

The 2nd URNCST Journal Case Abstract Competition: Human Reproductive Health and Environment



URNCST Journal
"Research in Earnest"

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Abstract

The URNCST Journal Case Competition provides undergraduate students with the opportunity to experience the peer review and publication process through participation in a case competition. Participants submit an abstract of a research protocol based on a topic proposed by the URNCST Journal. The following abstracts were submitted by undergraduate students to the 2nd URNCST Journal Case Competition held during December 2018. This case competition's topic was on human reproductive health and the environment. To learn more about this abstract competition and submit your own, please visit:

<https://urncst.com/index.php/competition/about>.

Keywords: reproductive health, case competition, URNCST Journal

Conference Abstracts

Note: These abstracts were peer-reviewed for quality of research content following being submitted to the URNCST Journal Case Competition. Abstracts are ordered alphabetically by last names of first authors.

URNCST Journal Case Competition

Human Reproduction and the Environment Abstracts

Environmental tobacco smoke and reproductive health: A research study

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Introduction: Environmental Tobacco Smoke (ETS), contains known carcinogens capable of accumulating inside the body. Passive exposure to ETS during pregnancy is particularly dangerous, as ETS substances metabolize to form toxic metabolites. These metabolites can pass through the placenta, posing disruption to the neurological and physical development of the fetus. Existing methods use smoke cessation drugs and regulate an individual's diet to increase the elimination rate of metabolites from the body. These methods are short-term and vary individually, making them time-consuming and ineffective. This proposal presents the use of a novel chemical known as N1-(4-fluorophenyl) cyclopropane-1-carboxamide, which can be used to inhibit the activity of CYP2A6 – the metabolizing enzyme of multiple carcinogens in ETS.

Methods: 3D-QSAR models were constructed in order to determine which characteristics are important to maximize inhibition potency of the CYP2A6 enzyme. Through the silico approach, these features were used in a virtual screening of over 60,000 compounds from the Maybridge chemical database.

Results: It could be hypothesized that through this process, 1 of the 4 potent CYP2A6 inhibitors is N1-(4-fluorophenyl) cyclopropane-1-carboxamide. Though the virtual screening process it is expected that when this novel chemical comes into contact with CYP2A6, it has the potential to significantly reduce the production of harmful carcinogen metabolites. This will relatively lower the amount of metabolites that the placenta can be exposed to.

Conclusions: The effectiveness of the procedure is recognized through IC50 values lower than 1 μ M. Clinical testing for these potent models in a clinical setting through randomized controlled trials is a future direction that will provide researchers information on drug administration, dosage, and enable recognition of other characteristics that potential inhibitors could consist of.

Implications: This research has the potential to be crucially beneficial as it reduces the amount of harmful metabolites that the placenta is exposed to, thereby enabling proper development of the fetus.

Industrial air pollution and human reproductive health: A research study

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Introduction: Air pollution results from a complex mixture of pollutants, including carbon monoxide, nitrogen dioxide and particulate matter from motor vehicle exhaust and industrial emissions. Although air pollution has received heightened attention in the past few decades, little is known about its effect on human reproductive health. This study aims to examine the relationship between air pollution, fertility and pregnancy complications.

Methods: The Air Quality Index (AQI) from Environment Canada reports the levels of air pollution in industrialized districts and rural regions. Male (n=50) and female (n=50) participants (18 to 35 years of age) living in locations with different AQI will be recruited. All participants will undergo a physical examination. Sperm samples will be collected from male participants and examined for sperm morphology, concentration and motility. A survey will be conducted to inquire about female participants' medical history, including the length of previous pregnancies and the occurrence of complications. The Pearson correlation coefficient (r) and linear regression will be used for statistical analysis.

Results: Since previous studies suggest that environmental and occupational exposures to chemicals and second-hand smoke may lead to adverse pregnancy outcomes, prolonged exposures to air pollutants are expected to correlate with poor reproductive health. Abnormalities in the morphology of reproductive organs, reduced sperm quality, and more premature births and pregnancy complications are expected for participants living in highly industrialized areas.

Conclusion: Different levels of pollution may correspond to varying reproductive health outcomes. To establish causality, the specific effect of each pollutant could be studied using model organisms. In addition, increased population densities in industrialized regions urge further research into the means of minimizing industrial pollution.

Implications: Elucidation of the effect air pollution on reproductive health could provide insights into the safety of urban environments and influence the provision of occupational safety training and regulations on industrial emissions.

