University of Ottawa
JOURNAL OF MEDICINE
JOURNAL MÉDICAL DE L'UNIVERSITÉ D'OTTAWA

UOJM celebrates return
First publication after forty-year absence

CLINICAL TIPS FOR MED STUDENTS
An enhanced approach to smoking cessation

A step-wise approach to managing and preventing obesity

RESEARCH
Binge eating disorder costs

Noise and stress

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Clinical experience in Morocco

Do you want a family? Choosing specialties

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UOJM JMUO
UNIVERSITY OF OTTAWA JOURNAL OF MEDICINE
JOURNAL MÉDICAL DE L'UNIVERSITÉ D'OTTAWA

A warm welcome to UOJM

We are very excited to introduce to you the first annual issue of the University of Ottawa Journal of Medicine (UOJM), a publication dedicated to showcasing student research. This issue is of particular significance to our students and faculty as it represents a new beginning after a forty-year hiatus.

UOJM was originally founded in the 1960s and published quarterly until the 1970s, when interest in the journal began to fade. Medical research at our university has since continued to flourish, but exciting work by many of our students has often remained unpublished. It is with this background in mind that we were inspired to re-launch the journal.

The goal of the re-launched UOJM is to introduce students to the process of peer-review and academic publication from the perspectives of reviewer and author. Students on the editorial board worked alongside faculty reviewers to develop skills associated with the critical appraisal of medical literature, while students who submitted articles received constructive feedback and had the opportunity to further improve their work for publication in our journal.

This has been a very busy and exciting year for everyone involved with the journal. We are very impressed with the quality of the submissions from our fellow students, who responded enthusiastically throughout the review process. While we hope that students have found the process helpful and inspiring, we also thank them wholeheartedly for giving us the opportunity to learn from their work during our exchanges throughout the year.

With the publication of UOJM now successfully achieved, we would like to express our gratitude to all of our student editors and reviewers, and Dr. Melissa Forgie and Dr. Phil Wells, who devoted countless hours to this initiative and were tremendously supportive. We would also like to thank our wonderful sponsors for their generous funding, which has made this project possible.

We are extremely proud to showcase the fruits of everyone's hard work. We have great expectations for the future of UOJM and hope that you find inspiration in this 2011 inaugural issue of the University of Ottawa Journal of Medicine.

Crystal S.Y. Cheung and Alexandre B. Sebaldt

C'est avec enthousiasme que nous vous présentons le premier numéro du Journal Médical de l'Université d'Ottawa (JMUO), publication ayant pour objectif de faire connaître les projets de recherche des étudiants. Ce numéro est d'une importance particulière pour nos étudiants et notre faculté puisqu'il représente une renaissance après une absence de quarante ans.

Le JMUO, fondé dans les années soixante, fut publié trimestriellement jusque dans les années soixante-dix. La recherche médicale à notre université a continué de prospérer, mais du travail passionnant de nos étudiants demeure souvent non-publié. C'est suite à cette constatation que nous avons décidé de relancer ce journal.

Le but du nouveau JMUO est d'initier les étudiants au processus d'évaluation par les pairs et à celui de la publication académique selon les points de vue du critique et ceux de l'auteur. Les étudiants au comité d'évaluation ont travaillé de pair avec des médecins à la faculté afin de développer les compétences requises pour une évaluation critique de la littérature médicale. Les étudiants ayant soumis un article ont reçu des commentaires constructifs, ce qui leur a permis d'en améliorer la qualité afin d'être publié dans notre journal.

Ce fut une année bien occupée et excitante pour tous ceux qui ont participé à la préparation du journal. Nous sommes bien impressionnés par la qualité des articles soumis par nos confrères de classe, qui ont participé avec enthousiasme tout au long du processus de revue. Nous espérons que les étudiants ont trouvé cette expérience utile et inspirante et nous les remercions sincèrement de nous avoir permis cet apprentissage mutuel lors nos échanges cette année.

Nous aimerions exprimer notre gratitude à tous nos éditeurs et évaluateurs, et à Dr. Melissa Forgie et Dr. Phil Wells, qui ont consacré de très longues heures à cette initiative et qui nous ont fourni leur appui. Nous aimerions aussi remercier nos merveilleux commanditaires pour leur généreux financement, qui a permis à ce projet d'être réalisé.

Nous sommes extrêmement fiers des résultats qui découlent des efforts soutenus de chacun des membres de notre équipe. Nous avons de grandes attentes pour l'avenir du JMUO et nous espérons que vous porterez un intérêt particulier à ce numéro inaugural 2011 du Journal Médical de l'Université d'Ottawa.

Crystal S.Y. Cheung et Alexandre B. Sebaldt

Bienvenue au JMUO

Under the leadership of Crystal Cheung and Alexandre Sebaldt, a group of students at the University of Ottawa Medical School have created, through great personal effort and remarkable skill, a medical journal for and by the University of Ottawa Medical Students. On behalf of the Faculty of Medicine we would like to congratulate them upon the launch of the first edition University of Ottawa Medical Journal.

The University of Ottawa Faculty Of Medicine prides itself on being a research intensive organization. The pursuit of excellence in research requires training, exposure, inquiring minds and above all dedication to hard work. Success in research requires an intimate understanding of all phases of research, from the conception of the question, formulation of the plan, conducting the research, analysing and interpreting the results and then writing and publishing the paper. Many researchers do not have the necessary skills to write and communicate the study. Writing scientific documents is a skill that is not usually taught in medical school curriculums. Probably one of the best ways to learn this skill is to be involved in the editorial process. The students that have worked on the University of Ottawa Medical Journal have spent countless hours of time and intellectual investment to create this journal and to create a process that ensures the journal meets the highest standards for publication of scientific material. We, Drs. Phil Wells and Melissa Forgie, have had the privilege to be involved in this process in an advisory capacity, and we can attest to the effort and quality that these students have provided to this undertaking. Ours was an easy role and one which has given us further insight into the quality of Medical Students at the University of Ottawa.

It is our true hope that this effort will be a step towards understanding the requirements to produce excellence in research, encourage some to pursue careers in research, and most importantly, contribute towards producing well rounded, knowledgeable physicians of the future. We couldn't be more proud!

Dr. Melissa Forgie and Dr. Phil Wells

Dr. Melissa Forgie
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Sous la direction de Crystal Cheung et d'Alexandre Sebaldt, un groupe d'étudiants de l'école de médecine de l'Université d'Ottawa ont créé, grâce à d'énormes efforts et à une habileté remarquable, une revue médicale à l'intention des étudiants en médecine de l'Université d'Ottawa. Au nom de la Faculté de médecine, nous aimerions les féliciter à l'occasion du lancement du premier numéro du Journal Médical de l'Université d'Ottawa.

L'Université d'Ottawa est fière d'être un établissement axé sur la recherche. La quête de l'excellence en recherche exige une formation, une exposition, un esprit curieux et surtout un engagement à travailler fort. La réussite en recherche exige une très bonne compréhension de toutes les phases de la recherche, de la conception de la question à la rédaction et la publication d'un article, en passant par la formulation du plan, la réalisation de la recherche, l'analyse et l'interprétation des résultats. Plusieurs chercheurs n'ont pas les compétences nécessaires pour rédiger et communiquer les résultats de leur étude. La rédaction de documents scientifiques n'est pas habituellement enseignée dans le cadre de programmes d'études en médecine. La meilleure façon d'apprendre cette aptitude est probablement de participer à un processus de rédaction. Les étudiants qui ont travaillé au Journal Médical de l'Université d'Ottawa ont donné un nombre incalculable d'heures de leur temps et de leur énergie intellectuelle pour créer cette revue ainsi qu'un processus qui fait en sorte que la revue satisfasse aux normes les plus élevées en matière de publication de documents scientifiques. Nous, les Drs Phil Wells et Melissa Forgie, avons eu le privilège de participer au processus à titre consultatif et nous pouvons témoigner des efforts qu'ont déployés ces étudiants et de la qualité de leur travail dans ce projet. Le rôle facile que nous avons joué dans ce projet nous a permis de constater la qualité des étudiants en médecine à l'Université d'Ottawa.

Nous espérons sincèrement que ces efforts serviront à mieux comprendre les exigences pour parvenir à l'excellence en recherche, à encourager des étudiants à poursuivre une carrière dans ce domaine et, surtout, à aider à former des futurs médecins bien équilibrés et instruits. Nous sommes tellement fiers!

Dre Melissa Forgie et Dr Phil Wells

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An enhanced approach to smoking cessation Introducing the 6th 'A' to medical students and physicians

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INTRODUCTION

Cigarette smoking is responsible for more than five million deaths per year and is the leading cause of preventable death worldwide [1]. Smoking is a significant risk factor for several types of cancer, coronary artery disease, stroke, gastric ulcers, osteoporosis, and various other diseases [1,2]. Despite the numerous consequences, more than one in five Canadians over the age of 12 continues to smoke, and more than 47,000 Canadians are predicted to die each year due to tobacco use [3,4]. The statistics in the United States are no less alarming [5]. In an effort to reduce smoking, many American states and all Canadian provinces and territories have increased tobacco taxes and instituted smoking bans in all public places and workplaces [5,6]. While these sanctions have discouraged some Canadians and Americans from smoking, there is still room for improvement as approximately 20% of North Americans still smoke [7,8]. As medical students, the next generation of physicians, it is our duty to advance smoking cessation programs to help lessen the burden of this destructive epidemic.

As trainees, medical students often get the most 'face time' with patients and therefore stand in the vanguard of the fight against tobacco use. Although the dangers of smoking are taught in medical school, the topic of smoking cessation is not presented in a coherent manner. Unfortunately, even for such a common and serious problem, medical schools are not teaching their students a systematic approach to helping patients who smoke. A study found that while most medical students may be very knowledgeable about the consequences of smoking, they are less informed about the benefits of smoking cessation. Since approximately 25% of these medical students underestimated both their patients' desire to quit smoking and the benefits of doing so, the authors concluded that greater emphasis should be placed on smoking cessation during medical school [9]. It is of utmost importance for medical students to feel comfortable leading a patient through smoking cessation counseling since physicians, amidst hectic clinics, often rely on their students to conduct this time-consuming task. For a medical student without an organized approach, this counseling session can be an overwhelming task that may be avoided altogether. Fortunately, the Surgeon General introduced a model of behavioural change known as the "five A's" to provide health professionals with a simple aid for smoking cessation counseling [10].

The "five A's" is a mnemonic that reminds physicians to *ask* about tobacco use, *advise* patients to quit, *assess* their willingness to do so, *assist* in the process, and *arrange* appropriate follow up. Although the "five A's" model provides an excellent framework for guiding a discussion between a physician and their patient, there appears to be some recognizable limitations to this model's simple structure [11]. For instance, while this tool provides an organized approach to smoking cessation in every patient, it fails to take account of the wide inter-patient variation that exists in practice, and the role it must play in managing the cessation process. Furthermore, the "five A's" model provides little information regarding the risks associated with smoking and the benefits of quitting. The aim of this paper is to enhance the "five A's" tool by including disease-specific information into smoking cessation counseling. We believe that by providing medical students and physicians with research-based evidence on smoking cessation, patients will possess a greater appreciation for the benefits of smoking cessation, increasing the likelihood of successfully quitting.

ADDING THE 6TH 'A'

In the current smoking cessation tool, we have enhanced the "five A's" model by adding a 6th "A" entitled *actual facts*. This novel section will highlight pertinent facts surrounding five of the most prevalent diseases linked to smoking. Concepts of primary and secondary disease prevention and mortality benefits throughout different disease stages will be discussed in the hope of educating patients on the benefits of smoking cessation. As busy medical students and physicians, it may be difficult to search for statistical evidence on the benefits of smoking cessation, although an abundance of information is available. Furthermore, it can be challenging to recall all pertinent facts about smoking cessation during a brief patient encounter. This newly-enhanced smoking cessation tool provides the most up to date and relevant facts to medical students and physicians regarding the benefits of smoking cessation (Box 1).

The following section outlines the components of the 6th 'A'. It discusses five smoking-related conditions including lung cancer, cardiovascular disease, stroke, chronic obstructive pulmonary disease (COPD), and second-hand smoke. While this list does not include all possible pathological consequences of smoking, we feel that these five conditions are the most common and life-threatening.

THE 6TH 'A': ACTUAL FACTS

Lung Cancer

Across Canada, lung cancer is responsible for approximately 32% of all cancer deaths in men and 25% of those in women. Cigarette smoking is the most significant preventable cause of lung cancer, accounting for approximately 85% of all lung cancers in Canada [12]. Indeed, smokers have a 20-fold greater lifetime risk of developing lung cancer compared to non-smokers [13]. According to the Centers for Disease Control and Prevention (CDC), when compared to non-smokers, male and female smokers are 23 and 13 times more likely to develop lung cancer, respectively [14].

Even if a patient is diagnosed with lung cancer, it is still worthwhile to help patients quit smoking. In patients diagnosed with early stage non-small cell lung cancer, the 5-year survival rate post-diagnosis was 33% in patients who continued to smoke, compared to 70% in those who quit upon diagnosis. Similarly, in patients with limited stage small cell lung cancer, only 29% of continuing smokers survived for five years, compared to 63% of those who quit smoking upon diagnosis [15]. Unfortunately, during the course of their study, they found that amongst the 1295 smokers diagnosed with lung cancer, less than half of them quit after their diagnosis. With these significant mortality benefits, all newly-diagnosed patients should be educated on the benefits of smoking cessation as part of their overall management [15].

Although persuading a patient to quit smoking completely is ideal, patients should at the very least be encouraged to reduce the quantity of cigarettes they smoke per day. A study found that heavy smokers (defined as smoking >20 cigarettes/day) can reduce their risk of lung cancer by 25% if they cut down their smoking to less than 10 cigarettes per day [16]. For many patients, this reduction in cigarettes may be a more achievable short-term goal that still provides significant benefits.

