students were informed about the voluntary and anonymous nature of the study and were told that they could terminate their participation at any time during the survey.

4 Results

4.1 Paper I: The Prevalence, Attitudes, and Correlates of Waterpipe Smoking

Prevalence

Overall, 21.6% (327) of students were classified as ever WP smokers and 9.7% (147) as current WP smokers. Of those reporting current WP smoking, 84.3% (124) smoked on 1 or 2 days a month, 89.06% (293) had started WP smoking after they had turned 12 years old, and 10.4% (34) were younger than 12. Of current WP smokers, 91.1% (134) smoked one session per day, 10.8% (16) smoked at home, and 49% (72) smoked at a café (Ghahvekhaneh). Ninety-five point two percent (140) of students reported that their age did not prevent them from being served a WP. Sixty-one point nine percent (91) of 147 reported that they did not notice any health warning on the WP tobacco packages. Out of 1,517 study participants, 6.9% (105) reported that they
would accept a WP if offered by their friends. From 327 non-current WP smokers, 14.1% (214) thought that they might enjoy smoking a WP.

**Correlates**

The students who started WP smoking under 12 years old had a significantly higher frequency (days) of WP smoking ($P = 0.02$). For ever-WP smokers, being in third grade of high school (AOR = 1.708; 95% CI [1.106, 2.638]; having experienced cigarette smoking, even one or two puffs AOR = 1.570; 95% CI [1.121, 2.200]; and accepting a WP offered by close friends (AOR = 3.311; 95% CI [2.173, 5.045]) showed significant odds ratios.

For current WP smokers, accepting a WP offered by close friends (AORs = 4.36; 95% CI [2.69, 7.07]) and gender (female) (AORs = 0.45; CI [0.30, 0.70]) showed significant odds ratios.

4.2 Paper II: Suicidal ideation and its correlates among high school students in Iran

**Prevalence**

The results showed that in the past 12 months 4.1% (62) of students had seriously considered attempting suicide. Thirteen point two percent (200) reported that they wanted to use alcohol or other drugs when they were worried. The results also revealed that 8.8% (134) had been sexually abused (“Have you ever been forced to have sexual intercourse when you did not want to?”). Also, 20.6% (313) declared that they had been bullied in the past 30 days. In addition, 15.1% (229) reported cigarette smoking during the past 30 days (current smokers), and 58.9% (894) reported that when they were worried about something that they did not eat or feel hungry.
Correlates

In relation to health risk behaviours, suicide ideation had a significant correlation among students with worries (AOR = 4.15; 95% CI [1.71, 10.07], current cigarette smokers (AOR = 3.00; 95% CI [1.69, 5.30], alcohol or other drugs users (AOR = 4.28; 95% CI [2.41, 7.59] and sexually abused students (AOR = 2.63; 95% CI [1.32, 5.24]).

4.3 Paper III: Prevalence and Correlates of Physical Activity/Inactivity and Sedentary Behavior among High-School Adolescents in Iran: A Cross-Sectional Study

Prevalence

According to the WHO definition of being physically active (having at least 60 minutes of moderate to vigorous PA per day on at least 5 days per week), the prevalence of PA was 27.8% (421), physical inactivity (<5 days/Weeks) 72.2% (1096) and sedentary behavior (sitting ≥3 h or more) 71.4% (1083).

Correlates of physical inactivity

Results showed that there was a gender difference with girls having 48% higher odds to be inactive than boys (Adjusted Odds Ratio (AOR) = 1.48; 95% CI [1.08, 2.03]. A higher BMI (being overweight or obese) (AOR = 2.22; 95% CI [1.23, 2.92]; walking/cycling to or from school on 1-4 days (AOR = 1.57; 95% CI [1.09, 2.25]; sedentary behavior (AOR = 1.85; 95% CI [1.39, 2.46]; low vegetable intake (AOR = 1.44; 95% CI [1.06, 1.97]; being bullied (AOR = 1.56; 95% CI [1.08, 2.25]; lack of parental support (AOR = 1.54; 95% CI [1.14, 2.07]; peer support (AOR = 1.36; 95% CI [1.04, 1.78]; and parental connectivity
(protective factors) (AOR = 1.44; 95% CI [1.10, 1.90]; were directly associated with physical inactivity. Walking/cycling to, or from, school on 5-7 days (AOR = 0.44; 95% CI [0.32, 0.60]; was negatively associated with physical inactivity.

