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# The Prognosis

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# Dear Reader,

I am pleased to introduce you to the seventh volume of *The Prognosis*, the 2017-2018 edition of McGill's student journal of global health. The journal was founded in 2011 by a group of McGill undergraduate students passionate about showcasing the highest caliber of global health research conducted across our university. This year, *The Prognosis* is the fruit of the labour and commitment of Anna, Carly, Kayla, Samantha, Sarah, and Srikanth, who worked hard to solicit, select, and edit the volume. It has been a pleasure working with them this year, and I wish them all the best in their future endeavours. I would also like to thank Kristin Hendricks of the Global Health Programs for her unwavering support to the editorial team in producing this journal.

The seven papers featured in this volume reflect a diverse set of challenges in global health, demonstrating the interdisciplinary nature of global health education at our university. The opening and closing articles of the journal are personal essays written by McGill medical students, drawing on their invaluable experience as passionate advocates of global and public health within the university and the larger Montreal and Quebec communities. As well, we have a piece assessing the importance of nationwide HPV vaccination in Canada, followed by three papers on maternal health—the first tackling the timely challenge of Donald Trump's global gag rule, the second investigating Ethiopia's innovative Healthcare Extension Program in ameliorating mothers' livelihood in the country, and the third paper analyzing the potentials of a heat-stable and life-saving drug for women with pregnancy complications. Finally, we have a thoughtful discussion of Canada's Ebola vaccine and the international neglect during the 2014 Ebola crisis.

I would like to ask readers to situate these articles within the current political climate that, as many scientists and pundits argue, is characterized by potentially detrimental 'attacks on science.' Over the last two years, of course, there have been tremendous examples of this phenomenon south of the border. These developments, however, are painfully reminiscent of the Harper era in Canada, where we saw, among others, the closure of the National Roundtable on the Environment and the Economy, the elimination of the position of National Science Advisor, and the literal destruction of libraries associated with the Department of Fisheries and Oceans. Scientists also reported being subjected to exceptionally restrictive communication protocols by the government, hindering them from freely relaying information to the media, the public, or to each other. Today, as students of and professionals in global health, we ought to be ever more vigilant about the value, purpose, and precarity of our work. *The Prognosis*, in a way, is a resistance to the powerful forces that want us to regress back, instead of move forward.

—Paniz Khosroshahy  
Editor-in-Chief  
Spring 2018

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# Community outreach as a priority: a global health new year's resolution

Julie De Meulemeester and Koray Demir



I stumbled into the Royal Victoria Hospital on a glacial December Saturday, one of those days where your legs resign in protest when you step outside, when you remember that most of the human body is water, and wonder what percentage of you is literally frozen solid at any given time. I was asked to see Noah, a patient with a skin infection, but his chart gave me a sense of a more complicated story. He was homeless and struggling with intravenous drug use, with recurrent skin ulcers and a poorly managed HIV infection. He had visited the emergency department several times in the last few weeks, where he frequently had arguments with the emergency team, who suspected he was seeking opioids and felt unsure about the most sustainable way to manage his diffuse chronic pain. Managing Noah's acute illness felt like the almost literal Band-aid to end all Band-aid solution metaphors. Perhaps by discharging him and sending him back into the deep cold, we were doing more net harm than good. He would continue to be unwell so long as he was on the streets, so long as

he was injecting drugs, so long as he was food-insecure and disconnected from the healthcare system. There are few things in medicine we can really say for sure—but of this, I was certain.

In the global health community, we are familiar with the idea that our social circumstances frame our health outcomes: social inequalities, which translate into health disparities, become unacceptable injustices that we work hard to correct (1). Noah is not a real patient, but his case is based on familiar stories from the dozens of marginalized patients I have seen since starting hospital work. Based on these experiences, I have had to wonder: to what extent do social determinants of health play a role in our immediate Montreal community and Quebec as a whole?

It turns out, unsurprisingly, that they matter a lot. An estimated 35% of Montrealers live with chronic illness, such as heart and lung disease, representing 70% of premature deaths in our city (2). Social and environmental factors are largely responsible for the development of these illnesses; among a number of concerning lifestyle indicators, one in six Montrealers is obese and 20% of the city's population still smokes cigarettes (3). These discouraging figures are significant for historically marginalized communities, such as homeless Montrealers. Over 3,000 people live on the city's streets, facing uniquely significant burdens of complex chronic diseases (like HIV and Hepatitis C), mental illness, and substance use (4, 5). Furthermore, the municipal distribution of poor health outcomes is predictably skewed towards disadvantaged parts of the city. The suspicion is that, because of structural reasons—such as low high school graduation, high unemployment, deserts of food and physical activity, and poor connection to healthcare services—life expectancy between wealthier and less fortunate parts of Montreal can be starkly different (6). As of 2011, the least wealthy Montrealers can be expected to live six years less than the wealthiest—the difference could be as wide as eleven years for people from Montreal's East End versus the wealthier parts of the West Island (5).