Box 1. A practical guide to smoking cessation: the 6A's to help your patient quit

1. ASK...

Every patient if they smoke! Ask casually during conversation and be nonjudgmental.

2. ADVISE...

The patient to quit in a caring and supportive manner. Make a personalized statement to the patient that can help the patient be aware of the dangers of smoking.

3. ASSESS...

The patient's willingness to quit. Find out more about the patient's stage of change (e.g., Is this patient in the pre-contemplation, contemplation, preparation, action, maintenance, or relapse stage of change).

4. ACTUAL FACTS...

Regarding the benefits of smoking cessation must be conveyed to each patient in a personalized manner.

- Provide patients with the latest facts about how smoking cessation can improve their life, directing the conversation towards the patient's pertinent medical issues and voiced concerns.
- See Box 2.

5. ASSIST...

In the current quit attempt.

- Offer appropriate Nicotine Replacement Therapy (NRT) as well as other pharmacological and non-pharmacological treatment options.
- If the patient is reluctant to quit, inform them about the important benefits of smoking reduction, and assist the patient by using the **DAS** technique for smoking reduction.

√ **D**elay the urge to smoke for 3-5 minutes (helps to cut down the 'automatic' cigarettes).

√ **A**void triggers (i.e., coffee, alcohol, eating, and being around others who are smoking).

√ **S**ubstitute cigarettes with other activities (e.g., chew on coffee stir sticks or sugar free gum, use nicotine replacement products that are similar to cigarettes, and exercise!)

6. ARRANGE...

Appropriate follow up to assess progress and tackle perceived obstacles.

- For outpatients, quitting rates are highest in patients followed for 4 or more counseling sessions, approximately 10 minutes each, initially monthly and later every 6-12 months.

Coronary Artery Disease

The leading cause of death in Canada is heart disease. As outlined by the Framingham study, the main risk factors for developing heart disease include age, diabetes, smoking, hypertension, and dyslipidemia. As future physicians, it cannot be overemphasized that smoking should be taken as seriously as other risk factors for coronary artery disease. On average, smokers suffer from myocardial infarctions (MI) at a much earlier age than ex-smokers and non-smokers. Smoking cigarettes increases the risk of developing coronary artery disease by two to four times, which is nearly twice the risk associated with hypertension in terms of the 10-year mortality [17].

Smoking further complicates the treatment of coronary artery disease. One large retrospective cohort study examined the effect of perioperative smoking on mortality rates post-cardiac surgery. It was found that smokers had significantly higher rates of pulmonary complications, renal failure necessitating dialysis, infections, and intensive care unit stays than their non-smoking counterparts. Moreover, regardless of a patient's smoking history, the mortality rate of those who smoked perioperatively was more than seven times greater than patients who did not smoke perioperatively [18]. The results of this study suggest that the benefits of smoking cessation may be experienced quite rapidly.

Within one year of quitting, the risk of having an MI drops by approximately 50%. After quitting for 15 years, the risk of having a heart attack is the same as a lifetime non-smoker [19]. Even after having an MI, reducing cigarette consumption can lead to significant mortality benefits. A study examined the benefits of smoking reduction in patients who have sustained an MI. The results indicated that for every five cigarette reduction per day, the 13-year mortality risk decreased by 11%. The benefits of smoking cessation, both before and after an MI, may be as significant as optimizing pharmacological therapy [20].

Stroke

Stroke is the third leading cause of death in Canada after all cancers and heart disease. Six percent of all deaths in Canada are due to stroke [21]. Smoking increases the risk of having a stroke by two to four times, making it one of the largest risk factors for stroke [22]. There is also a dose-response relationship between smoking and stroke risk, as heavier smokers have a greater risk for stroke compared to lighter smokers. Those who smoke more than 40 cigarettes per day have twice the risk compared to those who smoke less than 10 cigarettes per day [23]. As such, there is a considerable benefit to smoking cessation, or simply reduction, on stroke risk.

Smoking cessation results in an immediate decrease in stroke risk. Several studies reported that ex-smokers having quit smoking for more than five years are at no increased risk of developing a stroke compared to non-smokers. The abolishment of the added risk upon smoking cessation does not depend on the number of pack years smoked. Thus, both heavy and light smokers who quit will eventually have a similar stroke risk to a non-smoker [24].

Counseling after a stroke has been shown to be beneficial for smoking cessation success. A study observed that 43% of counseled patients had quit smoking three months after their stroke compared to 28% of patients not counseled [25]. The average daily consumption of cigarettes in those who continued to smoke had decreased significantly: 28% of the smokers at baseline smoked more than 20 cigarettes per day, while the proportion decreased to 10% three months after the stroke [25].

Another study followed patients for 6 months post-stroke and found that only 21% of smokers quit after having a stroke [26]. These results were confirmed by Gall et al., who found that the majority of smokers continued to smoke five years post-stroke. Unfortunately, very few of these smokers recalled having received any smoking cessation advice [27]. A large study is currently underway examining the various methods of post-stroke prevention, including smoking cessation programs [28].

Chronic Obstructive Pulmonary Disease (COPD)

Smoking is the most important cause for the development of COPD. Smoking cessation is the only intervention that has been proven to both reduce symptoms and inhibit the progression of COPD [29]. According to the Global Initiative for Chronic Obstructive Lung Disease (GOLD) guidelines, approximately 50% of smokers will develop COPD [30]. In general, smokers are 12 to 13 times more likely to die due to COPD [31]. Although there is no treatment for COPD, the decline in lung function can be slowed by smoking cessation. A study revealed that smokers with COPD who quit smoking had half the annual decline in their forced expiratory volume (FEV1) compared to those who continued to smoke. The rate of lung function decline in ex-smokers was similar to that in healthy non-smokers [32].

Furthermore, a study following patients with severe, early-onset COPD found that for every 10 pack-year history of smoking, the mortality risk increased by 20%. However, regardless of the pack year history of smoking, patients who quit smoking enjoyed a three-fold reduction in mortality risk compared to similar patients who continued to smoke. In other words, both lifetime smoking intensity and current smoking status independently increased mortality in patients with severe COPD. This indicates that quitting is beneficial at anytime [33].

Second-Hand Smoking

Smoking does not only affect the smoker, but it also has detrimental effects on people in proximity to the smoker. In fact, more than 47,000 Canadians die prematurely each year due to tobacco use, and almost 8,000 non-smokers die each year from exposure to second-hand smoke [34]. Numerous studies have shown that second-hand smoke affects health.

For example, non-smokers who have frequent exposure to second-hand smoke have a 20 to 30% increased risk of lung cancer and heart disease [35]. In addition, a study showed that increased exposure as a child led to an increased risk of lung cancer as an adult [36]. Another study revealed that 30 minutes of exposure to second-hand smoke in young, healthy individuals altered the vascular endothelium in non-smokers. This caused their endothelial response to be indistinguishable from that of smokers [37]. In general, studies conclude that the health risk of passive smoking is as high as 33% of the risk of active smoking. If current rates of tobacco use continue, approximately 1 million Canadians will die over the next 20 years as a direct result of smoking and second-hand smoke [38].

CONCLUSION

It is the duty of medical students and physicians to diagnose, treat, and prevent disease. Although the diagnosis and treatment of disease receives more attention in the classroom, the media, and in practice, it is crucial to place equal merit on disease prevention. The power of a physician's recommendation can pose tremendous benefit. In regards to smoking cessation, even the simplest suggestion can be highly efficacious. That is to say, telling a patient to quit smoking nearly doubles their chances of doing so [39]. Although our paper aims to provide an enhanced method for counseling patients on smoking cessation, we recognize that time constraints may not always make our novel model applicable. Furthermore, our model will need frequent updates as new research is published regarding the benefits of smoking cessation. As such, the responsibility will be placed upon medical students and physicians to incorporate new relevant information into the model. In other words, our proposed model may be viewed as a foundation to be built upon as new research evolves. Ultimately, the value

Box 2. Actual facts about the benefits of smoking cessation

LUNG CANCER

- Smoking, the chief preventable cause of lung cancer, accounts for 85% of all lung cancers.
- Lung cancer is responsible for 32% of all cancer deaths in men and 25% in women.
- Smokers have a 20-fold greater lifetime risk for developing lung cancer than non-smokers.
- Those who smoke >20 cigarettes per day can reduce their risk of lung cancer by 25% if they cut down their smoking to <10 cigarettes per day.
- In smokers diagnosed with early stage NSC lung cancer, the 5-year survival rate post-diagnosis was 33% in patients who continued to smoke, compared to 70% in those who quit upon diagnosis. Similar numbers were seen in limited stage SC lung cancer (29% vs. 63%).

CORONARY HEART DISEASE

- Smoking increases the risk of developing coronary artery disease by 2-4x.
- Smokers present with MI at an earlier age than ex-smokers and non-smokers.
- After quitting for 15 years, the risk of having an MI is the same as a lifetime non-smoker.
- In elderly patients undergoing cardiac surgery, the perioperative mortality rate of smokers is 7 times greater than that of a non-smoker.
- For every 5 cigarette reduction per day, the 13-year mortality risk decreases by 11%.
- Smoking should be treated as aggressively as the other major risk factors for CV disease.

STROKE

- Smoking increases the risk of having a stroke by 2-4x.
- Those who smoke >40 cigarettes per day have twice the risk of stroke compared to those who smoke <10 cigarettes per day. Any reduction in smoking shows exponential benefit.
- After 5 years of smoking cessation, the added stroke risk of having smoked becomes negligible.
- In post-stroke patients, only 28% of smokers will quit smoking without counseling, compared to approximately 43% of smokers who will quit with any type of smoking cessation counseling.

COPD

- Quitting smoking is the only intervention that has been proven to reduce symptoms and inhibit progression of COPD.
- 50% of smokers will develop COPD in their lifetime and the risk increases with age.
- Smokers have a 12-13x increased risk of dying due to COPD.
- Smokers who quit display an annual decline in their FEV1 at half the rate of those who continue smoking, and their rate of lung function decline is comparable to a healthy non-smoker.
- In patients with severe, early onset COPD, those who quit smoking at any time enjoy a three-fold reduction in mortality risk compared to a similar patient who continues to smoke.

SECOND-HAND SMOKING

- Approximately 8,000 non-smokers die each year from exposure to second-hand smoke.
- Non-smokers exposed to frequent second-hand smoke have a 20–30% increased risk for lung cancer and heart disease.
- Within 30 minutes of exposure to second-hand smoke, non-smokers' vascular endothelial response becomes indistinguishable from that of active smokers.
- The health risk of passive smoking is as high as one-third the risk of active smoking.

of our model will depend on its acceptance and utilization by health care professionals.

In summary, physicians and medical students may benefit from a guide that can both summarize and simplify the pertinent evidence surrounding smoking cessation. At the very least, we hope this paper has reiterated the significance of smoking as a colossal risk factor for many diseases and our role as medical students and physicians in health advocacy and disease prevention. It remains to be seen whether adding this new tool will have a significant impact on medical students' ability to influence smoking cessation. Our next step is to create a reference guide to smoking cessation that can be used at the bedside, ultimately raising awareness and decreasing the burden of this deadly epidemic.

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Take the stairs! A step-wise approach to involving medical students in the management and prevention of the obesity epidemic

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ABSTRACT

Obesity is second only to cigarette smoking as the leading preventable cause of illness and death. While performing research in the Weight Management Clinic at The Ottawa Hospital, we participated in recurring discussions about the multidisciplinary nature of obesity management and the complexity of the disease itself. We believe that medical students should play a larger role in the management of obesity, and we propose a step-wise model to achieve this goal. The step-wise model includes: 1) assessing medical student attitudes about obesity, 2) attending didactic lectures about obesity, 3) engaging in active learning opportunities about obesity, 4) encouraging physician shadowing, and 5) allowing students to take clinical action in the clerkship years.

L'obésité occupe la deuxième place après le tabagisme en tant que cause la plus évitable de maladies et de décès. En travaillant à la Clinique de gestion du poids de l'Hôpital d'Ottawa, nous avons participé à des discussions récurrentes au sujet de la gestion multidisciplinaire du poids et de la complexité de la maladie même. Nous croyons que les étudiants en médecine devraient jouer un plus grand rôle dans la gestion de l'obésité, et nous proposons un modèle progressif composé d'étapes afin d'atteindre ce but. Ce modèle structuré comprend: 1) l'évaluation des attitudes que portent les étudiants en médecine envers l'obésité, 2) la participation a des cours didactiques concernant l'obésité, 3) l'engagement a des opportunités d'apprentissage actives au sujet de l'obésité, 4) l'encouragement de stage d'observation auprès de médecins, et 5) la chance aux étudiants de prendre des actions cliniques durant les années de l'externat.

INTRODUCTION

The world has been plagued with the obesity epidemic for years, with the associated health care costs exceeding $100 billion annually [1]. Particularly significant obesity-associated medical conditions include type II diabetes, atherosclerosis, and obstructive sleep apnea [2]. Obesity is second only to cigarette smoking as the leading preventable cause of illness and death [1]. Despite the prevalence of obesity, a 66% increase in obesity-related discrimination has been reported in the United States over the last decade [3]. In one study, medical students reported that patients who were morbidly obese were the most common target of derogatory humor among staff physicians, residents, and students [4]. This would suggest that medical students are well aware of their involvement in the stigmatization of obese patients, and instead should be more involved in patient education and care. The University of Ottawa Undergraduate Medical School curriculum has devoted one week to obesity in an attempt to address the lack of education in the field of obesity and to promote sensitivity towards this subject.

