

# **Cigarette vs. E-Cigarette Smokers at University of Toronto**

## **Mississauga**

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## CIGARETTE VS. E-CIGARETTE SMOKERS AT UTM

### **Abstract**

On January 1<sup>st</sup>, 2019, University of Toronto banned smoking on all three campuses. The motivation behind it, as Kelly Hannah-Moffat stated, is to “have healthier campuses”. Moreover, she noted that “the health hazards of smoking and second-hand smoke are well-documented”. Throughout the article, the author discussed the importance of the ban. The article also emphasized how University of Toronto, Mississauga will be able to accommodate the current population of smokers by allocating Designated Smoking Areas across the whole campus but also make the campus healthier.

Moreover, according to a Washington Post article, electronic smoking devices such as vapes and juuls, were banned across several states as a result of an investigation conducted by the state health departments in Illinois and Wisconsin. They tracked 53 patients, with median age of around 19 years old. They noticed a pattern where all the patients ended up in the hospital. Most of them were diagnosed with respiratory distress syndrome, a life threatening disease with the first death occurring on August 23<sup>rd</sup>, 2019.

Due to those issues, we have decided to conduct an investigation at University of Toronto campus at Mississauga. We believe that our project is relevant to the issues listed above and will allow us to have an idea on how many students on campus are putting themselves at risk. Moreover, it will give us an idea of how we can have resources available to help them lead a healthier lifestyle.

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### **Cigarette vs. E-Cigarette Smokers at University of Toronto Mississauga**

#### **Introduction**

The purpose of the research project was to find the proportion of smokers at University of Toronto Mississauga that are cigarette smokers and the proportion of smokers that are e-cigarette smokers. This project reveals how much of UTM's population are smokers, and also states what kind of instruments are used to smoke. Furthermore, our project will help determine whether or not to add more Designated Smoking Areas (DSAs) on campus, and to choose better and optimal locations for new DSAs. Placement of increased DSAs in optimal locations will help the smokers on campus, as they will have better locations to smoke at. At the same time, the non-smokers will also be benefitted as they are less likely to receive second-hand smoke/exposure to a toxic chemical/substance they never consumed before, or people with respiratory issues such as asthma, and so on. Lastly, ex-smokers (those who quit smoking) will be affected positively, as walking by a DSA and smelling vape juice/smoke may cause them to get withdrawals and possibly relapse.

Our study would affect UTM in a positive manner, as many non-smokers do not like the harsh smell of cigarette smoke and do not want to be exposed to it. Therefore, knowing the number of smokers and the instruments being used to smoke allows for better allocation of DSA's throughout campus minimizing distaste among all three populations: smokers, non-smokers and ex-smokers. The data on smokers will help make predictions about the future of the population of smokers and what they may smoke.

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### **Methodology**

For our study, we have chosen Simple Random Sampling in order to observe and survey different people. It helped us distinguish the students and the staff of university. We then divided them by smoking device. We observed 119 people and received 7 relevant responses from our survey, for a total of 126 people sampled. We chose Simple Random Sampling as our sampling technique because we are not interested in any other factors such as gender, age, etc., that may affect data collected, thereby Stratified Random Sampling is not appropriate for us to use here. We want to see the proportion of smokers without any factors affecting it. In other words, we are interested in a homogeneous population.

### **Analysis**

The total population of students at UTM is 14,544. To find the population of smokers on campus, Statistics Canada was used, and it was revealed that the total population of smokers aged 18-34 in Canada is 19.2% of Canada's total population. Taking 19.2% of UTM's total population gave us that a total of 2792 UTM students are smokers. From the 2792 students, a sample of 126 smokers was taken via an online survey sent out by email to randomly generated STA304 students, as well as through observations at Designated Smoking Areas. Of the 126 smokers observed, we found that 103 were cigarette smokers, and the remaining 23 were e-cigarette smokers, implying an astounding 82% of smokers are cigarette smokers and the remaining 18% are e-cigarette smokers at University of Toronto Mississauga. We found through our calculations that the true proportion of people who smoke cigarettes is between 75% and 88%, meaning that 12% to 25% of smokers are e-cigarette smokers with a margin of error of 5%.