Granted, these are precisely the kinds of injustices that inspire us to engage in global health efforts. I wonder, however, how much we are actually doing to improve these health disparities at our own doorstep. In my experience, we have generally focused our efforts within the McGill “bubble,” organizing conferences, lectures, and enough wines-and-cheeses for keen global health students to ironically exceed federal alcohol consumption recommendations (7-9). No doubt these awareness-building and scholarly events are important, particularly for university students. But although there is not any readily available data on how we as a group allocate our resources, it certainly seems that we often neglect engaging closely with the

community and working on projects which directly target the social determinants of health.

I am optimistic, however, that this tide is turning: through faculty-led programs and several student initiatives, we, as a McGill community, are taking steps to work directly with disadvantaged populations (10). For instance, McGill's Global Health Programs trains a rapidly expanding pool of Global Health Scholars, who have been conducting field research in Northern Canada and abroad since 2016. Closer to home, the leaders of the student-led initiatives MealCare and Monthly Dignity have been working tirelessly to distribute food and feminine hygiene products, respectively, to those most in need (11, 12). As student leaders preparing our groups and their budgets for the new year, I think we should be inspired by this trend and be deliberate in our planning to put local disparities front and centre in our efforts. We should remember that collaborative approaches and diversified skill sets are necessary to address complex community needs. In McGill's healthcare programs, the concept of teamwork is rightfully drummed into our heads. We attend interdisciplinary workshops where we learn to explore each of our roles in fictional cases such as Noah's, and develop plans of care for standardized patients with complex histories (13-15). We also attend the monthly meetings of McGill Association of Students in Healthcare, where we discuss opportunities for cooperation on projects and events.

Moreover, our healthcare curriculums contain immediate and longitudinal components of public health education. During the very first day of medical school, we gather into our small groups to discuss the case of Maggie, an Indigenous woman with diabetes, marking the beginning of 'Block A'—an entire month focused on public health. As well, in their fourth year of studies, nursing students even get the opportunity to build partnerships with underserved communities and initiate health promotion projects (16). However, to date, there have been too few projects enabling students to bring all these curricular components to fruition in the real world. The year 2017 marked the founding of the Community Health and Social Medicine (CHASM) Incubator, which matches deserving projects with funding and mentorship (17). The program received 14 applications from students of all academic backgrounds, but only three could be accepted into the program—demonstrating the wealth of knowledge and willingness to participate in meaningful collaborative projects among McGill students.

Surrounded by these exciting developments and opportunities, we should commit to directly engaging with social determinants of health. Let us identify global health leaders in all healthcare programs who can work synergistically to initiate, support, and advocate for interdisciplinary projects. Let us be culturally sensitive



when working with marginalized groups and follow the mantra of ‘nothing about us without us.’ Let us be diligent and intelligent in investing our resources to serve the most pressing needs, and be accountable by carefully monitoring our outcomes. Let us partner with experienced faculty as well as graduate and professional students across disciplines to broaden our efforts. Our projects will be richer and more impactful because of it. In 2018, let us roll up our sleeves, get to work, and do as much good as we possibly can.

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# An inclusive approach to Human Papilloma Virus vaccination: the case for gender neutral vaccination in Canada

Sabrina Bartolucci, Lilia Brahim, Allison Hecht, Jasmine Li-Brubacher, Natasha Leblanc, Geneviève Mailhot, Janna Shapiro, and Chelsey Weir



## Background

**H**uman papillomavirus (HPV) is the most common sexually-transmitted infection among Canadians (1). The causal link between specific serotypes of HPV and cervical cancer is well-established (2). HPV infections lead to more than 500,000 cases of cervical cancer worldwide each year (3), and have motivated a strong research campaign to develop rigorous screening tests and prophylactic HPV vaccines (2). Gardasil was first approved in 2007 as a quadrivalent vaccine to prevent HPV infection in young women (4). This vaccine has proven to be safe and effective, with significant reductions in genital warts and cervical lesions in vaccinated females (3). In 2007, Australia became the first country to implement

a national HPV vaccination program, administering Gardasil through a school-based program targeting females aged 12 and 13 years while implementing a catch-up program for females aged 13 to 26 in a school or community setting (5, 6). In 2009, the World Health Organization (WHO) recommended the implementation of a national HPV vaccine program aimed at countries with high levels of HPV infection and cervical cancer (7). Since then, many other countries have followed Australia's path and implemented similar programs.