While performing research in the Weight Management Clinic at The Ottawa Hospital, we participated in recurring discussions about educating medical students and trying to change their attitudes to pave the way for better care of obese patients. We developed a step-wise approach to engage new medical students in the management of obesity.

Step 1: Assessing medical student attitudes towards obesity

Given that students applying to medical school are assessed for their sensitivity and demonstration of empathy and compassion, their attitudes about the obesity epidemic can be assessed as well. Bias, prejudice and negative attitudes of health professionals towards obesity remain a major barrier in the care of obese individuals. As a result, overweight people may be reluctant to seek health care due to fear of scolding or humiliation [5]. A sympathetic attitude toward all patients, including the obese, should be assessed among candidates seeking admission to medical school. In addition, student openness to changing, or adjustment of their attitudes in view of the evidence-based research and their clinical experiences, could also be reviewed through personal reflection exercises over the four years of medical school.

Step 2: Attending didactic lectures about obesity

Given the multi-factorial nature of obesity, many of

the topics discussed in the early years of medical school relate to obesity, while also discussing the various public health issues at play. Attending lectures about the clinical correlates, co-morbidities, and management of obesity is therefore central to this step. The literature suggests that there is a clear need for more obesity education among health care professionals. For example, among internal medicine residents in two university-based residency training programs, researchers discovered a good knowledge of obesity risks, but poor skills, attitude and knowledge about obesity itself [6]. This idea has been integrated into the University of Ottawa's new obesity week curriculum, which began in December 2009 and has proven quite successful for students and faculty.

Step 3: Engaging in active learning about obesity

While didactic lectures are likely to be effective for conveying new information to medical students, having students take action with the educational tools gained in their obesity lectures might prove even more effective. For example, during the Obesity Week at the University of Ottawa's Faculty of Medicine, students are asked to expand on what they have learned through the development of a public health campaign aimed at changing societal views about obesity. The active process of researching, brainstorming, and setting a plan in motion could be helpful in consolidating new knowledge.

Step 4: Encouraging physician shadowing

After learning about obesity, the next logical step is for students to observe real-life clinical encounters about obesity. Our recommendation is that students seek opportunities to observe practicing health professionals such as family physicians, internists, and surgeons in their weight discussions with patients. While the goal is not to follow the physicians' exact approaches, students are encouraged to develop their own unique way of discussing their patients' weight, previous weight loss attempts, and weight management recommendations. They will learn to feel comfortable and demonstrate professionalism and sensitivity in these patient interactions.

Step 5: Taking clinical action

It is understandable that practicing physicians are extremely busy, so when students are asked to see patients, they often spend more time with them than the physicians themselves. This leads to step 5 – medical students taking clinical action. There are many benefits for having clerkship medical students discuss weight matters with patients. First of all, the patient may feel less scorned by a student than a fully-licensed, practicing MD. Overweight patients may be afraid to seek help due to the possibility of scolding by physicians [5]. Secondly, the medical student is asked to perform a thorough medical history at the University of Ottawa as part of their training, and as such, there may be a greater opportunity for rapport building and honesty on the part of the patient. Thirdly, the medical student will feel more involved in patient care, and finally, the student may be more likely to have such discussions with their own patients in the future.

CONCLUSION

Obesity remains a prevalent disease that requires a change in both personal and societal views to manage it more effectively. While medical students may play a role in the stigmatization of obesity, we believe that they can be part of the solution. We suggest that medical students become involved more extensively in the management of obesity by integrating this step-wise approach to patient care: 1) assessing the medical student's own attitudes towards obesity, 2) attending didactic lectures about obesity, 3) engaging in active learning, 4) physician shadowing, and 5) taking clinical action in the clerkship years. The goal for improved integration of medical students in the management of obesity may help patients to better understand and address their weight. The management of obesity undeniably requires a multi-disciplinary team, and the medical student could play a more active role.

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Road traffic noise in the national capital region: Noise-induced annoyance and changes in salivary stress biomarkers

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ABSTRACT

A number of studies have described an association between long-term exposure to community noise and an elevated risk of stress-related illnesses, including cardiovascular disease. Annoyance with community noise is thought to be an important source of stress. This pilot project examined the relationship between annoyance with sources of community noise (road traffic, aircraft, and construction) and salivary stress biomarkers (alpha-amylase and cortisol). Participants included 29 residents (13 males, 16 females; aged 21-80) living in high (>65 dBA) and low (<50 dBA) traffic noise areas of the national capital region. A face-to-face interview assessed participants' levels of annoyance. Biomarkers were extracted from saliva samples and measured using enzyme immunoassays. Residents from the high traffic noise area showed increased levels of alpha-amylase ($p = 0.03$). There was no detectable association between biomarker concentrations and annoyance with road traffic, aircraft, or construction noise. This suggests that annoyance is not an intermediary between community noise and indicators of stress.

Plusieurs études ont démontré une association entre l'exposition à long terme de la pollution sonore communautaire et le risqué accru de maladies reliées au stress, incluant les maladies cardiovasculaires. Le dérangement que cause les bruits communautaires est considéré comme une source importante de stress. Ce projet pilote examine la relation entre le dérangement que cause les sources de bruits communautaire (le trafic routier, les avions ainsi que la construction) et certains biomarqueurs de stress salivaires (alpha-amylase et cortisol). Les participants comprenaient 29 résidents (13 males, 16 femelles; âgés de 21-80 ans) vivant dans des aires de la région de la capitale nationale de haut (>65 dBA) et de bas (<50 dBA) niveaux de bruits routiers. Une entrevue en personne a permis d'évaluer le degré de dérangement que présentaient les participants. Les biomarqueurs ont été extrait des échantillons de salive et mesurés en utilisant des immunoessaies enzymatiques. Les résidents des aires de trafic routier élevé ont démontré des niveaux élevés d'alpha-amylase ($p=0.03$). Il n'y avait pas d'association détectable entre les concentrations de biomarqueurs salivaires et le niveau de dérangement relié aux bruits du trafic routier, des avions ou de la construction. Ceci suggère que le dérangement ne représente pas un intermédiaire entre les bruits communautaires et les indicateurs de stress.

INTRODUCTION

The World Health Organization (WHO) defines community noise as unwanted sound emitted from all sources except noise at the industrial workplace. This includes sound from ground transportation, air traffic, construction work, people, animals, and neighbourhood or city activities [1]. Road traffic is one of the most predominant sources of community noise in the living environment, and annoyance is a central effect of its exposure [2]. Health Canada and the WHO consider noise-induced annoyance by itself to be a significant adverse health effect [3,4], and a number of European studies have suggested an association between long-term exposure to road traffic noise and an elevated relative risk of stress-related illnesses, including cardiovascular disease. For example, one case-control study of 4,000 German cardiac patients observed an increased relative risk of myocardial infarction for those patients living in high traffic noise areas [2]. A team of Swedish researchers surveyed 667 residents of Stockholm and estimated their exposure to traffic noise using noise-dispersion models and onsite noise assessments. In this study, residents living in higher traffic noise areas were significantly more likely to report a diagnosis of hypertension [6].

These observations are thought to result from noise acting as a stressor by disturbing sleep at night or by causing annoyance during the day [2,7,8]. Michaud, Keith, and McMurchy reported on two cross-Canada telephone surveys commissioned by Health Canada [9]. The first survey probed the extent to which Canadians were annoyed by environmental noise in general. They asked participants the following questions: "Over the past 12 months or so, when you are at home, how much are you bothered, disturbed, or annoyed by noise from outside your home?" (p. 41) and "What type of noise from outside your home bothers, disturbs, or annoys you the most?" (p. 41). Approximately 8% of the 2,565 respondents indicated that they were "very" or "extremely" annoyed by environmental noise, most commonly attributed to road traffic. The second follow-up telephone survey asked 2,667 Canadians about their annoyance specifically towards traffic noise, and found that 7% of respondents were "very" or "extremely" annoyed. Based on these findings, Michaud

et al. estimated that nearly 2.1 million (± 400,000) Canadians 15 years of age or older are highly annoyed by community noise in general, and about 1.8 million (± 350,000) Canadians are highly annoyed by traffic noise in particular.

According to the noise-stress hypothesis, noise-induced annoyance is a form of psychological stress that can increase neuroendocrine activity in the hypothalamic pituitary adrenal (HPA) axis and the sympathetic nervous system, causing increases in blood pressure and cardiac output. Chronic annoyance results in chronic activation of these neuroendocrine systems, that over time, can result in permanent vascular changes that may increase one's risk of developing heart disease or hypertension [2,7,8]. Research investigating other forms of psychological stress lends support to this hypothesis. For example, when participants are asked to record a five-minute speech and then complete a series of difficult math problems, heart rate increases and they express elevated levels of salivary biomarkers that indicate neuroendocrine activation [10,11]. Activation of the same systems has been observed in individuals anticipating a competition or an evaluation of their performance [12,13].

Animal research, however, demonstrates that chronic exposure to noise may not necessarily result in an attenuated stress response. Samson, Sheeladevi, Ravindran, and Senthilvelan [14] exposed groups of Wistar rats to four-hour bursts of 100 dB continuous white noise everyday for 1 day, 15 days, and 30 days. These researchers detected elevated levels of plasma corticosterone and brain norepinephrine (NE) in all three groups, which suggests that the rats failed to habituate even after 30 days of continuous exposure. Changes in glucocorticoids such as corticosterone represent the activity of the HPA axis, whereas changes in NE indicate sympathetic nervous system responses.

In humans, endogenous HPA axis activity can be inferred from levels of the glucocorticoid cortisol, which can be non-invasively extracted from saliva. Like those of many other mammalian hormones, cortisol levels follow a normal cyclic variation, reaching their highest point shortly after awakening. Concentrations then decline gradually over the course of the day, showing transient pulsatile activity throughout the waking hours. These transient deviations can indicate a stress response, which in the face of a potential threat, is normal and generally adaptive. However, sustained deviations from the normal circadian rhythm can indicate pathology. For example, abnormally high morning cortisol levels can suggest hyperactivity in the HPA axis and have been associated with chronic stress and depressive symptoms [15,16]. Blunted morning levels have also been observed in individuals exposed to low frequency noise at night time [17].

Direct measures of sympathetic nervous system activity in humans typically involve extracting NE from samples of blood plasma or urine, and less-invasive alternatives often require sophisticated psychophysiological equipment [12]. These methods are unsuitable for field research and risk inducing a confounding stress response. However, recent studies have shown that salivary alpha-amylase is sensitive to psychological stress and is highly correlated with sympathetic nervous system activity [10,11,18]. It may also be significantly related to NE levels, but this point has recently become a matter of some debate [18]. Regardless, when taken together, salivary cortisol and alpha-amylase profiles provide a comprehensive assessment of the stress response system using a single, non-invasive technique that does not induce confounding stress [19].

To date, no studies have assessed the effect of long-term exposure to traffic noise on both salivary cortisol and alpha-amylase, and research has not yet characterized the relationship between these biomarkers and noise-induced annoyance. This information is invaluable to researchers exploring the putative link between noise and serious stress-related illnesses. Cardiovascular disease, for example, is responsible for more than one-third of deaths worldwide, and many forms of cardiovascular disease can be prevented by identifying and managing the risk factors [20]. Research has suggested that noise may be a risk factor. Understanding the mechanism through which noise promotes cardiovascular disease may be an essential step in attenuating its harmful effects.

This pilot project examined the relationship between noise-induced annoyance and salivary stress biomarkers in residents living in high and low traffic noise areas of the National Capital Region (NCR). It was hypothesized that residents living in high traffic noise areas would score higher than residents in low traffic noise areas on measures of stress and annoyance.

METHODS

Participants

Participants included 29 adult residents (13 males, 16 females) aged 21-80 (M = 41.3, SD = 14.98) years, recruited from the NCR. Suitable neighbourhoods were identified using online maps that showed residences in relation to identifiable sources of community noise (primarily road traffic). Traffic volume statistics for these neighbourhoods were used to approximate noise exposure. Participants were then contacted either by telephone or during an unannounced visit at their residence. Telephone numbers were obtained using the online reverse telephone directory at http://www.canada411.com. Recruitment took place during weekday evenings or daytime weekends from November 2006 to February 2007. The overall response rate was approximately 5.7%, or 4.0% and 7.3% for telephone and door-to-door recruitment, respectively.

Participants were categorized into two groups based on their estimated exposure to traffic noise. Participants in the low traffic noise condition were recruited from residential areas where the posted speed limit was 40 km/h and the estimated noise exposure was 50 dBA or less. Participants in the high traffic noise condition lived along a heavily travelled four-lane road where the posted speed limit ranged 60 to 70 km/h and the estimated noise exposure was 65 dBA or more. Data from 6 males and 4 females were excluded from the study because they failed to provide a complete set of

saliva samples. The final participant pool included 19 NCR residents, including 11 and 8 in the low and high traffic noise groups, respectively. All participants provided written consent at the time of the interview and received a $30 honorarium for their full participation in the study. This study was approved by the Social Sciences and Humanities Research Ethics Board at the University of Ottawa (File Number: 10-06-09).

Measures

Survey design. This study used a 44-item socio-acoustic survey designed specifically for this research. The survey is based primarily on validated questions from the National Survey of Attitudes to Environmental Noise [21], a socio-acoustic survey designed by the National Aeronautics and Space Administration [22], and surveillance research by Michaud et al. [9]. It focused on attitudes towards noise from road traffic, aircraft, and construction work, featuring questions about: 1) the extent to which a respondent finds noise annoying, 2) the frequency of noise interference with household behaviours and sleep, 3) the extent to which a respondent feels noise annoyance has an adverse impact on his or her health, 4) a respondent's personal noise sensitivity and tolerance, 5) the coping strategies that a respondent uses for dealing with noise, and 6) the importance of intrusive noise relative to other environmental and community issues. The survey was designed to be completed electronically with the assistance of an interviewer.