Hanging up on male infertility: Effects of mobile phone emitted electromagnetic waves on sperm quality

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Introduction: Human male sperm quality has been steadily declining over the past century. One proposed explanation is the increased use of mobile devices, which emit radiofrequency electromagnetic waves (RF-EMW). Investigations of this theory have been limited to correlational studies with conflicting results, partly due to differences in methodologies and selected outcome measures. We propose a sham-controlled experiment to reveal the precise effects of RF-EMW on quantified parameters of sperm quality—specifically viability and motility.

Methods: Donor sperm samples are cultured and assigned to one of four conditions: exposure to 0 MHz (control), 450 MHz, 900 MHz, or 1350 MHz. Treatments involve exposure to an RF-EMW emitting device for 1 hour per day over 3 days. The Trypan Blue Exclusion Method of quantification through cytoplasm staining is utilized to assess viability, and computer-aided semen analysis (CASA) platforms are utilized to assess motility. Sperm quality measures are obtained for each condition at baseline and on each day following exposure. Repeated Measures ANOVA on SPSS is used for statistical analysis.

Results: A significant decrease in the proportion of Trypan Blue-stained cells, the observed motility of sperm cells, and overall sperm quality is expected with increased RF-EMW exposure.

Conclusion: Although additional high-powered studies are required to further quantify these effects, this study highlights the clinical relevance of RF-EMW exposure to reproductive health.

Implications: A potential causal link between mobile phone exposure and declining sperm quality may influence governmental regulation concerning mobile RF-EMW emissions and increase awareness of any clinically-relevant risks associated with RF-EMW exposure.

A review of involuntary exposure: Second-hand smoke during pregnancy

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Introduction: It is well established that tobacco use has detrimental effects on the human body; these negative effects can primarily be avoided by not smoking. However, for many non-smokers, second-hand smoke (SHS) carries similar adverse effects as first-hand exposure. The impacts of SHS can be seen during periods of pregnancy and on fetal development and birth outcomes, especially in developing countries. During periods of development, the presence of SHS in the immediate environment can pose serious health risks to both mother and fetus.

Methods: Using Google Scholar and PubMed databases, articles containing keywords such as “second-hand smoke”, “involuntary exposure”, “tobacco” and “pregnancy” were evaluated for use in this review. In addition, the World Health Organization’s (WHO) Tobacco Free Initiative recommendations were of significant guidance.

Results: Results from this scoping review demonstrate that the only way to protect people from the dangers of SHS is to create an environment which is entirely smoke free. This is due to how nicotine is able to cross the placenta and concentrate in fetal tissue, which is shown to have negative effects on growth and neural development. Furthermore, prenatal tobacco exposure has shown to negatively affect speech processing and is connected to nicotine addiction. Additionally, over 470 million women globally aged 15-49 years are regularly exposed to SHS in their homes, and during pregnancy.

Conclusion:

Exposure to SHS globally has shown to have negative fetal developmental implications. Within the developing world, and in nations with less stringent regulations on smoking, there is an increased exposure to SHS which corresponds to greater rates of adverse impacts on fetal growth and neural development.

Implications: Due to the difficulty of limiting SHS in household environments in the developing world, there needs to be greater emphasis on prenatal health and the implications of SHS on the household by local health systems and governments.

The use of white noise to mask noise pollution and protect male reproductive health

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Introduction: Noise pollution has been linked to decreased sperm count due to the stress response initiated by the body when exposed to disruptive background noise. If it is the *effect* (i.e., stress), rather than the *presence*, of background sound that affects reproductive health, then calming background sounds may be the solution. Low frequency white noise has been shown to help those suffering with anxiety, insomnia, and stress. This proposal suggests the use of white noise to mask noise pollution and thereby reduce the risk to male reproductive health.

Methods: Thirty healthy males in their late twenties be categorized into three groups by level of noise pollution at night in their place of residence—low (< 75 dB), medium (75 – 90 dB), and high (> 90dB). The males will complete a sperm count test, blood cortisol test, and Perceived Stress Scale questionnaire to measure their initial sperm health and stress levels. The males will then be given a white noise machine to be used at a frequency of 50 dB at night. Each month for a total of twelve, the males will complete the same three tests at the same time of day (e.g., evening).

Results: With the use of a white noise machine, the expected results are an increase in sperm count, decrease in blood cortisol levels, and a lower score on the questionnaire.

Conclusion: If stress levels are lowered, white noise shows the potential to reduce the negative effects of noise pollution on male reproductive health.