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Based on our calculations, there was sufficient evidence to reject our assumption that the proportions are equal. This is because the probability that there could be more observations that are more non-supportive of our assumption is almost nil.

### **Discussion**

There were several things throughout the course of this research project that could have been done better or differently. The survey sent out by email to randomly generated students in STA304 was too short and was made brief to increase more responses. However, this caused us to miss out on important information such as gender, age, program of study, reason for smoking, etc. of the responder. Gathering information on these variables would have allowed us to see if there is some kind of correlation between smoking and other factors. Even though we were interested in the number/proportions, knowing about any correlations among these factors would have been interesting. The survey responses also only came of use if the person responding was someone who actually was a smoker, because if they were not a smoker, then there is no relevant data that could be collected. This reduced the amount of data we could have used. Observations of smokers at Designated Smoking Areas scattered across campus, however, allowed us to bridge this gap. It allowed us to collect enough relevant data to conduct our calculations and make a valid conclusion about the smokers on campus.

### **Conclusion**

To summarize, there are two issues we found in our study. We figured, that there are 4.5 times more cigarette smokers than e-cigarette smokers. This result shows us, that there is a greater possibility of having second-hand smokers throughout University of Toronto Mississauga. The Designated Smoking Areas have improved the situation of passive smokers

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inhaling the cigarette smoke back in the beginning of 2019. However, they did not decrease the number of smokers drastically in populated areas of university. Thus, it would be better to decrease the amount of Designated Smoking Areas in more populated areas of the campus, such as Deerfield Hall or Instructional Building, and place them in less populated areas, for example distant parking spots. The second issue that arose was the number of e-cigarette smokers. Since they make up 18% of total smoking population, our hypothesis of having equal number of cigarette and e-cigarette smokers was wrong. This led us to the conclusion, even though there are not a lot of them, they still would need to make usual check-ups at hospitals or Health and Counselling Centre at University of Toronto Mississauga. Clearly, there are lot of cigarette smokers as well allowing us to conclude that the university needs to provide more resources to help students quit smoking and give them opportunities to lead a healthier lifestyle.

## CIGARETTE VS. E-CIGARETTE SMOKERS AT UTM

**References:**

- Statistics Canada. *Table 13-10-0096-10 Smokers, by age group*
- UofT News. *UofT plans to ban smoking on all campuses in new letter*
- Hannah Knowles, L. S. (2019, November 21). *What we know about the mysterious vaping-linked illness and deaths*. Retrieved from [https://www.washingtonpost.com/health/2019/09/07/what-we-know-about-mysterious-vaping-linked-illnesses-deaths/?fbclid=IwAR1J8sITp2kMxFxcVm6q4mRi-GJUmVfNSiK-UoS0HleZthcO2q-oCQ9\\_qtY](https://www.washingtonpost.com/health/2019/09/07/what-we-know-about-mysterious-vaping-linked-illnesses-deaths/?fbclid=IwAR1J8sITp2kMxFxcVm6q4mRi-GJUmVfNSiK-UoS0HleZthcO2q-oCQ9_qtY).



**Appendix A: Calculations:**

## Technical Progress Report      STA304 Fall 2019

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2019-11-14

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We declare that this assignment is solely our own work, and is in accordance with the University of Toronto Code of Behaviour on Academic Matters.

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This submission has been prepared using L<sup>A</sup>T<sub>E</sub>X.

## 1 Introduction

**Hypothesis:** There are more cigarette smokers than e-cigarette smokers. Most of them smoke at a Designated Smoking Area (DSA).

**Objective:** Find number of cigarette smokers vs number of e-cigarette smokers by Simple Random Sampling (SRS).

$$y_i = \begin{cases} 1, & p: \text{if individual smoked cigarette} \\ 0, & q: \text{if individual smoked e-cigarette} \end{cases}$$

$$H_0 : p = q$$

where there is no difference between the proportion of students who smoke cigarettes and those who smoke e-cigarettes.

$$H_a : p > q$$

where the proportion of cigarette smokers is greater than the proportion of e-cigarette smokers.

