

**A COMPARISON OF HEALTHY PEOPLE 2020 –  
LHI TOPICS BETWEEN STUDENT POPULATIONS  
WITHIN THE USA, GERMANY, AND POLAND**

**MASTER’S THESIS**

by

Wiktoria Kaczmarek-Sondej

from Burgdorf

supervised by

Prof. Dr. Gerhard Fortwengel, Hochschule Hannover, Germany

and

Dr. Barbara Hewitt, Texas State University, USA

Medical Information Management

Hochschule Hannover - University of Applied Sciences and Arts

submitted on

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## ABSTRACT

As noted by Roman poet Virgil already more than 2,000 years ago: “The greatest wealth is health.”. Without health, there is no happiness, no peace, and no success according to the Reflections Recovery Center from Arizona, United States (USA, U.S.). The goal of the Healthy People 2020-project (HP2020), which is led by the Office of Disease Prevention and Health Promotion (ODPHP), was to “promote quality life, healthy development, and health behaviors across all life stages” among the U.S. population. HP2020 measures progress by using so-called Leading Health Indicators (LHI), reliable data sources, baseline values as well as targets for LHI-individual improvements for every measurable objective to be achieved by 2020 and each following decade. In the further course, these values were compared to student populations from the U.S., Germany, and Poland. The goal of this master's thesis was to obtain more data on international health, particularly among student populations. For the statistical analysis, data were obtained from an online survey that was distributed to students in at least one university in each of the three countries. In total, data from 380 students were analyzed in terms of HP2020 goal attainment. To determine if statistically significant differences were present, the z-test was used. The biggest differences emerged on the following topics: access to healthcare, environmental quality, obesity as well as reproductive and sexual health.

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## LIST OF ABBREVIATIONS

ACA	Affordable Care Act
AFSP	American Foundation for Suicide Prevention
AIDS	Acquired Immune Deficiency Syndrome
ANOVA	Analysis Of Variance
BAuA	Bundesanstalt für Arbeitsschutz und Arbeitsmedizin ( <i>Federal Institute for Occupational Safety and Health</i> )
BZFE	Bundeszentrum für Ernährung ( <i>Federal Centre for Nutrition</i> )
COPD	Chronic Obstructive Pulmonary Disease
CoV	Corona Virus
COVID-19	Corona Virus Disease 2019
DEBRA	Deutsche Befragung zum Rauchverhalten ( <i>German Survey on Smoking Behavior</i> )
DTaP	Diphtheria And Tetanus Toxoids And Acellular Pertussis Vaccine
et al.	et alia ( <i>and others</i> )
EU	European Union
f	female
FIW	Federal Interagency Workgroup
GDP	Gross Domestic Product
GER	Germany
GKV	Gesetzliche Krankenversicherung ( <i>Statutory Health Insurance</i> )
HepB	Hepatitis B Vaccine
HHS	Health and Human Services
Hib	Haemophilus Influenzae Type B
HIV	Human Immunodeficiency Virus
HP	Healthy People
HP2020	Healthy People 2020
IWPR	Institute For Women's Policy Research
LHI	Leading Health Indicator

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LHIT	Leading Health Indicator Topic
m	male
MDE	Major Depressive Episode
MMR	Measles, Mumps, Rubella
MS	Microsoft
N/A	Not Applicable, No Answer
NIMH	National Institute of Mental Health
NSB	National Science Board
NSDUH	National Survey on Drug Use and Health
NSF	National Science Foundation
ODPHP	Office of Disease Prevention and Health Promotion
OECD	Organization for Economic Co-operation and Development
PA	Physical Activity
PAG	Physical Activity Guidelines for Americans
PCP	Primary Care Provider
PCV	Pneumococcal Conjugate Vaccine
PL	Poland
QoL	Quality of Life
RKI	Robert-Koch-Institut ( <i>Robert Koch Institute</i> )
S&T	Science and Technology
SAMHSA	Substance Abuse and Mental Health Services Administration
SARS-CoV-2	Severe Acute Respiratory Syndrome Coronavirus 2
SHS	Secondhand Smoke
SIDS	Sudden Infant Death Syndrome
SPSS	Statistical Package For The Social Sciences
STD	Sexually Transmitted Disease
USA/U.S.	United States of America
vs.	versus
WHO	World Health Organization

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# 1 INTRODUCTION

This chapter of the master's thesis comprises the purpose and motivation, the problem statement, the definition of the objectives, the questions concerning these objectives and the structure.

## 1.1 PURPOSE AND MOTIVATION

According to the World Health Organization (WHO), global life expectancy has increased by 5.5 years in the period between 2000 to 2016. This leads to the assumption that the quality of health care has also improved during this period [1]. But it is not surprising, as stated by the Commonwealth Fund, that people in the U.S. - in view of the lack of universal health insurance - are more likely than people in other countries to forego necessary health care for cost reasons. However, some countries, including Germany (GER), offer nationwide coverage at low cost while ensuring rapid access to specialized services [2].

There are various rankings worldwide that evaluate the health care system of the respective country. Germany and the U.S. are often listed in the *TOP*. For example, Germany is included in a list without numbering with 13 countries and is ranked 25th in a list of 100 countries [2, 3]. In another ranking, Germany is in fifth place out of ten of the countries with the best healthcare system [4]. Further studies and investigations are carried out, for example, on the basis of the respective Gross Domestic Product (GDP), waiting times for treatment, the costs of health care in relation to the gross domestic product and per capita [5]. Even though Poland's health care system is supposed to be one of the best in Europe according to the Statistical Office of the European Union (EU), there is great underfunding of the health care system and many hospitals are threatened with permanent closure [6, 7].

The Healthy People 2020 (HP2020) Federal Interagency Workgroup from the Office of Disease Prevention and Health Promotion (ODPHP) identified twelve Leading Health Indicator Topics (LHIT) to determine and improve the U.S. citizens' health. The topics have been chosen to work on the health issues with high priorities and actions that can be taken to address them. Furthermore, these LHITs are being used to facilitate collaboration across various sectors and to motivate action at the national, state, and community levels to improve the health of the country's population [8].

This master's thesis will address nine of the twelve LHITs and compare student populations of the U.S., Germany, and Poland to assess differences and similarities between these three nationalities. The following nine LHITs will be examined in this thesis: 1. Access to Health Services; 2. Environmental Quality; 3. Injury and Violence; 4. Mental Health; 5. Nutrition, Physical Activity, and Obesity; 6. Oral Health, 7. Reproductive and Sexual Health; 8. Substance Abuse; 9. Tobacco. In order to keep the survey relevant to student populations and to reduce the amount of questions, three LHITs will not be covered in this thesis: Clinical Preventive Services; Maternal, Infant and Child Health and Social Determinants [9].

When identifying projects from Germany and Poland that are similar to HP2020, one example is the Federal Institute for Occupational Safety and Health (BAuA: Bundesanstalt für Arbeitsschutz

und Arbeitsmedizin) which has initiated a work and research program in Germany. The BAuA planned to intensify networking and collaboration as well as cooperation with other universities and BAuA's fields of action by initiating this program. There are four major topics BAuA is focusing on: "ensuring that chemicals and products are safe to use"; "making work in the company humane"; "preventing work-related illnesses - promoting health and employability" and "understanding the effects of changes in the world of work and further developing instruments of occupational health and safety". Companies collect measures for a three-year-period, from 2018 until 2021 [10]. A project of this kind does not yet exist for all of Germany.

Poland has many health-related projects, but they are always focused on a specific disease or issue, such as curing haemophilia or child births [11, 12]. In general, the health programs address either important epidemiological phenomena or health problems (other than epidemiological ones), which affect all or a specific target group of patients - with real possibilities to eliminate or reduce these problems or the implementation of new medical procedures and prevention.

According to a report from 2018 from the National Science Foundation's (NSF) from the National Science Board (NSB), the U.S. is considered to be the global leader in science and technology (S&T) [13]. A 2019 publication by the Organization for Economic Cooperation and Development (OECD) states that the US spends more money on health care in percentage terms than other OECD countries. It was found that the USA spends about twice as much money on health per person as other countries [14].

The online survey regarding the leading health topics is conducted in the U.S., Germany, and Poland in the respective language. In the context of this master's thesis, the differences and similarities resulting from the survey will be analyzed in detail. The methodical procedure as well as the survey will be discussed in detail in this master's thesis.

As part of this master's thesis, nine of the twelve Leading Health Topics will be examined in a statistical analysis to identify differences and similarities between the student populations of the U.S., Germany, and Poland. Data sets from a multinational survey are used for this comparative analysis. Subsequently, the extent to which the survey results differ from country to country and the influence of subject relevant parameters on the results are evaluated.

## **1.2 PROBLEM STATEMENT**

Since the three countries invest very different sums in the health care system and have different levels of technological progress in medicine, measurable differences in the results can be expected. The following problem results from the described facts:

Problem: There is no analysis that examines the USA, Germany, and Poland with regard to the nine Leading Health Indicator Topics mentioned above.

## **1.3 OBJECTIVE**

The following objective was developed from the problem that arose.

In detail, the following objectives are to be achieved:

Objective: The results from a survey conducted in the USA, Germany, and Poland will be analyzed using the selected nine Leading Health Indicator Topics.

## **1.4 TASK DEFINITION**

The following questions can be derived from the objective and will be answered in this thesis:

Regarding the Objective:

Question 1: What influence do subject relevant parameters have on the results of the respective country?

Question 2: To what extent do the results differ from country to country?

## **1.5 THESIS STRUCTURE**

This first two sections of this master's thesis include the introduction and fundamentals, which cover the basic knowledge necessary to understand this master's thesis. The following chapter "Methods" describes how the data was collected using a survey including translation into German and Polish. The subchapters "Data Preparation" and "Data Analysis" deal with the methods used to evaluate the data and explain the task definitions. The results of the analysis are presented in the section "Results" in addition to the problem definition, objective, and task definition. Additionally, the definition of the problem, objective and task definition are dealt with again in a reflective manner. The section "Discussion And Outlook" deals with the discussion of the results of this work in comparison with other studies and with possible suggestions for improvement, which would have to be changed in the future.

## 2 FUNDAMENTALS

This section covers the basics that contribute to the understanding of the whole topic. This includes the project itself, the Leading Health Indicator Topics, which are all briefly described, and the development of the LHI Topics in the past.

### 2.1 PROJECT: HEALTHY PEOPLE 2020

HP2020 was founded at great expense, starting with the selection of the LHI Topics. The entire process was led by the HP2020 Federal Interagency Workgroup (FIW). The FIW consists of about 50 members from several federal departments, e.g. the U.S. Department of Health and Human Services (HHS) [8].

Several reports from the Advisory Committee of the Secretary for National Health Promotion and Disease Prevention for 2020 and the Institute of Medicine of the National Academy of Sciences have given the HHS some recommendations for the completion of the LHI. The so-called "Health Determinants and Health Outcomes by Life Stages Conceptual Framework" was used to organize and select suitable HP2020 LHI Topics. By using this approach, it is possible to focus on both, societal as well as individual factors that have an impact on public health leading to health inequities from infancy to old age. In this way, strategic opportunities to support health and enhance the quality of life (QoL) for all Americans are identified [8].

### 2.2 LEADING HEALTH TOPICS

The 12 LHI Topics are comprised of 26 indicators. The nine topics covered in more detail in this paper are the following: 1. Access to Health Services, 2. Environmental Quality, 3. Injury and Violence, 4. Mental Health, 5. Nutrition, Physical Activity, and Obesity, 6. Oral Health, 7. Reproductive and Sexual Health, 8. Substance Abuse and 9. Tobacco, and described in more detail in the following sections.

#### 2.2.1 ACCESS TO HEALTH SERVICES

The first LHIT is "Access to Health Services", which is measured using two indicators "persons with medical insurance" and "persons with usual primary care provider". The goal is for 100% of U.S. citizens to have a health insurance coverage and access to a primary care provider (PCP). Since it has an impact on one's health if someone has access to both it is even concerning that nearly one in four Americans did not have a primary care provider or health center where they can receive regular medical services at the beginning of this decade and almost one fifth of all Americans do not have health insurance. When people without health insurance access health services in the U.S., they are often burdened with high out-of-pocket expenses and medical bills since they have no health insurance [15]. The United States had only 2.6 practicing physicians per 1,000 citizens in 2018, while Germany had 4.3 (2018) and Poland only 2.4 practicing physicians per 1,000 citizens in 2017 [16].

In Germany it is required by law to have health insurance coverage [17]. According to the German *GKV-Spitzenverband*, which is the sole statutory health insurance association at the federal level,

approximately 90 percent of all German citizens (around 73 million people) are insured on the statutory health insurance level. The remaining 10 percent are covered by private health insurance or other insurance systems [18, 19].

In Poland, health care insurance is also mandatory for most citizens, such as farmers, self- and unemployed people, pensioners, and employees. Dependent family members of insured persons are also covered and do not have to pay insurance contributions. Volunteers, for example, who do not need to join the mandatory health insurance, can take out voluntary insurance [20, 21].

### 2.2.2 ENVIRONMENTAL QUALITY

There are two measurements that determinate “Environmental Quality”. One is the air quality, the second one is the number of children that are exposed to secondhand smoke. Poor air quality has an impact on several aspects of one’s life. It can impact the QoL, can induce illnesses and is capable of impairing various systems in the human body (Figure 1) [22, 23]. According to the WHO, 23% of all deaths worldwide are linked to environmental factors with 36% of those deaths among 0-14 year old children [24].

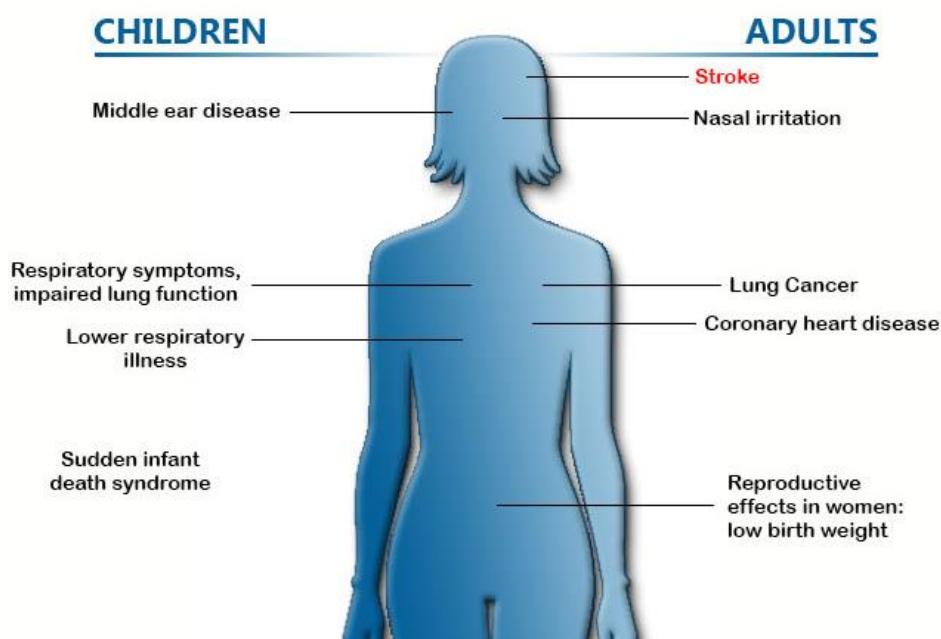
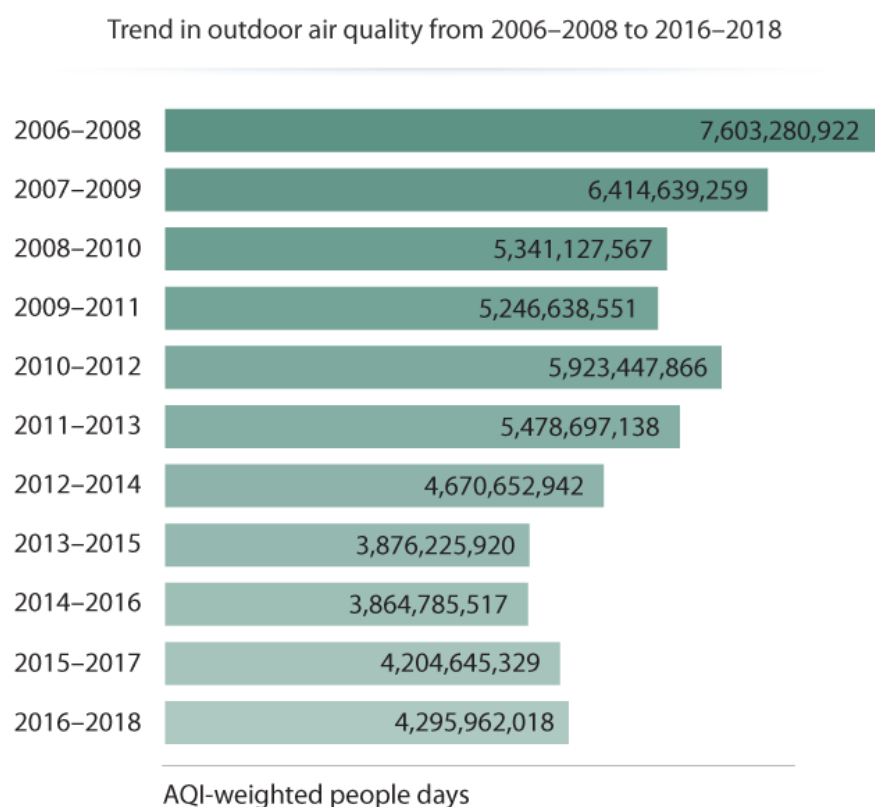


Figure 1: Health Consequences Caused By Secondhand Smoke Exposure

This topic is focused on the indicators “Air Quality Index (AQI) exceeding 100” and “Children aged 3-11 years exposed to secondhand smoke”. The HP2020-goal is to decrease AQI < 100 (weighted by AQI value and population) to 6.843 billion. The AQI reports all air quality values from 0 to 500 once daily with AQI > 100 considered as unhealthy air pollution levels [25, 26].

The HP2020 objective for environmental quality tracks only two Criteria Air Pollutants (CAP) (ozone and particulate matter), which are responsible for over 95% of poor air quality days, they are both combined in the AQI. The HP2010 objective tracked six CAPs: ozone matter, particulate matter, carbon monoxide, nitrogen oxides, sulfur dioxides and lead [25].

The second indicator belonging to this HP2020 topic is “Children aged 3-11 years exposed to secondhand smoke”. In 2005 – 2008, the baseline measured that 52.2 percent of children in the US, aged 3 to 11 years, were exposed to secondhand smoke (SHS). The 2020 goal was most importantly to decrease the number of children aged 3 to 11 years experiencing SHS by 10 percent to 47.0 percent, but in general to reduce the number of all nonsmokers exposed to secondhand smoke.



**Figure 2: Trend In Outdoor Air Quality**

Environmental quality has a notable impact on people’s health. If the air quality is poor, it can contribute to several illnesses, e.g., asthma, different kinds of cancer or cardiovascular diseases. Gastrointestinal illnesses, again cancer, even neurological disorders and many other health issues can be caused by poor water quality. Moreover, there are some chemicals which can contribute to toxic effects like acute poisonings [22].

### 2.2.3 INJURY AND VIOLENCE

“Injury and violence,” examines the effects and health consequences of violence and injuries, not only on the injured person, but also on friends, family members, communities, and other affected persons. Being a victim or witness of violence can have lifelong effects on physical, social, and emotional well-being. Both intentional violence and unintentional injuries can have many causes, such as physical assault, domestic violence, traffic accidents or even self-inflicted injuries and can happen to you anywhere. Its LHIs are “Injury deaths” and “Homicides” [27].



