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Assessing the Effects of Standardized School-Based Educational Cessation Programs for Adolescent Smokers: A Research Protocol

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Abstract

Introduction: Cigarette smoking is a significant public health issue, and the primary cause of preventable health problems in the Greater Toronto Area (GTA). Nevertheless, the prevalence of adolescent smoking remains high. Our proposed study aims to investigate the effectiveness of school-based educational programs in reducing adolescent smoking rates in the GTA. It will compare the results of weekly integrated education sessions offered throughout a school term to more focused, discrete sessions offered at two different points in the term at 10 secondary schools in the GTA. The findings will help inform potential policy and curricular changes to promote smoking cessation among current and future youth.

Methods: This study utilizes an experimental quantitative research design. Multi-stage cluster sampling will be used. 10 schools will be selected, with 20 students being recruited per school. The intervention group will receive a school-based education program for smoking cessation, lasting an academic semester. The control group will receive an educational session at the beginning and end of the semester. The inclusion criteria is as follows: participants must be (a) adolescents aged 12-17 and attending an accredited primary or secondary school, (b) living in the GTA, and (c) current daily smokers. The Fagerström Test for Nicotine Dependence (FTND) and biochemical tests will be used to collect pertinent data about smoking cessation rates. Abstinence will also be assessed using the Russell Standard.

Results: The study will use statistical tests to compare the proportion of students in the intervention group who quit smoking to the control group. The primary outcome measures will be 4-week and 6-month abstinence counts and nicotine dependency as measured by the FTND. The analysis will be conducted using IBM SPSS ver. 29.

Discussion: The results of this study will provide valuable insight into the effectiveness of educational programs in promoting smoking cessation among youth, which will inform the design of future school-based interventions. Additionally, the study will help to understand adolescent smoking patterns, which can be used to guide public health policies.

Conclusion: The results will have the potential to inform future education and public health strategies for encouraging adolescent smoking cessation.

Keywords: adolescent smokers; smoking cessation; Greater Toronto Area; Fagerström Test for Nicotine Dependence; educational interventions; public health

Introduction

Cigarette smoking is the primary cause of preventable health problems in the Greater Toronto Area (GTA), resulting in the death of nearly half of its users [1]. More specifically, tobacco smoking is a precursor in more than 85% of incidence cases of lung cancer and is linked to respiratory diseases, cardiovascular diseases, and several other health problems [2]. While daily smoking significantly increases the risk of individuals to these health conditions, occasional smoking can also preponderate the risk profile. Fortunately, smoking cessation can reduce an individual's risk of future health problems [3]. As such, research into the quality and accessibility of education on smoking risks to the public has been a topic of focus in the literature. Despite this, the prevalence of adolescents in the GTA who smoke remains significant.

In 2014, about 10.6% of GTA residents reported smoking daily [1]. Despite a decline in cigarette use over past decades, an estimated 19% of adolescent youth still experiment [4]. While this is often limited to occasional or social use, adult smoking behaviours are largely rooted in adolescence. 0% of dependent adults in the GTA claim that the behaviour is initiated before the age of 18 [5]. There are various reasons for this. First, adolescents are highly vulnerable to exposure during social situations where smoking behaviours are observed (such as by family or friends) and are susceptible to academic and social pressures, which may influence them to experiment with smoking to aid them cognitively, psychologically, or

socially [6]. The vulnerability of adolescents to various lifestyle pressures makes studying interventions that can effectively stop cigarette smoking early in its tracks important.

While the literature on various policy changes, such as the prohibition of cigarette use on school grounds, has indicated that they are somewhat effective, there is a dearth of literature on the short and long-term effects of school-based educational interventions in the GTA on sustained smoking cessation rates among adolescents [7]. To address this gap in knowledge, our proposed research study will have two objectives. These will be to (1) study the efficacy and feasibility of standardized school-based educational programs for youth, specifically between the ages of 12-17 and (2) to compare the effectiveness of two types of interventions: a) education that is integrated into student coursework throughout a school term and b) discrete educational sessions offered at two separate time points at the beginning and end of the term. Studying these objectives will allow us to advocate for potential policy or curricula changes to curb smoking in future generations of adolescents.