Questions that asked participants to evaluate their annoyance towards a specific source of noise were cast in two different standardized formats given by the International Organization for Standardization Technical Specification (ISO/TS) for noise annoyance assessment. According to ISO/TS-15666 [23], one format was written with a five-point adjectival response category (Not at all, Slightly, Moderately, Very, or Extremely annoyed), while the other recorded answers on an 11-point numerical scale (where "0" was equivalent to Not at all annoyed and "10" was equivalent to extremely annoyed). The ISO/TS-15666 deems the two formats necessary because the options given under an adjectival category do not necessarily hold the same meaning for all individuals. With this standardization, one response category can be validated by the other, and relevant comparisons can be made with the results of other survey studies. For the purposes of this pilot study, the data analysis considered only those questions pertaining to traffic noise interference with sleep and annoyance with noise from traffic, aircraft, and construction work.

Procedure

Interview. The survey was administered at the respondent's residence or workplace at a prearranged date and time. A field researcher read the survey questions to the participant from a laptop computer and recorded the participant's responses electronically. The participant was instructed to follow along on the laptop computer to ensure the clarity of the question asked and the accuracy of the information recorded. Each interview took approximately 30 minutes to complete. Interviews were conducted in English only, during weekday evenings or daytime weekends from November 2006 to February 2007.

Saliva sampling. After completing the interview, a field researcher instructed the participant on how the saliva samples should be collected and stored. These instructions were provided verbally and in writing. Participants provided the first sample immediately following the interview to ensure that they understood the collection and storage procedures. Each saliva sample was collected using a commercially available Salivette® (Sarstedt, Montreal, QC, Canada). Each participant was instructed to chew on the sterile cotton swab included in the Salivette for approximately 2 minutes. The swab was then to be placed in the sample holder and stored in the participant's freezer until pick up 24 to 48 hours later. Participants were asked to avoid eating food 30 minutes before providing a sample, to rinse their mouths with water 10 minutes before providing a sample, and to refrain from drinking alcoholic beverages for the duration of their participation in the study.

Salivary cortisol and alpha-amylase follow a normal circadian variation that includes rapid changes shortly after awakening and more gradual changes over the course of a day. For this reason, each participant was asked to provide six additional samples so that a complete circadian profile could be obtained. Participants collected these samples by themselves at three different times over two consecutive days. The first sample was to be provided immediately upon awakening; the second, 30 minutes following awakening; and the third, just before going to bed. After completing all seven samples, participants were instructed to telephone the lead investigator for pick up. Within two days of receiving the call, the investigator picked up the samples and transported them in a cooler to the lab. Once at the lab, the samples were stored at -80ºC until processing. During processing, samples were thawed and then centrifuged at 1500 g for 3 minutes. The supernatant liquid was then fractioned into separate vials and stored at -80ºC according to the assay manufacturer's specifications for long-term storage of a saliva specimens [24, 25]. The assays were performed approximately 2 weeks later.

Immunoassay. Cortisol and alpha-amylase were extracted from the saliva and measured using commercially available enzyme immunoassay kits (Salimetrics, State College, PA, United States). Stored samples were thawed, gently vortexed, and re-centrifuged at 3000 g for 15 minutes prior to being added to the assay according to the manufacturer's specifications for salivary cortisol [24] and salivary alpha-amylase [25]. The final concentrations of the two biomarkers were recorded in micrograms of cortisol per decilitre of saliva and enzyme units of alpha-amylase per millilitre of saliva.

Statistical analysis. Mean levels of cortisol and alpha-amylase were analyzed in separate three-way mixed analyses of variance (Group x Sampling Day x Sampling Time). Participants were divided into independent groups by sex (Male vs. Female), traffic noise exposure (High vs. Low),

and the frequency to which traffic noise interfered with sleep (Never vs. Seldom vs. Sometimes vs. Often vs. Always). Participants were also divided by level of annoyance with noise from road traffic, aircraft, and construction work.

RESULTS

Participants indicated their level of annoyance on a five-point adjectival scale and on an 11-point numerical scale. A preliminary screening of the data failed to detect any significant differences between responses on the two scales. For this reason, the 11-point scale was removed from the analysis, and participants were divided into independent groups according to their responses on the five-point adjectival scale (Not At All, Slightly, Somewhat, Very, and Extremely). When no participants reported a particular level of annoyance, that annoyance group was removed from the analysis. Specifically, the "Extremely" annoyed group was removed from the traffic noise analyses, and the "Moderately", "Very", and "Extremely" annoyed groups were removed from the aircraft noise analyses. Furthermore, the "Always" group was removed from the sleep disturbance analyses. The final annoyance groups are displayed in Table 1, and the final sleep disturbance groups (and the number of participants in each) included the "Never" (7), "Seldom" (3), "Sometimes" (6), and "Often" (2) interfered groups.

Biomarker concentrations over time. A total of 12 mixed ANOVAs were conducted, including six that used cortisol levels as the dependent variable and six that used alpha-amylase levels as the dependent variable. In each mixed ANOVA, cortisol and alpha-amylase levels did not change significantly over the two sampling days (in all cases, $p > 0.25$; data not shown). However, a main effect of Sampling Time was usually observed. In most cases, post hoc analyses detected a significant decrease in cortisol and a significant increase in alpha-amylase at bedtime after the 30-min sample (Table 2).

Table 1. Number (and percentage) of participants (N = 19) indicating levels of annoyance with sources of community noise on an adjectival scale.

Source	Not at all	Slightly	Moderately	Very	Extremely
Road traffic noise	3 (16)	10 (53)	5 (26)	1 (5)	-
Construction noise	5 (26)	3 (16)	8 (42)	1 (5)	2 (11)
Aircraft noise	15 (79)	4 (21)	-	-	-

Note: A dash indicates a zero value. These categories were deleted from any statistical analysis.

Biomarker concentrations and sex. No sex differences were detected in concentrations of cortisol (M = 0.26, SE = 0.05 µg/dl in males compared to M = 0.34, SE = 0.06 µg/dl in females) or alpha-amylase (M = 48.20, SE = 15.40 U/ml in males compared to M = 43.15, SE = 8.79 U/ml in females). No significant interactions of sex were observed.

Biomarker concentrations and traffic noise exposure. Traffic noise exposure had a significant effect on levels of alpha-amylase, $F(1, 16) = 5.97$, $p = 0.03$, but no effect on levels of cortisol. Alpha-amylase levels in the high traffic noise group (M = 60.51, SE = 12.52 U/ml) were significantly higher than those in the low traffic noise group (M = 33.42, SE = 9.47 U/ml). No significant interactions of traffic noise exposure were observed.

Biomarker concentrations and sleep disturbance. The frequency that road traffic noise interfered with sleep had no effect on cortisol or alpha-amylase levels. No signifi-

Table 2. Mean concentrations and standard errors of salivary cortisol and alpha-amylase at each sampling time for each set of independent groups.

Groups	Awake		30 min.		Bed		F[a]
	Mean	Standard Error	Mean	Standard Error	Mean	Standard Error	
Cortisol (µg/dl)							
Sex	0.37	0.06	0.45_z	0.06	0.07	0.03	38.89**
Noise exposure	0.38	0.06	0.47_z	0.08	0.08	0.03	41.10**
Traffic	0.39	0.07	0.65_z	0.10	0.09	0.04	27.44**
Aircraft	0.42	0.09	0.49_z	0.09	0.10	0.06	28.48**
Construction	0.41	0.12	0.58_z	0.15	0.10	0.06	48.73**
Alpha-amylase (U/ml)							
Sex	50.46	16.26	32.68	7.12	53.89	12.90	3.53*
Noise exposure	54.34	14.48	32.65	6.77	55.40	11.73	4.68*
Traffic	59.13	21.37	35.33	7.57	53.12	17.81	2.39
Aircraft	49.46	16.41	33.13_z	8.40	61.42	13.60	5.10*
Construction	44.40	18.83	28.03	10.16	47.17	14.00	1.86

Note: Means marked with a subscript ("z") are significantly different from means in the same row under the Bed column (Tukey HSD, $p<0.05$); [a]$df_{error} = 34$ for each analysis, except for Traffic ($df = 30$) and Construction ($df = 28$); *$p < 0.05$. **$p<0.0001$

cant interactions involving sleep disturbance were observed.

Biomarker concentrations and noise-induced annoyance. Levels of annoyance with traffic noise had a significant effect on cortisol concentrations, but this effect depended on the sampling day and the sampling time, $F(6, 30) = 4.85$, $p = 0.001$ (Figure 1a). Unfortunately, the small number of participants in the higher annoyance categories prevented a meaningful analysis of the simple main effects. The level of annoyance with construction noise also had a significant effect on cortisol concentrations that depended on the sampling day, $F(8, 28) = 2.39$, $p = 0.04$ (Figure 2a). Once again, an analysis of the simple main effects was inconclusive. Cortisol was unaffected by annoyance with noise from aircraft (Figure 3a), and alpha-amylase was unaffected by annoyance with any of the three sources of noise (Figures 1b, 2b, and 3b).

DISCUSSION

The results of this pilot project provide very little support for the hypothesized link between noise-induced annoyance and human stress biomarkers. On average, participants who reported high levels of annoyance with noise from road traffic, aircraft, or construction work produced levels of salivary stress biomarkers that were similar to those produced by participants who reported being annoyed much less. In addition, residents living in a high traffic noise area of the NCR generally did not show higher levels of salivary cortisol than did residents living in several low traffic noise areas of the same region. High traffic noise residents did, however, show increased levels of salivary alpha-amylase. These results could suggest that community noise exposure is only capable of producing a mild or incomplete stress response, characterized by some sympathetic nervous system arousal. These results could also suggest that annoyance is not an intermediary between noise and indicators of physiological stress.

It should be noted that in this study, most participants indicated that they were "Not at all" or only "Slightly" annoyed with noise from road traffic, aircraft, or construction work, and that road traffic noise "Never" or only "Seldom" interfered with their sleep. This result is not necessarily surprising. It is possible that many of the participants in the high traffic noise group, despite living in close proximity to a heavily travelled major road, were shielded from the noise by certain aspects of their residence or behaviour. Closed windows, for example, can significantly attenuate outdoor sound levels [8], and during the interview, some of the residents living in the high-noise regions noted parenthetically that they kept their windows closed all the time because of the constant road traffic noise. It is also notable that the interviewing and salivary sampling in this project took place exclusively during the winter, a season when people are much more likely

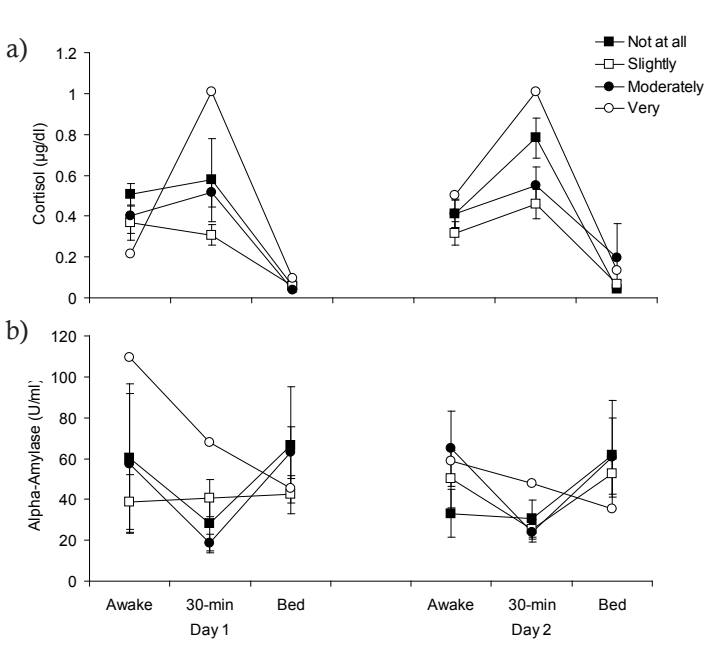

Figure 1. Level of annoyance with traffic noise had a significant effect on cortisol but not alpha-amylase. (a) A significant three-way interaction (Annoyance x Sampling Time x Sampling Day) for cortisol was observed ($p = 0.001$), but an analysis of the simple main effects was inconclusive. (b) Alpha-amylase concentrations were not significantly affected by participants' annoyance with traffic noise. Error bars represent standard errors of the mean.

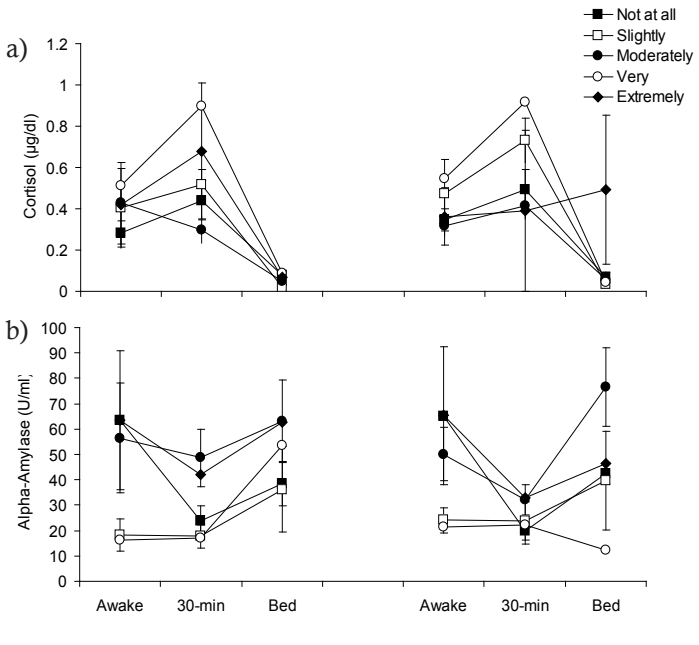

Figure 2. Level of annoyance with construction noise had a significant effect on cortisol but not alpha-amylase. (a) A significant two-way interaction (Annoyance x Sampling Day) for cortisol concentrations was observed ($p = 0.04$), but an analysis of the simple main effects was inconclusive. (b) Alpha-amylase concentrations were not significantly affected by participants' annoyance with construction noise. Error bars represent standard errors of the mean.

to be indoors with their windows closed. For this reason, participants were specifically instructed to respond based on their experiences "over the last 12 months or so", but this instruction may have not fully accounted for seasonal effects.