In addition to the causal link between HPV and cervical cancer, HPV is also associated with anogenital warts and cancers of the penis, anus, oral cavity and oropharynx (1), and 40,000 men develop HPV-associated cancers worldwide each year (3). In 2014, the pharmaceutical company Merck released a 9-valent version of the HPV vaccine to expand coverage against additional HPV serotypes that cause cervical, vaginal, vulvar, anal, penile, head, and neck cancers (3, 8). Despite the efficacy of Gardasil, the prevalence of HPV-associated cancers in men continues to rise (1). In response to this phenomenon, Australia also became the first country to implement a gender-neutral HPV vaccination strategy: in 2013, the country began vaccinating males between 12 to 13 years old in the school-based program, and then ran a catch-up program for males between the ages of 14 to 15 years (1). Since then, other countries such as the U.S., Austria, and Canada have also recommended vaccination in males. Globally, there are now more than 70 governments taking part in the HPV vaccination program, though only 14 of those include the male population in their program (9).

In 2015, Prince Edward Island, Alberta, Nova Scotia, Quebec and Manitoba were the only provinces that had implemented a gender neutral vaccination program (1). Other provinces, such as British Columbia had implemented male vaccination for the men who have sex with men (MSM) population (1). As of 2017, all provinces and territories have adopted gender-neutral vaccination programs for pre-adolescents. The many benefits of a gender-neutral HPV vaccine, however, do not come without risks and costs. The objective of this case study is to assess all aspects of a gender-neutral approach to the HPV vaccine, and to demonstrate the impact of vaccination in both males and females on the improvement of overall HPV-related outcomes compared to female-only vaccination regimens. HPV-related outcomes assessed include health outcomes, cost effectiveness, and gender equality.

## **Methods**

A literature search was performed on PubMed, Google Scholar and Medline using the search terms such as "HPV vaccination," "Gender-neutral", "cost-effectiveness" and

“immunization scale-up programs.” Favored articles included both cross-sectional studies, meta-analyses, and studies relying on models for cost-effectiveness.

## **Results**

### *Health outcomes*

The effectiveness of the HPV vaccine can be evaluated by analyzing HPV-related health outcomes, such as the rates of HPV infection, genital warts, precancerous lesions, and cancer (10). To determine whether the inclusion of males in vaccination programs will improve these outcomes, we must first evaluate the advantages and shortcomings of female-only vaccine campaigns. In a meta-analysis of 20 studies in high-income countries where vaccine coverage rates were above 50% in girls, rates of infection with HPV types 16 and 18 were found to decrease by 68% in young women compared to the pre-vaccine era (11). Furthermore, the prevalence of anogenital warts decreased by 61% and infections with serotypes of HPV not included in the vaccine (HPV 31, 33, and 45) also decreased, suggesting that the vaccine provides cross-protection for these strains (11). Herd effects were also observed: rates of anogenital warts in boys below 20 years of age, and in women who were not vaccinated, decreased after the introduction of the vaccine (11). In countries where vaccine coverage was below 50% in girls, positive effects were seen in the prevalence of HPV infection and anogenital warts, but these effects were limited to the vaccinated population, indicating a lack of cross-protection or herd immunity (11). Together, these data demonstrate that attaining majority female vaccination has positive health outcomes in the greater population.

After the implementation of female-only vaccination in Australia, a national sentinel surveillance network collected data on the effects of vaccination on various populations (10). Consistent with the meta-analysis discussed above, a 59% reduction in genital warts was found in the female cohort targeted by the vaccine program (10). A smaller decline in the rates of genital warts was seen in men who have sex with women. Notably, no decline was observed in the rates of genital warts in MSM (10). These data demonstrate that female-only vaccination campaigns are effective in protecting women, but ignore vulnerable populations such as the MSM community.

Considering this shortcoming, it is relevant to investigate whether vaccinating males would substantially increase coverage in the population. As stated, only recently have all Canadian provinces and territories adopted gender-neutral vaccination programs, and few other countries have implemented these programs with high uptake. As

such, in this case study, prospective studies were used to assess the potential benefits of administering the vaccine to both boys and girls. In one such study, Marty et al. performed epidemiological estimates for HPV-related disease, considering HPV transmission, cervical cancer development, and occurrence of genital warts as health outcomes (12). The analysis compared vaccinations in only 12-year old girls to vaccination in both 12-year old boys and girls. The results demonstrated that the introduction of a gender-neutral HPV vaccination as opposed to a female-only vaccination would decrease the incidence of HPV health-related outcomes such as genital warts in both males and females, as well as head, neck, anal, and penile cancers in males. Furthermore, this study estimated that men's immunization would increase protection for women (12, 13). In conclusion, although arguments have been made to favour the female-only vaccination strategy due to attained herd immunity, this study demonstrates that vaccinating males can allow for further protection for both genders as well as the currently vulnerable MSM population.