The HP2020 baseline was 59.7 deaths, caused by injuries, per 100,000 population in 2007. The target for HP2020 is to decrease this type of death by 10 percent to 53.7 deaths per 100,000 population [28].

The HP2020 baseline was 6.1 homicides per 100,000 population in 2007. The target for HP2020 is to decrease homicides by 10 percent to 5.5 deaths per 100,000 population [28].

#### **2.2.4 MENTAL HEALTH**

The LHI topic “Mental Health” examines the number of people affected by mental disorders and the number of people committing suicide. Its LHIs are “Suicides” and “Adolescents with a major depressive episode in the past 12 months”. In 2017, about 971 million people, which is about 13% of the global population, suffered from some kind of mental disorder [29]. Mental health affects not only adults but also children and adolescents. Many affected persons suffer from more than one mental health disorder. Mental health influences a person’s well-being, relationships, and the way the person can live her life. Untreated mental health disorders often lead to bad behaviors like drug and alcohol abuse, suicide, or self-destructive and violent behaviors [30].

The HP2020 goal is to reduce the number of deaths caused by suicide by 10 percent to 10.2 suicides per 100,000 population. The baseline is 11.3 suicides per 100,000 population in 2007 [31].

#### **2.2.5 NUTRITION, PHYSICAL ACTIVITY, AND OBESITY**

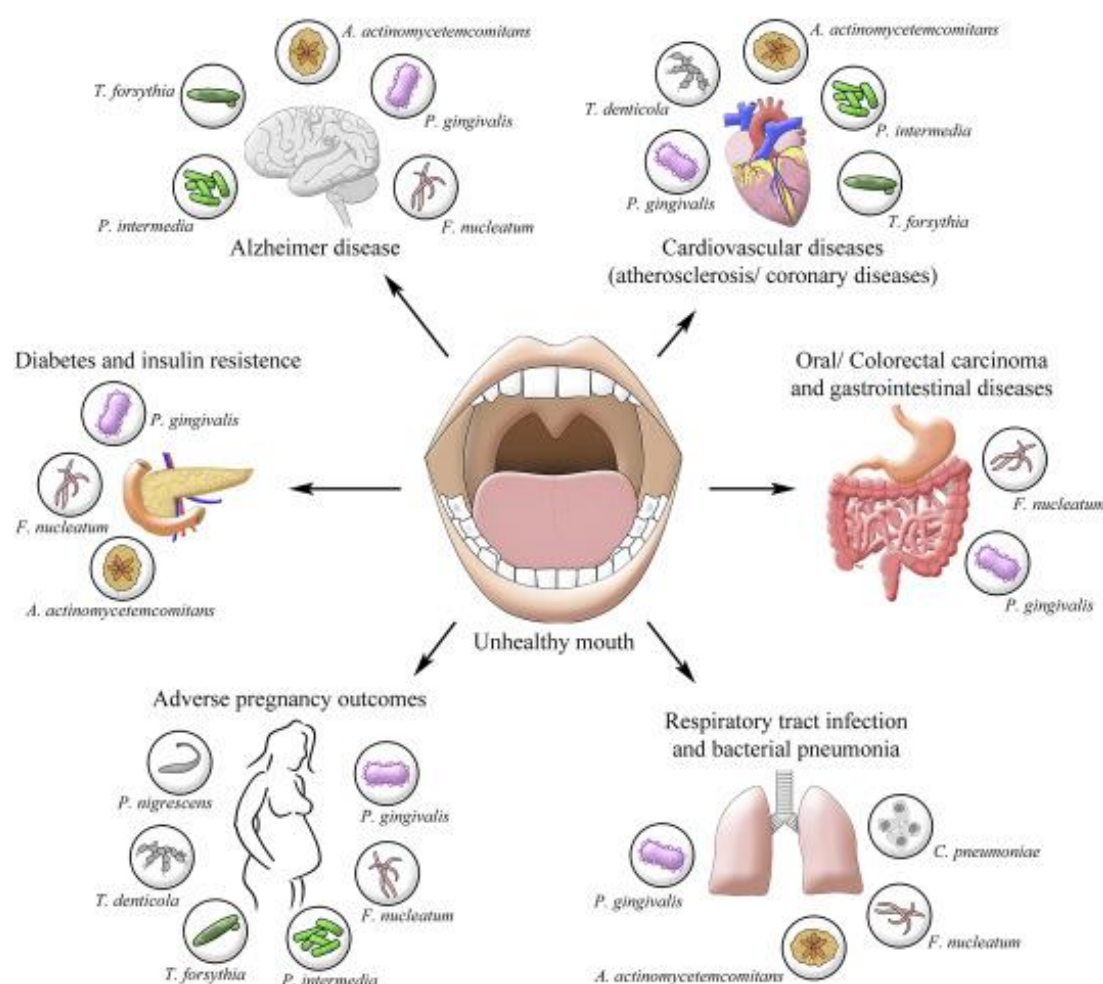
The “Nutrition, Physical Activity, and Obesity” Topic clearly shows how great the influence of physical activity (PA) and healthy nourishment is on obesity, so these two factors should not be overlooked. The influence is determined by the following factors: “Adults meeting aerobic physical activity and muscle-strengthening objectives,” “Obesity among adults,” “Obesity among children and adolescents,” and “Mean daily intake of total vegetables.” Body weight itself also has a big impact on the well-being and general health of a person. It helps to minimize the risk of various heart diseases and some cancer forms, improve mood and energy levels and to strengthen bones, muscles, and joints. If someone already suffers from health problems, following and adhering to these factors helps to keep the disease(s) in check so their condition does not deteriorate further. Obesity, for example, increases the risk of developing diabetes, unhealthy blood pressure or osteoarthritis and is also connected with the origin of some forms of cancer [32].

The Healthy People 2020 target for PA is 20.1 percent of adults over 18 years old to meet the guidelines for aerobic PA and muscle-strengthening activity [33]. The Healthy People 2020 target regarding nutrition is 1.16 cup equivalent of total vegetables per 1,000 calories [33]. The baseline for obesity in the period from 2005-2008 was a Body Mass Index (BMI) of 33.9 among persons aged at least 20 years. The HP2020 target is 30.5, which means a 10 percent improvement [34].

#### **2.2.6 ORAL HEALTH**

Oral problems like caries or cancer are the reason for oral pain for millions of people all over the world. These problems are also linked to other diseases like strokes or diabetes but also to poor

oral health in pregnant women (Figure 3) [35]. These issues could be prevented by more frequent visits at the dentist. The indicator is “Children, adolescents, and adults who visited the dentist in the past year”. While 44.5% of persons aged two years and older visited a dentist in the past twelve months (baseline), the target for 2020 was set to 49.0% [36, 37].



**Figure 3: Associations Between An Unhealthy Mouth And Other Diseases**

## 2.2.7 REPRODUCTIVE AND SEXUAL HEALTH

The first indicator regarding the LHIT “Reproductive and Sexual Health” is “Sexually active females receiving reproductive health services,” while the second one is entitled “Knowledge of serostatus among HIV-positive persons.” This LHIT explores safety measures offered to protect against sexually transmitted diseases (STD) and barriers to obtaining appropriate reproductive and sexual health services [38, 39].

Reproductive and sexual health services reduce costs by providing contraception, testing and treatment for STDs and HIV, prenatal care and screening for violence by intimate partners and reproductive cancers, nutritional and PA counselling, and referrals for treatment of substance abuse [38].

The baseline for sexually active females aged 15-44 years who received reproductive health services in the past 12 months in 2006-2010 was 78.6%. In 2015-2017, 78.0% of sexually active females between the ages 15-44 received reproductive health services in the past 12 months. The HP2020 target is 86.5%, which means a 10 percent improvement over the baseline [40].

The baseline for those 13 years or older living and aware of their HIV infection is 82.8% (2010). The HP2020 target is 90.0%, which is in line with the National HIV/AIDS Strategy [40].

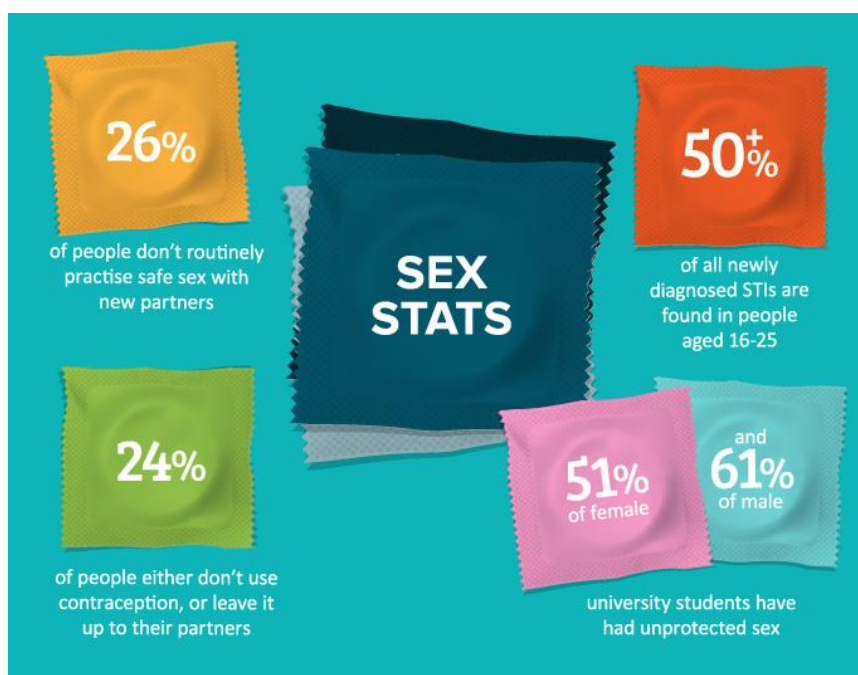


Figure 4: Sex Stats

### 2.2.8 SUBSTANCE ABUSE

The LHI topic “Substance Abuse” is composed of the indicators “Adolescents using alcohol or illicit drugs in past 30 days” and “Binge drinking in past month – Adults”. The term substance abuse covers both drugs and alcohol and can have a significant impact on social conditions such as financial problems, violence and crime, and family difficulties. Furthermore, it can contribute to health problems, e.g. cardiovascular conditions, STDs, homicide, and suicide [41].

The baseline for 2015 is 14.2 % of adolescents aged 12 to 17 years reported use of alcohol or any illicit drugs during the past 30 days. The HP2020 target is 12.8%, which means that the 10 percent improvement target-setting method has been reused [42].

The baseline for 2015 is 26.9 % of adults aged 18 years and older reported that they engaged in binge drinking during the past 30 days. The HP2020 target is 24.2%, which means that the 10 percent improvement target-setting method has been reused [42].

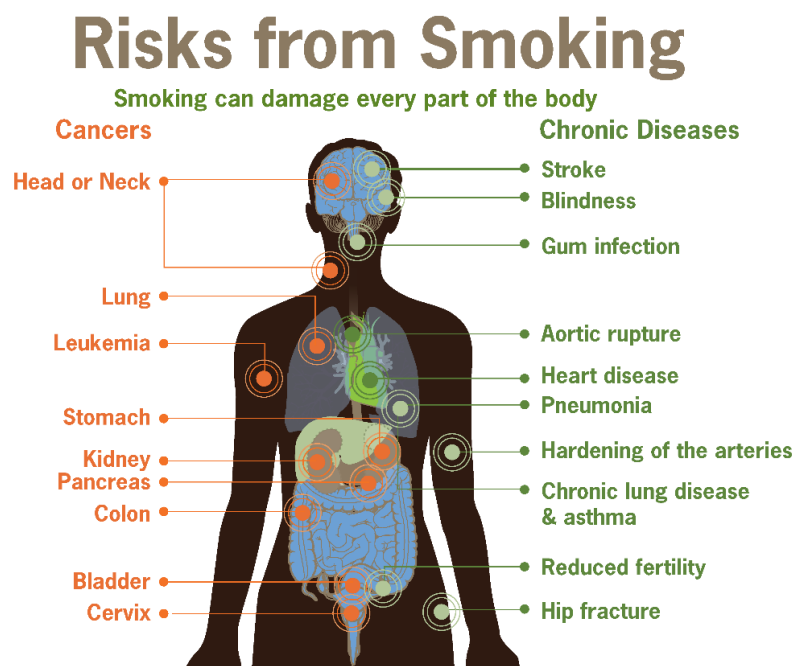
### 2.2.9 TOBACCO

The title of the last LHI topic, “Tobacco,” focuses on two indicators. The first one is “Adult cigarette smoking,” the second one is “Adolescent cigarette smoking in past 30 days.” Moreover, it is often the cause for diseases and health problems, for example, heart diseases and strokes,

vision problems, several forms of lung diseases, e.g., chronic obstructive pulmonary diseases (COPD), as well as cancers, for example cancer of the mouth and throat, bladder, lung or kidney and death (Figure 4) [43, 44]. Also, secondhand smoke often causes health related problems including respiratory and ear infections, asthma, or sudden infant death syndrome (SIDS) in infants and children. Secondhand smoke can also lead to heart disease and lung cancer in adults. Smokeless tobacco can result in a number of serious oral health problems, including periodontal disease, oral and gum cancer and tooth loss [43]. In this thesis, it is located in the LHI Topic "Environmental Quality."

In 2008, 20.6% of adults aged 18 years and over were current cigarette smokers, which represents the baseline (age adjusted to the year 2000 standard population). The HP2020 target is 12.0%, the target-setting method is "Retention of Healthy People 2010 target" [45].

The second indicator's baseline is 19.5% of adolescents in grades 9 through 12 smoked cigarettes in the past 30 days (2009). The target for HP2020 is 16.0%, the target-setting method is again "Retention of Healthy People 2010 target" [46].



**Figure 5: Risks From Smoking**

### **3 METHODS**

This part of the master's thesis focuses on the methods of preparation, statistical analysis and evaluation of the survey results and deals with the survey used, the collective of survey participants, data preparation and statistical aspects.

#### **3.1 SURVEY METRICS AND TRANSLATION**

Survey questions were adapted from a survey previously used by researchers from Texas State University [47]. Where necessary, the questions were modified to measure the answers to key LHI points better. Additionally, questions on the current topic "COVID-19" were also added by the researcher.

The survey included several questions focusing on various health-related aspects, such as: height and weight, health insurance coverage, access to general practitioners and specialists, chronic diseases, substance abuse (alcohol and drugs), reproductive and sexual health, stress, and physical exercise levels.

To avoid problems with the survey due to language barriers and to adapt the questions to the respective national (health) system, all questions were modified if necessary and translated into German and Polish.

#### **3.2 SOFTWARE USED FOR STATISTICAL ANALYSIS**

Data was collected using Qualtrics and downloaded to Microsoft (MS) Excel 2019, to cleanse the data. The researcher analyzed the data using MS Excel 2019 and IBM SPSS Superior Performing Software System, formerly Statistical Package for Social Sciences (SPSS) version 26. SPSS can analyze various numerical data types. The menu-drive graphical user interface in SPSS allows for quick analysis.

#### **3.3 DATA COLLECTION**

The target population for this study was college students 18 years of age and older. Students from all three participating countries, including Texas State University, San Marcos, USA; Hochschule Hannover, Hanover, Germany, and State Higher Vocational School, Racibórz, Poland received an e-mail invitation to participate in the survey. Reminders were sent twice to encourage the students to answer the survey. It took about 15 minutes to answer all questions.

#### **3.4 DATA PREPARATION**

In this subchapter, the exact process that led to the final response pool for the comparative statistical analysis is explained in more detail. To protect respondent's privacy, the survey was conducted anonymously. This has no influence on the results of the statistical analysis. One criterion for including a data set in the statistical analysis was that the survey was 100% completed. This could be seen in one column of the file when the responses were exported from Qualtrics. In addition, unserious answers were not evaluated.

In the U.S., 239 students began the survey; however, 47 were eliminated due to incomplete responses and 192 were included in the analysis. In Germany, 32 of the 135 participants who started the survey, were excluded from the statistical analysis for the same reason, leaving 103 in the end. In Poland, 41 of 126 data sets were eliminated due to incomplete responses. Thus, the final number of cases is  $n=85$  participants, who were included in the statistical analysis from Poland. In some cases, those selecting the "Prefer Not To Answer" response option were grouped with those who did not respond to this question at all (N/A).

### 3.5 DESCRIPTIVE STATISTICS

To get an overview of the data to be analyzed, descriptive statistics can be used to create graphs and tables and to analyze characteristics such as the mean value, dispersion, correlation coefficients, or the standard deviation and the number of cases  $n$ . Since it is only a way to describe data, no data or results are interpreted. Many questions can be answered by the sole application of descriptive statistics. In almost all investigations, surveys and studies the different parameters will have various scale levels. Demographic data is collected for almost all analyses. Frequencies and proportions can be presented either in numbers or in the form of frequency tables or frequency/ pie charts [48, 49].

For illustration purposes, the methods mentioned above will be applied in the further course of this master's thesis and some diagrams and different types of tables will be created.

### 3.6 INDUCTIVE STATISTICS

In Inductive Statistics, procedures and methods are provided that make it possible to arrive at general statements about a population based on statistical models and data from samples. Common methodologies are, for example, *Analysis Of Variance* (ANOVA) or hypothesis testing. Furthermore, it is used to compare, test, and predict future outcomes. Inductive statistics is divided into statistical testing and statistical estimation. The latter includes the handling of so-called point and interval estimators. Statistical testing deals with hypothesis testing, which includes formulating hypotheses and the goal of proving the alternative hypothesis [48, 50–52].

For the statistical models in section 4.2, the hypotheses in the respective results section apply.

When the variance is known, the z-test is used to compare means of two distributions. When the sample is compared to a population, the one-sample z-test is useful. The survey always requires comparing the means of two samples. Thus, to determine if there is a statistically significant difference between two countries, the two-tailed two-sample z-test will always be applied to two of the three countries surveyed [53].

The resulting values affirm whether there is a difference between the proportions of students from two countries (U.S.-GER, U.S.-PL, GER-PL) or not. MS Excel was used to calculate all the required values for the tests and the z-tests themselves.

The z-test is performed as follows:

1. Formulation of the **null and alternative hypotheses** for each question to be studied.  
These are:

null hypothesis:  $H_0: P_1 = P_2$   
where  $P_1 - P_2 = 0$

alternative hypothesis:  $H_1: P_1 \neq P_2$   
where  $P_1 - P_2 \neq 0$

2. Determination of the **significance level** ( $\alpha$ ): 5%
3. Determination of **acceptance and rejection range** by finding the critical value of z [54]

The critical region at which the null hypothesis is rejected is then:

If alpha is 5%, use  $z_{0.025}$ , which leads to the value 1.96 since the rejection area is divided into left and right ( $2 \times 2.5\%$ ).