The population for this study will be adolescents in the GTA. As an intervention, weekly 1-hour education sessions will be integrated into health classes in 20 schools. Our comparator is adolescents receiving two, three-hour educational interventions at the beginning and end of the semester. The primary outcome is the number of adolescents who quit after one year. Thus, our research question is:

How do standardized school-based educational cessation programs offered weekly over an entire semester affect the proportion of adolescent smokers (aged 12-17) in the GTA who quit compared to adolescents who receive an educational session at the beginning and end of a semester?

Methods

Description of Literature Search Strategies

Searches were completed using PubMed and the Queen's University Library. Multiple searches were conducted using important terms. 'Educat*', 'smok*', 'cessation', 'school', and 'effectiveness' were terms relevant to our research question (Figure 1). 'Adolescent*' and 'Toronto' were included to narrow the search to our population of interest. Only articles published in the period 2016-2022 were assessed. There were various articles exploring the effects of negative labels and health warnings on smoking cessation. Many results displayed that intention to quit was related to increased health concerns and an increased positive attitude towards quitting, as well as stronger social norms towards quitting, which were all mediated by these warning labels [8]. However, a gap in the literature was found among the population of youth smokers regarding the potential efficacy of school-based educational cessation programs, which may instill these same attitudes towards smoking to a greater degree.

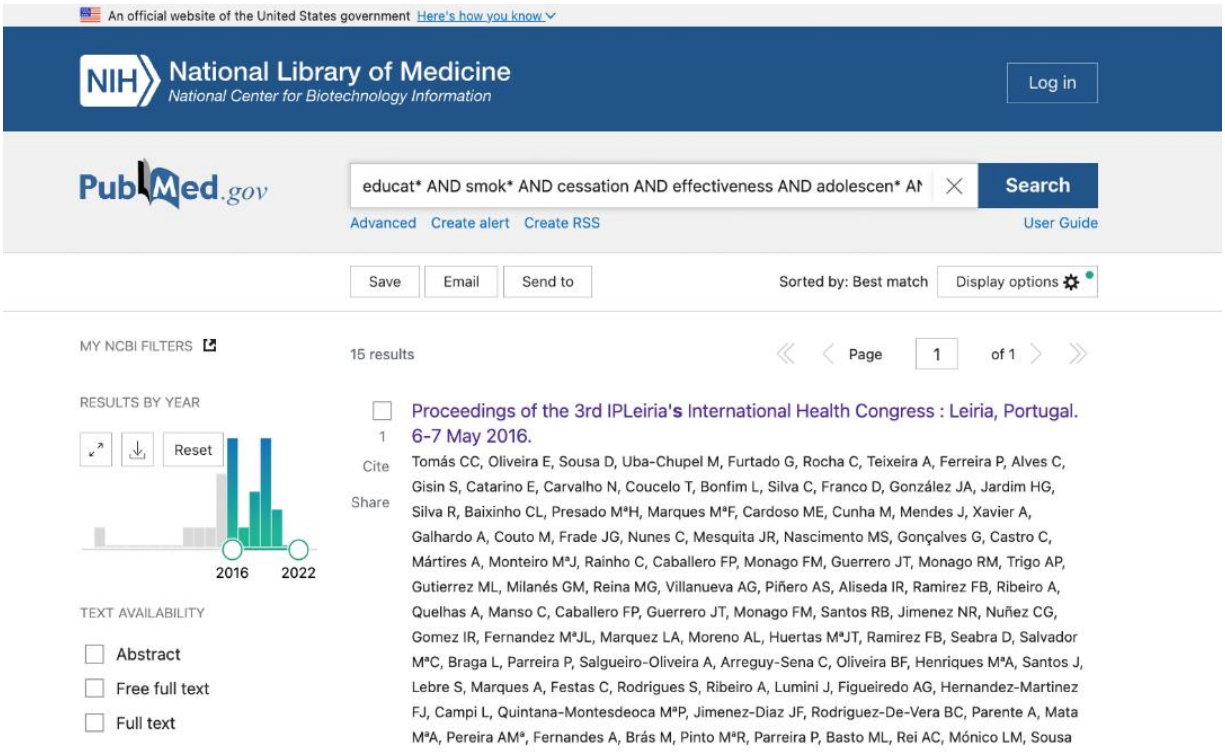

Figure 1. Literature search on PubMed using keywords 'Educat*', 'smok*', 'cessation', 'school', and 'effectiveness'.