### *Cost effectiveness*

The cost-effectiveness of implementing HPV vaccination in males in addition to females has been highly debated since the beginning of mass vaccination with the quadrivalent HPV vaccine. The main economic argument against gender-neutral vaccination is that the cost-effectiveness of vaccinating males decreases as vaccine coverage in females increases. Some researchers have argued that even in populations where uptake levels are as low as 50% in females, focusing efforts on increasing female coverage rates is more cost-effective than implementing a vaccination program that targets males as well (14, 15). For example, a 2012 study found that the cost-effectiveness of implementing a gender-neutral vaccine program in Quebec would amount to CAD \$434,000 per quality-adjusted life year (QALY), greatly exceeding the province's cost-effectiveness threshold typically set at CAD \$50,000 per QALY (16). The cost of the vaccine would therefore have to be lowered to CAD \$12 per dose to reach this threshold (16). However, this and many other cost-effectiveness projections do not consider several key factors, such as lower-than-expected vaccination rates in females (1), the marginal administrative costs of vaccinating men, and the recent shift from three to two doses of the vaccine. They also often fail to account for the economic burden of genital warts, the rise of non-cervical HPV related cancers, as well as the health risks facing the MSM population and individuals who engage in sexual activity outside their region of immunization (1).

The dosing schedule of a vaccination program must also be taken into account in cost-effectiveness assessments. At the time of licensing, the HPV vaccine was given in three doses over six months (17). However, in 2014, the WHO revised the immunization schedule and now recommends a two-dose regimen (17). A recent study comparing the two regimens found that, if the two-dose schedule provides protection for at least 20 years, the benefits of including a third dose are small, rendering the two-dose schedule as the more cost-effective option (17).

Another factor that must be incorporated in assessing the cost-effectiveness of vaccinating males against HPV is the burden of non-cervical HPV-related cancers, such as oropharyngeal cancers (OPC). It has been estimated that, by 2020, OPC rates will surpass that of cervical cancer and become the most common HPV-related cancer in the U.S. (18). Moreover, the rates of HPV-related diseases in men in developed countries have increased in recent years, accounting for 38.8% of the direct costs of HPV-related diseases (19). Given these trends and considering that herd immunity takes decades to materialize, it is questionable whether protecting males solely through herd immunity is sufficient (19).

In a study conducted in 2015, it was estimated that the implementation of the quadrivalent HPV vaccine in males for the prevention of OPC would save Canadians between CAD \$90 and \$144 per individual compared to having no vaccine program in males (19). When this finding was applied to a theoretical cohort of 12-year old boys over their lifetime, vaccinating males was found to result in estimated savings of CAD \$8 to \$28 million. However, this study could not evaluate herd immunity from females to males, and as a result, the cost-effectiveness of male vaccination may have been overestimated (19). A Denmark study highlighted the high economic burden of genital warts, estimating that the country spends a total treatment cost of €8 million per year on treating the disease (20). The study concluded that vaccinating males in Denmark is “a cost effective preventive intervention that would lead to a faster prevention of cancers, cancer precursors and genital warts in men and women” (20). Altogether, these studies show that in high-income countries such as Canada, the increasing burden of non-cervical HPV-related diseases in the male population results in the cost-effectiveness of gender-neutral HPV vaccination programs.

### *Gender equality & inclusivity*

The inclusion of males in HPV vaccination is a crucial step towards non-discriminatory prevention of significant diseases related to HPV. Despite the evidence and support for the vaccination of both boys and girls, there are many social constructs and inequities

that continue to halt the progress of gender-neutral vaccination programming. Targeting only girls conveys the messages that HPV-related diseases are limited to girls, that girls are “more prone to promiscuous behavior,” or even that girls bear the responsibility for transmitting HPV (21). The over-identification of HPV with females has in fact been referred to as the “feminization of HPV” (22), and overall narrowed the lens for HPV prevention, creating stigma in communities.

Moreover, as discussed earlier, many vaccination policies in Canada have historically looked at the issue through heteronormative conventions, ignoring MSM populations who in fact bear high rates and incidence of HPV (22, 23). In July 2015, British Columbia announced its plan to provide the HPV vaccine for boys, MSM, and men who are “street-involved” (24). Although a step forward to protecting all individuals, this policy created further ethical conflict. The school-based HPV vaccination program offered the vaccine to eleven-year-old boys, requiring these children to identify their sexual identity at a young age in order to receive health services. This requirement could have possibly delayed boys’ access to the vaccine until they were comfortable in identifying as homosexual, and had an overall stigmatizing effect by only targeting homosexual men and excluding heterosexual ones (25). As of January 2017, British Columbia has adopted a truly gender-neutral HPV vaccination program. In conclusion, including all males in the HPV vaccination programs will counteract the feminization of HPV and contribute to a non-discriminatory and inclusive approach to public health in Canada.