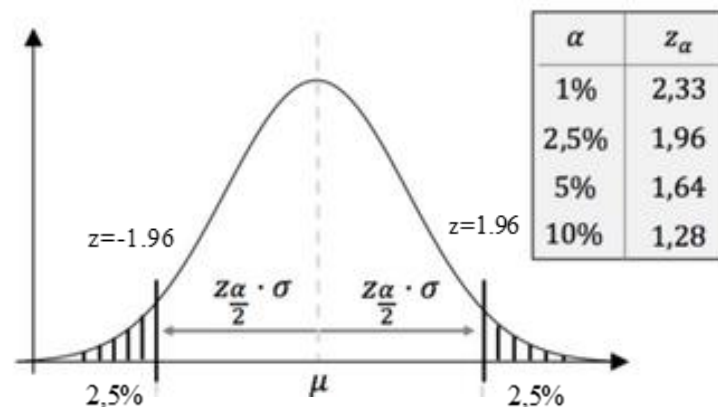


Figure 6: Gaussian Distribution

The acceptance area is then between -1.96 and +1.96.

4. Calculate **test statistics** (z- and p-values).
5. Make a **test decision** according to the **z-value**.
6. make a **test decision** according to the **p-value**:

$p < 0.05$  leads to the rejection of the null hypothesis, thus the decision resulting from the z-test is confirmed if z was less than -1.96 or greater than +1.96 and thus also led to the rejection of the null hypothesis.

Decision rules:

If  $z > -1.96$  or  $z < +1.96$ , p must be greater than 0.05 to not reject the null hypothesis.

If  $z < -1.96$  or  $z > +1.96$ , p must be less than 0.05 to reject the null hypothesis.

## 4 RESULTS

In this chapter all results of the statistical data set analysis are evaluated regarding the defined task definitions. After the demographic data, the evaluations of the similarities and differences between the country-results follow. A summary of the results is given at the end of the chapter.

### 4.1 DEMOGRAPHICS

The participants, whose data will be included in the following statistical analyses, included 380 participants (Table 1). Among them, 192 participants are from the USA (29% male, 69% female), 103 from Germany (15% male, 82% female) and 85 from Poland (19% male, 79% female).

**Table 1: Frequency Of Sexes**

Frequency of Sexes						
	U.S.		Germany		Poland	
Sex	Count	%	Count	%	Count	%
Male	55	29	15	15	16	19
Female	134	69	85	82	67	79
Other	1	1	2	2	0	0
N/A	2	1	1	1	2	2
<b>Total</b>	192	100	103	100	85	100

The average age of the respondents from the U.S. was 31, with a range from 18 to 76, the average age of German respondents was 24 (range: 18 to 40), compared to an average respondents' age of 28 in Poland (range: 20 to 50). The students from the U.S. who chose "Other" at citizenships are from the following countries: South Korea, India, Mexico, Bangladesh, Belize, Iran, Nigeria, Denmark, Uruguay, Turkey, and one not further specified African citizenship. The "Other" citizenships from Germany include Lithuania, Kyrgyzstan and two without further details. In Poland no one has chosen "Other" as an answer to the question of citizenship. More detailed demographic data on the participant collective can be found in the following two tables 2 and 3.

**Table 2: Age In Years**

Age In Years (Descriptive)						
Country	N	Blanks	Minimum	Maximum	Mean Value	Standard Deviation
U.S.	192	24	18	76	31.2	12.5
Germany	103	2	18	40	24.3	4.4
Poland	85	49	20	50	28.4	7.4

**Table 3: Frequency Of Citizenships**

Frequency Of Citizenships						
	U.S.		Germany		Poland	
Citizenship	Count	%	Count	%	Count	%
U.S.	169	88	0	0	0	0
Germany	2	1	96	93	0	0
Poland	0	0	2	2	83	98
Other	21	11	4	4	0	0
N/A	0	0	1	1	2	2
<b>Total</b>	192	100	103	100	85	100



## 4.2 ANALYSIS

### 4.2.1 EVALUATION: ACCESS TO HEALTH SERVICES

Twenty-four students (13%) from the U.S. and one student (1%) from Germany indicated that they did not have any health insurance coverage. In Poland, every student has stated that they have health insurance. Since the resulting z-values for U.S.-GER (7.909) as well as 9.013 for U.S.-PL are greater than 1.96, the null hypothesis was rejected. The same applies to the z-value for GER-PL (-5.080) because it was less than -1.96. So, the  $H_{11}$  was not rejected, which implies that a difference existed between the proportion of students with health insurance in the U.S., Germany, and Poland.

#### Null Hypothesis $H_01$

The proportion of students in the USA, Germany, and Poland who have health insurance is the same for each country.

#### Alternative Hypothesis $H_{11}$

The proportion of students in the USA, Germany, and Poland who have health insurance is different for each country.

**Table 4: Health Insurance**

Health Insurance						
	U.S.		Germany		Poland	
Type	Count	%	Count	%	Count	%
Public Health Insurance	15	8	0	0	7	8
Parent's Insurance Plan	44	23	0	0	3	4
Private Insurance Through Employer Or Workplace	60	31	0	0	2	2
Private Insurance Through Insurance Company	12	6	0	0	2	2
Private Insurance (unspecified)	0	0	8	8	9	11
Military, Tricare, VA	12	6	0	0	1	1
Medicaid, Medicare	11	6	0	0	1	1
The Indian Health Service	0	0	0	0	0	0
Mandatory Insurance (Law)	0	0	94	91	53	63
Other	12	6	0	0	6	7
No Insurance	24	13	1	1	0	0
Cash	2	1	0	0	1	1
<b>Total</b>	192	100	103	100	85	100
	<b>z-value</b>			<b>p-value</b>		
<b>U.S. - GER</b>	7.909			0.002		
<b>U.S. - PL</b>	9.013			0		
<b>GER - PL</b>	-5.080			0		

Most of the students from the U.S. sought medical treatment within the last year (80%), in Germany it was 90% of the participating students and in Poland 87%. Since the z-values for U.S.-PL and GER-PL from Table 5 are greater than 1.96, we fail to reject the null hypothesis  $H_{02}$  for

these tests and accept the alternative hypothesis which says there are differences between the proportions of students who sought medical treatment in both tests including Poland.

### Null Hypothesis $H_02$

The proportion of students in the USA, Germany, and Poland who sought medical treatment in the last year is the same for each country.

### Alternative Hypothesis $H_12$

The proportion of students in the USA, Germany, and Poland who sought medical treatment in the last year is different for each country.

**Table 5: Sought Medical Treatment**

Sought Medical Treatment						
	U.S.		Germany		Poland	
Time	Count	%	Count	%	Count	%
Within The Last Month	41	21	0	0	21	25
Within The Last Three Months	63	33	27	26	24	28
Within The Last Six Months	3	2	25	24	15	18
Within The Last Year	47	24	41	40	14	16
Within The Last Two Years	0	0	5	5	11	13
Over Two Years	38	20	5	5	0	0
<b>Total</b>	192	100	103	100	85	100
	<b>z-value</b>			<b>p-value</b>		
<b>U.S. - GER</b>	-1.771			0.087		
<b>U.S. - PL</b>	2.233			0.036		
<b>GER - PL</b>	4.050			0.006		

More than the half of all students from each country seek regular treatment at primary care physicians (PCP) as you can see in Table 6. It was 147 students (69%) from the U.S., 69 (67%) from Germany and 50 (58%) from Poland. Twenty-two students (12%) from the U.S., 29 students (28%) from Germany, and 29 (34%) from Poland visited a specialist for treatment in the past year. Since no on-campus student health centers exist in Germany and Poland, the values from the U.S. (10 students (5%)) are not comparable. Again, a z-test was performed to test hypothesis  $H_3$ . The resulting z-value for U.S.-GER was 12.116 with a p-value of 0, the z-value for U.S.-PL was 10.928 (p-value: 0), which means that the alternative hypothesis was accepted in both cases. Also, the z-value for GER-PL (-2.137) was less than -1.96 (p-value: 0.033), indicating that the null hypothesis will be rejected as well, which affirms that a significant difference existed between the proportions of students from Germany and Poland who visited medical facilities for regular medical treatment.

### Null Hypothesis $H_03$

The proportion of students in the USA, Germany, and Poland who visited any kind of medical facility for regular treatment is the same for each country.

### Alternative Hypothesis $H_13$

The proportion of students in the USA, Germany, and Poland who visited any kind of medical facility for regular treatment is different for each country.

**Table 6: Locations Visited For Regular Treatment**

Locations Visited For Regular Treatment						
U.S.			Germany		Poland	
Location	Count	%	Count	%	Count	%
PCP	147	69	69	67	50	58
Student Health Center	10	5	0	0	0	0
Specialist	0	0	29	28	29	34
Outpatient Clinic	22	12	1	1	3	4
Emergency Room	6	4	0	0	1	1
Other	20	10	4	4	1	1
N/A	0	0	0	0	2	2
Total Responses*	215	100	103	100	86	100
	z-value			p-value		
U.S. - GER	12.116			0		
U.S. - PL	10.928			0		
GER - PL	-2.137			0.033		
*Since multiple selection was possible, there may be more answers than the number of participants in the respective country.						

The students were also asked “When you need to seek treatment, how long does it normally take you to get an appointment? “. To provide an example, on this question, 50% from the U.S., 31% from Germany and 52% from Poland answered they could get an appointment for a well visit within one week. For sick care, it was 34% students from the U.S., who could get an appointment within one week, 53% from Germany and 83% from Poland. In case of an emergency, 61% of the students from Germany and 58% from Poland indicated they were able to access emergency-healthcare within one day. As can be seen in Table 7, most of the students from the U.S. did not provide an answer to that question.

**Table 7: Lead Time To Get An Appointment**

Lead Time To Get An Appointment								
<i>Figures in %</i>		1d	1w	2w	1m	2m	6m	1y
<b>U.S.</b>	Well Visit	35	15	11	4	4	3	4
	Sick Care	29	5	4	2	10	3	0
	Specialist	20	14	10	7	5	3	3
	Emergency	4	1	0	1	1	1	5
<b>GER</b>	Well Visit	14	17	28	17	19	5	0
	Sick Care	49	4	3	4	0	0	2
	Specialist	7	7	17	9	9	9	4
	Emergency	61	4	1	1	1	0	0
<b>PL</b>	Well Visit	24	28	8	8	5	7	1
	Sick Care	52	31	2	2	2	1	2
	Specialist	8	21	6	15	13	16	14
	Emergency	58	1	0	0	0	0	0

The following Table 8 describes how students rate their own health and allows comparisons between the students' health ratings from each country. Roughly 10-12% of the students from each country responded that their health status was excellent. The majority from all countries chose the second-best option "Very Good," including 44% from the U.S., 48% from Germany, and 40% from Poland. Two students from each country rated their health as "poor". Only three students from the U.S. were not sure or did not know how to rate their health and two students from Poland did not respond to that question at all.

To test the hypothesis, all z-scores were calculated. The z-score for U.S.-GER was 0.732 (p-value: 0.464), the z-score for U.S.-PL was 0.232 (p-value: 0.817) and the z-score for GER-PL was -0.390 (p-value: 0.707) which means we fail to reject the null hypothesis for all three cases, signifying no difference existed between the proportion of students from the U.S., Germany, and Polish students regarding their health rating.

#### Null Hypothesis H<sub>0</sub>4

The proportion of students in the USA, Germany, and Poland who rated their health is the same for each country.

#### Alternative Hypothesis H<sub>1</sub>4

The proportion of students in the USA, Germany, and Poland who rated their health is different for each country.

**Table 8: Health Rating**

Health Rating						
U.S.			Germany		Poland	
Location	Count	%	Count	%	Count	%
Excellent	19	10	10	10	10	12
Very Good	85	44	49	48	34	40
Good	60	31	32	31	27	32
Fair	23	12	10	10	10	12
Poor	2	1	2	1	2	2
Don't Know/ Not Sure	3	2	0	0	0	0
N/A	0	0	0	0	2	2
<b>Total</b>	192	100	103	100	85	100
<b>z-value</b>				<b>p-value</b>		
<b>U.S. - GER</b>	0.732			0.464		
<b>U.S. - PL</b>	0.232			0.817		
<b>GER - PL</b>	-0.390			0.707		

Table 9 compares the relationship between students' chronic conditions and their current treatment status. For all chronic conditions, most of the students from all three countries answered "Not Applicable" or did not answer at all (N/A). Apart from the fact that no student in Poland had or has HIV/AIDS, Tuberculosis and/or Cancer, there is at least one student in every country who has or had at least one of the diseases or who responded "Other". The most prevalent disease in

the U.S (22%) and Germany (11%) is Asthma and in Poland it is High Blood Pressure (6%) and Asthma (6%). Furthermore, some students from all countries answered “Other” including 16% from the U.S., 9% from Germany and 21% from Poland.

**Table 9: Chronic Conditions**

<b>Chronic Conditions</b>									
<i>Figures In %</i>		<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>
<b>U.S.</b>	<b>A</b>	4	3	8	2	4	2	2	4
	<b>B</b>	6	2	5	0	0	0	0	6
	<b>C</b>	2	1	4	0	1	0	0	4
	<b>D</b>	1	1	5	0	5	1	3	2
	<b>E</b>	0	0	0	0	0	0	0	0
	<b>N/A</b>	87	93	78	98	90	97	95	84
<b>GER</b>	<b>A</b>	3	1	4	1	1	1	1	3
	<b>B</b>	1	2	1	1	1	1	1	3
	<b>C</b>	0	0	6	0	0	0	0	3
	<b>D</b>	2	0	0	0	3	1	0	0
	<b>E</b>	83	86	79	87	84	86	87	51
	<b>N/A</b>	11	11	10	11	11	11	11	40
<b>PL</b>	<b>A</b>	1	1	0	0	2	0	0	5
	<b>B</b>	1	0	4	0	0	0	0	11
	<b>C</b>	2	1	0	0	0	0	0	4
	<b>D</b>	2	1	2	0	1	0	0	1
	<b>E</b>	58	61	60	61	62	64	64	33
	<b>N/A</b>	36	39	34	39	35	36	36	46
1=High Blood Pressure, 2=Diabetes, 3=Asthma, 4=HIV/AIDS, 5=STD, 6=Tuberculosis, 7=Cancer, 8=Other A=I Have But Not Currently Being Treated For, B=Currently Under Care Of Physician For Condition, C=Treated For And Will Take Medicine For Rest Of Life, D=Treated For And No Longer Need Treatment, E=Not Applicable									

Table 10 and 11 infer whether the immunizations and flu shots for the students are up to date. Based on the results from Table 10, 170 students (88%) from the U.S. and 71 students (68%) from Germany were up-to-date with their immunizations, and one student from the U.S. and 13 students from Germany responded that they would have their immunizations updated soon. To test the null hypothesis, the z-score was computed. The resulting z-value was -5.605. It implies there is sufficient evidence to reject the null hypothesis that the proportions of students whose immunizations are current are similar in the U.S. and Germany. The same applies to the test between U.S.-PL with a z-value of -4.632. 51 students (61%) from Poland responded that they were up-to-date on their immunizations at the time of the survey, while there was again one student who wanted to update his immunizations soon. The z-score of 1.080 for GER-PL did not lead to the rejection of the null hypothesis.

### **Null Hypothesis $H_05$**

The proportion of students in the USA, Germany, and Poland whose immunizations are up to date is the same for each country.

### **Alternative Hypothesis $H_{15}$**

The proportion of students in the USA, Germany, and Poland whose immunizations are up to date is different for each country.

Table 10: Immunization

Immunization								
		Yes	No	No But Will Get Up-To-Date Shortly	N/A	Total	z-value	p-value
U.S.	Count	170	7	1	14	192	-5.605	0
	%	88	4	1	7	100		
GER	Count	71	17	13	2	103		
	%	68	17	13	2	100		
U.S.	Count	170	7	1	14	192	-4.632	0.003
	%	88	4	1	7	100		
PL	Count	51	28	1	5	85		
	%	60	33	1	6	100		
GER	Count	71	17	13	2	103	1.080	0.300
	%	68	17	13	2	100		
PL	Count	51	28	1	5	85		
	%	60	33	1	6	100		

Regarding their flu shot, 50% from the U.S. and about a quarter from Germany (26%) said they were up-to-date, compared with almost the half (46%) in Poland. Three students from the U.S. and Poland and ten from Germany answered they would have updated their immunizations soon. With z-scores of -5.350 (U.S.-GER) and 3.160 (GER-PL), the results indicate a rejection of the null hypothesis which implies there is no difference between the proportions of students whose flu shots are current. A z-score of -1.607 for U.S.-PL is not leading to the rejection of  $H_0$ .

#### Null Hypothesis $H_0$

The proportion of students in the USA, Germany, and Poland whose flu shots are up to date is the same for each country.

#### Alternative Hypothesis $H_1$

The proportion of students in the USA, Germany, and Poland whose flu shots are up to date is different for each country.

Table 11: Flu Shot

Flu Shot								
		Yes	No	No But Will Get Up-To-Date Shortly	N/A	Total	z-value	p-value
U.S.	Count	96	75	6	15	192	-5.350	0.005
	%	50	39	3	8	100		
GER	Count	27	64	10	2	103		
	%	26	62	10	2	100		
U.S.	Count	96	75	6	15	192	-1.607	0.127
	%	50	39	3	8	100		
PL	Count	39	40	3	3	85		
	%	46	46	4	4	100		
GER	Count	27	64	10	2	103	3.160	0.002
	%	26	62	10	2	100		
PL	Count	39	40	3	3	85		
	%	46	46	4	4	100		

### 4.2.2 EVALUATION: ENVIRONMENTAL QUALITY

When asked about their concerns regarding air quality, 28% from the U.S. indicated that there are current air pollution issues, while 43% from Germany and remarkable 79% from Poland indicated the same. Only two students from the U.S. did not respond to that question. A z-score of 1.686 for U.S.-GER means that the null hypothesis cannot be rejected. Since the other two z-scores, 8.091 for U.S.-PL and 5.370 for GER-PL, were greater than 1.96, the results led to the rejection of the null hypothesis while leading to the acceptance of the alternative hypothesis  $H_17$ . The rejection avers that the proportion of students who say there are currently problems with air pollution varies significantly between U.S.-PL and GER-PL.

#### Null Hypothesis $H_07$

The proportion of students in the USA, Germany, and Poland who have concerns regarding air quality is the same for each country.

#### Alternative Hypothesis $H_17$

The proportion of students in the USA, Germany, and Poland who have concerns regarding air quality is different for each country.

**Table 12: Concerns With Air Quality**

Concerns With Air Quality						
	U.S.		Germany		Poland	
	Count	%	Count	%	Count	%
Yes, There Is Current Air Pollution Issues	54	28	43	43	67	79
No, There Are No Current Air Pollution Issues	78	41	30	29	10	12
Not Aware	58	30	29	28	8	9
N/A	2	1	0	0	0	0
<b>TOTAL</b>	192	100	102	100	85	100
	<b>z-value</b>			<b>p-value</b>		
<b>U.S. - GER</b>	1.686			0.092		
<b>U.S. - PL</b>	8.091			0.006		
<b>GER - PL</b>	5.370			0.008		

Regarding diseases caused by air pollution, 131 of 225 U.S. student responses indicated they had at least one disease associated with air pollution. In Germany, it was 96 of 124 and 92 of the 104 from Poland. For U.S.-GER, a z-value less than -1.96 resulted (-2.519) causing the rejection of the null hypothesis  $H_08$ . The other two z-values, -1.663 for U.S.-PL and 0.798 for GER-PL do not provide sufficient proof to reject the null hypothesis.

#### Null Hypothesis $H_08$

The proportion of students in the USA, Germany, and Poland who fear getting sick from air pollution is the same for each country.

### Alternative Hypothesis H<sub>18</sub>

The proportion of students in the USA, Germany, and Poland who fear getting sick from air pollution is different for each country.