Research Methods

Based on the gap identified in the literature and the comparative nature of the research question, an experimental quantitative research design will best answer the study question. The control group will receive an educational session at the beginning and end of the semester. These sessions will include general, un-catered information on smoking, such as statistics and the increased risk of disease (ex: lung disease, cancer, etc…), and why it is important to quit. The intervention group will be given an identical initial and final session, and will also receive the educational intervention in between.

The intervention will consist of a school-based education program for smoking cessation developed by the authors. The intervention will involve weekly 1-hour sessions, lasting an entire academic semester. The content will be catered to the age group and lifestyles of study participants. For instance, it will disclose the particular harms of nicotine use at their given age, the short-term and life-long dangers of addiction, and the benefits of cessation. These sessions will also provide education on behavioural, cognitive, and stress-management techniques to assist with cessation [3,7]. The program has not yet been developed, and thus has not undergone approval.

After the final session, researchers will make recommendations regarding medication and counselling to aid long-term cessation to both the intervention and control group. The proportion of adolescents who quit smoking among both groups will be measured.

The study's inclusion criteria are as follows: participants must be (a) adolescents aged 12-17 and attending an accredited primary or secondary school, (b) living in the GTA, and (c) current daily smokers. Participants must also show an interest in quitting smoking. Adolescents who (a) are already receiving cessation treatment, such as a nicotine patch, (b) have significant mental, physical, or developmental abnormalities, and (c) are pregnant, will be excluded from this study. A school-wide survey will be administered in order to determine which students are eligible. For participant recruitment, the research team will work collaboratively with school staff and administration to refer participants to the study, and will also communicate to students and families via online newsletters.

The unit of analysis is the educational intervention, which will be investigated regarding how education quality impacts cessation rates. The observation units are the students. The sampling frame includes primary and secondary schools across the GTA, consisting of the City of Toronto, as well as the regional municipalities, including Durham, Halton, Peel, and York. The sample size will include 10 different schools, with 20 students being recruited per school, where 10 participants will be assigned to the intervention group, and 10 to the control group (see results for study design). Our study will utilize cluster sampling, where the population of eligible students in the region will be grouped by school, and each school will represent a cluster. 20 clusters will be randomly selected using a random number generator. Further, multi-stage cluster sampling will be used to randomly select 20 students from within each cluster. Participants will also undergo random assignment to the intervention or control group using a random number generator.

Justification of Research Methods

A quantitative design was chosen because our research is concerned with the proportion of students who quit smoking, which relies on numerical data and statistical procedures. Further, an experimental quantitative design is appropriate since the study involves an intervention and control group, where the direct cause-and-effect relationship between quality of education and smoking cessation can be examined [6]. In addition, the random assignment of participants will help increase validity by minimizing bias and reducing the impact of unknown confounding variables, ensuring that the two groups are as similar as possible [6].

Multistage cluster sampling was chosen to create a feasible sampling frame, as the population of interest is large. It utilizes naturally occurring, eligible clusters within the population, which are representative of the entire population, and selects a subsample of participants within each cluster [9]. Cluster sampling also requires fewer resources throughout the sampling process, where time, financial, and travel constraints were barriers to our study [10]. The specified exclusion criteria are supported by recent, credible studies of behavioural and educational smoking cessation programs, and will allow us to control for confounding variables such as age, sex, medication, and baseline addiction intensity of students [11,12].

Data Collection Strategies

The Fagerström Test for Nicotine Dependence (FTND) and biochemical tests will be used to collect pertinent data about smoking cessation rates. The FTND survey evaluates the intensity of physical nicotine addiction and consists of six questions (see Appendix A) that assess the quantity of cigarette consumption, compulsion to use, and dependence [13]. With an ordinal measure of nicotine dependence, yes/no answers are scored from 0-1 and multiple-choice answers are scored from 0-3 [13]. After the total score (0-10) is determined, higher scores indicate a more intense nicotine dependence [13]. Furthermore, FTND will be conducted on-site via online surveys on a facilitator's computer in a private room at each school. The date/time will be chosen based on the participants' availability. One participant will enter the room with no time restriction. Facilitators will not be present in the room, however, they will be present on-site to provide instructions, obtain informed consent in writing, and solve any technical difficulties. To assess the accuracy of the FTND answers, facilitators will also conduct biochemical verification.