**Correlates of Sedentary behavior**

Walking/cycling to, or from, school on 1-4 days (AOR = 1.40; 95% CI [1.05, 1.88]); being physically inactive (AOR = 1.53; 95% CI [1.19, 1.97]); inadequate fruit intake (AOR = 1.79; 95% CI [1.33, 2.41]); and being bullied (AOR = 1.70; 95% CI [1.23, 2.33]; were positively associated with sedentary behavior.

**4.4 Paper IV: Fruits and vegetables intake and its correlates among high-school students in Iran: A Cross-Sectional Study**

**Prevalence**

According to the defined cut-off points, the prevalence of fruit intake was 76.1% (1154) (≥ 2 times/daily) and vegetable intake 23% (349) (≥ 3 times /d).

**Correlates of low fruit intake**

Being a student in grade11 (3rd) (AOR=1.90; 95% CI [1.21 – 2.99], sedentary behavior (sitting ≥3h/d) (AOR=1.93; 95% CI [1.43 – 2.61], low intake of vegetables (intake < 3 daily) (AOR=3.40; 95% CI [2.33 – 4.97], low or lack of parental support (AOR=1.52; 95% CI [1.17 – 1.98], low or lack of peer support (AOR=1.33; 95% CI [1.03- 1.73], and the lack of enough food (hunger) at the home (AOR=1.47; 95% CI [1.03-2.11]

**Correlates of low Vegetable intake**

A higher BMI (overweight or obese) (AOR=1.89; 95% CI [1.21 -2.95], low consumption of fruit (consumption < 2 daily) (AOR=4.95; 95% CI [3.12 – 7.85],
lack of peer support (AOR=1.36; 95% CI [1.03- 1.78], and insufficient PA ((≥5d/week) (AOR=1.45; 95% CI [1.08-1.95].

5 Discussion

The main aim of this thesis was to investigate the prevalence and correlates of health risk behaviors and protective factors among high school adolescents (15-17 years old) in Tabriz, Iran, based on the WHO GSHS questionnaire. The papers are discussed separately for the sake of clarity.

5.1 Paper I: The Prevalence, Attitudes, and Correlates of Waterpipe Smoking

Findings from Paper I showed that the prevalence of ever-WP smoking among both sexes was 21.6% in Tabriz. There was no gender difference showing that both boys and girls wanted to experience WP smoking. Overall, 9.7% of participants were classified as current WP smokers (smoked past 30 days). The study showed that the students who started WP smoking under 12 years old smoked more days than other students. It also revealed the fact that someone in their family must have provided them with a WP, because preparing WP is not an easy task for an 11 year old child. This fact raised many discussions about the role of parents and families in terms of access to, or facilitating the smoking of, a WP for their children and neglecting their responsibilities regarding tobacco prevention. This finding illustrates the “role of family” in risk taking among adolescents [1.5.3.1 The role of family]. A WP is not as addictive as cigarettes since current WP-smokers only reported smoking once or twice a month, and just for one session. The unavailability of
WP was the important factor for infrequent WP smoking among students. Lack of a suitable place to smoke and ownership of a WP at home also play an important role. The students whose parents have a WP at home have both access and a place to smoke it without fear from their parents. A study performed in Tabriz, in 2011, among high school students showed that 6% of students were current WP smokers. In comparison with our results, which showed a 3.7% increase during the past 3 years, the proportion of current WP smokers was 9.7%. This may support the findings of this 2011 study, which claimed that 1.5% of ever-WP smokers turned into regular WP users (current WP smokers) [171]. The prevalence of WP smoking among women aged 15–24 years in Tehran was 6.9 % in 2012 [172], and in Iran’s southern cities, it was 8.2 % [173].