**Table 13: Illnesses Of Concern From Air Pollution**

Illnesses Of Concern From Air Pollution						
U.S.			Germany		Poland	
	Count	%	Count	%	Count	%
Asthma	50	22	22	18	24	23
Other Breathing Issues	54	24	45	36	45	43
Other Illnesses	27	12	29	23	23	22
N/A	94	42	28	23	12	12
TOTAL Responses*	225	100	124	100	104	100
	z-value			p-value		
U.S. - GER	-2.519			0.002		
U.S. - PL	-1.663			0.096		
GER - PL	0.798			0.425		
*Since multiple selection was possible, there may be more answers than the number of participants in the respective country.						

### 4.2.3 EVALUATION: INJURY AND VIOLENCE

When the students were asked about the risks and experiences concerning relationship violence, 10% from the U.S., 21% from Germany, and 10% from Poland replied they are at risk to or already experienced injuries in relationships. Another proportion of all students surveyed felt at risk of or already experienced physical harm (U.S: 13%, GER: 24%, PL 16%) as well as rape, which was 14% from the U.S., 24% from Germany, and 12% from Poland. 10% from the U.S. were affected by date/relationship violence while it was 21% from Germany, and 10% from Poland. Concerning murder/homicide 5% of the U.S. students answered they are affected, 14% from Germany felt they are at risk while it was 7% from Poland. As shown in Table 14, many students from all countries did not respond to that multiple choice question though.



**Table 14: Injury And Violence – Risk And Experienced**

<b>Injury And Violence – Risk And Experienced</b>								
<i>Figures In % C=Count</i>		<b>At Risk</b>		<b>Experienced/ Victim</b>		<b>N/A</b>		<b>TOTAL Responses*</b>
		<b>C</b>	<b>%</b>	<b>C</b>	<b>%</b>	<b>C</b>	<b>%</b>	<b>C (100%)</b>
<b>U.S.</b>	Injury	17	17	45	46	36	37	98
	Physical Harm That Can Lead To Death	10	5	16	8	169	87	195
	Rape	7	4	19	10	167	86	193
	Date/Relationship Violence	5	3	14	7	174	90	193
	Murder/Homicide	7	4	2	1	183	95	192
	None	102	53	4	2	86	45	192
<b>GER</b>	Injury	6	6	44	43	53	51	103
	Physical Harm That Can Lead To Death	19	18	6	6	78	76	103
	Rape	18	17	7	7	78	76	103
	Date/Relationship Violence	16	16	5	5	82	79	103
	Murder/Homicide	14	14	0	0	89	86	103
	None	24	20	22	18	73	62	119
<b>PL</b>	Injury	11	14	23	28	46	58	80
	Physical Harm That Can Lead To Death	10	12	3	4	72	85	85
	Rape	6	7	4	5	75	88	85
	Date/Relationship Violence	5	6	3	4	77	91	85
	Murder/Homicide	5	6	1	1	79	93	85
	None	36	33	33	31	39	36	108
*Since multiple selection was possible, there may be more answers than the number of participants in the respective country.								

#### 4.2.4 EVALUATION: MENTAL HEALTH

Table 15 illustrates how many students ever contemplated suicide. 69 students (36%) from the U.S., 22 students (22%) from Germany, and 11 students (13%) from Poland responded that they had either contemplated or attempted suicide. Again, z-values were computed to test the hypothesis for all three cases. The z-value for U.S.-GER was 0.589 which is not in the rejection area of the null hypothesis. The other two z-values, -2.960 for U.S.-PL and -2.883 for GER-PL, provided sufficient evidence that the null hypothesis  $H_0$  was rejected for these two cases.

##### Null Hypothesis $H_0$

The proportion of students in the USA, Germany, and Poland who contemplated suicide is the same for each country.

##### Alternative Hypothesis $H_1$

The proportion of students in the USA, Germany, and Poland who contemplated suicide is different for each country.

**Table 15: Contemplated Suicide**

<b>Contemplated Suicide</b>						
	<b>U.S.</b>		<b>Germany</b>		<b>Poland</b>	
	<b>Count</b>	<b>%</b>	<b>Count</b>	<b>%</b>	<b>Count</b>	<b>%</b>
Yes And Attempted It	14	7	5	5	6	7
Yes - But Never Attempted It	55	29	17	17	5	6
No	113	59	75	72	68	80
N/A/Choose Not To Answer	10	5	6	6	6	7
<b>TOTAL</b>	192	100	103	100	85	100
	<b>z-value</b>			<b>p-value</b>		
<b>U.S. - GER</b>	0.589			0.056		
<b>U.S. - PL</b>	-2.960			0.003		
<b>GER - PL</b>	-2.883			0.004		

In Table 16 you can see the number of students who know where to get help if someone else is contemplating suicide. 87% from the U.S., 83% from Germany, and 78% from Poland responded they know where to get help concerning suicide. A z-test was performed, to test the hypothesis for this question. In all three cases, the z-scores are between -1.96 and 1.96. These results did not provide sufficient evidence to accept the alternative hypothesis that the proportions of students who knew where to get help if someone else had suicidal thoughts differed among all three countries at the time of the survey.

### Null Hypothesis $H_0$

The proportion of students in the USA, Germany, and Poland who know where to get help if someone else is contemplating suicide is the same for each country.

### Alternative Hypothesis $H_1$

The proportion of students in the USA, Germany, and Poland who know where to get help if someone else is contemplating suicide is different for each country.

**Table 16: Know Where To Get Help If Someone Else Is Contemplating Suicide**

<b>Know Where To Get Help If Someone Else Is Contemplating Suicide</b>						
		<b>Yes</b>	<b>No</b>	<b>N/A</b>	<b>Total</b>	
<b>U.S.</b>	<b>Count</b>	167	21	4	192	-0.664 0.507
	<b>%</b>	87	11	2	100	
<b>GER</b>	<b>Count</b>	85	17	1	102	
	<b>%</b>	83	17	1	100	
<b>U.S.</b>	<b>Count</b>	167	21	4	192	-1.594 0.111
	<b>%</b>	87	11	2	100	
<b>PL</b>	<b>Count</b>	66	17	2	85	
	<b>%</b>	78	20	2	100	
<b>GER</b>	<b>Count</b>	85	17	1	102	-0.945 0.345
	<b>%</b>	83	17	1	100	
<b>PL</b>	<b>Count</b>	66	17	2	85	
	<b>%</b>	78	20	2	100	

Table 17 gives information about students who experienced a major depressive episode (MDE) in the past year. About one third (31%) of the U.S. students, 9% of the German and 15% of the Polish students experienced a MDE during the last year. To test the hypothesis for all three cases, a z-test was performed. The resulting z-scores were -2.520 and -3.245 for U.S.-GER and U.S.-PL, implying the rejection of  $H_{011}$  for these two cases while leading to the acceptance of the alternative hypothesis  $H_{111}$ . With a z-score of -1.378, this is not true in the case of GER-PL, so the null hypothesis cannot be rejected. This in turn means that there are no differences between the proportion of students in Germany and Poland who experienced a MDE in the past 12 months.

### Null Hypothesis $H_{011}$

The proportion of students in the USA, Germany, and Poland who experienced a major depressive episode in the past year is the same for each country.

### Alternative Hypothesis $H_{111}$

The proportion of students in the USA, Germany, and Poland who experienced a major depressive episode in the past year is different for each country.

**Table 17: Experienced A Major Depressive Episode In The Past 12 Months**

Experienced A Major Depressive Episode In The Past 12 Months								
		Yes	No	Maybe	N/A	Total	z-value	p-value
U.S.	Count	60	98	32	2	192	-2.520	0.002
	%	31	51	17	1	100		
GER	Count	9	84	10	0	103		
	%	9	81	10	0	100		
U.S.	Count	60	98	32	2	192	-3.245	0.001
	%	31	51	17	1	100		
PL	Count	13	45	26	1	85		
	%	15	53	31	1	100		
GER	Count	9	84	10	0	103	-1.378	0.168
	%	9	81	10	0	100		
PL	Count	13	45	26	1	85		
	%	15	53	31	1	100		

As shown in Table 18, 125 students (65%) from the U.S., 46 students (45%) from Germany, and 39 students (46%) from Poland revealed they were currently feeling stressed. The resulting z-scores for U.S.-GER (-3.242) and for U.S.-PL (-2.926) mean that the hypothesis can be rejected, whereas  $H_{112}$  was accepted for these two cases. Therefore, there was sufficient evidence to confirm differences between the proportions of students from the U.S. and Germany as well as Poland. A z-score of -0.629 does not lead to the rejection of  $H_{012}$  for the test between GER-PL.

### Null Hypothesis

The proportion of students in the USA, Germany, and Poland who are currently feeling stressed is the same for each country.

### Alternative Hypothesis $H_{112}$

The proportion of students in the USA, Germany, and Poland who are currently feeling stressed is different for each country.

**Table 18: Currently Feeling Stressed**

<b>Currently Feeling Stressed</b>								
		<b>Yes</b>	<b>No</b>	<b>Maybe</b>	<b>N/A</b>	<b>Total</b>	<b>z-value</b>	<b>p-value</b>
<b>U.S.</b>	<b>Count</b>	125	40	25	2	192	-3.242	0.001
	<b>%</b>	65	21	13	1	100		
<b>GER</b>	<b>Count</b>	46	36	21	0	103		
	<b>%</b>	45	35	20	0	100		
<b>U.S.</b>	<b>Count</b>	125	40	25	2	192	-2.926	0.003
	<b>%</b>	65	21	13	1	100		
<b>PL</b>	<b>Count</b>	39	24	21	1	85		
	<b>%</b>	46	28	25	1	100		
<b>GER</b>	<b>Count</b>	46	36	21	0	103	-0.629	0.950
	<b>%</b>	45	35	20	0	100		
<b>PL</b>	<b>Count</b>	39	24	21	1	85		
	<b>%</b>	46	28	25	1	100		

The table data in Table 19 compare the number of students in the United States, Germany, and Poland who had access to stress prevention or reduction programs. More than the half of the students from the United States (68%) and Poland (65%) responded they had access to stress management programs. In Germany, only 39 students (38%) indicated that they had access these programs. The z-values for U.S.-GER (-5.212) and U.S.-PL (-4.615) were less than -1.96 which means they are in the rejection area. Only the z-value for GER-PL (-0.029) is in the fail to rejection area which means there are no differences between the proportions of students from Germany and Poland who have access to stress soothing programs.

### **Null Hypothesis $H_0$ 13**

The proportion of students in the USA, Germany, and Poland who have access to stress prevention or reduction programs is the same for each country.

### **Alternative Hypothesis $H_1$ 13**

The proportion of students in the USA, Germany, and Poland who have access to stress prevention or reduction programs is different for each country.

**Table 19: Access To Programs To Prevent Or Reduce Stress**

<b>Access To Programs To Prevent Or Reduce Stress</b>							
		<b>Yes</b>	<b>No</b>	<b>N/A</b>	<b>Total</b>	<b>z-value</b>	<b>p-value</b>
<b>U.S.</b>	<b>Count</b>	128	62	2	192	-5.212	0
	<b>%</b>	68	32	1	100		
<b>GER</b>	<b>Count</b>	39	64	0	103		
	<b>%</b>	38	62	0	100		
<b>U.S.</b>	<b>Count</b>	128	62	2	192	-4.615	0.004
	<b>%</b>	68	32	1	100		
<b>PL</b>	<b>Count</b>	55	28	2	85		
	<b>%</b>	65	33	2	100		
<b>GER</b>	<b>Count</b>	39	64	0	103	-0.029	0.977
	<b>%</b>	38	62	0	100		
<b>PL</b>	<b>Count</b>	55	28	2	85		
	<b>%</b>	65	33	2	100		

#### 4.2.5 EVALUATION: NUTRITION, PHYSICAL ACTIVITY, AND OBESITY

When asked about their eating behavior, more than 80% of all students ate at least one portion of fruit. To provide some examples, in the USA, the figure was 81%, in Germany 85% and in Poland even 88% on an average day. Nearly the half (47%) of the U.S. students eat lettuce-based salads on average days while it is 54% in Germany and remarkable 84% in Poland. 35% from the U.S., 29% from Germany and 72% from Poland indicated they do not consume any portion of sweets on average days. For almost every category, 1-2% of students from the three countries always failed to respond.

**Table 20: Nutrition**

Nutrition									
Figures In %	Servings →	0	1	2	3	4	5	≥6	N/A
	Food Group ↓								
U.S.	Fruit	17	34	29	13	3	1	1	2
	White Starch	29	36	18	8	3	2	2	2
	Vegetables	15	33	28	12	6	4	4	2
	Lettuce-Based Salads	51	38	6	3	0	0	1	2
	Dairy Servings	23	39	23	8	4	1	1	1
	Proteins	8	36	28	20	4	3	1	1
	Grain Products	16	31	30	14	5	3	1	1
	Sweets	35	40	14	5	3	0	2	2
	Junk Food	50	29	13	4	2	1	1	1
GER	Fruit	14	52	22	9	2	0	0	1
	White Starch	36	43	15	3	1	0	0	2
	Vegetables	9	44	27	12	7	1	0	1
	Lettuce-Based Salads	45	45	9	0	0	0	0	1
	Dairy Servings	18	45	25	6	4	1	1	0
	Proteins	42	38	16	2	0	0	1	1
	Grain Products	11	31	36	14	3	3	3	0
	Sweets	29	50	13	7	1	0	0	0
	Junk Food	63	26	7	2	0	0	1	1
PL	Fruit	11	41	28	9	4	5	1	1
	White Starch	9	34	35	11	4	5	2	0
	Vegetables	35	49	5	4	2	1	2	1
	Lettuce-Based Salads	16	40	24	10	4	4	2	0
	Dairy Servings	16	51	19	5	4	0	4	1
	Proteins	9	40	29	11	2	4	4	1
	Grain Products	28	47	11	7	4	0	3	0
	Sweets	72	21	4	1	0	1	0	1
	Junk Food	72	22	4	1	0	1	0	0

As can be seen in Table 21, several differences could be determined between the proportions of the students from the U.S., Germany, and Poland. Starting with the calculated values for the fruit-category, only the z-value of GER-PL (-2.129) is in the rejection area of the null hypothesis

because it is less than -1.96. When testing the consumption of white starch, the null hypothesis is rejected in all three cases. Thus, the alternative hypothesis is accepted for all of them, indicating there are differences between the proportions of students from the U.S., Germany, and Poland. Moreover, the null hypothesis is rejected for the U.S.-PL (z-value: 4.778) and GER-PL (z-value: 3.859) cases when testing the consumption of vegetables because the z-values are greater than 1.96. The same applies for the tests between U.S.-GER and GER-PL when testing the protein consumption of the students, both test results including Poland when testing grain product and sweet consumption and for U.S.-GER and U.S.-PL where the test was about junk food.

#### Null Hypothesis H<sub>014</sub>

The proportion of servings of selected food categories in the USA, Germany, and Poland is the same for all students from each country.

#### Alternative Hypothesis H<sub>114</sub>

The proportion of servings of selected food categories in the USA, Germany, and Poland is the same for all students from each country.

**Table 21: Nutrition: z- and p-values**

Food Group	z-value		p-value	
Fruit	U.S.-GER:	1.875	U.S.-GER:	0.061
	U.S.-PL:	-1.289	U.S.-PL:	0.198
	GER-PL:	-2.129	GER-PL:	0.033
White Starch	U.S.-GER:	3.583	U.S.-GER:	0
	U.S.-PL:	-2.602	U.S.-PL:	0.009
	GER-PL:	-4.083	GER-PL:	0.044
Vegetables	U.S.-GER:	0.997	U.S.-GER:	0.319
	U.S.-PL:	4.778	U.S.-PL:	0.007
	GER-PL:	3.859	GER-PL:	0
Lettuce-Based Salads	U.S.-GER:	-0.148	U.S.-GER:	0.882
	U.S.-PL:	-6.164	U.S.-PL:	0
	GER-PL:	-6.042	GER-PL:	0
Dairy Servings	U.S.-GER:	-0.618	U.S.-GER:	0.536
	U.S.-PL:	-0.538	U.S.-PL:	0.590
	GER-PL:	0.019	GER-PL:	0.985
Proteins	U.S.-GER:	7.806	U.S.-GER:	0.005
	U.S.-PL:	-0.293	U.S.-PL:	0.760
	GER-PL:	-5.503	GER-PL:	0.037
Grain Products	U.S.-GER:	-0.822	U.S.-GER:	0.411
	U.S.-PL:	3.012	U.S.-PL:	0.003
	GER-PL:	3.379	GER-PL:	0.001
Sweets	U.S.-GER:	0.733	U.S.-GER:	0.464
	U.S.-PL:	5.663	U.S.-PL:	0.009
	GER-PL:	5.074	GER-PL:	0
Junk Food	U.S.-GER:	2.679	U.S.-GER:	0.007
	U.S.-PL:	3.792	U.S.-PL:	0
	GER-PL:	1.071	GER-PL:	0.284

The next two tests addressed the students' physical activity: number of times a student exercises and the minutes that a student exercised per day on average. Data showed that approximately 20-30% of all students do not exercise regularly. Majority from all countries responded they exercise two or three days each week. A z-test was calculated to determine if there was a difference in the proportions of students who exercised regularly. Only the U.S.-GER result implies that there is a difference between these two countries, since the z-value of 3.013 is greater than 1.96 (p-value: 0.003), leading to the rejection of the null hypothesis  $H_{015}$  for this case.

### Null Hypothesis $H_{015}$

The proportion of students in the USA, Germany, and Poland who exercise regularly is the same for each country.

### Alternative Hypothesis $H_{115}$

The proportion of students in the USA, Germany, and Poland who exercise regularly is different for each country.

**Table 22: Exercising Times Per Week**

Exercising Times Per Week						
	U.S.		Germany		Poland	
	Count	%	Count	%	Count	%
Zero	36	19	31	30	20	24
1 Day Per Week	17	9	13	13	8	9
2 Days Per Week	37	18	20	19	18	21
3 Days Per Week	33	16	18	17	17	20
4 Days Per Week	23	12	12	12	5	6
5 Days Per Week	24	13	0	0	7	8
6 Days Per Week	15	9	2	2	7	8
7 Days Per Week	5	3	6	6	3	4
N/A	2	1	1	1	0	0
<b>TOTAL</b>	192	100	103	100	85	100
	<b>z-value</b>			<b>p-value</b>		
<b>U.S. – GER</b>	3.013			0.003		
<b>U.S. – PL</b>	1.014			0.310		
<b>GER – PL</b>	-1.559			0.119		

When asked about minutes of exercise per training day, U.S. students responded they averaged about 42 minutes per day, compared to 28.42 minutes for German students and nearly 38 minutes for the Polish students. None of the resulting z-scores lead to the rejection of the null hypothesis for any of these three cases since they are all in the fail to rejection region, as shown in Table 23.

### Null Hypothesis $H_{016}$

The proportion of training times from all students in the USA, Germany, and Poland is the same for each country.

### Alternative Hypothesis $H_{116}$

The proportion of training times from all students in the USA, Germany, and Poland is different for each country.