We expect to see more cigarette smokers, but e-cigarettes are rising in popularity as of 2019, so it is possible that they have surpassed cigarettes in popularity now.

## 2 Appendix

**Calculations:** The method of data collection used is Simple Random Sampling. There are 14,544 students in University of Toronto Mississauga. Our population  $N$  represents the population of smokers at UTM. According to Statistics Canada, 19.2 percent of Canada's population aged 18-34 are smokers. Therefore, the population of smokers at UTM should be 19.2 percent of 14,544.  $N = 0.192 * 14,544 = 2792$ .

### 1. Population Parameter:

$$\hat{p} = \frac{1}{n} \sum_{i=1}^N y_i$$

$$\Rightarrow \hat{p} = \frac{1}{126} \sum_{i=1}^{126} y_i$$

$$\Rightarrow \hat{p} = \frac{1}{126} \sum_{i=1}^{126} 103, \text{ as according to the data collected, 103 of 126 smokers}$$

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were smoking cigarettes

$\Rightarrow \hat{p} = 0.8175$ , which is the estimate of the population proportion of cigarette smokers.

$\Rightarrow 1 - 0.8175 \approx 0.1825 = \hat{q}$ , which the estimate of the population proportion of e-cigarette smokers.

## 2. Variance of Point Estimate:

$$\hat{V}(\hat{p}) = (1 - \frac{126}{2792}) \frac{(0.1875)(0.1825)}{126-1}$$

$$\Rightarrow \hat{V}(\hat{p}) = (0.95)(0.00119355)$$

$$\Rightarrow \hat{V}(\hat{p}) = 0.0011338725$$

## 3. Bound B

$$B = 2\sqrt{\hat{V}(\hat{p})}$$

$$\Rightarrow B = 2\sqrt{0.0011338725}$$

$$\Rightarrow B = 0.067346046$$

Margin of error for the study: 0.067346046

## 4. 95% Confidence Interval

$$(\hat{p} - B, \hat{p} + B)$$

$$\Rightarrow (0.8175 - 0.067346046, 0.8175 + 0.067346046)$$

$$\Rightarrow (0.7502, 0.8848)$$

Interpretation of the Confidence Interval: We are 95% confident that the true proportion of people who smoke cigarettes is in between 0.750 and 0.884

## 5. p-value

Test statistics for two proportions

$$Z = \frac{(\hat{p}-\hat{q})-(p-q)}{\sqrt{(\frac{1}{n_1}+\frac{1}{n_2})}}$$

where  $n_1 = 103$  (sampled population of cigarette smokers), and  $n_2 = 23$  (sampled population of e-cigarette smokers)

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$$\Rightarrow Z = \frac{(0.8175 - 0.1825) - 0}{\sqrt{(\frac{1}{103} + \frac{1}{23})}}$$

$$\Rightarrow Z = \frac{0.635}{\sqrt{(0.0532)}}$$

$$\Rightarrow Z = 2.7531$$

$$p - \text{value} = P(Z > 2.7531) \approx 0$$

Since  $p\text{-value} < \alpha = 0.05$  there is sufficient evidence to reject the null hypotheses. We can conclude by saying the proportion of cigarette smokers is most likely not equal to the proportion of e-cigarette smokers.

Final Report starts here

Our objective is to find the proportion of smokers that are cigarette smokers and the proportion of smokers that are e-cigarette smokers. We tested the hypothesis that there are more cigarette than e-cigarette smokers. In order to test this hypothesis, we assumed our hypothesis was false and attempted to contradict it.

We found that about 82% of smokers are cigarette smokers at University of Toronto Mississauga. We are 95% confident that the proportion of people who smoke cigarettes is in between 0.750 and 0.884, meaning that the e-cigarette smokers 12% to 25% are e-cigarette smokers.

## CIGARETTE VS. E-CIGARETTE SMOKERS AT UTM

## Consent Form:

**STA304H5 Fall 2019**  
**Student Consent Form**  
**Appendix B**

You are invited to participate in a number of class research projects lead by STA304H5 instructor Dr. Luai Al Labadi.