In 2007, the GYTS national survey of 1,996 Iranian middle school students, aged 13–15, showed that 43.8 % had smoked a WP at least once, and 16.5 % were current WP smokers [76]. According to previous studies, WP smoking is increasing among 15–24 year olds despite the difference in percentages between WP smoking in country provinces and among different ages and educational grades. This difference between cities can be explained by the culture of the society in which the study has been performed. Iranian society is multicultural, comprising different ethnic groups, such as Azeri, Arab, Kurd, Turkman, Baloch, Talesh, Gilak and Lurs. Each ethnic group has its own culture and attitudes that influence social behavior. Tehran is a large, multicultural city with approximately 14 million inhabitants, and most of the people have moved there from other cities. Tabriz is city with a predominantly Azeri population and has religious attitudes and rigid ideas
about tobacco smoking, especially among adolescents and women, that differ from those in Tehran.

In Iran and Arab countries, there are so-called “cafés” which are the main places for smoking a WP, and females are often barred from these cafés. A study in Saudi Arabia [174] showed that half of high school students have smoked WP there. Our study showed that 49% of current WP smokers smoked at a café in Tabriz. Half of the females, who are socially restricted in Saudi Arabia, smoked WPs in their homes in contrast with our study, where just 14.2% of current female WP smokers had smoked at their homes. Forty point eight percent had smoked a WP at coffee shops, which had broken the rules and served WP to their under-age customers. Such cafés in Iran are known as “Ghahvekhaneh”, which is a place for serving WP and tea mostly to men regardless of their age. Ghahvekhaneh are traditional places that have served tea and a WP to their customers, mostly elderly men, for many years. However, these places are now meeting places for adolescents during their spare time. Restricting WP availability to adolescents in these places is very difficult for the Iranian authorities due to the influence of cafés from both cultural and traditional aspects, despite the Iranian FCTC regulations [175]. Ninety-five point three percent of students reported that their age did not prevent them from being served a WP, so the ban on the serving a WP to those under 18 years old should be taken into consideration by public health authorities. The “role of the society” is thus an important component in risk-taking actions [1.5.3.3 The Role of Society] among adolescents in terms of providing them with a WP. Regarding the attitudes of students, 7.3% of WP smokers reported that they did not want to stop smoking and 14.1% of non-WP smokers stated that they might enjoy smoking a WP. According to a study
performed among college students, there was a strong association between positive attitudes to WP smoking and being a current and regular user of a WP in the future [176]. Accepting a WP offered by a close friend is an important aspect which should be taken into consideration by the public health authorities. Teaching the students life skills and increasing their awareness of how to say “no” to a close friend offering a high-risk action may be important interventions. As mentioned, a positive attitude to WP smoking, plus receiving an offer from a close friend, can lead a non-WP smoker to experiment [171]. The “role of peers” in this risky action (offering a WP) was classified as “social and environmental theories of risk taking” among adolescents [1.5.3.2 The role of peers & 1.5.3]. The present study suggests several findings that should be considered by the authorities. First; both genders have experimented with a WP at the same level. Second; the tendency to experiment with WP smoking among girls increased. Third, easy access and preparing a WP for under-18s in cafes, or in the home by their families or parents, exacerbates the problem. Three conclusions regarding the low prevalence of WP use in Tabriz compared to the national average GYTS [76] could be drawn. First, the sample for the national GYTS study was drawn from urban and rural areas throughout the whole country (Iran) whereas our study was only conducted in Tabriz city. Second, Tabriz city is one of Iran’s five megacities, and behavioral patterns may differ in megacities compared to other cities. Third, there are differences in the cultural norms of Tabriz and the rest of the country.
5.2 Paper II: Suicidal ideation and its correlates among high school students in Iran

Regarding suicide ideation, Paper II found that 4.1% of the students seriously considered attempting suicide. We could not find any other studies conducted among school students in Iran. In western provinces of Iran, the prevalence of suicide behavior among Kurdish adults is high [114]. In addition, in the city of Karaj, the prevalence of suicide ideation, suicide plans and suicide attempts among the general population was 12.7%, 6.2% and 3.3%, respectively [115].

Many countries in the world have implemented the GSHS survey and, based on their published data and articles about suicide ideation, we can make some comparisons. For example, the prevalence of suicide ideation among school adolescents in Zambia was 32.2% [101], in Brazil 14% [177] and among Guyana adolescents 18.4% [178]. In addition, the suicide ideation rate in Tanzania was 11.2% [99] and in Thailand 8.8% among school adolescents [179].