**Table 23: Exercising Minutes Per Day on Average**

<b>Exercising Minutes Per Day on Average</b>			
	Minimum ( $\neq 0$ )	Maximum	Average
<b>U.S.</b>	3	120	41.57
<b>Germany</b>	5	240	28.42
<b>Poland</b>	10	110	38.21
	<b>z-value</b>		<b>p-value</b>
<b>U.S. – GER</b>	-0.755		0.450
<b>U.S. – PL</b>	1.338		0.181
<b>GER – PL</b>	1.169		0.242

Furthermore, students were asked about their reasons for not exercising as some people are prevented from doing so. Most of all students replied they do not have enough time for exercising or chose other and used the free text field. The most common other reasons are no motivation, no discipline, laziness, low self-control, avoidance, and other focus than exercising at the time of the survey.

**Table 24: Reasons For Not Exercising**

<b>Reasons For Not Exercising</b>						
	<b>U.S.</b>		<b>Germany</b>		<b>Poland</b>	
	<b>Count</b>	<b>%</b>	<b>Count</b>	<b>%</b>	<b>Count</b>	<b>%</b>
Medical	7	4	1	1	6	7
Physical Work	9	5	3	3	6	7
No Time	51	27	22	21	29	35
Other	32	17	23	22	31	36
N/A	93	46	54	53	13	15
<b>TOTAL</b>	192	100	103	100	85	100

According to the WHO, a body mass index (BMI) over 30 is considered obese [55]. The BMI of 37% of the U.S. students is rated as obese, while it is only 4% of the German and 2% of the Polish students. 8% from the U.S., 14% from Germany as well as from Poland did not answer on that question.

### **Null Hypothesis $H_0$ 17**

The proportion of students in the USA, Germany, and Poland who are obese is the same for each country.

### **Alternative Hypothesis $H_1$ 17**

The proportion of students in the USA, Germany, and Poland who are obese is different for each country.



Table 25: Obesity

Obesity						
	U.S.		Germany		Poland	
BMI	Count	%	Count	%	Count	%
<30	105	55	85	82	71	84
≥30	71	37	4	4	2	2
N/A	16	8	14	14	12	14
<b>TOTAL</b>	192	100	103	100	85	100
	<b>z-value</b>			<b>p-value</b>		
<b>U.S. – GER</b>	-12.826			0		
<b>U.S. – PL</b>	-13.675			0		
<b>GER – PL</b>	-0.603			0.547		

#### 4.2.6 EVALUATION: ORAL HEALTH

In Table 26 you can see how many students visited a dentist in the past twelve months. It was 68% of the U.S. students, 87% of the German and 74% of the Polish students. Since all z-values are less than -1.96 or greater than 1.96, the null hypothesis is rejected in all three cases implying there were differences between the proportions of students from the U.S., Germany, and Poland, who visited a dentist within the last year.

##### Null Hypothesis $H_0$ 18

The proportion of students in the USA, Germany, and Poland who visited a dentist in the past year is the same for each country.

##### Alternative Hypothesis $H_1$ 18

The proportion of students in the USA, Germany, and Poland who visited a dentist in the past year is different for each country.

Table 26: Visited A Dentist Within The Past 12 Months

Visited A Dentist Within The Past 12 Months							
		Yes	No	N/A	Total	z-value	p-value
U.S.	Count	130	62	0	192	6.053	0
	%	68	32	0	100		
GER	Count	90	8	5	103		
	%	87	8	5	100		
U.S.	Count	130	62	0	192	2.194	0.032
	%	68	32	0	100		
PL	Count	63	19	3	85		
	%	74	22	4	100		
GER	Count	90	8	5	103	-2.604	0.010
	%	87	8	5	100		
PL	Count	63	19	3	85		
	%	74	22	4	100		

### 4.2.7 EVALUATION: REPRODUCTIVE AND SEXUAL HEALTH

Table 27 shows the number of female students who received reproductive health services in the past 12 months. Most of the students from the U.S. (80%) and Germany (91%) did not use these services. 55 students from Poland (82%) gave no answer or answered, “Not Applicable”. To test hypothesis number 19, a z-test was performed. The resulting z-value for U.S.-GER was -3.052 (p-value: 0.002), implying that the null hypothesis can be rejected. The same is true for the other two z-values, -10.934 for U.S.-PL (p-value: 0) and -9.275 for GER-PL (p-value 0) since all z-values are less than -1.96. Therefore, there is enough proof that there are differences between the proportions of students from all countries who used reproductive health services.

#### Null Hypothesis $H_019$

The proportion of students in the USA, Germany, and Poland who received reproductive health services in the past year is the same for each country.

#### Alternative Hypothesis $H_119$

The proportion of students in the USA, Germany, and Poland who received reproductive health services in the past year is different for each country.

**Table 27: Received Reproductive Health Services**

Received Reproductive Health Services							
		Yes	No	N/A	Total	z-value	p-value
U.S.	Count	19	107	7	134	-3.052	0.002
	%	15	80	5	100		
GER	Count	1	77	7	85		
	%	1	91	8	100		
U.S.	Count	19	107	7	134	-10.934	0
	%	15	80	5	100		
PL	Count	4	8	55	67		
	%	6	12	82	100		
GER	Count	1	77	7	85	-9.275	0
	%	1	91	8	100		
PL	Count	4	8	55	67		
	%	6	12	82	100		

Table 28 gives information about the number of female students who received gynecological services in the past 12 months. It was 88 students from the U.S. (66%), 62 students (73%) from Germany and 8 students (12%) from Poland who accessed gynecological services. The z-value for U.S.-GER is 1.149 (p-value: 0.173) and hereby less than 1.96, so we fail to reject the null hypothesis and accept the alternative one. Again, most of the students from Poland (81%) did not answer the question or answered, “Not Applicable”. Z-values of -14.606 (p-value: 0) for U.S.-PL and -14.845 (p-value: 0) for GER-PL indicated that the hypothesis can be rejected for both cases leading to the support of the alternative hypothesis  $H_{120}$ .

**Null Hypothesis H<sub>0</sub>20**

The proportion of students in the USA, Germany, and Poland who received gynecological services in the past year is the same for each country.

**Alternative Hypothesis H<sub>1</sub>20**

The proportion of students in the USA, Germany, and Poland who received gynecological services in the past year is different for each country.

**Table 28: Received Gynecological Services**

Received Gynecological Services							
		Yes	No	N/A	Total	z-value	p-value
U.S.	Count	88	46	0	134	1.149	0.251
	%	66	34	0	100		
GER	Count	62	23	0	85		
	%	73	27	0	100		
U.S.	Count	88	46	0	134	-14.606	0
	%	66	34	0	100		
PL	Count	8	5	54	67		
	%	12	7	81	100		
GER	Count	62	23	0	85	-14.845	0
	%	73	27	0	100		
PL	Count	8	5	54	67		
	%	12	7	81	100		

The students were asked if they are sexually active. 72% from the USA responded they were sexually active compared to 71% of the students from Germany. The resulting z-score was 0.039 (p-value: 0.969). Thus, the null hypothesis was not rejected since the z-score was in the fail to reject area. The other two z-scores, -2.144 for U.S.-PL and -2.025 for GER-PL, led to the rejection of the null hypothesis while leading to the acceptance of the corresponding alternative hypothesis H<sub>1</sub>21 indicating there was enough evidence to demonstrate that the proportions of students who are sexually active differed in these tests.

**Null Hypothesis H<sub>0</sub>21**

The proportion of students in the USA, Germany, and Poland who are sexually active is the same for each country.

**Alternative Hypothesis H<sub>1</sub>21**

The proportion of students in the USA, Germany, and Poland who are sexually active is different for each country.

Table 29: Sexually Active

Sexually Active							
		Yes	No	N/A	Total	z-value	p-value
U.S.	Count	138	46	8	192	0.039	0.969
	%	72	24	4	100		
GER	Count	73	27	3	103		
	%	71	26	3	100		
U.S.	Count	138	46	8	192	-2.144	0.032
	%	72	24	4	100		
PL	Count	52	23	10	85		
	%	61	27	12	100		
GER	Count	73	27	3	103	-2.025	0.043
	%	71	26	3	100		
PL	Count	52	23	10	85		
	%	61	27	12	100		

For those students, who are sexually active, it is necessary to use some form of contraceptives to prevent pregnancy. 88% from the U.S., remarkable 100% from Germany, and 90% from Poland implied they used condoms, IUDs, the pill, or something else to inhibit pregnancy. The resulting z-value of 2.508 (p-value: 0.012) for U.S.-GER leads to the rejection of  $H_{022}$  for this case. The other two z-values, 0.241 for U.S.-PL and -1.652 for GER-PL, are within the fail to reject area. Thus, we do not reject  $H_{022}$  for these two cases, indicating there are no differences between the proportions of students in U.S.-PL and GER-PL who used some form of pregnancy prevention.

### Null Hypothesis $H_{022}$

The proportion of students in the USA, Germany, and Poland who protect themselves or their partners from pregnancy is the same for each country.

### Alternative Hypothesis $H_{122}$

The proportion of students in the USA, Germany, and Poland who protect themselves or their partners from pregnancy is different for each country.

Table 30: Protect Themselves Or Their Partners From Pregnancy

Protect Themselves Or Their Partners From Pregnancy									
		Condom	IUD	Pill	Other	N/A	Total	z-value	p-value
U.S.	Count	38	22	42	20	16	138	2.508	0.012
	%	28	16	30	14	12	100		
GER	Count	24	11	33	5	0	73		
	%	33	15	45	7	0	100		
U.S.	Count	38	22	42	20	16	138	0.241	0.810
	%	28	16	30	14	12	100		
PL	Count	17	2	22	6	5	52		
	%	33	4	42	12	10	100		
GER	Count	24	11	33	5	0	73	-1.652	0.098
	%	33	15	45	7	0	100		
PL	Count	17	2	22	6	5	52		
	%	32	4	42	12	10	100		

Furthermore, protection from sexually transmitted diseases is very important. 51% from the U.S., 68% from Germany and outstanding 92% from Poland answered they used condoms or something else to protect themselves or their partners from STDs. In most cases, "Other" turned out to be long-term monogamous relationships, dental dams, and appropriate testing, according to the students. The pill was not included as that. In all three cases, the null hypothesis is rejected since all z-values are greater than 1.96, leading to the acceptance of the alternative hypothesis  $H_{123}$  implying there are differences between the proportion of students from all three countries who protect themselves from STDs.

### Null Hypothesis $H_{023}$

The proportion of students in the USA, Germany, and Poland who protect themselves or their partners from sexually transmitted diseases is the same for each country.

### Alternative Hypothesis $H_{123}$

The proportion of students in the USA, Germany, and Poland who protect themselves or their partners from sexually transmitted diseases is different for each country.

**Table 31: Protect Themselves Or Their Partners From STDs**

Protect Themselves Or Their Partners From STDs							
		Condom	Other	N/A	Total	z-value	p-value
U.S.	Count	60	10	68	138	2.557	0.010
	%	44	7	49	100		
GER	Count	44	6	23	73		
	%	60	8	32	100		
U.S.	Count	60	10	68	138	5.300	0.016
	%	44	7	49	100		
PL	Count	34	14	4	52		
	%	65	27	8	100		
GER	Count	44	6	23	73	2.093	0.036
	%	60	8	32	100		
PL	Count	34	14	4	52		
	%	65	27	8	100		

Forty-six students (24%) from the U.S. stated they have children. As one can see in Table 32, in Germany, it was 8 students (8%). The z-value of -3.993 leads to the rejection of the null hypothesis for U.S.-GER. Moreover, the resulted z-value for GER-PL of 3.334 (p-value 0.001) is greater than 1.96 and hereby leading to the rejection of the null hypothesis as well. The remaining z-value of 0.340 for U.S.-PL (p-value: 0.734) falls in the fail to reject region of the null hypothesis, indicating there are no differences between the proportions of students in U.S.-PL who have children.

### Null Hypothesis $H_{024}$

The proportion of students in the USA, Germany, and Poland who have children is the same for each country.

### Alternative Hypothesis $H_{124}$

The proportion of students in the USA, Germany, and Poland who have children is different for each country.

Table 32: Have Children

Have Children						
		Yes	No	Total	z-value	p-value
U.S.	Count	46	146	192	-3.993	0
	%	24	76	100		
GER	Count	8	95	103		
	%	8	92	100		
U.S.	Count	46	146	192	0.340	0.734
	%	24	76	100		
PL	Count	22	63	85		
	%	26	74	100		
GER	Count	8	95	103	3.334	0.001
	%	8	92	100		
PL	Count	22	63	85		
	%	26	74	100		

Some information about the students' children can be found in Table 33: most of the children belong to the age group "19 And Above", 65 of 106 from the U.S., 3 of 10 from Germany and 14 of 32 from Poland.

Table 33: Children Age Groups

Children Age Groups						
		Newborn – 5y	6y – 12y	19y And Above	Total Children	Total Students Surveyed
U.S.	Count	28	13	65	106	192
	%	26	12	62	100	100
GER	Count	3	4	3	10	103
	%	30	40	30	100	100
PL	Count	9	9	14	32	85
	%	28	28	44	100	100

#### 4.2.8 EVALUATION: SUBSTANCE ABUSE

The next Leading Health Indicator Topic explored substance abuse including drugs and alcohol. As the results in Table 35 below display, the students were asked about their substance consumption. Majority of all students consumed 1-5 times per month either 1-3 drinks (female)/ 1-4 drinks (male) or  $\geq 4$  (female)/ $\geq 5$  (male). It should be mentioned here that five or more drinks in one sitting is considered "binge drinking". It is 54% from the U.S., 61% from Germany, and 68% from Poland. 34% from the U.S. students did not consume any alcoholic drinks while it was 63% in Germany and 59% in Poland who did not consume alcoholic drinks. Only 1% from Germany consumed opioids 1-5 times per month. 3% U.S. as well as German students consumed illicit drugs 1-5 times each month on average.

**Table 34: Substance Abuse Per Month**

Substance Abuse Per Month						
Figures in %		1	2	3	4	5
Times Per Month ↓						
U.S.	0	40	77	82	100	97
	1-5	38	16	9	0	3
	6-10	10	3	3	0	0
	11-15	5	1	1	0	0
	16-20	3	1	1	0	0
	21-25	2	1	1	0	0
	≥ 26	1	1	3	0	0
	N/A	1	0	0	0	0
GER	0	41	85	89	99	97
	1-5	46	15	8	1	3
	6-10	7	0	0	0	0
	11-15	2	0	1	0	0
	16-20	2	0	2	0	0
	21-25	0	0	0	0	0
	≥ 26	1	0	1	0	0
	N/A	1	0	0	0	0
PL	0	35	82	94	100	100
	1-5	52	16	4	0	0
	6-10	7	0	1	0	0
	11-15	4	0	0	0	0
	16-20	0	0	0	0	0
	21-25	0	0	0	0	0
	≥ 26	0	0	0	0	0
	N/A	2	2	1	0	0
1=Alcoholic Drinks: 1-3 Female/ 1-4 Male, 2=Alcoholic Drinks: ≥4 Female/≥5 Male, 3=Marijuana/Weed/Bhangi, 4=Opioids (Morphine, Hydrocodone, Fentanyl, etc.), 5=Illicit Drugs (Heroin, Cocaine, Ecstasy)						

#### 4.2.9 EVALUATION: TOBACCO

The results of the two questions, if the students smoke or vape, are summarized in Table 36 and Table 37. Thirty students (16%) from the U.S., 18 students (15%) from Germany and 13 students (16%) from Poland responded they do at least one of these two options. None of the six tested cases led to the rejection of the null hypothesis since all z-scores are within the fail to reject area and hereby between -1.96 and 1.96. Majority of all students responded they did not smoke or vape at the time of the survey though.

##### Null Hypothesis $H_0$ 25

The proportion of students in the USA, Germany, and Poland who smoke is the same for each country.

##### Alternative Hypothesis $H_1$ 25

The proportion of students in the USA, Germany, and Poland who smoke is different for each country.

**Null Hypothesis H<sub>0</sub>26**

The proportion of students in the USA, Germany, and Poland who vape is the same for each country.

**Alternative Hypothesis H<sub>1</sub>26**

The proportion of students in the USA, Germany, and Poland who vape is different for each country.

**Table 35: Smoke**

Smoke						
	U.S.		Germany		Poland	
	Count	%	Count	%	Count	%
Yes	13	7	13	13	9	11
No	179	93	90	87	74	87
N/A	0	0	0	0	2	2
<b>Total</b>	192	100	103	100	85	100
	<b>z-value</b>			<b>p-value</b>		
<b>U.S. - GER</b>	1.604			0.120		
<b>U.S. - PL</b>	1.054			0.301		
<b>GER - PL</b>	-0.380			0.707		

**Table 36: Vape**

Vape						
	U.S.		Germany		Poland	
	Count	%	Count	%	Count	%
Yes (High Nicotine Content)	4	2	2	2	0	0
Yes (Medium Nicotine Content)	6	3	1	1	0	0
Yes (Low Nicotine Content)	5	3	1	1	4	5
Yes (No Nicotine Content)	2	1	1	1	0	0
Quit Within The Past Year	9	5	2	2	1	1
No	166	86	96	93	80	94
<b>Total</b>	192	100	103	100	85	100
	<b>z-value</b>			<b>p-value</b>		
<b>U.S. - GER</b>	-1.090			0.276		
<b>U.S. - PL</b>	-1.417			0.157		
<b>GER - PL</b>	-1.488			0.137		

The results of the two questions, if the students are trying to quit smoking or vaping, are summarized in Table 38 and Table 39. Seven students from the U.S. answered they were trying to quit smoking as well as vaping while it was four students from Germany who were trying to quit smoking and two vaping. Six students from Poland were trying to quit smoking and one was trying to quit vaping. All z-scores are in the fail to reject area affirming there were no differences between the proportions of students from the U.S., Germany and Poland who were trying to quit smoking or vaping at the time of the survey.



**Null Hypothesis H<sub>0</sub>27**

The proportion of students in the USA, Germany, and Poland who try to quit smoking is the same for each country.

**Alternative Hypothesis H<sub>1</sub>27**

The proportion of students in the USA, Germany, and Poland who try to quit smoking is different for each country.

**Null Hypothesis H<sub>0</sub>28**

The proportion of students in the USA, Germany, and Poland who try to quit vaping is the same for each country.

**Alternative Hypothesis H<sub>1</sub>28**

The proportion of students in the USA, Germany, and Poland who try to quit vaping is different for each country.

**Table 37: Try To Quit Smoking**

Try To Quit Smoking							
		Yes	No	N/A	Total	z-value	p-value
U.S.	Count	7	5	1	13	-1.306	0.204
	%	54	38	8	100		
GER	Count	4	8	1	13		
	%	30	62	8	100		
U.S.	Count	7	5	1	13	0.431	0.743
	%	54	38	8	100		
PL	Count	6	3	0	9		
	%	67	33	0	100		
GER	Count	4	8	1	13	1.604	0.118
	%	30	62	8	100		
PL	Count	6	3	0	9		
	%	67	33	0	100		

**Table 38: Try To Quit Vaping**

Try To Quit Vaping							
		Yes	No	N/A	Total	z-value	p-value
U.S.	Count	7	10	0	17	0.324	0.801
	%	41	59	0	100		
GER	Count	2	2	1	5		
	%	40	40	20	100		
U.S.	Count	7	10	0	17	-0.743	0.513
	%	41	59	0	100		
PL	Count	1	3	0	4		
	%	25	75	0	100		
GER	Count	2	2	1	5	-0.803	0.447
	%	40	40	20	100		
PL	Count	1	3	0	4		
	%	25	75	0	100		

Table 39 shows how many students were exposed to secondhand smoke and where that happened. Most of the students indicated they were exposed to secondhand smoke when visiting their friends, at bars and at home (each 96%) as well as at restaurants (95%) and at work (94%). Only few students were exposed to secondhand smoke in other locations (5%). This includes places such as the campus, out in public and bus/train stations.