Some participants also mentioned that because aircrafts only occasionally passed over their homes, they found the noise exciting rather than annoying. A number of participants noted that noise from construction work rarely reached their homes and that the most annoying aspect of the construction work was traffic caused by road closures, not the noise. The distribution of participants annoyed by environmental noise seems to approximately follow the results obtained in the Canadian national studies [9], with the majority of participants demonstrating little or no annoyance. The low number of participants obtained in the present study, however, may limit a fair and accurate comparison with the national data.

Residents may have also displayed indifferent levels of annoyance and salivary stress biomarkers because of habituation. However, especially for intermittent noise events, there does not appear to be the same level of habituation to noise-induced annoyance as there may be for some other effects of noise exposure, such as sleep disturbance [26,27]. In fact, there is evidence that annoyance towards community noise actually worsens over time [28]. It should also be noted that humans repeatedly exposed to psychological stressors often show an attenuating response for cortisol but not for indicators of sympathetic nervous system activity [29,30,31]. This difference in habituation could explain why alpha-amylase levels in our participants were elevated with high-noise exposure while cortisol levels were not.

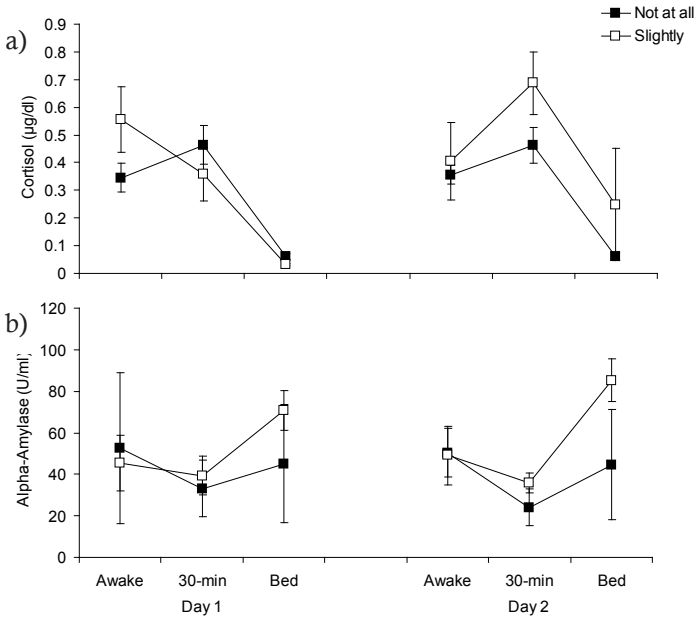

Figure 3. Level of annoyance with aircraft noise had no significant effect on cortisol or alpha-amylase. Cortisol levels are depicted in (a). Alpha-amylase levels are depicted in (b). Error bars represent standard errors of the mean.

It is of interest that this increase in alpha-amylase had no apparent association with increases in noise-induced annoyance. This result could indicate that noise exposure has an effect on salivary stress biomarkers that is not dependant on noise-induced annoyance. However, since only a small number of participants indicated high levels of annoyance, it is also possible that this study simply lacked the statistical power necessary to uncover such an interaction. The overall lack of participants indicating higher levels of annoyance caused some groups to be deleted from the analysis and limited the number of comparisons that could be made. In some cases, this also prevented the analysis of significant statistical interactions. The lack of participants may have also inflated the variability of each annoyance category, thereby increasing the probability of a Type II error. The independent elevation in alpha-amylase could alternatively suggest that participants were exposed to stressors other than noise and annoyance. The survey designed for this project asked participants to list things that they disliked about their neighbourhood, other than noise, in an effort to probe for extraneous and confounding sources of stress. It also asked participants about factors that could potentially modify or produce stress, including for example, socioeconomic status, marital status, cardiovascular risk factors such as smoking or hypertension, perceived health status, and perceived stress level. However, these items were excluded from this study's results because there were not enough participants to drive a meaningful analysis of the responses.

It should also be noted that an increase in stress-related biomarkers does not always indicate a stress response. Animal research demonstrates the biological plausibility of this argument. For instance, Merali et al. observed that rats offered familiar but especially palatable food can demonstrate a glucocorticoid elevation that is approximately comparable to being restrained and stressed by an experimenter for 20 min [32]. Woodson et al. similarly observed glucocorticoid elevations in male rats exposed to a sexually-receptive female rat, and those elevations were equivalent to those seen in males threatened by a predatory cat [33]. Alpha-amylase could have similarly been elevated for reasons that are unrelated to stress.

A particularly strong result that emerged from this study was the effect of time on salivary cortisol and alpha-amylase. In most analyses, both stress biomarkers displayed their expected cyclic variations, even with only 19 participants. Thirty minutes after awakening, cortisol demonstrated its usual peak, while alpha-amylase demonstrated its usual low. These cycles were also generally stable across both sampling days. This result has been replicated by several studies [11,19] and lends credence to the salivary sampling methods employed in this pilot project.

The small participant pool occurred primarily because of a 5.7% response rate. This is drastically lower than the 33% obtained by Michaud et al. in the Canadian national studies [9]. Residents may have been hesitant to participate for a number of reasons. First, residents were contacted

weekday evenings around dinner time and Saturday mornings when they may have been occupied with other activities. Second, in order to participate, residents were required to make an appointment and allow a team of two interviewers into their home for approximately 30 minutes. This may have been too intrusive for some. Third, the recruitment team was composed strictly of undergraduate students who may have lacked apparent credibility. Finally, some residents were uncomfortable providing saliva samples. Some expressed fears that DNA or drug testing would be performed and immediately refused to participate on that basis. Many of those who provided consent clearly disliked the taste of the cotton swab and may have discontinued their participation for that reason.

A larger, more comprehensive study will follow up this pilot and will attempt to address some of the limitations of this study. This follow up study should use the same salivary sampling methods but should consider expanding its recruitment techniques. A radio or newspaper announcement might increase the response rate and quell some of the fears associated with saliva sampling. A telephone, email, or pen-and-paper variant of the interview-survey should also be considered to avoid inconveniencing participants with an appointment schedule and a research team inside their homes. With a more successful response rate, researchers could probe several different regions of the NCR, constructing multiple categories of noise exposure (low, medium, high, etc.). Such a strategy could allow for an exposure-response interpretation of the results.

This follow up study should also consider some revisions to the survey in order to control for the noise protection provided by a participant's dwelling. In particular, the survey should ask if the participant has sound-reducing windows installed. This may be a default installation in some high-noise regions, and the current survey format only asks participants if they themselves have installed sound-reducing windows since they have moved in. The survey should also probe the approximate time participants spend outdoors around their home, as this may be the only time they are significantly exposed to the outdoor sound levels. In high traffic regions, this would also help approximate exposure to traffic exhaust, which has also been associated with an increased relative risk of myocardial infarction [34].

Community noise is ubiquitous and annoyance is the most commonly studied reaction central to its exposure. High annoyance can affect one's quality of life and may be a key intermediate between noise and stress-related illnesses. The results of this pilot study could not clearly associate noise-induced annoyance and physiological stress, but future research may be able to explore additional factors that play a role in deciphering the correlation between noise and stress.

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A review of health care utilization and costs in women with binge eating disorder

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ABSTRACT

BACKGROUND: Binge eating disorder (BED) is the most common eating disorder (ED), with a lifetime prevalence of 3.5% among women. The two most common comorbid conditions with BED are depression and obesity, both of which are associated with high health care utilization and costs. Examination of the health care utilization of EDs represents a gap in the literature, particularly for BED which is the newest ED identified in the Diagnostic and Statistical Manual for Mental Disorders (DSM-IV). The aim of this study is to review relevant literature on EDs and health care utilization, with a focus on BED. Then, we will comment on the existing literature and describe potential future studies.

METHOD: We searched online databases and inspected reference lists of other research articles for relevant literature on health care utilization and BED.

RESULTS: The literature searches identified four relevant studies that examined health care utilization in women with BED. Two of these studies found that women with BED reported higher use of health services compared to a healthy comparison group without an ED or any other Axis I psychiatric disorder. Another study found that both obesity and having an ED were associated with increased number of health professional visits. The last study found that high levels of lifetime functional impairment and a lifetime diagnosis of an ED resulted in greater likelihood of seeking treatment for an eating problem from a health professional.

CONCLUSION: Future studies on health care costs of BED must include the impact of the common comorbities, such as depression and obesity, and must thoroughly examine the different sources of health care services utilized by these individuals. In addition, further research on the underlying cause for the greater utilization of health care amongst BED patients and effective resource allocation are necessary.

CONTEXTE: L'hyperphagie boulimique (HB) est le désordre d'alimentation le plus commun, ayant une prévalence à vie de 3.5% parmi les femmes. Les deux comorbidités les plus communes avec l'HB sont la dépression et l'obésité, deux conditions étant associées à des coûts ainsi qu'utilisation du système de santé accrue. L'étude de l'utilisation du système de santé relié aux désordres d'alimentation démontre une lacune dans la littérature, particulièrement l'HB qui est le plus récent désordre alimentaire identifié dans le Diagnostic and Statistical Manual for Mental Disorders (DSM-IV). Le but de cette étude est d'analyser la littérature pertinente aux désordres alimentaire ainsi que l'utilisation du système de santé qui y est reliée, avec un attrait particulier pour l'HB. Après quoi, nous émettrons des commentaires sur la littérature existante et décrirons le potentiel de futures recherches. **MÉTHODES:** Nous avons cherché les bases de données en ligne et inspecté les listes de références d'autres recherches afin de retrouver de la littérature reliée à l'utilisation du système de santé et de l'HB. **RÉSULTATS:** Nos recherches de littérature ont identifié quatre études pertinentes qui ont étudié l'utilisation du système de santé parmi les femmes atteintes d'HB. Deux de ces études ont trouvé que les femmes atteintes d'HB rapportaient une utilisation plus élevée des services de santé comparativement à un groupe contrôle en santé, sans désordre d'alimentation ou de tout autres désordres psychiatriques de l'Axe I. Une autre étude a permis de déterminer que l'obésité et l'atteinte d'un désordre alimentaire augmentent tous deux le nombre de visites chez un professionnel de la santé. La dernière étude a quant à elle déterminée qu'une décence fonctionnelle de niveau élevée pendant toute une vie ainsi qu'un diagnostic continu de désordre alimentaire engendraient de plus grandes probabilités de rechercher un traitement pour le désordre alimentaire de la part d'un professionnel de la santé. **CONCLUSION:** Les futures études sur les coûts du système de santé associés à l'HB devront inclure l'impact que possède les comorbidités communes, telles que la dépression et l'obésité, et devrait examiner en profondeur les différentes sources de services de santé qu'utilisent ces individus. De plus, de plus amples recherches sur les causes sous-jacentes de l'utilisation accrue des soins de santé parmi les patients atteints d'HB ainsi que l'allocation effective des ressources sont nécessaires.

INTRODUCTION

Binge eating disorder (BED) is the most common eating disorder (ED), with a lifetime prevalence of 3.5% among women and 2.0% among men [1]. BED is characterized by recurrent episodes of binge eating in the absence of compensatory strategies to prevent weight gain [2]. BED was included in the fourth edition of the Diagnostic and Statistical Manual for Mental Disorders [2] as an eating disorder not otherwise specified (EDNOS) and under "Criteria for Further Study". Research on BED has progressed tremendously in the past decade. Past reviews support that BED is a clinically significant disorder [3, 4]. The co-existing physical and mental disorders, such as obesity and depression, compound the severity of this illness and the need for care. As such, there is a need for further research on assessing the impact that BED has on health and health care costs.

The recurrent binge eating and the absence of compensatory strategies lead to a higher prevalence of obesity among individuals with BED compared to those with bulimia nervosa (BN) and without BED [5]. For instance, Striegel-Moore and colleagues found that the prevalence of obesity among individuals with BED was 65.3% [6]. This was about three times the estimated rate of obesity among Canadian women at 22% and twice as high as that found among individuals with BN at 33.5% [7]. Unlike BED, BN is characterized by engaging in compensatory strategies following binge episodes. Further, a recent study by Grenon and colleagues with a sample of 105 women seeking treatment for BED found that all participants were overweight or obese with a reported mean BMI of 38.20 (SD = 6.80) [8]. This signifies that the women were severely obese. Since obesity is common in BED, the negative health burdens of obesity must also be evaluated when assessing health costs associated with BED.

Depression is the most common psychological disorder among women with EDs. The current literature suggests that there is a significant association, both statistically and clinically, between depression and BED. The prevalence of lifetime history of depression amongst BED patients ranged from 34% to approximately 50% [9-13]. In particular, the prevalence of depression is greater amongst treatment-seeking BED patients (67.27%) [8]. In this case, it is important to examine the impact of the high prevalence of depression on health care costs associated with BED. Other studies have also shown that BED is associated with additional comorbid psychiatric disorders [13-15]. Nevertheless, depression is consistently shown to be the most prevalent comorbid psychiatric disorder among women with BED [10, 11]. Therefore, along with obesity, the impact of depression on BED will be examined closely throughout the present review.