According to research in EMRO countries, the prevalence of suicide ideation was between 13% and 17% [98].

In comparison with other countries’ GSHS survey data, the rate of suicide ideation among our sample was lower. The culture of the society in terms of strong family bonds which can have a protective effect on suicidal behavior [98, 101, 180], and the role of religion, cannot be ignored. In Iran, the family plays an important role in society and provides support and help to its members during hard times [181]. Islam denounces self-killing and considers it as Haram (forbidden) and against God [182].

From the related correlated factors for suicide ideation, worry leading to loss of appetite among students showed 4 times higher odds for suicide ideation
than among students who were not worried. In previous GSHS surveys performed in Venezuela [183] and Zambia [101] among school students, the same results were achieved. Many factors, such as socio-economic concerns, poor health and family problems can cause worry among adolescents [184]. An Iranian study among the general population, that assessed attempted suicide resulting in death, suggested that disappointment about future life among young people can be the main risk factor for suicide ideation [114]. These risk factors, which may lead to suicide ideation and suicide attempts among adolescents, should be scrutinized by public health authorities.

Regarding the other correlated factors for suicide ideation, higher significant odds were found for thoughts about using alcohol or other drugs to feel better, and current smoking (past 30 days). In Iran, due to the legal restriction on alcohol consumption, we could not find formal and published information with which to make comparisons, but many studies have indicated a positive association between alcohol consumption and substance abuse and suicide ideation [100, 185]. In one study [186], a positive association between suicidal ideation and non-medical use of prescription drugs was found. Furthermore, in the Republic of Benin, alcohol consumption and illicit drug use were associated with suicide ideation [180]. Another study, in South Korea of 75,643 students from middle- and high schools showed a statistically significant association between smoking and suicidal behavior [187].

Regarding sexual abuse, we found 8.8% of our sample to be the victims of sexual abuse. Students who had been sexually abused had 2.63 times higher odds of suicide ideation. Sexual abuse in this thesis has been defined as, “been forced to have sexual intercourse when you did not want to”. According to research, there is a positive relationship between sexual abuse and suicidal
behavior and ideation [188, 189]. Being sexually abused leads to negative mental health outcomes, such as depression, smoking and alcohol use, and these risk factors put adolescents at a greater risk of suicidal behaviour [190,191]. The high rate of sexual abuse among our sample raises many questions and this issue needs further research by responsible authorities.

5.3 Paper III: Prevalence and Correlates of Physical Activity/Inactivity and Sedentary Behavior among High-School Adolescents in Iran: A Cross-Sectional Study

Paper III showed the high prevalence of PIA (72.2%) and sedentary behavior (71.4%) among students, and the results were in line with other published GSHS studies in terms of low prevalence of PA and higher prevalence of PIA and sedentary behavior [117, 123].

Being female was the risk factor for PA [117, 192, 193]. In many studies, females had a lower PA than boys and this is possibly because social restrictions and physical barriers for females were greater than for males. Our study found that girls were 48% less active than boys. In Iran, the gender difference plays an important role in terms of PA because of cultural and environmental factors. There are different barriers for girls preventing them from PA in public places. According to the rules, females are not to permitted to ride in a public places thus precluding this form of transport in traveling to and from school. In addition, the risk of street violence is another issue that leads parents not to provide school busses for the journey. We also found that there was association between higher BMI and PIA [194]. Students that were overweight or obese had 122% higher odds to be PIA. Research also has shown that students with normal weight were PA [195]. Sedentary behavior
(sitting ≥3hrs/day) was another risk factor for PIA and the main reason for sedentary behavior among Iranian school students was the high amount of screen-time activities, such as playing games or watching TV [134]. In the present study, the students with sedentary behavior had higher odds of being PIA, and the association between PIA and sedentary behavior were significant. These results are in accord with those of other studies [196]. Also, students with PIA had higher odds of sedentary behavior. The students that engaged in walking or cycling to or from school on 5-7 days had lower odds of being PIA, and in contrast, students with 1-4 days walking or cycling from or to school had 57% higher odds of being PIA. As mentioned, the barriers for walking or cycling for the female students had a major impact on this associated factor. Also, the students walking/cycling 1-4 days to or from school had higher odds of sedentary behavior.