*What will participants be asked to do?*

Participants will be asked to complete a number of brief questionnaires. Each questionnaire will consist of 2 to 3 questions, and you may be asked to complete in up to 20 of these questionnaires. The questionnaires may be sent and returned by email, or may be completed using pen and paper, or may be completed using oral interviews.

*What will you gain by participating?*

By participating in this study you will help your peers experience the research process. In addition, participation in this study allows you to gain first-hand experience of the research process. You will learn about asking research questions, experimental ethics, and data privacy – all important topics for a statistician or a researcher.

*What happens if you don't want to participate in the study? Or decide to discontinue participation?*

You have the right to decline to participate any number of the questionnaires, and to decline to respond to any individual question on a questionnaire, or to discontinue participation at any time, and your decision to participate or not participate will not negatively impact you in any way, it will not affect your achievement in STA304H5 Fall 2019, or any other University of Toronto Mississauga course, or your admission to any University of Toronto Mississauga program. Please note that once a questionnaire has been completed, the data will not be removed from the data analysis for that questionnaire.

*How is your right to privacy maintained?*

We respect your right to privacy and confidentiality. At no time will the students conducting the projects have knowledge of your student ID. At no time will the Course Instructor or any of your Teaching Assistants be able to connect your questionnaire answers to your identity. The only people who will ever have access to this information will be the group who designed the questionnaire. Immediately after data collection is complete, every group will create an anonymized dataset with all personal information, such as student emails, removed.

All data will be securely kept and protected at all times. Paper questionnaires and consent forms will be shredded in December 2019. All electronic data will be deleted in December 2019.

*Do you have any more questions?*

If you have any questions regarding this study, please do not hesitate to contact Dr. Luai Al Labadi, Assistant Professor Teaching Stream in Statistics, Deerfield Hall, Room 3072, 3359 Mississauga Road North, Mississauga, ON, L5L 1C6 or email [luai.allabadi@utoronto.ca](mailto:luai.allabadi@utoronto.ca).

**If you feel that you understand the above conditions of participation, have had your questions answered by the researchers, and wish to participate in this study, please check the "I Accept" box on the next page and print your student ID. Then bring that page with you to your lecture on September 21<sup>st</sup>.**

**You are invited to participate in a research study conducted by a group of researchers led by Dr. Luai Al Labadi from the University of Toronto Mississauga.**

☐ **I Accept**

☐ **I Decline**

**Student ID:** \_\_\_\_\_

## Questionnaire:

Are you a smoker?

What do you smoke?

Do you smoke at UTM?

Do you smoke at designated smoking areas?

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## Data Set

## From observations

Observer	Observations				
	Date	Time	Location	Observations	DSA
Wafiqah	Tuesday, October 22nd	3:00-3:10 pm	CCT	2 cigarette	Yes
				1 other	Yes
		4:00-4:30	IB	14 cigarettes	Yes
				3 vapes	Yes
		6:00-6:05	IB	3 cigarette	Yes
				1 vape	Yes
		5:55-6:00	NE	1 Vape	No
		4:45-4:50	DH	1 cigarette	Yes
		8:30-9:00	DH	1 cigarette	Yes
				1 Vape	Yes
Dmitrii	Monday, October 21st	10:00-10:10	DH	2 Cigarettes	Yes
		11:00-13:00	DH	4 Cigarettes	Yes
				1 Juul	Yes
		14:00-15:30	DH	2 Cigarettes	Yes
				1 Other	Yes
		15:30-16:00	IB	2 Cigarettes	Yes
				1 Vape	Yes
				1 Iqos	Yes
				3 Cigarettes	No
		10:30-11:00	DH	1 Cigarette	Yes
	Wednesday, October 23rd			1 Cigarette	No
		12:00-13:00		2 Cigarettes	Yes
				1 Other	Yes
				2 Cigarettes	No
		14:50-15:10	IB	2 Cigarettes	Yes
	Thursday, October 24th			1 Cigarette	No
		8:30-9:00	DH	1 Cigarette	Yes
		10:00-13:30	DH	7 Cigarettes	Yes
				2 Other	Yes
				1 Cigarette	No
				2 Juul	No
		13:40-14:00	IB	2 Cigarettes	Yes
		16:00-17:30	DH	2 Cigarettes	Yes
				4 Cigarettes	No
				1 Juul	No
		17:40-18:00	Library-IB	2 Cigarettes	Yes
				2 Cigarettes	No
Navya Manik	Monday, October 28th	13:00-13:10	Davis-CCT	5 Cigarettes	Yes
	Saturday, October 26th	10:00-12:00	Blind Duck	2 cig	No
				2 Vapes	No
				1 Juul	No
Tamjot	Monday, October 28th			2 Iqos	No
		15:00-15:10	IB (Front)	2 Cigarettes	Yes
				10 Cigarettes	No
	Thursday, October 14th			1 Vape	Yes
		15:50-16:10	IB (Front)	6 Cigarettes	Yes
				7 Cigarettes	No
Kabeer	Friday October 25th	7-7:10	CCT Link	1 Vape	No
				2 Cigarettes	No
	Wednesday October 30th			1 vape	No
		4-4:05	CCT Link	2 Cigarettes	No