The high prevalence of obesity, depression, poor physical health, and lower health-related quality of life reported amongst women with BED may contribute to the higher health care utilization and costs among these women. For the purposes of this study, health care utilization will refer to any medications, tests, services, professional and specialist visits, and consultations that incur a cost towards health care and utilize health care resources. Grenon and colleagues found that the self-reported total health care costs of women seeking treatment for BED were at least 36.45% higher than an age and sex matched national average [8]. Yet, little research has been done on the economic implications of EDs, particularly for BED [16]. Such research is important to gain a better understanding of the factors that contribute to these higher health care costs, such as comorbid obesity and depression, and how clinicians can devise treatments to help lower these health costs.

The purpose of this literature review is to examine the existing research on health care utilization and costs among women with BED as well as to investigate the determinants of the higher health care costs associated with BED compared to individuals without BED. Striegel-Moore and colleagues reported that this area of study represents a gap in the literature on ED treatment [17]. Examining the different types of health services utilized by patients with BED will allow clinicians to identify factors, such as concurrent illnesses and health problems, which could be included in treatment planning to reduce the economic burden of BED.

Before reviewing the literature on BED and health care costs, we will briefly discuss the impact of obesity and depression on health care costs, as these two health conditions are most commonly seen in women with BED. Then the literature on eating disorders, including health care utilization of anorexia nervosa and bulimia nervosa, will be briefly summarized before reviewing the current state of knowledge about health care utilization and factors that increase the costs associated with BED. After reviewing the literature on BED and health care costs, clinical implications and potential future research will be discussed.

The Impact of Obesity and Depression on Health Care Utilization

In Canada, the overall prevalence of obesity increased from 10% in 1970 to 23% in 2004, with recent rates of 23% in men and 22% in women [7]. These growing rates of obesity are a serious concern, particularly because obesity leads to many devastating health outcomes and lower health-related quality of life [7]. Obesity increases the risk of life-threatening illnesses, such as type II diabetes, cardiovascular diseases, hypertension, stroke, gallbladder disease, osteoarthritis, sleep apnea, and at least eight different cancers, including endometrial cancer, breast cancer, prostate cancer, and colon cancer [18-20]. Anis and colleagues also identified 18 different comorbid health conditions that were linked to being overweight and obese [21]. Further, the prevalence of chronic diseases attributable to obesity from 1970 to 2004 has increased by 60% in women.

Previous research has shown that there is an increased risk of becoming depressed with one or more co-occurring chronic diseases [22]. Depression is another burdensome illness and is the second major source of disability among

Canadians after cardiovascular diseases [23]. The lifetime prevalence of major depressive disorder (MDD) in Canada is 12.2 % for individuals between 25 and 45 years of age [24]. Furthermore, women are particularly vulnerable to developing depression, and their lifetime prevalence for depression is about twice as high as it is for men. Depression is an important determinant of population health status because of its extremely high prevalence and associations with numerous health problems, including major medical conditions, impaired physical and psychological functioning, and premature mortality [25]. Depression may decrease the ability to cope with burdensome physical symptoms; therefore comorbid depression with BED will heighten psychological distress. Furthermore, depression increases the likelihood of engaging in maladaptive health behaviours, such as smoking, poor diet, over-eating, sedentary lifestyle, poor adherence to medical regimens, as well as other physiological effects [26].

Much effort has been put forth to determine the association between obesity and depression as well as the underlying mechanisms [27, 28]. For instance, increased appetite and weight gain are common symptoms of depression, and depression may increase the risk of binge eating [29]. Moreover, the stigmas attached to obesity and mental illness may exacerbate depressive symptoms [28]. Simon and colleagues found that obesity is associated with approximately a 25% increase in odds of having mood and anxiety disorders [30].

Given their substantive health burdens, both obesity and depression are associated with elevated health care utilization and costs [21, 31-34]. These higher health costs are seen in a vast number of medical services, including primary care visits, specialty visits, mental health visits, emergency room visits, pharmacy costs, laboratory and x-ray examinations, and inpatient costs. Anis and colleagues estimated that in 2006, the total direct health care costs associated with being overweight and obese were $6.0 billion which accounted for 4.1% of total health expenditures in Canada [21]. In a study of patients in a large health-maintenance organization in California, U.S.A., participants with a BMI greater than 35 incurred 44% higher mean annual total health care costs than those with a BMI of 20-24.9 [32]. Similarly, individuals within a large health-maintenance organization in Washington, U.S.A. that were diagnosed with depression had health care costs that were 79% higher than those without depression [34].

Previous research suggested that the prevalence of obesity in BED ranged from 65.3% to 73% [5, 6], whereas prevalence of depression in BED ranged from 34% to 67.27%. These proportions indicate that women with BED are likely to suffer from additional health risks caused by obesity and depression and therefore may incur higher health care costs.

Eating Disorders and Health Care Utilization

Health service use reveals the clinical significance of EDs because it reflects the extent of impairments as well as social and economic burdens from associated costs. The scarcity of research on health care utilization of EDs can be demonstrated by the results of a comprehensive review from Simon and colleagues [16] who identified only two cost-of-illness studies [see 35, 36], one burden-of-disease study that estimated health care costs in Australia [see 37], and fourteen related studies that commented on health care resources of EDs. However, Simon and colleagues selectively reported health care costs of only six of the identified studies which included comprehensive cost estimates for EDs.

A study conducted in Germany by Krauth and colleagues calculated the annual health care costs for anorexia nervosa (AN) and bulimia nervosa (BN) to be €65 million (89 million Canadian dollars) and €10 million (13.52 million Canadian dollars), respectively [35]. These cost estimates were based on benefit data listed by health insurance schemes, pension insurance schemes, and from epidemiological studies on the prevalence of EDs and mortality rates. This cost-of-illness analysis for EDs measured health care utilization by examining hospitalization, rehabilitation services, and indirect costs through inability to work and premature death. There were no costs of primary care, out-patient care or medications included. No calculations were made for BED or EDNOS. The few number of literature reviews and studies which examined the health care costs of EDs placed more emphasis on AN and BN than BED [16, 35]. This may be because AN has the highest mortality rate among any psychiatric disorder and BN was described as early as 1980 as a serious psychiatric disorder in the DSM-III [38]. BED is a newer disorder, recognized in the DSM-IV in 1994 [39]. Although little is currently known about the mortality associated with BED [16], obesity, which is common in BED, is expected to increase the mortality risk [40].

METHOD

Criteria for Choice of Literature for this Review

The focus of the present paper is on BED and its associated health care utilization. As indicated, obesity and depression are two major comorbidities associated with BED. Therefore, we selected articles that provided information on the health care utilization and costs associated with EDs, BED, obesity, and depression.

We outlined a specific search strategy for selecting articles exclusively on BED and health care utilization (see next section). We referred to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) for reporting the results of the present literature review [41]. The first (TL) and second author (GT) developed the search terms and finalized the search procedures. The first author (TL) of this study reviewed the relevant literature and selected the studies to be included in the present review. The second author (GT) was consulted on these choices, and any potentially ambiguous decisions about study inclusion were made by consensus. Refer to Figure 1 for our systematic process of selecting these articles on BED and health care utilization.

Search Methods for Identification of Studies

The following search words and combinations thereof were searched from abstracts and titles of studies in online databases (PubMed, PsychInfo, The Cochrane Reviews): (1) "health care utilization"; (2) "health care costs"; (3) "health services"; (4) "economic burden"; (5) 1 OR 2 OR 3 OR 4; (6) "eating disorder"; (7) "binge eating disorder"; (8) 6 OR 7; (9) 5 AND 8. Quotations were used when we entered each of the search terms. In Figure 1, the number of articles identified through database searches accomplished by completing the above steps is indicated. Hence, the search strategy was as follows: (["health care utilization" OR "health care costs" OR "health services" OR "economic burden"] AND ["eating disorder" OR "binge eating disorder"]).

We inspected the reference lists in the articles selected from the above searches for additional relevant information on EDs, BED, depression, obesity, and associated health care utilization and costs.

Exclusion and Inclusion Criteria for Literature on Binge Eating Disorder and Health Care Utilization

We used the following system to choose the articles to be included in the Results. First, we selected only those articles that included female participants with BED to compare studies with participants of the same sex. Second, we excluded articles that assessed other health conditions in the participants with BED, with the exception of obesity and other EDs. Studies on BED and health care utilization commonly pooled BED with either BN or EDNOS, and we took this into consideration when selecting our studies. Third, we discarded any articles that did not include measures of health care utilization which included domains of health care that incurred a cost, such as medication, health professional visits, emergency visits etc. Lastly, we excluded articles which dated prior to 1994 as BED was not yet included in the DSM.

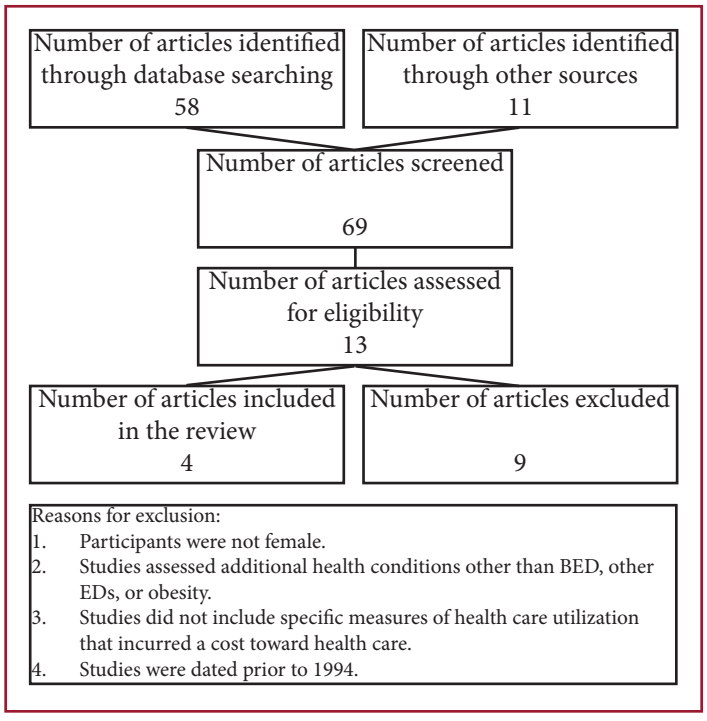

Figure 1. Flow chart of systematic process for selecting articles on binge eating disorder and health care utilization.

RESULTS

In this section, we review the relevant literature on health care utilization and costs associated with BED. Using our search strategies outlined in the Methods section, 58 research articles were identified through searching online databases, and 11 additional articles were identified by inspecting reference lists of other articles (see Figure 1). Of the 69 articles screened, 13 were inspected more carefully for eligibility to include in the present review. By inspecting the titles and abstracts of the articles, 56 articles were excluded as they were not relevant to the objective of our review. Amongst the 13 remaining studies, four articles met all the inclusion criteria and were reviewed in greater detail. We identified three studies that examined health care utilization and costs of BED and one other relevant study that examined obesity and EDs. Refer to Table 1 for a summary of the four selected studies.

The first selected study was conducted by Striegel-Moore and colleagues in 2004. This was the only study found that exclusively examined health care utilization among women with BED and did not include other EDs. With a total sample size of 518, this study compared use of health services in a community sample of women with BED, a sample of healthy women, and a sample of women with a non-ED related Axis I psychiatric disorder [39]. Measurements of health care utilization for this study included participants' use of emergency room visits, outpatient physician visits for medical care, outpatient psychotherapy visits, and days spent in the hospital over the previous 12 months. Results showed that women with both BED and other Axis I disorders reported higher use of health services compared to the healthy comparison group. There was a medium effect size for the difference between the group with BED and the healthy comparison group on health services used (Cohen's d = 0.73; Note: small effect > 0.20; medium effect > 0.50; large effect > 0.80), indicating that women with BED had greater use of health care services. There was a large effect size for the difference between the group with non-ED Axis I disorders and the healthy comparison group on health services used (Cohen's d = 0.93), indicating that the group with non-ED Axis I disorders reported significantly greater use of health care services. However, there were no significant differences between the group with BED and the group with non-ED Axis I disorders on use of health services, the effect size of which was not reported.

BED has unique factors that contribute to higher health care use and costs (e.g., obesity), and as such, BED should be examined separately from BN in assessing health care utilization. However, in our second identified study con-

ducted by Striegel-Moore and colleagues in 2005, women with a history of BN or BED were pooled into one group and the total sample size consisted of 1582 women [17]. This study examined the health services used in a sample of women with history of adolescent BN or BED, women with other non-ED related Axis I psychiatric disorders, and a healthy group of women with no history of psychiatric disorders. All women in this study were recruited from the community and asked about health services used in the last 12 months. Health care utilization was measured by examining emergency department visits, physician visits, psychotherapy visits, hospitalization, and total service days. Results showed that history of BN/BED in adolescence was associated with elevated health service use, assessed by higher number of total service days, outpatient psychotherapy visits, and emergency department visits compared to the healthy sample. Yet, this increased health service use was attributed to having a psychiatric disorder rather than having an ED diagnosis. There were significantly higher total health service days reported among a combined group of women with BED/BN and women with non-eating Axis I disorders compared to the health service days reported among the healthy comparison group ($p<0.0001$). However, the effect size was small (Cohen's $d = 0.14$). This small effect size suggests that the relationship between these two variables is weak even if statistically significant. Women in the BN/BED group did not differ significantly from women in the non-ED related Axis I disorders group in health services used. In addition, the study suggested that BN or BED in adolescence causes greater health impairment that continues into adulthood.