**Table 39: Exposed To Secondhand Smoke**

<b>Exposed To Secondhand Smoke</b>							
<i>Figures In %</i>		<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>
<b>U.S.</b>	<b>A</b>	15	11	4	13	3	2
	<b>B</b>	5	4	3	7	2	1
	<b>C</b>	0	0	7	1	1	1
	<b>D</b>	76	81	82	75	89	27
	<b>N/A</b>	4	4	4	4	5	69
<b>GER</b>	<b>A</b>	1	1	8	1	3	3
	<b>B</b>	4	0	8	18	5	3
	<b>C</b>	39	15	5	32	3	1
	<b>D</b>	55	81	77	48	87	48
	<b>N/A</b>	1	3	2	1	2	45
<b>PL</b>	<b>A</b>	2	2	18	8	6	2
	<b>B</b>	1	0	2	9	6	4
	<b>C</b>	30	13	2	29	6	4
	<b>D</b>	60	76	71	47	73	32
	<b>N/A</b>	7	9	7	7	9	58
1=Bars, 2=Restaurants, 3=At Home, 4=At A Friends, 5=At Work, 6=Other A=Daily, B=Once Per Week, C=Once Per Month, D=Never							

#### 4.2.10 ADDITIONAL EVALUATION: COVID-19

Some additional questions examined the current pandemic in 2020: COVID-19. Table 40 illustrates data if the students had COVID-19. One percent from the USA (two students) as well as Germany (one student) had had a COVID-19-infection. 6% of all students (21 of 380) had been exposed to an infected person at least once. The test results narrowly led to rejection of the null hypothesis for GER-PL, suggesting that there is sufficient evidence to confirm the different proportions of students infected with or exposed to COVID-19 between these two countries.

##### Null Hypothesis $H_{029}$

The proportion of students in the USA, Germany, and Poland who had COVID-19 is the same for each country.

##### Alternative Hypothesis $H_{129}$

The proportion of students in the USA, Germany, and Poland who had COVID-19 is different for each country.

**Table 40: Had COVID-19**

Had COVID-19						
	U.S.		Germany		Poland	
	Count	%	Count	%	Count	%
Yes	2	1	1	1	0	0
No But I Have Been Exposed	11	6	8	8	2	2
No	177	92	94	91	79	93
N/A	2	1	0	0	4	5
<b>Total</b>	192	100	103	100	85	100
	<b>z-value</b>			<b>p-value</b>		
<b>U.S. - GER</b>	0.463			0.643		
<b>U.S. - PL</b>	-1.929			0.054		
<b>GER - PL</b>	-1.970			0.048		

As shown in Table 41, more than 75% students from all three countries responded they are staying away from others to avoid COVID-19. It was 80% from the U.S. and Germany and 76% from Poland who stay away from others to avoid an infection. 5 students from the U.S. did not respond on that question. With z-values of -0.111 for U.S.-GER, -0.152 for U.S.-PL and -0.034 for GER-PL, the null hypothesis is not rejected. This means that there are no differences between the proportions of students from all countries who stay away from others to avoid COVID-19.

### Null Hypothesis H<sub>030</sub>

The proportion of students in the USA, Germany, and Poland who stay away from others to avoid COVID-19 is the same for each country.

### Alternative Hypothesis H<sub>130</sub>

The proportion of students in the USA, Germany, and Poland who stay away from others to avoid COVID-19 is different for each country.

**Table 41: Stay Away From Others To Avoid COVID-19**

Stay Away From Others To Avoid COVID-19						
	U.S.		Germany		Poland	
	Count	%	Count	%	Count	%
Yes	155	80	82	80	65	76
No, I Have To Go To Work	27	13	18	17	20	24
No – Other Reason	8	4	3	3	0	0
N/A	5	3	0	0	0	0
<b>Total</b>	192	100	103	100	85	100
	<b>z-value</b>			<b>p-value</b>		
<b>U.S. - GER</b>	-0.111			0.912		
<b>U.S. - PL</b>	-0.152			0.879		
<b>GER - PL</b>	-0.034			0.973		

### 4.3 SUMMARY OF THE RESULTS

Table 42: Summarized Results

Title	Group	z-value	p-value	Hypothesis
1. Health Insurance	U.S.-GER U.S.-PL GER-PL	-3.148 9.013 -5.080	0.002 0 0	Differences existed between the proportions of students who have health insurance from all countries.
2. Medical Treatment	U.S.-GER U.S.-PL GER-PL	-1.771 2.233 4.050	0.087 0.036 0.006	Differences existed between the proportions of students who sought medical treatment between U.S.-PL and GER-PL.
3. Locations Visited for Regular Treatment	U.S.-GER U.S.-PL GER-PL	12.116 10.928 -2.137	0 0 0.033	Differences existed between the proportions of students who have locations for regular treatment between U.S.-GER and U.S.-PL.
4. Health Rating	U.S.-GER U.S.-PL GER-PL	0.732 0.232 -0.390	0.464 0.817 0.707	No differences existed between the proportions of students who rated their health from all countries.
5. Immunization	U.S.-GER U.S.-PL GER-PL	-5.605 -4.632 1.080	0 0.003 0.300	Differences existed between the proportions of students whose immunization is up-to-date between U.S.-GER and U.S.-PL.
6. Flu Shot	U.S.-GER U.S.-PL GER-PL	-5.350 -1.607 3.160	0.005 0.127 0.002	Differences existed between the proportions of students whose flu shot is up-to-date between U.S.-GER and GER-PL.
7. Concerns With Air Quality	U.S.-GER U.S.-PL GER-PL	1.686 8.091 5.370	0.092 0.006 0.008	Differences existed between the proportions of students who have concerns regarding air quality between U.S.-PL and GER-PL.
8. Illnesses Of Concern From Air Pollution	U.S.-GER U.S.-PL GER-PL	-2.519 -1.663 0.798	0.002 0.096 0.425	Differences existed between the proportions of students who fear getting sick from air pollution between U.S.-GER.
9. Contemplated Suicide	U.S.-GER U.S.-PL GER-PL	0.589 -2.960 -2.883	0.056 0.003 0.004	Differences existed between the proportions of students who contemplated suicide between U.S.-PL and GER-PL.
10. Know Where To Get Help If Someone Else Is Contemplating Suicide	U.S.-GER U.S.-PL GER-PL	-0.664 -1.594 -0.945	0.507 0.111 0.345	No differences existed between the proportions of students who know where to get help if someone else is contemplating suicide from all countries.
11. Experienced A Major Depressive Episode In The Past 12 Months	U.S.-GER U.S.-PL GER-PL	-2.520 -3.245 -1.378	0.002 0.001 0.168	Differences existed between the proportions of students who experienced a MDE in the last year between U.S.-GER and U.S.-PL.
12. Currently Feeling Stressed	U.S.-GER U.S.-PL GER-PL	-3.242 -2.926 -0.629	0.001 0.003 0.950	Differences existed between the proportions of students who are currently feeling stressed between U.S.-GER and U.S.-PL.
13. Access To Programs To Prevent Or Reduce Stress	U.S.-GER U.S.-PL GER-PL	-5.212 -4.615 -0.029	0 0.004 0.977	Differences existed between the proportions of students who have access to stress soothing programs between U.S.-GER and U.S.-PL.

14. Nutrition	U.S.-GER	1.875	0.061	No differences existed between the
a) Fruit	U.S.-PL	-1.289	0.198	proportions of students when testing
	GER-PL	-2.129	0.033	fruit consumption from all countries.
b) White Starch	U.S.-GER	3.583	0	Differences existed between the
	U.S.-PL	-2.602	0.009	proportions of students when testing
	GER-PL	-4.083	0.044	white starch consumption from all
				countries.
c) Vegetables	U.S.-GER	0.997	0.319	Differences existed between the
	U.S.-PL	4.778	0.007	proportions of students when testing
	GER-PL	3.859	0	consumption of vegetables between
				U.S.-PL and GER-PL.
d) Lettuce-Based Salads	U.S.-GER	-0.148	0.882	Differences existed between the
	U.S.-PL	-6.164	0	proportions of students when testing
	GER-PL	-6.042	0	consumption of lettuce-based salads
				between U.S.-PL and GER-PL.
e) Dairy Servings	U.S.-GER	-0.618	0.536	No differences existed between the
	U.S.-PL	-0.538	0.590	proportions of students when testing
	GER-PL	0.019	0.985	dairy consumption from all countries.
f) Proteins	U.S.-GER	7.806	0.005	Differences existed between the
	U.S.-PL	-0.293	0.760	proportions of students when testing
	GER-PL	-5.503	0.037	protein consumption between
				U.S.-GER and GER-PL.
g) Grain Products	U.S.-GER	-0.822	0.411	Differences existed between the
	U.S.-PL	3.012	0.003	proportions of students when testing
	GER-PL	3.379	0.001	consumption of grain products
				between U.S.-PL and GER-PL.
h) Sweets	U.S.-GER	0.733	0.464	Differences existed between the
	U.S.-PL	5.663	0.009	proportions of students when testing
	GER-PL	5.074	0	consumption of sweets between
				U.S.-PL and GER-PL.
i) Junk Food	U.S.-GER	2.679	0.007	Differences existed between the
	U.S.-PL	3.792	0	proportions of students when testing
	GER-PL	1.071	0.284	junk food consumption between
				U.S.-GER and U.S.-PL.
15. Exercising Times Per Week	U.S.-GER	3.013	0.003	Differences existed between the
	U.S.-PL	1.014	0.310	proportions of students who exercised
	GER-PL	-1.559	0.119	regularly between U.S.-GER.
16. Exercising Minutes Per Day on Average	U.S.-GER	-0.755	0.450	No differences existed between the
	U.S.-PL	1.338	0.181	proportions of students when testing
	GER-PL	1.169	0.242	exercising minutes per day on
				average from all countries.
17. Obesity	U.S.-GER	-12.826	0	Differences existed between the
	U.S.-PL	-13.675	0	proportions of students who are
	GER-PL	-0.603	0.547	between U.S.-GER and U.S.-PL.
18. Visited A Dentist Within The Past 12 Months	U.S.-GER	6.053	0	Differences existed between the
	U.S.-PL	2.194	0.032	proportions of students who visited a
	GER-PL	-2.604	0.010	dentist in the past year from all
				countries.
19. Received Reproductive Health Services	U.S.-GER	-3.052	0.002	Differences existed between the
	U.S.-PL	-10.934	0	proportions of students who received
	GER-PL	-9.275	0	reproductive health services from all
				countries.

20. Received Gynecological Services	U.S.-GER U.S.-PL GER-PL	1.149 -14.606 -14.845	0.251 0 0	Differences existed between the proportions of students who received gynecological health services between U.S.-PL and GER-PL.
21. Sexually Active	U.S.-GER U.S.-PL GER-PL	0.039 -2.144 -2.025	0.969 0.032 0.043	Differences existed between the proportions of students who are sexually active between U.S.-PL and GER-PL.
22. Protect Themselves Or Their Partners From Pregnancy	U.S.-GER U.S.-PL GER-PL	2.508 0.241 -1.652	0.012 0.810 0.098	Differences existed between the proportions of students who protect themselves or their partners from pregnancy between U.S.-GER.
23. Protect Themselves Or Their Partners From STDs	U.S.-GER U.S.-PL GER-PL	2.557 5.300 2.093	0.010 0.016 0.036	Differences existed between the proportions of students who protect themselves or their partners from STDs between from all countries.
24. Have Children	U.S.-GER U.S.-PL GER-PL	-3.993 0.340 3.334	0 0.734 0.001	Differences existed between the proportions of students who have children between U.S.-GER and GER-PL.
25. Smoke	U.S.-GER U.S.-PL GER-PL	1.604 1.054 -0.380	0.120 0.301 0.707	No differences existed between the proportions of students who smoke from all countries.
26. Vape	U.S.-GER U.S.-PL GER-PL	-1.090 -1.417 -1.488	0.276 0.157 0.137	No differences existed between the proportions of students who vape from all countries.
27. Try To Quit Smoking	U.S.-GER U.S.-PL GER-PL	-1.306 0.431 1.604	0.204 0.743 0.118	No differences existed between the proportions of students who try to quit smoking from all countries.
28. Try To Quit Vaping	U.S.-GER U.S.-PL GER-PL	0.324 -0.743 -0.803	0.801 0.513 0.447	No differences existed between the proportions of students who try to quit vaping from all countries.
29. Had COVID-19	U.S.-GER U.S.-PL GER-PL	0.463 -1.929 -1.970	0.643 0.054 0.048	Differences existed between the proportions of students who had COVID-19 between GER-PL.
30. Stay Away From Others To Avoid COVID-19	U.S.-GER U.S.-PL GER-PL	-0.111 -0.152 -0.034	0.912 0.879 0.973	No differences existed between the proportions of students who stay away from others to avoid COVID-19 from all countries.

## 5 DISCUSSION AND OUTLOOK

### 5.1 DISCUSSION OF THE RESULTS

In this section, the obtained results are discussed and studies or surveys from specialized literature are contrasted.

#### ACCESS TO HEALTH SERVICES

The target for the first indicator “Persons with medical insurance” of this Leading Health Indicator Topic was 100% for 2020 [56]. Thirteen percent from the USA and 1% from Germany responded they have no insurance. One percent from the USA as well as from Poland pay cash. Visibly furthest from the 100% mark is the USA, while the target has almost been reached in Germany and Poland.

According to National Health Interview Survey (NHIS) 2019, 14.7% adults (18-64 years old) from the U.S. were uninsured, which nearly coincides with the results of this master’s thesis [57]. Therefore, the results are fully comparable. The same applies to the rate of uninsured adults in the U.S. regarding the Commonwealth Fund Biennial Health Insurance Survey 2020, which was 12.5% [58]. Since health insurance coverage is required by law in Germany, the quote should be 100%. In the survey, it was 99% of the German students who had either public or private insurance coverage. In Poland, health insurance is mandatory as well. Thus, the quote should be 100%, too. None of the Polish students responded they have no insurance coverage, so the national target is met among the students who took part in this survey. To sum up, all proportions of students who have health insurance coverage were significantly different.

The second indicator was “person with a usual primary care provider” for regular medical treatment, which is defined as “a particular doctor’s office, health center, or other place that a person usually goes to if sick or needing advice about health [...]” by HP2020 [59]. Only 2% of the Polish students did not respond on that topic, all other students visited at least one health place. The HP2020 target for that indicator was 83.9%, which is met by all countries [56].

#### ENVIRONMENTAL QUALITY

The first LHI of this Topic is “Reduce the number of days the Air Quality Index (AQI) exceeds 100, weighted by population and AQI”. The Particulate Matter 2.5 (PM<sub>2.5</sub>) concentration illustrates fine inhalable particles and is a routine proxy indicator for air pollution. The origin of 2.5 is from the diameters of the particles, which size, in general, is 2.5 micrometers and smaller [60, 61].

The air quality average in the U.S. was 37 µg/m<sup>3</sup> in 2019. The US-PM<sub>2.5</sub> concentration in 2019 was never above the WHO exposure recommendation, which is 10 µg/m<sup>3</sup> according to the belonging guideline [62, 60]. In 2019, an AQI of 46 was reported for Germany. Since 46 is less than 100, that value meets the HP2020 goal which was AQI<100. Furthermore, the PM<sub>2.5</sub> concentration in Germany only once exceeded the WHO exposure recommendation in 2019 [63]. According to a worldwide ranking, Poland was in 53rd place in 2019, with a pollution average of

18.67  $\mu\text{g}/\text{m}^3$  the best place among the three countries. Followed by Germany in 74th place with an average value of 11.01  $\mu\text{g}/\text{m}^3$  (2019) and the U.S. in place 87 with an average of pollution of 9.04  $\mu\text{g}/\text{m}^3$  in 2019 [64]. These data are like the survey results in that Polish students (79%) were most concerned about air pollution and American students (28%) were least concerned. In Germany, the figure was 43%, which is consistent with the air pollution ranking. Poland's air quality average is 65  $\mu\text{g}/\text{m}^3$  for the year 2019 and is hereby also meeting the HP2020 goal of  $\text{AQI} < 100$ . Its  $\text{PM}_{2.5}$  was also only once above the WHO exposure recommendation in 2019 [65]. Between 2006 and 2008 as well as 2014 and 2016, the number of AQI-weighted people days (WPD) fell from 7.603 to 4.296 billion, i.e., by 43%, thus exceeding the HP2020 target [66].

The second LHI addresses people, especially children aged 3-11 years old, exposed to secondhand smoke. The target for adults aged 18 years and older was 33.8%. As already stated before in the chapter "Access to Health Services", secondhand smoke causes many diseases, e.g., respiratory infections in children or heart diseases in adults [67]. Even though many students answered "never", most of all students were exposed to secondhand smoke in at least one location.

## INJURY AND VIOLENCE

In terms of injury prevention, this LHI Topic targeted 10% improvement to 53.7 in injury-related deaths, from 59.7 deaths per 100,000 population from baseline. According to our survey, most students who have experienced violence are found in the U.S (46%) while it was 43% from Germany and 28% from Poland who responded they experienced injuries in the past. In 2014, there were 12,620 injuries per 100,000 population in the U.S [68]. Since no comparable data was found for Germany and Poland, the results are only comparable to a limited extent.

Sixteen students from the U.S., 6 from Germany and 3 from Poland indicated that they were victims of physical harm that could have led to death. Injury was included in the *TOP 3* causes of death in the U.S. in 2018 [69]. The CDC indicates that yearly 214,000 people die from injury- and violence-related incidents [70]. In Germany, there were 546,363 police-recorded cases of physical harm in 2019, 78 of which ended in death as the Federal Criminal Police Office stated [71]. Meanwhile, there were 9,811 cases in 2019 in Poland [72]. This results in the following values of physical violence per 100,000 inhabitants in 2019: 246.8 in the USA and 164.5 in Germany while it was only 17.14 in Poland in 2018 [73–75]. As can be seen from the figures, both the results from the survey and the additional ones follow the same trend. The USA has the highest number of physical harm cases, followed by Germany and finally Poland.

Ten percent of the U.S. students, 7% of the German students and 5% of the Polish students responded they already experienced rape. In the U.S., there were 29.9 cases of rape per 100,000 population in 2019 while it was 11.4 in Germany (2019) and 3.2 in Poland (2015) according to the country statistics [76–78]. These statistics result in the same order as the survey that is the subject of this master's thesis. Hence, the results of the survey are entirely consistent with the country statistics.



The second Indicator of that Topic was “Homicide”. At the baseline (2007), there were 6.1 homicides per 100,000 population in the U.S., the target-setting method was an improvement by 10 percent to 5.5. homicides per 100,000 population. When students were asked about experiences and risk regarding homicide, 5% from the U.S., 14% from Germany and 7% from Poland responded they are at risk or already victims who experienced homicide. In 2018, the homicide rate in the U.S. was 4.96 per 100,000 population while it was 0.95 in Germany and 0.73 in Poland [79]. These results are not entirely consistent with those of the survey. However, it should be noted that one student from the USA and one from Poland stated that they had already had experience with homicide, whereas this was not the case in Germany.