### *Scale-up & Implementation*

The results reviewed above indicate that vaccinating both boys and girls against HPV is a cost-effective strategy to improve HPV-related health outcomes and promote inclusive, ethical practices in the Canadian health care system. As to scale-up and implementation, an important consideration pertains to the structure and governance of health care in Canada. Under the Canada Health Act (CHA), provinces and territories have jurisdiction over the management, organization, and delivery of healthcare, including immunization. In a 2012 report on HPV vaccination, the National Advisory Committee on Immunization (NACI) included five updated immunization recommendations, two of which targeted males specifically (26). Subsequently, as of July 2016, the Public Health Agency of Canada (PHAC) has updated its recommendations to include the quadrivalent and nonavalent HPV vaccines for males 9 to 26 years of age for the prevention of anal cancers (26). These recommendations have informed provincial legislations in introducing gender-neutral



vaccination regimens. In Ontario, for example, approximately 150,000 school-aged youth will now be eligible to receive the vaccine every year (27).

The outlook for gender-neutral vaccination scale-up within provinces is promising. Importantly, the existing healthcare facilities and institutions, such as hospitals, pharmacies, schools, and private clinics involved in the distribution of the vaccines can alleviate some of the hurdles in scaling up the program. For instance, given the existing school-based delivery programs, accessing a new target population of young men would be relatively easy to orchestrate. In addition, the favourable public opinion surrounding male vaccination against HPV can make communication and social mobilization easier (28). In fact, public advocacy and support has been and will be critical in the inclusion of males in HPV vaccination programs. In 2015, the Canadian Pharmacists Association released a statement urging the federal government to enhance the current immunization policy as it “[puts] the health of Canadians at risk” (29). This type of advocacy was critical for the emergence of gender-neutral vaccination programs across all Canadian provinces and territories (30).

Finally, given the successful administration of the female-only vaccination schedules in Canada, public health policy makers can draw on the lessons learned in the past decade for further improving provincial gender-neutral vaccination programs. Canada also stands to benefit from modeling after approaches to gender-neutral HPV vaccination in countries with a similar GDP per capita and health system capacity, such as Australia.

### *Conclusion*

The objective of this case study was to demonstrate improvements in overall HPV-related outcomes as a result of the implementation of HPV vaccination programs in both males and females. Gender-neutral HPV vaccination is beneficial in terms of the burden of HPV-related disease, cost-effectiveness, and gender inclusivity. The lessons learned in the implementation of the gender-neutral HPV vaccine across Canadian provinces and territories could also inform the scale-up of similar programs to other similar socio-economic settings with universal health coverage.

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# Trump's global gag rule and its impact on maternal health worldwide

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## Introduction

In 1973, the U.S. Congress passed the Helms Amendment under the Foreign Assistance Act, stating that U.S. governmental funds could not be used to finance abortions as a method of family planning, or to motivate or coerce any person to practice abortions (1). In 1984, this policy, in turn, influenced President Ronald Reagan's authorization of the Mexico City Policy, also known as the Global Gag Rule (GGR). The policy restricts U.S. funding to those foreign organizations providing voluntary abortion services, including services that do not use American funds directly to finance abortion (2). For instance, even if an organization undertakes abortion services financed internally or through non-U.S. funds, it is not eligible to receive U.S. federal funding to support programs unrelated to abortion (1). Since the Reagan era, this policy, having resulted in a significant loss of U.S. funding for many

organizations worldwide, has been implemented by every Republican administration and rescinded by every Democratic administration (3).

Despite much international attention given to its improvement in recent years, maternal health remains a significant global health challenge (4). In 2015, an estimated 303,000 women worldwide died of preventable pregnancy or childbirth-related causes including hemorrhage, infection, unsafe abortion, and obstructed labour (4, 5). It is further estimated that, as of 2015, 99% of maternal deaths occurred in developing countries, with sub-Saharan Africa and South Asia being the regions most affected (4). In much of the developing world, access to vital medicines and reproductive health services pose significant challenges to sustaining the maternal health of women and girls.

Over the last decade, the U.S. has been, according to the Kaiser Family Foundation, “the largest funder and implementer of global health programs worldwide” (6). In fact, global health has been a significant component of the country’s “international development portfolio, accounting for about 24% of the international affairs budget,” totalling \$10.4 billion in 2017, up from \$5.3 billion in 2006 (6). However, the Trump administration has proposed a slash in global health funding for 2018. Despite the U.S. having maternal and child health (MCH) as one of its main global health priorities, the proposed budget only allocates \$1.05 billion to MCH, a cut of more than \$200 million from 2017. Given the U.S.’s crucial role in global health initiatives, these funding cuts will dramatically impact efforts towards improving MCH worldwide.