Obesity accounts for significant impairments in BED, and as such, it is important to examine the differences in health care utilization between obese women without an ED and obese women with an ED. Our third identified study was conducted in Australia by Mond and colleagues in 2009. They examined a community sample of 4,643 women aged 18-42 years to compare health burdens of individuals with an ED to health burdens of overweight individuals [42]. Participants completed self-report measures on ED psychopathology, health-related quality of life, and health care utilization. Health care utilization was measured by reports on the

Table 1. Summary of the reviewed studies including: sample sizes, eating disorder diagnoses, type of study, types of health care utilization assessed, and main findings/conclusions.

Study	Sample size	Eating disorders specified	Types of health care utilization	Main results/conclusions
Striegel-Moore et al. (2004)	BED = 162 Healthy comparison = 249 Non-eating Axis I = 107 *N* = 518	BED	• Emergency room visits • Outpatient physician visits for medical care Outpatient psychotherapy visit • Hospitalization • Total service days	• Women with BED and other Axis I disorders reported significantly higher use of health services compared to healthy comparison group • No significant difference between BED group and non-eating Axis I disorders group on health services used
Striegel-Moore et al. (2005)	BED/BN = 67 Non-eating Axis I = 443 Healthy comparison = 1072 *N* = 1582	BED/BN	• Emergency department visits • Outpatient physician visits Outpatient psychotherapy visits • Hospitalization • Total service days	• Significantly higher total health service days reported among a combined group of women with BED/BN and women with non-eating Axis I disorders compared to those reported by healthy comparison group • BN/BED group did not differ significantly from non-ED related Axis I disorders group in health services used
Mond et al. (2009)	Non-obese/Non-ED = 3709 Obese/Non-ED = 498 Non-obese/ED = 298 Obese/ED = 138 *N* = 4643	Any ED diagnosis applicable (AN, BN, BED, EDNOS)	• Consultations with a general practitioner • Treatment sought from a health professional for a problem with eating or weight/description of problem	• Participants who were both obese and had an ED reported greatest number of health professional visits of all the subgroups • Obesity and having an ED were associated with increased number of health professional visits and consultations • Being overweight was associated with greater physical impairment and having an ED was associated with greater psychosocial impairment
Mond et al. (2007)	AN = 18 BN = 51 BED = 31 EDNOS = 59 *N* = 159	Any ED diagnosis applicable ("bulimic-type" EDs)	• Types of treatment sought out for problems with eating • Prescription and non-prescription medications	• High levels of functional impairment and a lifetime diagnosis of BED were variables most strongly associated with treatment for an eating problem • Women with bulimic-type EDs rarely receive mental health treatment for an ED problem, but receive treatment for a general mental health problem and/or weight loss

Notes: AN= Anorexia nervosa; BN = Bulimia Nervosa; BED = Binge Eating Disorder; EDNOS = Eating Disorder Not Otherwise Specified; ED = Eating Disorder; *N* = Number of participants.

number of consultations with a general practitioner for any health problem in the past six months, treatment sought from a health professional for a problem with eating or weight, and a description of the problem. Participants were also assessed for height, weight, and BMI. Being overweight was associated with greater impairment in physical functioning and comparatively little impairment in psychosocial functioning; the converse is observed for ED symptoms. Yet, being overweight and exhibiting ED symptoms were independently associated with similarly elevated rates of primary care visits during the past 6 months and lifetime treatments regarding eating or weight problems. Both obesity and having an ED were associated with increased number of health professional visits and consultations. Moreover, participants who suffered from both obesity and an ED reported the greatest number of health professional visits of all subgroups. There was a medium effect size between higher levels of psychosocial impairment and the combination of higher ED symptoms and higher BMI (R^2 = 0.14; Note: small effect > 0.02; medium effect > 0.13; large effect > 0.19). This medium effect was mostly due to the strongly negative relationship between greater ED symptom severity and decreased psychosocial functioning (β = -0.36), while controlling for effects of BMI. Although the Mond et al. study did not focus on BED, the results are relevant to BED. This is because the authors reported higher health professional visits in individuals who are both obese and have an ED compared to: (1) individuals who have an ED but are not obese, or (2) individuals who are obese but do not have an ED. Women with BED are typically overweight and as such, they are likely to experience greater physical and psychosocial impairments, increased medical visits for eating and weight problems, and lower health-related quality of life [42].

Examining the types of treatments commonly sought by women with BED will reveal how well BED is detected and managed among health care providers. Our fourth identified study was also conducted in Australia by Mond and colleagues in 2007. This study examined the use of health services in a community sample of 159 women with "bulimic-type EDs", a category which included BED [43]. For this study, health care utilization was assessed by asking participants about the types of treatment they sought out for problems with eating (treatment specifically for eating problem, treatment for general mental health, or treatment for weight loss), prescription medications, and non-prescription medications. Out of 159 participants, only 40.3% had received treatment for an eating problem, whereas 94.9% of participants had received treatment for one of these three categories: eating, general mental health or weight. Most had received treatment for a general mental health problem (74.2%) and/or weight loss (72.8%). They all had used one or more "lifestyle" interventions which mostly consisted of self-help treatments. The use of non-prescription medicines such as vitamins and minerals was also common, with 65% of participants reportedly using them. Comparatively, fewer participants had used antidepressant (36.3%) or anxiolytic medication (15.3%). Of note is that high levels of lifetime functional impairment and a lifetime diagnosis of BED were the variables most strongly associated with treatment for an eating problem. Relative to the other predictor variables [see 43], having a lifetime diagnosis of BED resulted in an odds ratio (OR) of 4.64 (95% CI: 1.433, 15.019) of seeking treatment for an eating problem from a general health practitioner, but not a mental health professional (p = 0.01). However, the OR of lifetime diagnosis of BED and seeking treatment from a mental health professional was not significant (4.054 [95% CI: 0.602, 27.281], p = 0.150). The implications of this study are that women with bulimic-type EDs rarely receive mental health treatment for an ED problem, but instead receive treatment for a general mental health problem or for weight loss. These findings indicated poor detection and management of EDs and low awareness of their significant comorbid health problems, such as obesity, which could prompt patients to seek treatment.

DISCUSSION

Current State of Knowledge on Binge Eating Disorder and Health Care Utilization, Commentary on the Literature and Future Implications

Comprehensive examination of health care utilization and costs of BED is a reported gap in the literature [16], and only four relevant studies were found to examine these health care costs. The results of the four reviewed studies demonstrated a trend of higher health care utilization associated with EDs [17, 39, 42, 43]. In particular, results of three of the studies indicated that BED is associated with greater use of health care services [17, 39, 43]. The remaining study demonstrated the serious functional impairments and higher health care utilization associated with both obesity and EDs [42]. Among the selected studies, the items used to measure health care utilization were not consistent, and this suggests a broad economic burden of BED in addition to clinical relevance in acknowledging the health, personal, and economic burdens of BED in treatment plans.

BED was not exclusively examined among the studies that evaluated health care utilization and costs in EDs [17, 42, 43]. BED is thought to have similar comorbid psychopathology as BN [38] and was, therefore, combined with BN for some investigations. However, differences in obesity rates between BN and BED suggest that combining these groups when estimating health care costs may be inappropriate and may undermine some unique features of BED. Combining patients with BN and BED into one group will likely misrepresent the significant health and economic burdens associated with obesity and BED. Further, obesity is a central issue only in BED but not in BN. The Striegel-Moore et al. study, for example, did not take the negative health effects of obesity into full account since the sample of women studied had a mixed range of BMIs and a mean age of 21 (SD = 0.74) [17]. Previous researchers documented that obesity and increased age are associated with higher health care use and costs [44,

45]. Therefore, obesity and age are crucial factors in examining the personal, social, and economic tolls of BED, and the health care utilization of BED must be examined separately.

Despite the numerous investigations describing frequent comorbid psychological conditions that co-occur with EDs [1, 11, 12], none of the previously-mentioned studies assessed comorbid psychological disorders which place substantial health and economic burdens on women with EDs. Depression is highly associated with BED, increased health care utilization, and lower health-related quality of life [8, 10, 34]. In addition to depression, BED is also associated with other comorbid psychiatric disorders, such as generalized anxiety disorder (GAD), panic disorder, parasuicidal behaviour, nicotine dependence, and probable alcohol use [12]. Therefore, a lack of formal assessment of the costs associated with these comorbid conditions is a serious deficit when examining the overall economic impact of BED. Only three of the previously-mentioned studies on BED and health care utilization measured BMI in their participants [see 39, 42, 43] and only one of the studies examined the impairments, professional treatments, and consultations associated with being overweight or obese [42]. Yet, none of the mentioned studies included assessment of health care costs and services associated with obesity, other than number of professional visits [see 42]. Nonetheless, obesity, on its own, is recognized as a life threatening condition with significantly higher health expenditures [18-20]. The majority of women with BED suffer significant impairments and health burdens due to obesity, and therefore will need health services and treatments that include treating obesity.

The results of the Striegel-Moore et al. study [39] and the Mond et al. study [43] suggest poor detection of EDs and that these women did not utilize the appropriate health care services for ED treatments. In the Striegel-Moore et al. study, women with BED reported fewer number of psychotherapy visits compared to women with other Axis I disorders [39]. In addition, Mond et al. found that women with bulimic-type EDs rarely receive mental health treatment for an ED problem, but instead receive treatment for a general mental health problem or for weight loss [43]. These results suggest that there may be barriers which hinder women from seeking specific treatments for BED. These barriers may include the inability of patients with BED to get reimbursed for psychotherapy services by insurance companies, and lack of recognition of BED as a disorder needing treatment by health care providers. Therefore, researchers must address these issues to make treatments for BED more accessible and adequately recognized in the health care system.

Future Studies and Recommendations

Based on our review of the available literature, we recommend that comprehensive studies on BED and health care utilization and costs must include the following: (1) formal assessment of highly prevalent comorbid conditions, including depression and obesity; (2) detailed reports of health care costs and services used over a period of time that assess as many domains of health expenditures as possible; (3) analyses of health care utilization and costs attributed to depressive symptoms while controlling for BMI, age, and ED symptoms; (4) analyses of health care utilization and costs attributed to BMI while controlling for depressive symptoms, age, and ED symptoms; and (5) examination of total health care expenditures incurred by women with BED compared to women without an ED that are weight and age matched. A study that is designed with these considerations in mind will take into account the impacts of obesity and depression on health care utilization and costs among women with BED. To our knowledge, there has not been any investigation of health care costs of BED and an age and weight matched group that examines the relative effects of obesity and depression.

A detailed report on health care utilization will also allow for examination of which services, medications, and resources are commonly utilized. The studies we identified in this review measured different domains of health care utilization. Generating an extensive assessment of health care utilization and costs that can be replicated will help standardize the measurements of health care costs and, thus, allow for a more accurate comparison of calculated costs among studies. This will, in turn, reveal the types of expenses that contribute to the higher health care costs of BED. We can then assess which services are needed in order to effectively target the complicated nature of BED.

Limitations

A limitation common to all of the studies is the potential inaccuracy of retrospective self-reported health care costs and uses [17, 39, 42, 43]. Self-reports are a convenient and feasible way of assessing these health expenses, and as such, using them allows for a larger sample size than other methods such as personal interviews. However, researchers must be conscientious in designing detailed and specific health care utilization questionnaires. Bhandari and Wagner reviewed 42 studies that evaluated the accuracy of self-reported health care utilization data [46]. They identified that under-reporting health care utilization is the most frequent problem in these self-reports. They advised that recall periods should not exceed 12 months, and 3 and 6 month time periods are preferable. The frequencies and types of utilization must also be carefully specified in self-reports as under-reporting is exacerbated by higher frequency of utilization. Therefore, specifying different types of health care utilization in questionnaires may help individuals recall different services used. Use of memory probes, such as landmark events and examples of health professionals can also help reduce under-reporting of utilization.

A previously-mentioned study by Mond and colleagues used trained interviewers to assess the health care utilization of their sample of participants with BED [43]. This may be one way to minimize misinterpreted or inaccurate information that may occur when reporting health care costs

and use. One study found by Striegel-Moore and colleagues did not incorporate self-report questionnaires, but instead they examined the health insurance claims of a U.S. database [47]. This may also lead to inaccurate assessment of health care utilization due to variability of individual insurance policies and the exclusion of expenses not eligible for reimbursement.

CONCLUSION

BED is a clinically significant illness with a lifetime prevalence rate of 3.5% among women [1]. These women with BED incur greater health care costs than women without EDs [39], such that women with BED spend at least 36.45% more health care dollars than an age and sex matched national average [8]. Although there is an emerging body of literature on the health economic implications of EDs, research on BED and health care utilization is scarce. Future studies examining health care expenditures among women with BED must formally assess common comorbities, such as depression and obesity, and must thoroughly examine different sources of health care services, medications, and treatments utilized. Such information will provide insight into the determinants that drive up health care costs among women with BED and will give necessary information towards devising targeted treatments.

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Observing differences between health care in Canada and Morocco

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In our increasingly inter-dependent world, exposure to international learning opportunities during our medical education will help us to become better physicians and more engaged, globally-connected citizens. As a second year medical student with a background in biology and public health, I view the world through a lens of population health and effective prevention strategies.

In the summer of 2010, I participated in an international elective in Rabat, Morocco with two other first year medical students. We were privileged to work in a urology clinic in the capital city's largest public teaching hospital, L'Avicienne. During this time, we were able to observe the local disease prevention strategies and subsequent health outcomes and compare them to those in Canada.