Abstinence will be gauged using the Russell Standard, which defines abstinence as a self-report of smoking no more than 5 cigarettes from the start of the follow-up period along with a negative biochemical test [14]. Abstinence must be validated with an exhaled CO concentration of less than 10 ppm (see Appendix A) [15]. Lastly, in case of difficulties with recruitment, all participants will be entered to win a draw for a $50 Amazon gift card.

The on-site, online FTND survey is designed to address possible barriers of other methods. First, surveys will not be printed on paper due to cost limitations. At home, online surveys also tend to have lower response rates and a greater likelihood of technical difficulties. Verbal surveys are time-consuming, and participants may struggle to understand long or complex questions. To minimize these barriers, a combination of an online and in-person survey will be conducted. The private room is designed to create a comfortable environment and prevent social desirability biases.

To ensure validity, FTND has proven to be externally valid given the questionnaire's modifications. The FTND is a valuable clinical tool with the scales' brevity and relations with relapse [16]. To ensure reliability, FTND is a standardized smoking assessment tool that has been heavily scrutinized by healthcare professionals since 1991 [17]. While the FTND is copyrighted by Taylor and Francis Ltd, it may be reproduced without permission. Although no validated consensus standard of defining smoking abstinence exists, the Russell Standard coupled with biochemical testing was chosen due to its widespread use in the literature [18].

Results

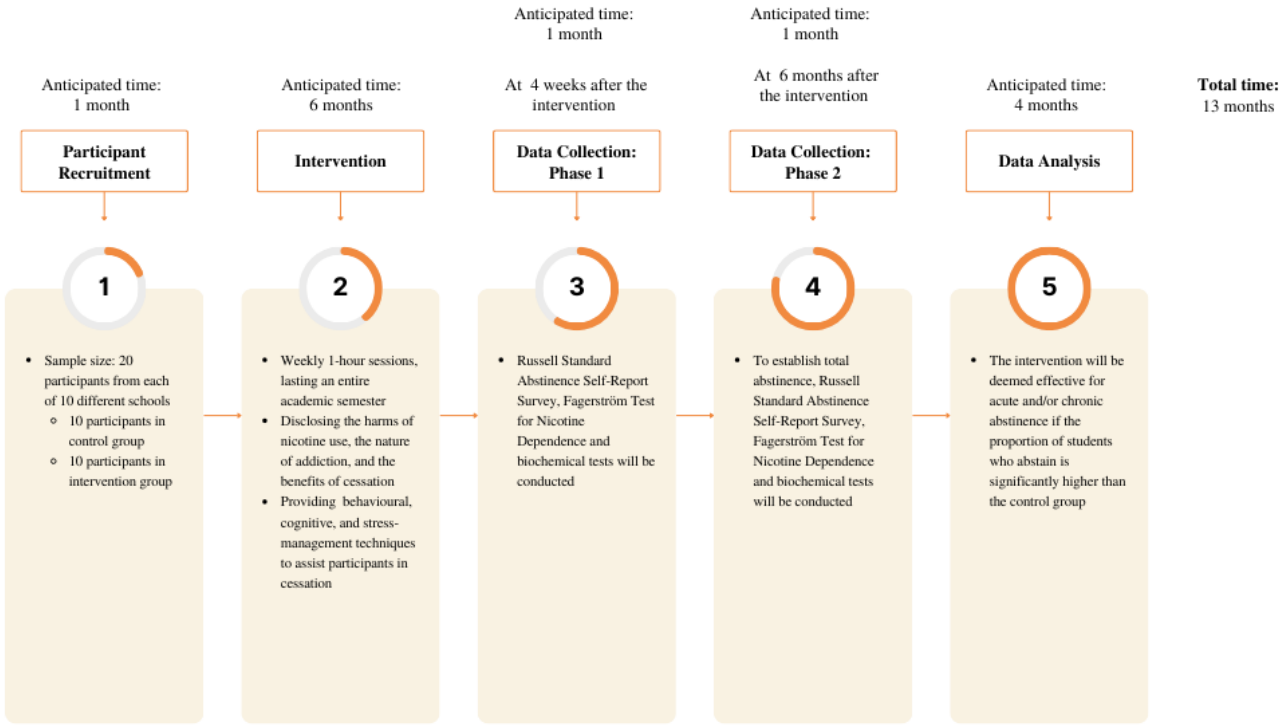

Figure 2. Anticipated timeline summarizing study methodology (created using Canva).