### *Trump and the Global Gag Rule*

On January 23, 2017, three days after his inauguration, U.S. President Donald Trump released a presidential memorandum reinstating the Mexico City Policy. In May of that year, the then Secretary of State Rex Tillerson endorsed the “Protecting Life in Global Health Assistance” implementation plan as the newest iteration of the GGR. The policy was expanded: Global Health Assistance now includes support for any international health programs funded by U.S. government departments or agencies, such as the Centre for Disease Control, whereas previous iterations only applied to the US Agency for International Development (USAID) (1). Under Trump’s GGR, organizations that independently provide family planning services will not qualify for USAID funding regardless of their primary mandate (3, 7). For example, organizations focused on combating Zika or HIV/AIDS with auxiliary service provision in family planning, previously eligible for U.S. funding, would

now be barred from receiving federal funds (1). In addition, Trump's GGR restricts U.S. funding not only to foreign NGOs but to all other recipients that enable the provision of safe abortion services, which could include foreign governments as well as U.N. agencies (2). Under the Bush administration's President's Emergency Plan for AIDS Relief (PEPFAR), organizations that included HIV treatment as part of a package with reproductive or maternal health care could still receive HIV/AIDS assistance, even if they could not receive funds for family planning assistance. No such exemption, however, exists under Trump's GGR (7).

## **Impacts of GGR**

### *Economic Impacts*

Trump's GGR has both direct and indirect impacts on affected countries' economic health. While previous iterations of GGR imposed \$600 million cuts, Trump's GGR suspends \$9 billion in funding for family planning, significantly impacting the budget of organizations such as Planned Parenthood International which is projected to lose \$100 million over the next four years. Marie Stopes International, an NGO focused on maternal health, reports that, without alternative sources of funding between 2017 and 2020, Trump's GGR could result in 6.5 million unintended pregnancies, 2.2 million abortions, 2.1 million unsafe abortions, and 21,700 maternal deaths (8). Moreover, the costs of treating medical complications from unsafe abortion by themselves can impose a significant financial burden on public healthcare systems in the developing world (9).

On a broader scope, Trump's GGR can negatively impact economic growth in affected countries. The economic health of developing countries is directly correlated with reduced fertility (10). When women have increased control over their fertility by having safe access to abortions and contraception, high school dropout rates decrease and employment opportunities increase, potentially leading to growth in GDP (11). In addition, a reduction in fertility rates changes the age structure of the population, leading to a period of one or more decades when the dependency ratio—the ratio of children and the elderly to the working-age population—declines, potentially improving a country's GDP (12).

### *Impacts on maternal health, family planning, and child health*

Though the purported goal of the GGR is to reduce the incidence of abortion, there is no evidence to suggest that it has been successful in its mandate (12). In 2011, the World Health Organization (WHO) investigated the relationship

between the reinstatement of the GGR and probability of a woman obtaining an abortion (13). The study found that, under Bush's GGR, women in countries most affected by GGR were 2.7 times more likely to have an abortion (13). Due to the limitations of the self-reported data, it is likely that the number of abortions is an understatement because of the stigma and legal restrictions around abortion in many of these countries.

One of the immediate consequences of the GGR is the disruption of family planning services in countries heavily dependent on U.S. foreign assistance for the implementation of these programs. Some organizations that provide reproductive health and family planning services have refused to comply with the policy due to their insistence on providing abortion services, often facing severe consequences. In 2002, after local family planning associations in 16 developing countries rejected the GGR policy, USAID contraceptive donations to these associations were terminated (14). For example, having rejected the GGR, the Planned Parenthood Association of Zambia (PPAZ) lost 24% of its core grant and had to scale back on its community-based distribution programs—a key source for distribution of free contraceptives, including condoms, to smaller NGOs and rural populations (15, 16).

Moreover, such disruptions to family planning services limit access to contraceptives and decelerate the uptake of modern contraceptives, therefore increasing the incidence of unwanted pregnancies. For example, a study investigating the effect of the GGR in Ghana found that unwanted pregnancies in the country's rural regions increased by 12% after the implementation of the policy (17). In fact, every year, 25 million unsafe abortions occur worldwide, and their often fatal consequences account for 13% of all maternal deaths (18, 19). While there is no direct evidence showing that the GGR increases maternal mortality (12), increases in unwanted pregnancy and decreases in access to safe abortions are both associated with more unsafe abortions and maternal deaths.

Finally, the use of contraceptives has a powerful impact on child survival by increasing the interval between successive pregnancies, in turn reducing the risk of adverse maternal, perinatal, and infant outcomes (20, 21). Limited access to contraceptives and the increase in unwanted fertility translates to inappropriate child spacing, endangering the survival and health of all children and the mother (12). In fact, the Ghana study cited above found that children conceived under the GGR have statistically significant growth deficits (17).

### *Impact on services related to HIV and other infectious diseases*

Many NGOs in low- and middle-income countries use an integrated model of care, where the organizations provide reproductive and maternal health care, primary care, infectious disease counselling and treatment, nutritional counselling, and many other services in one setting. This approach reduces the costs of having distinct clinics for each service, makes care more accessible and efficient for patients, and, importantly, integrates HIV services and reproductive health.