Canada and Morocco have comparable populations in terms of their size (Canada in 2008: 33,259,000; Morocco in 2008: 31,606,000); however, they differ significantly in their resources [1]. Canada's gross national income (GNI) per capita is approximately 10 times greater than Morocco's (Canada in 2008: $38,710; Morocco in 2008: $4,190) [1]. These disparities in wealth translate to disparities in health care spending. In Canada, the total expenditure on health per capita is 13.5 times greater than Morocco's (Canada in 2008: $3,672; Morocco in 2008: $273) and the Canadian expenditure on health as a percentage of gross domestic product (GDP) is double that of Morocco's (Canada in 2008: 10% of GDP spent on health; Morocco in 2008: 5.1% of GDP spent on health) [1]. Life expectancy, which can be taken as a crude measure of health outcomes, accurately reflects this difference in wealth. The average Canadian life expectancy is 81, while the average Moroccan's is only 72 years of age [1].

In Canada, we are taught that prevention is a major focus in our health care strategy. During my international elective, I observed that this strategy may not be feasible in Morocco. I have become more aware of differences in medical practices between high-income countries such as Canada and middle-income countries such as Morocco.

Canadian medical students learn that treatment at an early stage of illness can be effective, less costly and less invasive. In Morocco, I learned that the Canadian approach, which emphasizes health promotion and disease prevention at the population health level, is not easily applicable in the Moroccan context where access to health services and physicians is limited. I observed that patients arrived sicker and later than those in Canada. They also tended to require more urgent and extreme remedies. For example, patients developed fist-sized kidney stones that completely destroyed their kidneys, which subsequently required surgical removal.

Congenital malformations that are treated early in life in the Western Hemisphere are treated much later in Morocco. Typically in Canada, congenital malformations are corrected during infancy or early childhood. We were introduced to cases such as a 19-year-old patient with bladder extrophy, which would have been corrected shortly after birth in Canada. In general, Moroccan patients present with diseases in more advanced stages than in Canada or the United States.

Unfortunately, while doctors in Morocco realize that earlier intervention would be best, there is little uptake for discussions on disease prevention in an environment that is shaped by resource scarcity. Health care in Canada is largely publicly funded and privately delivered, while in Morocco, healthcare is mostly privately funded and privately delivered [2]. In Morocco, the relative shortage of resources at the population and individual levels combined with the lack of availability of health care insurance have broad public health implications. Although Morocco offers excellent care to its citizens who have access to health services, Morocco fails to provide adequate access to health care in less fortunate citizens. Fur-

thermore, health care insurance in Morocco is voluntary, not universal as it is in Canada. Today only about 16% of Moroccans have health insurance and the majority of these individuals are civil servants. The remaining 84% of the population pays out-of-pocket to see a doctor, and health care access becomes restricted due to personal financial constraints [2]. The result of these financial limitations is that the opportunity for primary and secondary prevention is often missed.

Despite being eligible to seek treatment at a Ministry of Health facility, Moroccans must personally finance these visits unless they fall below a low-income cut-off. A certificat d'indigence allows individuals below this threshold to receive publicly-provided care at no cost. Moroccans who are neither indigent nor insured can apply to receive partially-funded care; however, exceptional patient advocacy skills are necessary to navigate these complex health policies [2].

The limited health insurance coverage is a significant challenge to improving the health status of Moroccans. Despite these persistent challenges, Morocco has achieved health care gains over the past 30 years. For example, it has significantly reduced the prevalence of infectious diseases [2]. While progress is incremental, there is a trend towards better health outcomes. With additional investment in health care spending, this trend can be sustained.

Access to health care is a complex issue comprised of health insurance, physician advocacy and patient health literacy. Implementing effective public health prevention and early detection requires support from a set of enabling conditions; two of which are capacity and allocation of adequate financial resources. During my elective, I acquired a deeper appreciation and respect for my medical colleagues in Morocco who, despite some financial limitations, are advancing health care and improving the well-being of their patients everyday. This experience has helped me frame the question of how to broaden access to health care and disease prevention, a recurrent and resonant issue both in Morocco and Canada.

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So you don't want a family, eh? A commentary on choosing a medical specialty

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A phenomenon has developed in the world of medicine and it's hard to know whom to blame. It begins with a seemingly innocent, judgment-free question: "What do you want to do as a specialty in the future?". This question has become a cloaked missile of judgment and personal attacks to which I and many of my female colleagues have inevitably learned to answer, "I'm not really sure yet."

Having learned this answer is not a reflection of inability or unwillingness to engage in a lengthy cerebral debate about the reasons why or why not various specialties would be suitable for a person in the same situation. It is, however, an unwillingness to engage in that same debate when it becomes centered on the reasons why a female should not go into a certain specialty if she wants to have a family. It is a subtle and measured refusal to be categorized as a future workaholic who will undoubtedly fail to have a successful love and family life, and this by their own choosing.

The current medical community has bred a generation of future physicians who view specialization as a social life death sentence. Being a medical student who has yet to go through the challenges of a night on call, let alone a lifetime's worth of dedication to the vocation, I am not arguing that there is no truth to the personal challenges that specialization in medicine exert on an individual. I am, however, baffled by what seems to be a shift in the mentality of ambitious and resilient individuals such as medical students, who have surmounted challenges of every sort, to one of defeat, surrender and conformity. Training to be a specialist is undoubtedly a grueling task, but why is it being presented and discussed as an impossible road to happiness? Why do we bombard a person who wants to become a specialist with all the negative statistics out there such as divorce rates, suicide rates and so on, rather than offer them words of encouragement and hope? Why do we choose to hang on to the negativities and leave behind the possibilities?

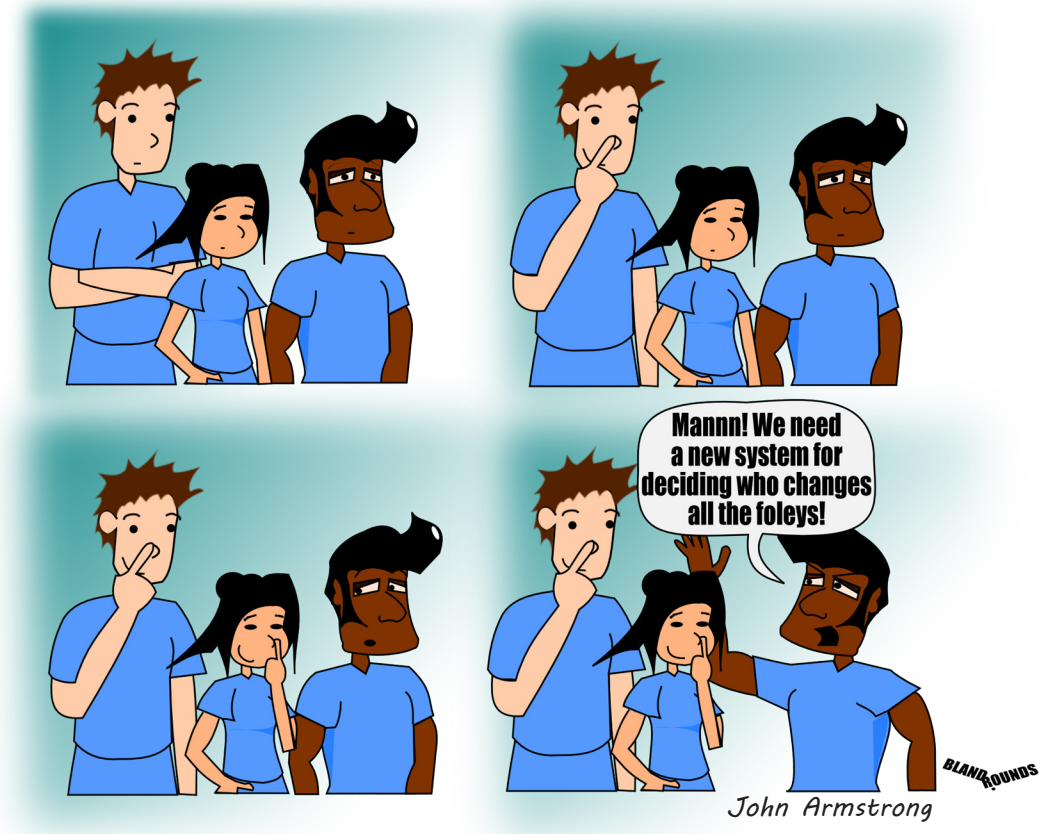
I question whether it is reasonable to attribute success in family life or love life to the amount of hours worked. Isn't it also necessary to factor in the host of personality and circumstantial elements that could affect such very personal matters? How then could we explain the success of those female specialists who are also in leadership positions in education and hospital management for instance? Those individuals have managed to have successful relationships and family lives while maintaining excellence in their careers. Directly associating relationship failure to choice of specialty would be equivalent to choosing a spouse solely based on profession. To attribute success in personal life to anything other than a multifactorial system is, in my opinion, unfounded.

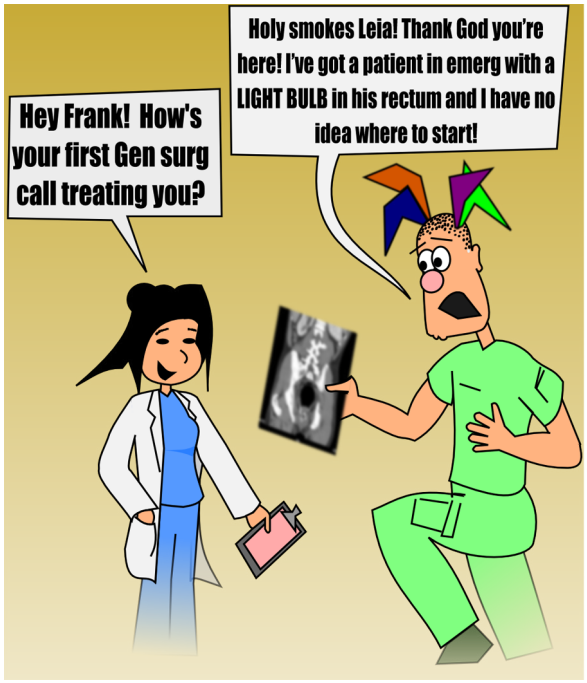
Furthermore, why is this issue one that seems to require special consideration from female medical students? Have we not as a society, or at least a subcategory of highly-educated individuals, surmounted this idea of traditional male and female roles? Are we actually regressing to an expectation that regardless of the equality in professions, education and ambition, females are accountable to carry out more of the " burden" in family life than males? Are we actually conforming, or worse yet, perpetuating this ignorance?

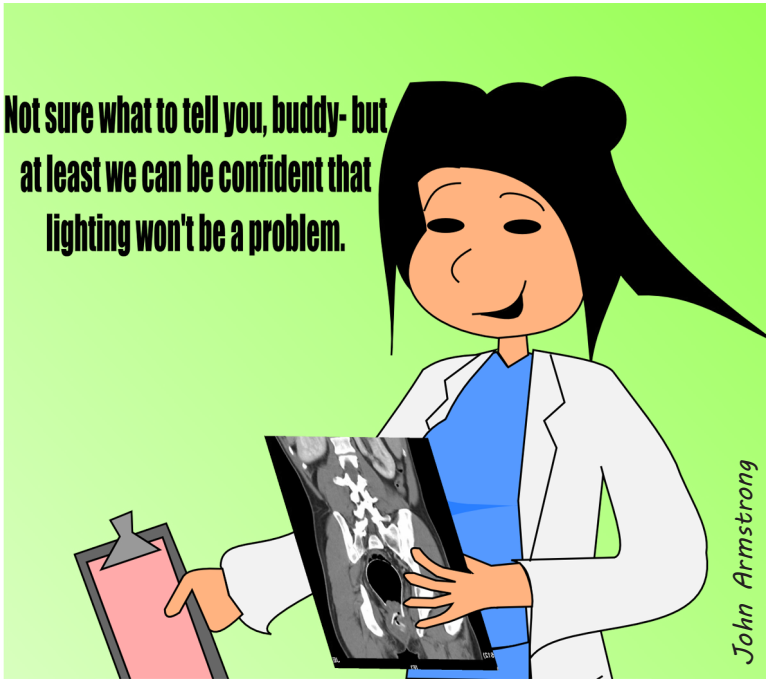
People who, perhaps unknowingly, cast such guilt on females who choose to be specialists seem to forget the possibility that some individuals may attribute equal or more value to career success than they do to success in other elements of their lives, and more importantly, that they are entitled to do so without judgment. If we were to consider the era preceding the second wave feminist movement in the 1960s, it would not be difficult to identify examples of women who had achieved great success in their love and family lives, only to feel unaccomplished and underappreciated in society. Are we witnessing the revival of the pre-movement ideology? And more importantly, do we really believe that a group of women who are inspired and hard working enough to choose medicine as a career will be satisfied basing their choices on societal norms and threats versus their passions and aspirations?

I remember a time before getting into medical school when I thought choosing a specialty would be an exciting opportunity to discover my passion. This has been replaced with a measured, cautious enthusiasm that is clouded by fear. It was at a brunch with a group of friends, all medical students, that I realized the ridiculousness of this conundrum. After I expressed an interest in surgery, a friend responded, "so you don't want a family, eh?". I then realized that in any other context, I would never allow myself to accept such a blatant, misguided generalization. It seemed to especially irk me that it came from another woman. The fact that I am considering this specialty does not mean that I do not want to have a family in the future, or that I am choosing to sacrifice this element of my life in any way. It does, however, mean that I am choosing to remain the person I have always been, a person who follows her passions regardless of the challenges these present. One who will be able to look into her future children's eyes and truthfully tell them that nothing can get in the way of their dreams. One who will proudly recount how hard work, strength and perseverance in the face of adversity is the way that the women of her generation, unfazed by the fear of failure, changed the way things were.

Bland rounds







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