Implications: Given the rising population density and subsequently increasing exposure to noise pollution, there is a need for further research on the relationship between background sound and health. If the proposal is correct, white noise machines offer a low-cost solution to protect the reproductive health of the individual in a metropolitan environment.

Maternal SSRI's and the infant microbiome: A research study

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Introduction: Human microbiome colonization occurs from birth into infancy and establishes an ecosystem of predominantly bacteria that influences immune system development, mental health, and risk of metabolic syndromes. Maternal fecal, vaginal and skin microbiota influences microbiome colonization. Pharmaceutical treatment for depression in pregnant women

includes the use of select serotonin reuptake inhibitors (SSRIs); however, SSRIs can decrease microbiome diversity due to their antimicrobial properties. The objective of this research is to explicitly explore microbiota diversity changes in maternal and infant microbiomes from SSRI use during pregnancy in a mouse model.

Methods: A mouse model with two control groups will be used against the SSRI treatment group. Mice will be treated with either no treatment, non-SSRI antidepressant treatment or SSRI treatment before, during and after pregnancy. Maternal mice will undergo skin, vaginal and fecal swabs before, during and after pregnancy. Infant mice will undergo skin swabs immediately post-birth, and fecal and skin swabs later in development. Skin, fecal and vaginal swabs will be analyzed using 16S rRNA (ribosomal Ribonucleic Acid) sequencing for differences in microbial diversity and statistically analyzed with an Analysis of Variance (ANOVA) test.

Results: The hypothesis is that decreased microbiota diversity will be observed in SSRI-treated maternal and infant mice compared to mice in control groups. Expected results will show both SSRI-treated maternal and infant mice with decreased diversity in commensal colonized bacteria phyla compared to maternal and infant mice in control groups.

Conclusion: These research results have the potential to elaborate on pharmaceutically induced maternal microbiome influences on infant microbiome colonization.

Implications: This study will bridge research in mental health, pharmaceuticals, pregnancy and the microbiome. These results will contribute to an increased understanding of SSRI effects on maternal microbiomes and infant microbiome colonization. These research results could lead to changes in SSRI prescription during pregnancy and could positively influence infant health outcomes.

Role of environmental toxin bisphenol A on human reproductive system: A research study

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Introduction: Bisphenol A (BPA), an environmental toxin found in the plastic container, feminine products and canned food, promotes polycystic ovary syndrome (PCOS), a common endocrine and fertility disorder. Since BPA acts as the estrogen agonist and androgen antagonist, the body produces more androgen sensing lack of androgen. This pathophysiology results in excess androgen (hyperandrogenism) and heightened immune system which are indicators of PCOS. Furthermore, over stimulated immune system produces autoantibodies like ANAs (anti-nuclear antibodies). This study aims to explore the role of BPA in PCOS by different diagnostic procedures and thus to predict that environmental toxins have a negative effect on the human reproductive system.

Methods: Two types of mice will be divided into four groups which are the wild type with BPA injection (wt- BPA) and control (wt-C), human mice with BPA injection (hm- BPA) and control (hm- C). Human mice are transgenic which have a similar immune system as human and are beneficial in studies related to immunology. Before injecting with BPA, androgen levels will be evaluated through a blood test. In addition, the ANA test will be administered for the detection of anti-nuclear antibodies. After injecting with BPA in half of the mice, androgen and ANA test will be conducted for all.

Results: Mice injected with BPA (wt -BPA and hm- BPA) are expected to have higher androgen level and positive ANA test compared to the control group (wt-C and hm- C).

Conclusion: This study will reveal how BPA is related to PCOS and thus will establish that environmental toxins can affect negatively on the human reproductive system.

Implications: This investigation will promote studies to discover how the other environmental toxins such as dioxin and phthalates can have a negative effect on the human reproductive system.

Conflicts of Interest

The author(s) declare that they have no conflict of interests.

Authors' Contributions

MHRC: Assisted authors with their abstract submissions, ensured abstracts adhered to correct formatting standards, sourced and assigned peer-reviewers, drafted the conference abstract booklet, and gave final approval of the version to be published.

JBS: Ensured abstracts adhered to correct formatting standards, drafted the conference abstract booklet, and gave final approval of the version to be published.

JYN: Designed and founded the URNCST Journal Case Abstract Competition, assisted authors with their abstract submissions, ensured abstracts adhered to correct formatting standards, sourced and assigned peer-reviewers, reviewed the drafted abstract booklet, and gave final approval of the version to be published.

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