## MENTAL HEALTH

“Suicide” is one of the two Mental Health Leading Health Indicators. According to the National Institute of Mental Health (NIMH), suicide was on the last place of the *TOP 10* leading causes of death overall in the U.S. (2018) but at the same time on the 2<sup>nd</sup> place of the *TOP 10* causes of death among people aged 10 to 34 and on 4<sup>th</sup> place among elderly individuals (aged 35 to 54) [80, 81]. The American Foundation for Suicide Prevention (AFSP) stated that the death rate for suicide is 14.2 per 100,000 population (2018) [82]. In Germany, there were more than 25 suicidal deaths each day in 2019 (9,014 in total) and 11 suicides per 100,000 population in 2018 [83]. In 2019, 10 suicide attempts per 100,000 inhabitants in Poland ended in death [84]. 7% from the U.S. as well as from Poland indicated they contemplated and attempted suicide while it was 5% of the German students. 29% from the U.S., 17% from Germany and 6% from Poland responded they thought about suicide without ever having attempted it. This is consistent with the research findings of this thesis. Adding the “yes” responses, 36% of American students, 22% of German students, and 13% of Polish students have considered suicide. The figures for suicide rates in the U.S. were also the highest and those for Poland the lowest among the three countries studied.

Furthermore, it is also important to know where to get help if someone else has suicidal thoughts. 87% from the U.S., 83% from Germany, and 78% from Poland said they knew where to turn for help in such a situation. There were no significant differences between the proportions of students who know where to get help if someone else is contemplating suicide among all countries as well.

The second LHI thematized major episodes of depression in the past year. Nearly one-third of the U.S. students indicated they experienced a MDE in the past year while it was 9% in Germany and 15% in Poland. In 2017, the prevalence of depressive disorders was about 5.9% of the U.S. population, 5.2% of the German population and 5.1% of the Polish population [85]. The National Survey on Drug Use and Health (NSDUH) carried out by the NIMH states that the prevalence of a MDE in the past year counted from 2017 included 7.1% of adults aged 18 years and older from the U.S [86]. The prevalence in Germany among adults increased from 2009 to 2017 (12.5% vs. 15.7%) while it was 3% of Polish adults aged 18-64 (2016) experiencing depressive episodes [87, 88]. The results from these surveys differ from the survey in this thesis. It was more students from the U.S. and Poland who responded they experienced at least one MDE in the past year than in the given surveys. Also, it was more German students who experienced at least one episode of

major depression than the overall average for Germany was in 2017 but less than the average among adults was.

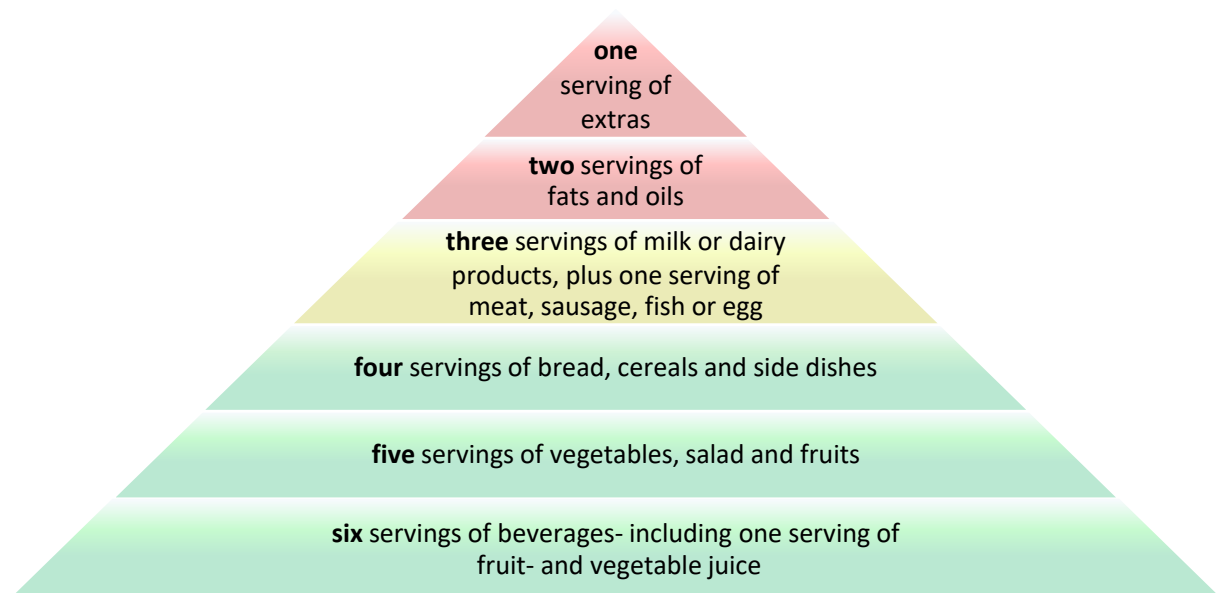
### **NUTRITION, PHYSICAL ACTIVITY, AND OBESITY**

The amount of PA as well as an individual's willingness to eat a healthy diet have a great impact on one's health. The first LHI of this Topic explored how many adults meet the objectives for PA from the Physical Activity Guidelines for Americans (PAG). In 2008, it was 18.2% of U.S. adults who met the guidelines according to the HP2020's website. According to the PAG, adults should train at least 150 to 300 minutes a week of moderate-intensity or 75 to 150 minutes of vigorous-intensity aerobic activity while it is best to spread the workouts throughout the week [89]. Nineteen percent of the students from the U.S., 30% from Germany and 24% from Poland indicated they do not exercise at all. One percent of the students from the U.S. as well as from Germany did not respond to the question. All remaining students exercise a minimum of one and a maximum of seven days a week. In terms of their exercise minutes, no significant differences could be gleaned from the survey results among all three countries. The U.S. students indicated they exercised at least 3 and not more than 120 minutes each day, the German students exercised between 5 and 900 minutes, and the Polish students exercised from 10 to 110. On average, this results in training times each day of 41.57 minutes for the U.S., 28.42 for Germany and 38.21 for Poland. One hundred of the 190 (53%) U.S. students who responded on that question meet the exercise times objective. In Germany, it is 41 of 101 (41%) students, while 42 of 85 (49%) Polish students achieved the targeted training times. In 2018, 54.2% of U.S. adults met the minimum PAG [90]. In 2010, about one-third of U.S. adults exercised the recommended amount [91]. The study "Gesundheit in Deutschland aktuell" (2014/15; *Health in Germany currently*) carried out by the Robert-Koch-Institute (RKI) concluded that 45.3% adults in Germany did enough PA measured by recommendations of the WHO [92]. Only 5% of 28,031 Polish adults polled in a Europe-wide survey said they exercise regularly, compared with 23% who exercise with at least some regularity [93]. Thus, it was nearly the same amount of U.S. students that trained compared to exercising U.S. adults in 2018. The German students trained a bit less than the German adults in the survey. Polish students exercised more than the polled adults from the survey.

The next LHI thematized obesity among adults as well as among children and adolescents. Obesity has a negative impact on health-related factors such as quality of life and mental health and can result from several causes and factors such as genetics or behavioral [94]. Furthermore, those who are obese are more likely to develop complications. For example, some develop type II diabetes or heart disease. Those who are considered obese also were more likely to die from COVID-19. Roughly one third (33.9%) of U.S. adults over 20 years old were obese in 2005-2008, whereas the HP2020 target was to reduce that percentage to 30.5%. According to the survey results, 37% of the students from the U.S. were obese while it was 4% from Germany and 2% from Poland. The CDC stated the obesity prevalence among U.S. adults was 42.4% in 2017-2018 [95]. According to the "Organisation for Economic Co-operation and Development" (OECD), 19.5% adults across all member-countries were obese in 2015. The rate of obese German adults

was 23.6% during that time while it was 16.7% of the adults in Poland [96]. All results are comparable, and it was to be expected that the obesity rate among U.S. students is a high figure but still lower than the average rate among adults was a few years ago. In Germany and Poland, the students' obesity rates are much lower than the average rates for these countries. Statistically significant differences were found only in the tests that included the United States.

As previously mentioned, a healthy diet has a great impact on our health as well. The last LHI is "Mean daily intake of total vegetables". Consequently, students were asked about their eating habits. The former German information service "AID" created a food pyramid (Figure 3). The further down something is, the more of it may be consumed, one can also follow the pyramid from green via yellow to red.



**Figure 7: own representation - food pyramid according to aid-infoservice**

The foundation of the triangle is six servings of beverages a day are recommended. The next level of the triangle recommends five servings of vegetables, salad, and fruits. The "Bundeszentrum für Ernährung" (BZfE, *The Federal Centre for Nutrition*) has more detailed recommendations. Namely, one should eat two servings of fruits, three servings of vegetables and additionally one serving of salad each day [97, 98]. Nearly half (47%) of the students from the U.S. eat at least two servings of fruits on average per day compared to 33% from Germany and 47% from Poland. Only one fourth (26%) of the U.S. students, 20% of the German students and 14% of the Polish students indicated they consume at least three servings of vegetables on an average day. Moreover, 48% from the U.S., 54% from Germany and 84% from Poland indicated they consume one serving of salad on a regular daily basis. The next stage on the triangle included breads, cereals, and side dishes with four recommended servings a day. In the survey, bread and cereals were included in the "Grain Products"-category. Only 9% of the U.S. students as well as of the German students and 7% of the Polish students responded they consume four or more servings of this food group on an average day. The next stage are three servings of milk or dairy products in addition to one serving of meat, sausage, fish, or egg. In the survey, milk and dairy products are included in the

“Dairy servings” section while there was no question about any kind of meat. Meat, sausage, and fish belongs to the protein rubric. Interestingly, 14% from the U.S., 12% from Germany and 13% from Poland declared they consume at least three servings of milk or dairy products per day. When exploring proteins such as meat and fish, 92% of the U.S. students, 57% of the German students and 90% of the Polish students affirmed they eat at least one serving of proteins on a regular daily basis. The consumption of fats and oils was not queried in the survey while it is the second last step of the food pyramid.

The top is one serving of extras like junk food and sweets or alcoholic drinks. It was 64% from the U.S. who indicated they eat one serving or more of sweets daily with 50% consuming at least one serving of junk food. In Germany, 71% consumed one or more serving of sweets with 36% also indicating they consumed one or more servings of junk food regularly. Last of all, 27% Polish students stated they eat at least one serving of sweets each day but also 28% who consume junk food. Thus, the results indicate that many students consume more than only one serving of extras on average days. In summary, while many of the students followed some of the recommendations as shown on the food pyramid, the results varied as one can see from the results.

## **ORAL HEALTH**

The LHI on “Oral Health” identified the number of “Children, adolescents, and adults who visited the dentist in the past year (OH-7)”. Dental health does not only include dental issues but also oral cancers, for example. Furthermore, many researchers note that poor dental health also has a negative effect on chronic diseases such as Diabetes or heart disease as well as causing premature birth [99, 100]. For example, one-fourth U.S. adults has untreated cavities [101]. According to the CDC, 64.9% of U.S. adults aged 18 years or older visited a dentist in 2018 [102]. BARMER, a major German health insurer, monitored its insured adults and found that 71.5% of them visited the dentist at least once in 2016 [103]. Another study found that 86% of German adults visited a dentist in 2018 [104]. In Poland, 67% visited a dentist in 2018 [105]. The results for the U.S. are almost the same as those from the survey from our survey (64.9% vs. 68%). For Germany, the value from the current survey (87%) is only slightly higher than that from the presented study (86%). The percentage of Polish adults (67%) who visited a dentist within the last year was lower than for Polish students (74%). Moreover, the proportions of students who visited a dentist in the past year also differed statistically significant among all three countries.

## **REPRODUCTIVE AND SEXUAL HEALTH**

The two LHI title of this Topic are “Sexually active females receiving reproductive health services,” and “Knowledge of serostatus among HIV-positive persons“. The first LHI was divided into two questions. First, female students were asked whether they received reproductive health as well as gynecological services in the last year. All students were asked if they were sexually active and if any had HIV as shown in Table 9: Chronic Conditions, but we did not ask for their serostatus.

Ten percent of the U.S. students received reproductive health services while only 1% from Germany and 5% from Poland did. When asked about receiving gynecological services: 66% of the U.S. female students, 73% from Germany and only 12% in Poland responded affirmatively. One should note that despite these low numbers, 61% of the Polish students indicated they are sexually active compared to 72% in the U.S. and 71% in Germany. While US-GER students were similar when it came to be sexually active, they differed in receiving reproductive services.

It is obvious that more students should use these services as adolescents and young adults since they are sexually active and vulnerable to STDs [106]. When asked about protecting themselves from STDs, 51% of the U.S. students who are sexually active indicated that they use condoms or something else (“Other”) to protect themselves or their partners while 68% of the German and 92% of the Polish students. Some of the best ways to prevent STDs are sex abstinence, vaccinations, less sex partners (best is mutual monogamy) and the use of condoms [107]. The proportions of students who protect themselves or their partners from STDs differed significantly between the U.S. and Germany as well as between the U.S. and Poland. Furthermore, 102 students (88%) from the U.S. indicated they use condoms, IUDs, or the pill for pregnancy prevention while only 20 students (14%) did not give a concrete answer and 12% did not respond to that question. In Germany, 100% of the students, indicated they use one of the birth control methods listed. Meanwhile, 90% of the Polish students who indicated they are sexually active use condoms, IUDs, or the pill for preventing pregnancy. Significant differences were found between the U.S.-GER.

Continuing, 24% from the U.S., 8% from Germany and 26% from Poland stated that they have children. Majority of these children from the U.S. (62%) and Poland (44%) were over 19 years old, while most of them in Germany (40%) were 6-12 years old. The proportion of students who have children differs statistically between U.S.-GER and GER-PL. According to the Institute For Women’s Policy Research (IWPR), more than one-fifth U.S. college students were parents in 2015/2016 [108]. Thus, the U.S students who are parents currently is higher than those who responded a few years ago to a different survey. In Germany, a study conducted in 2019 indicated that 6% of students were parents which is lower than in the U.S. [109]. No comparable data were found for Poland, but it can be said that more Polish students have children than those from the U.S. and Germany.

## **SUBSTANCE ABUSE**

The penultimate LHI Topic is titled “Substance Abuse” with the following LHIs: “Adolescents using alcohol or illicit drugs in past 30 days, “and “Binge drinking in past month – Adults.“ It is known that drug abuse has a negative impact on health and increases the risk of infection. For example, you can contract hepatitis C or human immunodeficiency virus (HIV) by using shared needle. One in ten HIV infections results from drug use. However, the use of the same needle is not the only risky behavior that drugs induce, it also increases the occurrence of risky sexual behavior, such as sex without a condom [110].

The goal of this LHI is to reduce alcohol abuse among adults from 26.9% during the past month to 24.2%. Consuming more than 4 drinks per females and 5 drinks per males is referred to as

binge drinking. More than half (59%) of U.S. students reported consuming 1-3 (female) or 1-4 (male) alcoholic beverages at least once in the past month while it was 23% who indicated consuming more than 4 (female) or 5 (male) at least once during the past month. Similarly, 58% of the German students answered they consumed 1-3f/1-4m alcoholic drinks during the past month while it was 15% who responded they did it 1-5 times. Poland leads with 67% 1-3/4 alcoholic beverages, while it is 16% for 4/5 or more beverages. While those binge drinking appears to be smaller for each country, the frequency of student consumption and the number of alcoholic beverages (more than the first response) is concerning. It is also more than the HP2020 baseline. Thus, students from all three countries drink more than they should and thus do not meet the HP2020 goal.

The next category was "Marijuana/Weed/Bhangi" where 9% of the U.S. students answered, they consumed one or more of these three substances 1-5 times during the past month with 3% indicating 6-10 times and 1% responding 11-15, 16-20 and 21-25 times, and another 3% who chose 26 times, which is almost daily. While 89% of the German students replied they have not consumed any of these substances, 8% did it 1-5 times, 1% 11-15 times, 2% 16-20 times and 1% more than 26%. In Poland, though 94% have not used Marijuana, Weed, or Bhangi in the past month, 4% have used it 1-5 times, and 1% have used it 6-10 times as well as 1% did not respond to this category. HP2020s goal was to achieve 12.8% of adolescents (12-17 years old) who report alcohol or any illicit drug use during the past 30 days from the baseline in 2015. The goal for adults was 9.2% from the baseline value 10.2% ( $\geq 18$  years) but it has been revised. Regardless, both U.S. and German students did not meet the target due to using more of these three substances, while students from Poland met the target for this category, whether it was the adolescent target or the revised adult target while not being a direct LHI.

The fourth category for this LHI was "Opioids," which includes substances such as Morphine, Hydrocodone, and Fentanyl. Only 1% from Germany indicated using opioids 1-5 times during the past month. All other students chose "0 times". Thus, the HP2020-goal for category number 4 - opioids is met as well.

Category 5 includes "Illicit Drugs" such as Heroin, Cocaine or Ecstasy. Few (3%) of both U.S. and German students responded they used it 1-5 times. Notably, majority of all students did not answer this question which is a good sign or were afraid to answer. These results either indicate leading to the achievement of the goal or the fear of revealing the use of illicit drugs. In 2018, 19.4% of the U.S. population used any illicit drug. For example, 16.7% of those 12 to 17 used illicit drugs, compared with nearly 40% (38.7%) of adults between 18 to 25, while about 1 in 6 (16.7%) of those aged 26 or older reported using drugs, according to the Substance Abuse and Mental Health Services Administration (SAMHSA) [111]. Since most of the U.S. students were 26 years old or older, the survey score is comparable to the score for that age category from the 2018- study. For the third category including Marijuana, Weed and Bhangi, 18% indicated they consumed some of these substances which means it was more than the average U.S. adults did in 2018. Since no one for the fourth category ("Opioids") and only 3% for the fifth category, which

was “Illicit Drugs”, the average was higher in prior studies than were indicated by the students in our study. In Germany, on average 3.3% adults consumed any illicit drug in 2018. Compared to the substance abuse of German students, those in the prior study consumed more drugs of the Marijuana/Weed/Bhangi- category, less of category 4, which included substances like Morphine, Hydrocodone and Fentanyl, and nearly the same (3%) of category 5, including Heroin, Cocaine and Ecstasy [112]. Previously studies revealed that 5.4% Polish citizens aged 15-64 used any kind of drugs (2018) [113]. Similarly, 5% of the Polish students consumed substances like Marijuana, Weed or Bhangi but no one consumed any “Opioids” (category 4) or “Illicit Drugs” (category 5).

## TOBACCO

Smoking is known to cause many diseases and disabilities. For example, over 16 million U.S. citizens live with diseases which were caused by smoking. Sadly, these diseases are preventable by avoid smoking as well as secondhand smoke. Furthermore, smoking and diseases causes by smoking can lead to death. The U.S. does not pay as much for prevention as the CDC recommends. Daily, 1.600 U.S. youth try their first cigarette. Exactly 14% U.S. adults smoked cigarettes in 2019, which is twice as much as students indicated in our survey (7%) [114, 115]. The LHI addressed to adults is titled: “Reduce tobacco use by adults”. According to the Federal Ministry of Health, in 2018, 23.8% adults aged 18 years and older smoked cigarettes in Germany. Compared to the German students surveyed, this is almost 11% more [116]. The percentage of smokers in Poland is very similar to that in Germany at 24% (2018), which is again higher than the number of students who smoke. No statistically significant differences resulted when testing smokers across the three countries.