In a recent study, the low intake of F&V was associated with PIA [197], and our study showed low vegetable intake to be associated with higher odds of PIA. Also, low fruit intake was associated with sedentary behavior. The students that reported being the victims of bullying had higher odds of PIA and sedentary behavior. Recent research has also shown an association between being bullied and PIA and sedentary behavior [198]. A Danish study of school adolescents has found that bullying is associated with PIA [131]. The students that reported parental support, connectivity and peer support were less inclined to PIA than those without such support. Parental encouragement and support play an important role in increasing the adolescents’ PA levels [199, 200]. Parents can plan for their leisure time PA and take their children out to play soccer and tennis. Cycling and walking with them to and from school also encourages PA. In conclusion, creating the proper environment
for female students to carry out PA, such as gym at school, making safe routes for walking, reducing screen time activities, availability of F&V at home, reinforcing parental and peer support and teaching life skills can help to students to increase their PA levels.

5.4 Paper IV: Fruits and vegetables intake and its correlates among high-school students in Iran: A Cross-Sectional Study

In Paper IV we have found that 76.1% of the students consumed fruits ≥ 2 times/daily, which according to defined cut-off points, means that most consumed the recommended level of fruit. However, vegetable intake was 23% (≥ 3 times /d). From the correlated factors identified through multivariate analysis, the students in their last year of high school (11th grade) had 90% higher odds of a lower intake of fruit. This shows that there is a tendency for fruit intake to decrease with increasing age with the risk that this habit can be transferred into adult hood [201]. Other studies have reported the same phenomenon [202,203]. Also, sedentary behavior was another correlated factor for fruit intake, and these students had 93% higher odds regarding consuming less fruit. The students with sedentary behavior spent most of their time engaged in screen-based activities leading them to consume much more junk and unhealthy foods instead of fruit or vegetables [158]. Both fruit and vegetable intake were associated with each other, and the students with an insufficient fruit intake had higher odds of consuming less vegetables and vice versa. As in Paper III, having a higher BMI was a negative correlated factor, and overweight or obese students 89% showed higher odds of eating
less vegetables. One study has shown that obese or overweight students consume lower F&V than normal weight students [204].

Among protective factors, parental and peer support were positively associated with F&V intake in this study. Lack of parental support was associated with lower fruit intake (52% higher odds), and a systematic review supports this finding [205]. Peer support at school was another factor that influenced fruit intake among students; the students without peer support had 33% higher odds of consuming less fruit, and 36% higher odds regarding lower intake of vegetables. Availability of food at home is another important issue that showed a significant association with fruit intake. Food insecurity is an important aspect of hunger that should be investigated in future research in order to assess its impact on students’ F&V intake.

This thesis, which has used the WHO GSHS questionnaire as a basis for data collection, has considered adolescent health factors from the core of the ecological model [Figure 1] to the fifth layer (environmental). Acknowledging that the determinants in the model can serve as positive or negative determinants, for example, family support can have a positive effect, such as increasing physical activity and a have negative effect, such as preparation of water pipes for the adolescents to smoke.

**Limitations**

This study has some limitations that should be taken into consideration when comparing the results or generalizing its findings to the other areas. The study is cross-sectional, not allowing causality to be established for any of the associated factors. The participants were from an urban area and were
students at the high schools of Tabriz city. They may not be representative of those from other urban centers, non-urban areas and adolescents not attending school. The study has used an anonymous, self-administered questionnaire, but we had no method to identify eventual under- or overreporting. The desire to present a positive picture in self-administered questionnaires can also affect the results. This study, using the frame of the WHO, GSHS questionnaire, has studied the risk and protective factors associated with health risk behaviors. These risk and protective factors do not include other related factors that can be found in other studies or literature reviews. The GSHS questionnaires do not have items about the social or socio-economic determinants of health, for example, family status, family income, or family educational level etc. The question provided by WHO in the Mental Health module that was used as an outcome variable, i.e. “suicide ideation” (“During the past 12 months, did you ever seriously consider attempting suicide?”), has been used in all studies of the GSHS mental health module and in the present study as an item for measuring suicide ideation. However, there may be some doubts about the appropriateness of this question for measuring suicide ideation. This question could benefit from being improved in WHO’s next revision of the GSHS Mental Health module.