As mentioned earlier, Trump's GGR does not include Bush's PERFAR or any other exemptions (3). As such, organizations that provide treatment and care for HIV, tuberculosis, malaria, maternal health, nutrition, or any other global health challenge, have to abide by GGR restrictions to be eligible for funding, and lack of compliance would entail far-reaching consequences at every level of prevention (22). At the primary level, the goal is to reduce the incidence (new cases) of disease. Under the GGR, limited funding for contraceptives and reduced resources for HIV-related community outreach and educational programs will further enable HIV transmission, hindering primary prevention efforts (23). Further, since non-compliant organizations have to cut back on testing resources or to simply shut down, secondary prevention strategies—aimed at identifying HIV-positive individuals to prevent further transmission—will also be vulnerable. Finally, tertiary prevention efforts, aimed at treating those with a disease and ensuring adherence to treatment, will also face impediments under Trump's GGR: many organizations either close or operate at reduced capacity, and treatment prices may increase. As well, the possibility of the disintegration of care means that those who normally accessed care at a particular clinic may have to visit multiple locations, leading to a potential decrease in adherence to treatment and reduction in the effectiveness of antiretroviral therapy.

It is important to note that the GGR can impede healthcare services relating to other infectious diseases, as well. However, this paper focused on the case of HIV due to the previous existence of the PEPFAR exemption.

### *An unfair burden*

The GGR disproportionately affect the most vulnerable in every community. When faced with funding cutbacks, it is common for organizations to scale back their community outreach programs due to these programs' high resource requirements,



hence depriving marginalized and at-risk populations of necessary care. For example, the slum neighbourhood of Eastleigh, Kenya, is home to many refugees from the Congo, Ethiopia, and Somalia, but has no government-run clinic (23). The Family Planning Association of Kenya was the only NGO providing reproductive health services in this area, including HIV counselling and testing. In 2001, community health workers reached 56,000 people with reproductive health information, education, and counselling, made 30,000 referrals, provided 75,000 people with contraceptives, and distributed 89,600 condoms. After the GGR was reinstated, the organization had to reduce community-based distribution efforts by half (23). Additionally, if lack of funding compels clinics to increase prices for services, the only people who will be able to access care are those who could already afford it, leaving the low income populations without options.

### **Future directions and Canada's chance**

In order to provide a funding platform for organizations that do not sign the GGR, Lilianne Ploumen, the Dutch Minister of Foreign Trade and Developmental Cooperation, launched the SheDecides campaign in January 2017 (24). The campaign's goal is to end reliance on single donors, offset the damage caused by the GGR, and enable communities to maintain access to sexual and reproductive health services (2, 24). Overall, the initiative's mandate is to improve access to maternal care, contraceptives, and abortion services for millions of women around the world (24). In March 2017, an international conference was held in Brussels to raise awareness and funds for the SheDecides campaign, bringing together political leaders from more than 50 countries, organizations, and foundations to discuss the large funding gap caused by the GGR and raise \$600 million to overcome the funding shortfall. While only \$190.1 million was raised during the conference, advocates believe the gap will soon be bridged by funding from highly-industrialized countries (25). Canada currently has the highest pledge of \$20 million to the SheDecides fund (25). Though the campaign is promising, the pledging countries could still be doing more. For instance, Canada's overall foreign aid budget is less than 0.3% of its GNP, short of the 0.7% target set by the UN (25). Unfortunately, this trend is consistent among many donor countries, and, moreover, countries often contribute far less than they pledge (7). As such, the challenges of retention and compliance ought to be overcome if SheDecides is to be successful.

With Canada's Feminist International Assistance Policy, the Trudeau government has already made a pledge to support efforts to empower women and girls worldwide. Facilitating the provision of access to information, services, and resources for women regarding reproductive health is a crucial component of this empowerment. In addition to the contribution to SheDecides, Canada has also promised \$650 million to fund reproductive health and support services (26). However, this investment is a drop in the \$9 billion bucket left empty by Trump's GGR. In times like these, the Trudeau government could become a leader in the efforts to improve MCH on a global scale. We look forward to seeing Canada take a bigger role in initiatives prioritizing gender equality and the empowerment of women and girls globally.

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# Ethiopia’s Health Extension Workers and maternal healthcare improvements

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## Background

Since late 1980s, maternal mortality—a key indicator of health and socioeconomic development—has been recognized as a major global health concern due to the alarming gaps in mortality rates between rich and low-middle income countries (LMICs). Yet maternal deaths are largely preventable, with over three quarters of them resulting from postpartum hemorrhage, puerperal infections, pre-eclampsia and eclampsia, complicated delivery, and unsafe abortions (1). The fifth goal set by the Millennium Development Goals (MDGs) was dedicated to improving maternal health, aimed at reducing related deaths by 75% before 2015 (2). By the end of the MDG mandate, the maternal mortality ratio (MMR) declined by approximately 43% globally, dropping from 385 to 216 deaths per 100,000 live births between 1990 and 2015 (3).