Among all smoking students surveyed, 9% are trying to quit smoking. Among them, 37% students were from the USA as well as from Germany while 26% were from Poland. There were no statistically significant differences when the proportions of smoking students trying to quit were analyzed across the three countries. In the U.S., there is a website providing help for people who want to quit smoking, e.g., smoke free texting or social media programs and apps [117].

Further, 8% of U.S. students reported vaping with either high, medium, low, or no nicotine, while 5% responded that they had quit within the past 12 months. In a national study, 21% of U.S. high school students vaped in 2018 which is 13% more than the number of students vaping in our study [118]. According to the German DEBRA study (Deutsche Befragung zum Rauchverhalten, English: German Survey on Smoking Behavior), an average of 1.1% of German adults vaped in 2020. One should note that most of those vaping were 18-24 years old (2.2%) [119]. Among German students, 5% reported vaping regularly, more than double the average for all German adults and 18–24-year-olds. In 2019, 3% of adults in Poland vaped, which was the highest percentage in the entire European Union (EU) [120]. Again, more students vaped than average Polish adults. No statistically significant differences emerged when the proportions of students vaporizing were examined across the three countries.

Among the vaping students, are 10 who were trying to quit smoking, it was 7 from the U.S., 2 from Germany and 1 from Poland. There was no statistically significant difference in the proportion of vaping students who were trying to quit at the time of the survey.

### **COVID-19**

Finally, this thesis also explored the current pandemic. In late 2019, Chinese authorities identified a novel coronavirus (CoV), called Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2), discovered in a local outbreak of pneumonia of unknown etiology in Wuhan, China. This virus has already claimed the lives of many people while many other people are still suffering from secondary diseases months later [121, 122]. This survey was taken early in the pandemic, and 1% of students from the U.S. as well as from Germany indicated they had COVID-19 while none from Poland had been infected. More than 90% of students from each country responded that they did not have COVID-19. Note, some students did not choose to respond to that question. There was only a slight statistically significant difference between Germany and Poland. As of June 30<sup>st</sup>, 2020, there were 1% registered COVID-19 infections in the U.S., compared with 0.002% in Germany and 0.001% in Poland [123–125]. When compared to the students, they had nearly six times less infections than the whole U.S. population. The German students had one-third of the population infections. Since no students had COVID-19 in Poland, the value for the whole population is higher as well. Infections can be prevented, e.g., by wearing masks, preferably and safest N95/KN95, good hygiene, especially frequent and regular hands washing and physical distancing. Another way to prevent infections is avoiding crowds and limit contacts to other people and households [126, 127]. The students were asked who is staying away from others to avoid COVID-19. Majority of all students is social distancing, 80% from the U.S. as well as from Germany and 76% from Poland. Some must go to work and therefore cannot keep social distance all the time, but they are probably wearing masks then, including 13% from the U.S., 17% of the German students and the rest, 24%, from Poland. Some people choose to not practice social distance because they are “Corona-deniers”. As Global News noted, "You don't have to believe in COVID-19 for it to kill you." Apparently, some people deny the existence of the coronavirus, the severity of the illness, or the probability they will get it. Since the students who answered "No - Other Reason" indicated in the free text field that they could not keep their distance in grocery stores, but masks are mandatory there. It is fairly certain that they are not among the deniers [128]. The proportions of students who stay away from others to avoid COVID-19 did not differ statistically significant.

## **5.2 LIMITATIONS**

In this chapter, the limitations of this master's thesis are discussed. In order to recruit as many students as possible for this survey, the survey was sent to students via email distribution lists. Most of the respondents took it seriously, though some gave unserious answers or did not answer at all, simply skipped most or all the questions. The response bias may have somewhat skewed the data set as well as affected the validity of this survey. Since each country has different types of health insurance as well as health care locations that are not available in other countries, it was



difficult to compare them. Furthermore, the questions regarding injury and violence were asked wrongly, especially “Experienced – Murder/Homicide”. For example, it could have been stated more clearly that the question asked whether the students experienced a murder of someone else/in their own circle. This should have increased the likelihood that students would make correct statements. In general, survey questions should have as little room for interpretation as possible to avoid misunderstandings. The questions about substance abuse regarding alcohol did not ask the question about binge drinking correctly even though it was a LHI from HP2020. In addition, most questions only dealt superficially with the topic being explored. The exact background and possible causes for certain answers were not investigated. Moreover, no interactions have been considered in the present work. Thus, it remains unknown whether the effect of one variable is influenced by another variable.

### 5.3 CONCLUSION

In this thesis, LHIs from the HP2020 project were examined among students from the USA, Germany, and Poland and compared with the values from the project as well as other studies and literature. Several differences were identified. The biggest differences were found on the following topics: healthcare access, environmental quality, obesity as well as reproductive and sexual health. For example, 13% of U.S. students did not have access to health insurance. When examining the average lead time to get an appointment, Germany was worst for waiting to see a doctor for a well visit but scored best for "Specialist" and "Emergency". Poland scored best for “Sick Care”. Majority of German students (58%) rated their health at least “Very Good” (first + second level). Most students suffering from chronic diseases are in the US (9.75%). However, at the same time, most students there are vaccinated (69%). Polish students have most concerns with air quality. Most students who have experienced relationship violence are in the US (72%). Germans, on the other hand, are the most at risk (71%). Most students who contemplated suicide live in the United States (36%). At the same time, most students there know where to find help if someone else is thinking about suicide (87%). Also, most students experienced a major episode of depression (31%) and are stressed (65%) there. On a good note, they have access to stress soothing programs (68%). While majority of U.S. students exercises regularly (80%), more students in the U.S. are obese with BMIs  $\geq 30$  (55%). German students have visited the dentist most frequently within the last 12 months (87%) as well as the gynecologist (73%). Furthermore, they protect themselves most from pregnancy (100%) while more Polish students protect themselves most from STDs (92%). When asked about their alcohol and substance consumption, U.S. students consume not only alcohol most frequently (82%) but also drugs regardless of the kind (22%). While students from Germany smoke most (13%), U.S. students vape most (9%). Also, more U.S. students try to quit smoking (54%) and vaping (41%). Two students from the U.S. had COVID-19, one from Germany and no one from Poland. Both the majority of U.S. and German students (80%) maintained social distance from others to avoid COVID-19. Similarly, 76% from Poland did so.

The survey was conducted at several universities from different countries as well as in several languages, which increased the sample and hereby the representativeness of the results of this work. This representativeness exists regardless of the limitations mentioned above. Furthermore, in Germany and Poland, the survey was conducted bilingually - in each case in the national language as well as in English, which increased the coverage of the survey.

## **5.4 FUTURE RESEARCH**

As already mentioned in the limitations, interactions between the variables are not discussed and the effects of the variables on each other remain unexplained. The effects of the variables on each other should be explored as some of the variables may be correlated. This would be a possible approach for future research. Furthermore, smaller effects of the answer choice "Other" may not have been apparent because some specific, less common choices have been combined into one category. Some individuals may have failed to respond to certain, more sensitive questions for fear that they could be identified and penalized for their responses. One additional concern was that the respondents in the U.S. were older than the traditional college age students in the U.S. This could have skewed the results and possibly studying younger students would change these results as well.

Furthermore, due to the scope of the project, not all LHIs were investigated, which is why no information, data and results on them can be found in this thesis. Topics such as these present issues for future study and research, perhaps even for another thesis comparing the U.S. with other countries. The parameters already tested in this work can also be included in further analyses to confirm or refute the statements. Therefore, it is recommended that further research be conducted in this area to address new research questions resulting from this work, among others, and to investigate the LHI Topics that were not examined in this thesis. Also, there were some questions that few students answered, or if the majority did, they answered negatively. These could also be good for future research to get answers to them at all or to confirm the results of this thesis.

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## APPENDIX

### APPENDIX I: SAMPLE EXCEL OUTPUT: z-TEST

#### CONTEMPLATED SUICIDE: U.S.-PL

Appendix Table 1: z-Test: Two Sample for Means

	Variable 1	Variable 2
Mean	2,61979167	2,87058824
Known Variance	0,48564996	0,3950173
Observations	192	85
Hypothesized Mean Difference	0	
Z	-2,9604622	
P(Z<=z) one-tail	0,00153589	
z Critical one-tail	1,64485363	
P(Z<=z) two-tail	0,00307178	
z Critical two-tail	1,95996398	

**APPENDIX II: HP2020 LHI SURVEY – ENGLISH**

English

**Default Question Block****Healthy People 2020 Thesis**

Barbara Hewitt, a faculty member in the Department of Health Information Management at Texas State University is conducting a research study to compare the availability of health as well as health conditions in different countries. You are being invited to complete this survey because you are a student in the United States, Germany, or Poland.

Participation is voluntary. The survey will take approximately 15 minutes or less to complete. You must be at least 18 years old to take this survey.

This study involves no foreseeable serious risks since we will keep your response anonymous. We ask that you try to answer all questions; however, if there are any items that make you uncomfortable or that you would prefer to skip, please skip to the next question or select non-applicable. Your responses are anonymous or confidential.

Possible benefits from this study are a better understanding of access to health care and health conditions in different countries.

Reasonable efforts will be made to keep the personal information in your research record private and confidential. No identifiable information will be collected with the survey. Any identifiable information obtained in connection with the drawing for the t-shirt will remain confidential and will be disclosed only with your permission or as required by law. The members of the research team and the Texas State University Office of Research Compliance (ORC) may access the data. The ORC monitors research studies to protect the rights and welfare of research participants.

Your name will not be used in any written reports or publications which result from this research. Data will be kept for three years (per federal regulations) after the study is completed and then destroyed.

After you finish all answers you feel comfortable completing, you can also enter your name into a drawing for a chance to win one of two Texas State t-shirts. The winners will be selected

randomly from those who complete the survey and provide their contact information in the second survey. Note the data collected for the drawing will not be tied to your answers on the first survey.

If you have any questions or concerns, feel free to contact:

Barbara Hewitt, Professor  
Health Information Management  
512-245-3502  
barbarah@txstate.edu

This project 6691 was approved by the Texas State IRB on [insert IRB approval date or date of Exemption]. Pertinent questions or concerns about the research, research participant's rights, and/or research-related injuries to participants should be directed to the IRB chair, Dr. Denise Gobert 512-716-2652 – ([dgobert@txstate.edu](mailto:dgobert@txstate.edu)) or to Monica Gonzales, IRB Regulatory Manager 512-245-2334 – ([meg201@txtstate.edu](mailto:meg201@txtstate.edu)).

If you would prefer not to participate, please do not fill out a survey. If you consent to participate, please complete the survey.

**1. Do you consent (agree) to start the study?**

- ☐ Yes
- ☐ No

**2. Age/How old are you? \_\_\_\_\_**

**3. What is your citizenship?**

- ☐ United States of America
- ☐ Germany
- ☐ Poland

**4. Sex**

- ☐ Male
- ☐ Female
- ☐ Other \_\_\_\_\_
- ☐ Prefer not to answer

**5. Have you received reproductive health services (such as prenatal/antenatal) in the past 12 months?**

- ☐ Yes
- ☐ No
- ☐ Not Applicable

**6. Have you received gynecological services (such as well women visit/birth control) in the past 12 months?**

- ☐ Yes
- ☐ No
- ☐ Not Applicable



**7. Are you sexually active?**

- ☐ Yes
- ☐ No
- ☐ Prefer not to say

**8. If you are sexually active, how do you protect yourself/your partner from pregnancy? (Remember that pulling out prior to ejaculation is not a form of birth control nor does it prevent sexually transmitted diseases)**

- ☐ Condom
- ☐ Diaphragm, or other IUD device
- ☐ None
- ☐ Other \_\_\_\_\_

**9. If you are sexually active, how do you protect yourself/your partner from sexually transmitted diseases? (Remember that pulling out prior to ejaculation is not a form of birth control nor does it prevent sexually transmitted diseases)**

- ☐ Condom
- ☐ None
- ☐ Other \_\_\_\_\_

**10. Do you have children?**

- ☐ Yes
- ☐ No
- ☐ Prefer not to answer

**11. How old are your children?**

- ☐ Newborn to 6 \_\_\_\_\_
- ☐ 6 to 12 \_\_\_\_\_
- ☐ 13 and older \_\_\_\_\_
- ☐ Total \_\_\_\_\_

**12. Which of the following locations do you seek regular treatment at?**

- ☐ Primary care physician
- ☐ Student Health Center
- ☐ Outpatient Clinic
- ☐ Emergency Room
- ☐ Other \_\_\_\_\_

**13. When is the last time you sought treatment?**

- ☐ Within the last month
- ☐ Within the last three months
- ☐ Within the last six months
- ☐ Within the last year
- ☐ Within the last two years
- ☐ Over 2 years

**14. When you need to seek treatment, how long does it normally take you to get an appointment?**

	Well visit/ Checkup	Sick care/ illness	Referral to Specialist	Emergency (Life Threatening)
Within 1 day	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Within a week	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Within 2 weeks	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Within a month	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Within 2 months	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Within 6 months	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Within a year	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other _____	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**15. What Health Insurance do you have?**

- ☐ Public Health Insurance (USA – Obama Care)
- ☐ Parent’s insurance plan
- ☐ Private insurance purchased through employer or workplace
- ☐ Private insurance purchased directly from insurance company
- ☐ The military, Tricare, or the VA
- ☐ Medicaid, Medicare
- ☐ The Indian Health Service
- ☐ No health insurance of any kind
- ☐ Cash
- ☐ Other \_\_\_\_\_

**16. In general, how would you rate your overall health?**

- ☐ Excellent
- ☐ Very good
- ☐ Good
- ☐ Fair
- ☐ Poor
- ☐ Don’t know/not sure
- ☐ Don’t wish to share

**17. Chronic conditions (please check all that apply)**

	I have but not currently being treated for	Currently under care of physician for condition	Treated for and will take medicine for rest of life	Treated for and no longer need treatment	N/A
High blood pressure	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Diabetes	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Asthma	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
HIV/AIDS	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
STD	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Tuberculosis	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Cancer	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other (please specify) _____	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**18. Are you up-to-date with your immunization?**

	Yes	No	No but will get up-to-date shortly
Immunizations	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Flu shot	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**19. Have you visited a dentist in the past 12 months?**

- ☐ Yes
- ☐ No

**20. Do you smoke?**

- ☐ Yes
- ☐ No

**21. How much do you smoke per day?**

- ☐ 1 to 2 cigarettes a day
- ☐ 3 to 5 cigarettes a day
- ☐ 6 to half a pack of cigarettes
- ☐ Over half a pack to a pack per day
- ☐ Over a pack per day

**22. Are you trying to quit smoking?**

- ☐ Yes
- ☐ No

**23. Do you vape?**

- ☐ Yes, with a high nicotine content
- ☐ Yes, with a medium nicotine content
- ☐ Yes, with a low nicotine content
- ☐ Yes, with no nicotine content
- ☐ Quit within the past year
- ☐ No

**24. How much do you vape per day?**

- ☐ 1 to 2 cigarettes a day
- ☐ 3 to 5 cigarettes a day
- ☐ 6 to 15 times
- ☐ 16 or more times per day

**25. Are you trying to quit vaping?**

- ☐ Yes
- ☐ No

**26. Are you exposed to secondhand smoke? Secondhand smoke is being exposed to smoke when another person is smoking.**

	Daily	Once per week	Once per month	Never
Bars	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Restaurants	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
At home	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
At a friends	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
At work	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other _____	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**27. In the past month, how many times have you used the following?**

- ☐ Alcohol (1-4 drinks (males) or 1-3 drinks (females) in one day? \_\_\_\_\_
- ☐ Alcohol (5 or more drinks (males) or 4 or more drinks (females) in one day? \_\_\_\_\_
- ☐ Marijuana/Weed/Bhangi \_\_\_\_\_
- ☐ Opioids (morphine, fentanyl, hydrocodone etc.) \_\_\_\_\_
- ☐ Illicit drugs (heroin, cocaine, ecstasy) \_\_\_\_\_

**28. On average, how many days per week do you drink? \_\_\_\_\_****29. Do you believe you are addicted to...**

	Believe I am	Been told I do but not in recovery program	In a recovery (currently)	Not applicable
Alcohol	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Marijuana	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Opioids	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Illicit drugs	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**30. Have you ever contemplated suicide?**

- ☐ Yes, and attempted it
- ☐ Yes, but never attempted it
- ☐ No
- ☐ Choose not to answer

**31. Do you know where to get help if someone else is contemplating suicide?**

- ☐ Yes, I know who to contact or how to find the suicide hotline number
- ☐ No, I don't know

**32. Have you experienced any major episodes of depression in the past 12 months?**

- ☐ Yes
- ☐ No
- ☐ Maybe

**33. Are you currently feeling stressed?**

- ☐ Yes
- ☐ No
- ☐ Maybe

**34. Do you have access to programs that prevent or reduce stress?**

- ☐ Yes
- ☐ No

**35. In the past month, how many times have you used the following?**

- ☐ Fruit (Banana, Orange, Apple, Mango, glass of fruit juice, Guava, handful of grapes) \_\_\_\_\_
- ☐ White Starch (e.g. baked, mashed, or fried potato. Handful-sized amount of ugali, or an handful of fries/chips) \_\_\_\_\_
- ☐ Vegetables (not including potatoes) \_\_\_\_\_
- ☐ Lettuce-based salads \_\_\_\_\_
- ☐ Dairy servings (milk, yoghurt, ice cream, or cheese) \_\_\_\_\_
- ☐ Meats or other proteins (hamburger, fish, chicken, etc.) \_\_\_\_\_
- ☐ Breads, cereals, and other grain products \_\_\_\_\_
- ☐ Candy, cookies, and other sweet products \_\_\_\_\_
- ☐ Chips/Crisps and other unhealthy snacks (junk food) \_\_\_\_\_

**36. How many times a week do you exercise in a typical week?**

- ☐ Zero
- ☐ 1 day per week
- ☐ 2 days per week
- ☐ 3 days per week
- ☐ 4 days per week
- ☐ 5 days per week
- ☐ 6 days per week
- ☐ 7 days per week

**37. How many minutes do you exercise on average per day? \_\_\_\_\_**

**38. Some people do not exercise. If you choose not to exercise, please indicate why you don't exercise?**

- ☐ Medical
- ☐ My work is physical
- ☐ Don't have time
- ☐ Other \_\_\_\_\_

**39. Health data (please enter if known)**

- ☐ Weight \_\_\_\_\_
- ☐ Height (feet) \_\_\_\_\_
- ☐ Height (inches) \_\_\_\_\_

**40. Do you have concerns with your air quality?**

- ☐ Yes, there is current air pollution issues
- ☐ No, there are no current air pollution issues
- ☐ Not aware

**41. What illnesses are of concern to you from air pollution?**

- ☐ Asthma
- ☐ Breathing issues
- ☐ Other \_\_\_\_\_

**42. Do you feel at risk or have you experienced the following?**

	At risk	Experienced/victim
Injury	<input type="radio"/>	<input type="radio"/>
Physical harm that can lead to death	<input type="radio"/>	<input type="radio"/>
Rape	<input type="radio"/>	<input type="radio"/>
Date/relationship violence	<input type="radio"/>	<input type="radio"/>
Murder/homicide	<input type="radio"/>	<input type="radio"/>
None	<input type="radio"/>	<input type="radio"/>

**43. Have you had the COVID-19?**

- ☐ Yes
- ☐ No but I have been exposed
- ☐ No

**44. Do you stay away from others to avoid COVID-19?**

- ☐ Yes
- ☐ No, I have to go to work
- ☐ No, other: \_\_\_\_\_

**APPENDIX III: CD**