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## From Questionnaire:

Questionnaire					
Timestamp	Are you a smoker?	What do you smoke?	Do you smoke at UTM?	Do you smoke at designated smoking areas?	
October 14th 15:54:08	No				
October 14th 16:51:26	No				
October 14th 17:05:51	No				
October 14th 19:19:53	Yes	Cigarettes	Yes	Yes	
October 14th 19:30:33	No				
October 14th 19:49:08	No				
October 14th 19:57:16	No				
October 14th 20:00:31	No				
October 14th 20:01:51	No				
October 14th 20:02:48	No				
October 14th 20:02:51	No				
October 14th 20:09:20	No				
October 14th 20:43:58	No				
October 14th 21:04:16	Yes	Cigarettes, Vape	No		
October 14th 21:11:02	No				
October 14th 21:33:01	No				
October 14th 22:03:58	Yes	Cigarettes	No		
October 14th 22:51:46	Yes	Cigarettes, Vape, Juul	Yes	Yes	
October 14th 23:41:39	No				
October 14th 23:41:44	No				
October 15th 1:58:02	Yes	Vape, Juul	Yes	Yes	
October 15th 13:20:35	No				
October 15th 14:56:11	No				
October 15th 15:42:48	No				
October 15th 16:03:33	No				
October 15th 16:05:06	No				
October 15th 21:35:47	No				
October 15th 22:29:18	Yes	Iqos	No		
October 16th 0:24:37	No				
October 16th 10:48:59	No				
October 16th 16:20:02	No				
October 17th 15:33:02	Yes	Cigarettes	Yes	Yes	
Totals					

## Totals:

Totals				
	Inside DSA	Outside DSA		Total
Cigarettes	66	24		90
Vape	3	3		6
Juul	1	3		4
Iqos	1	0		1
Other	5	0		5
Total	76	30		
Total people observed				106

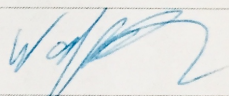

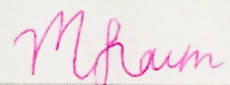
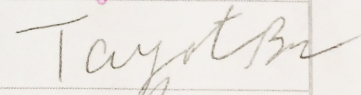
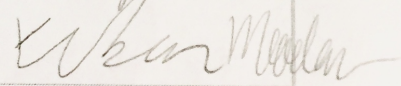


**University of Toronto at Mississauga**  
**Fall 2019**  
**SURVEYS, SAMPLING AND OBSERVATIONAL DATA**  
**STA304H5F L0102**

**COURSE PROJECT**

**Final Written Report Due – 25 Nov 2019**

All undersigned students have made a significant contribution to this project:

Name (Print)	Student Number	Signature
Wafaah Raisa	1004336916	
Dmitri Strizhkov	1004099308	
Navya Gupta	1004349715	<u>Navya</u>
Manik Rana	1004591907	
Tarrajot Singh Bains.	1004318080	
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