**Implications**

The results of the present thesis should be taken into consideration by public health authorities in the field of adolescent’s health in Iran and this thesis suggests the following implications:
• Prevention programs and interventions need to be implemented in both schools and society, for example, increasing students’ awareness and life skills as well as teaching them how to ‘say no’ when offered a waterpipe or participation in risky actions. In society, moves could be made to limit adolescents’ access to waterpipes by banning the selling of tobacco products to under 18 year olds. Health warnings could also be displayed on such products.

• School health promotion programs for students should also cover the psychological aspects by creating support for victims of sexual abuse, teaching students how to manage stressful situations and avoid risky behaviors.

• Health-promoting activities should include the participation of parents, for example, by accompanying the students when participating in physical activities. In designing interventions, the role of parents should be taken into consideration. Their role can be both positive and negative in relation to health risk behaviors.

• The present thesis was a pilot model of a GSHS survey in Iran that can be used in other cities to evaluate students’ health status.

Conclusion and future research

The results of the studies in the present thesis suggest that the prevalence of health risk behaviors among high school students in the city of Tabriz, in comparison with the students in other Iranian cities or other countries, is low in some behaviors, such as suicide ideation. It is the same regarding behaviors
such as, physical inactivity and sedentary behavior. However, prevalence is higher, for example, regarding fruit intake. Overall, there is an urgent need for interventions to be implemented to decrease the prevalence of risk behaviors to an acceptable level. The conclusions are summarized below:

- The prevalence of ever waterpipe smoking among both males and females was high. Also, there was a gender difference in current WP smoking, with boys smoking a WP more than girls. There were positive attitudes toward WP smoking among students, and accepting a WP offered by a best friend was the most important risk factor for WP smoking. Interventions that address the increasing awareness of parents and students about the harmfulness of WP smoking, and banning the selling of tobacco products to under 18 year olds should be considered (I).

- The prevalence of suicide ideation was lower among our sample in comparison with other countries. The students that were sexually abused, were current cigarette smokers, used alcohol or other drugs and were worried had a higher risk of suicide ideation. Interventions need to be developed to prevent these risk factors (II).

- The prevalence of physical inactivity and sedentary behavior was high in our sample. The students that were bullied, used school transport instead of walking or cycling, lacked family and peer support were at higher risk of physical inactivity and sedentary behavior (III).

- The prevalence of fruit intake was acceptable among students, but not vegetable intake. Interventions targeting sedentary behavior, low
intake of vegetables and fruit, lack of parental support, lack of peer support, hunger were significantly associated with low consumption of fruit and vegetables among students (IV).

It is suggested that future research should explore the socio-economic and demographic determinants of students’ health risk behaviors, to identify related risk factors to these determinants rather than the current identified risk factors (correlated factors). More research is needed to find out how, and by whom, the students are being sexually abused as well as to identify which students are susceptible to becoming victims of bullying.
Appendix

Steps in applying Probability Proportional to Size (PPS) and calculating Basic Probability Weights

<table>
<thead>
<tr>
<th>First stage:</th>
<th>PPS sampling → larger clusters have bigger probability of being sampled</th>
</tr>
</thead>
<tbody>
<tr>
<td>Second stage:</td>
<td>Sampling exactly the same number of individuals per cluster →</td>
</tr>
<tr>
<td></td>
<td>individuals in large clusters have smaller probability of being sampled</td>
</tr>
<tr>
<td>Overall:</td>
<td>Second stage compensates first stage, so that each individual in the</td>
</tr>
<tr>
<td></td>
<td>population has the same probability of being sampled</td>
</tr>
</tbody>
</table>

1. Calculate the sample size for each strata.

2. Separate population data into strata. The following steps will have to be applied for each strata.

3. List the primary sampling units (Column A) and their population sizes (Column B).

   Each cluster has its own Cluster Population Size \((a)\).

4. Calculate the cumulative sum of the population sizes (Column C).

   The Total Population \((b)\) will be the last figure in Column C.