The study will follow the timeline shown in Figure 2. During participant recruitment, the sample size of 20 participants from 10 different schools will be recruited over an anticipated period of 1 month. The intervention will involve weekly 1-hour sessions for an entire academic semester, and the anticipated duration is 6 months. During phase 1 of data collection, Russell Standard Abstinence Self-Report Survey, FTDN and biochemical tests will be conducted 4 weeks after the intervention, and the anticipated duration is 1 month. During phase 2 of data collection, data for total abstinence will be collected at 6 months after the intervention using the Russell Standard Abstinence Self-Report Survey, FTDN and biochemical tests, and the anticipated duration is 1 month. During data analysis, the effectiveness of the intervention will be assessed, and the anticipated duration is 4 months. As for progress to date, the recruitment process has not yet been initiated.

Discussion

To determine if the proportion of students in the intervention group who quit smoking is greater than the proportion in the control group, independent *t*-testing or Mann-Whitney U testing will be conducted. A test result is statistically significant if $p < 0.05$. Testing will be conducted for both 4-week and 6-month abstinence counts, as well as nicotine dependency as measured by the FTND. Specifically, the intervention will be deemed effective for acute and/or chronic abstinence if the proportion of students who abstain is significantly higher than the control group. Likewise, the intervention will be deemed effective at reducing tobacco dependency if the intervention group has a significantly lower mean FTND score. Analysis will be conducted using IBM SPSS ver. 29.

The data analysis aims to determine if the proportion of students in the intervention group who quit smoking is significantly greater than the proportion in the control group. In theory, smoking cessation would be defined as the cessation of smoking in perpetuity, though this is impossible to measure. Therefore, 4-week and 6-month abstinence measures by the Russell Standard will be used as primary outcomes to approximate true cessation [15].

The intervention and control groups are independent samples in that the observed cessation rate values in one group are not related to or matched with corresponding values in the other. As the means of two independent groups are being compared, the most appropriate statistical test for this study is an independent *t*-test. If the results of a Shapiro-Wilk or F-test confirm that the normality or equal variance of data cannot be assumed respectively, then the independent *t*-test's non-parametric equivalent (the Mann-Whitney U test) is most appropriate.

Limitations of the study could include the sample size of 600 participants which could contribute underpowered results. Additionally, the results derived from the sampling population in the GTA may not be generalizable to other populations.

Conclusion

To conclude, the rationale behind this study is grounded in the need for future research on the effects of educational programs for adolescent populations over an extended period on smoking cessation rates. This study will help to determine whether the intensity and frequency of educational sessions significantly impact the rates of smoking cessation among youth. Analysis of the study results will help augment our understanding of adolescent smoking patterns and encourage the design of future school-based interventions. Thus, this study is highly relevant to the field of pediatric and adolescent health given that the experimental smoking prevention programs may constitute a successful strategy in encouraging adolescent smoking cessation and help inform public health policies to curb tobacco use.

List of Abbreviations

GTA: Greater Toronto Area
GYTS: Global Youth Tobacco Survey
FTND: Fagerström Test for Nicotine Dependence

Conflicts of Interest

The author(s) declare that they have no conflicts of interest.

Ethics Approval and/or Participant Consent

Prior to data collection and participant recruitment, questionnaire questions will be compiled for an application to seek ethics approval from the Health Sciences Ethics Research Board. Informed consent will also be obtained from participants.

Authors' Contributions

KP: Was the principal author of this manuscript including the conceptualization of the study and writing the introduction, conclusion, and abstract.
CJ: Contributed to designing the study and edited the final submission, assisted with writing the abstract and methods section, specifically the description of literature review strategies, research methods, and justification of research methods.
SL: Contributed to the study design and planning, assisted with writing the abstract, data collection and results, designed Figure 2, and edited the final published version.
DJ: Contributed to planning the study methods, wrote the data collection strategies discussion sections, and contributed to editing and proofreading the final published version.
OG: Contributed to study planning, editing the final version and assisted in writing the research methods and justification of research methods.

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