5. Determine the Number of Clusters \((d)\) that will be sampled in each strata.
6. Determine the *Number of Individuals to be sampled from each cluster (c)*. In order to ensure that all individuals in the population have the same probability of selection irrespective of the size of their cluster, the same number of individuals has to be sampled from each cluster.

7. Divide the total population by the number of clusters to be sampled, to get the *Sampling Interval (SI)*.

8. Choose a random number between 1 and the *SI*. This is the *Random Start (RS)*. The first cluster to be sampled contains this cumulative population (Column C). [Excel command =rand()*SI]

9. Calculate the following series: RS; RS + SI; RS + 2SI; …. RS+(d-1)*SI.

10. The clusters selected are those for which the cumulative population (Column C) contains one of the serial numbers calculated in item 8. Depending on the population size of the cluster, it is possible that big clusters will be sampled more than once. Mark the sampled clusters in another column (Column D).

11. Calculate for each of the sampled clusters the *Probability of Each Cluster Being Sampled (Prob 1)* (Column E).

\[
\text{Prob 1} = \frac{a \times d}{b}
\]

\[
\begin{align*}
\text{a} & = \text{Cluster population} \\
\text{b} & = \text{Total Population} \\
\text{d} & = \text{Number of Clusters}
\end{align*}
\]
12. Calculate for each of the sampled clusters the *Probability of each individual being sampled in each cluster (Prob 2)* (Column G).

\[
\text{Prob 2} = \frac{c}{a}
\]

\(a\) = Cluster population

\(c\) = Number of individuals to be sampled in each cluster

13. Calculate the overall basic weight of an individual being sampled in the population.

The basic weight is the inverse of the probability of selection.

\[
\text{BW} = \frac{1}{\text{prob 1} \times \text{prob 2}}
\]
Example:
Population 20000 in 30 clusters.
Sample 3000 from 10 clusters using PPS.
Calculate Prob. 1 = probability of selection for each sampled cluster,
Calculate Prob. 2 = probability of selection for each individual in each of the sampled clusters,
Calculate the overall weight = inverse of the probability of each individual being sampled in the population

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cluster</td>
<td>Size (a)</td>
<td>Cumulative sum</td>
<td>Clusters sampled</td>
<td>Prob 1</td>
<td>Individuals per cluster (c)</td>
<td>Prob 2</td>
<td>Overall weight</td>
</tr>
<tr>
<td>1</td>
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<td>1028</td>
<td>905</td>
<td>51%</td>
<td>300</td>
<td>29%</td>
<td>6.7</td>
</tr>
<tr>
<td>2</td>
<td>555</td>
<td>1583</td>
<td></td>
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Definitions

The sampling frame is the list of ultimate sampling units, which may be people, households, organizations, or other units of analysis.

Random sampling is data collection in which every person in the population has a chance of being selected which is known in advance. Normally this is an equal chance of being selected. Random samples are always strongly preferred, as only random samples permit statistical inference.

Probability proportion to size is a sampling procedure under which the probability of a unit being selected is proportional to the size of the ultimate unit, giving larger clusters a greater probability of selection and smaller clusters a lower probability. In order to ensure that all units (ex. individuals) in the population have the same probability of selection irrespective of the
size of their cluster, each of the hierarchical levels prior to the ultimate level has to be sampled according to the size of ultimate units it contains, but the same number of units has to be sampled from each cluster at the last hierarchical level. This method also facilitates planning for field work because a pre-determined number of individuals is interviewed in each unit selected, and staff can be allocated accordingly. It is most useful when the sampling units vary considerably in size because it assures that those in larger sites have the same probability of getting into the sample as those in smaller sites, and vice versa.

The design effect \((D)\) is a coefficient which reflects how sampling design affects the computation of significance levels compared to simple random sampling (discussed below). A design effect coefficient of 1.0 means the sampling design is equivalent to simple random sampling. A design effect greater than 1.0 means the sampling design reduces precision of estimate compared to simple random sampling (cluster sampling, for instance, reduces precision). A design effect less than 1.0 means the sampling design increases precision compared to simple random sampling (stratified sampling, for instance, increases precision).
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