Sub-Saharan Africa, however, still struggles with an estimated regional average of 546 maternal deaths per 100,000 (3, 4). As new and more ambitious targets have been set with the Sustainable Development Goals, reinforced interventions at an accelerated pace are urgently needed to improve access to skilled pre- and post-natal care, especially in remote areas (5). Ethiopia is the second most populous country in Sub-Saharan Africa, with nearly 40% of the national population living below the extreme poverty line and approximately 83% residing in rural areas (6, 7). Yet, the country has experienced an astonishing 71% drop in maternal mortality, making it quite a unique case in the African panorama (8). Much of this progress has been achieved over the last decade as the implementation of the Health Extension Program (HEP) substantially expanded maternal healthcare coverage in the country. The HEP is a comprehensive health outreach strategy designed to provide a wide-reaching primary care platform and strengthen Ethiopia's existing health institutions (7, 9).

#### *The pre-HEP era: barriers to maternal health in Ethiopia*

Prior to HEP's implementation, the average distance to a health facility in Ethiopia was 15 kilometers, often traversed over unpaved roads by foot, making healthcare facilities physically inaccessible to a large portion of the population. Additionally, suffering a human resource crisis, Ethiopia only had one healthcare worker per 3,036 people before 2003 (7, 10, 11), with the healthcare worker-to-population ratio being as low as 1:10,000 in rural regions (12). It is well established that providing a continuum of care through the antenatal, delivery, and postnatal phase is crucial for preventing pregnancy-related deaths; however, care coverage in all three aspects was limited for Ethiopian mothers, with substantial disparities across the country due to healthcare facility inaccessibility and unavailability of adequately trained staff in rural regions (7).

According to the 2000 Ethiopia Demographic and Health Survey (EDHS), though quality antenatal care has been associated with decreased morbidity and mortality, 78% of mothers living in rural areas received no antenatal care in the seven years preceding the survey. Of the women who did receive care, only 10% made at least four antenatal visits, which is the minimum number of antenatal visits recommended by the World Health Organization (WHO), and only 27% of them were given information about pregnancy-related complications (13). Furthermore, according to EDHS, a low proportion of Ethiopian mothers delivered under the care of skilled health professionals, with approximately 95% of births taking place at home without any supervision. Of cases of supervised births, 30% were assisted by traditional

birth attendants (TBAs), compared to 6% assisted by skilled health professionals (13). TBAs are women from the community who are called upon to aid in all local births based on their previous experience. While they have little formal training and resources for handling high-mortality pregnancy complications such as hemorrhage and preeclampsia, they are knowledgeable in cultural practices and often perceived as more familiar and comforting to the women they are assisting, and thus more culturally acceptable (14). Lastly, considering that a large proportion (65-75%) of maternal deaths occurs in the first 48 hours after birth, providing quality postnatal care has been increasingly recognized as a core intervention in reducing maternal mortality (15). Surveyed mothers, however, were found to often be unaware of potentials for postpartum complications as well the need for postnatal health checkup. In fact, in the pre-HEP period, only 8% of mothers received checkups in the crucial 48 hours after birth (13).

### **The Health Extension Program (HEP): an overview**

The HEP is a community-based health program first piloted in 2003 in four agrarian regions of Ethiopia, expanded to all rural regions in 2004 (15). The program aims to improve primary health services in rural and pastoral regions through a community-based approach focused on preventative health interventions in addition to basic curative care via transfer of knowledge and skills to households (15, 16). The HEP strengthens the existing healthcare structure by introducing Health Extension Workers (HEWs)—referring to women trained for a year in a certificate program delivered by the Ministry of Education—to deliver essential interventions from village health posts (12, 17). The HEP was modified to better accommodate rural and pastoral regions in 2006 and expanded to urban areas in 2010 (18).

Since 2005, Ethiopia's public health system has been organized into three major tiers (12). In rural areas, where distance is a restricting factor in the size of the population that a clinic can serve, HEW health posts (one post exists for every 3,000 to 5,000 people) refer patients based on severity to health centres, which can refer people upwards to primary hospitals and from there to specialized hospitals. In urban regions, HEWs are stationed at health centres (each centre serving up to 40,000 people) and refer patients directly up to the secondary tier of care, comprised of general hospitals, which in turn provide more in-patient services. Lastly, specialized hospitals make up the tertiary level of care. The structure of this system has made healthcare much more accessible to a majority of Ethiopians, and over two thirds of the population now uses public rather than private facilities for primary and preventative care (12,

16). The HEP, as demonstrated, is an integral part of the Ethiopian health system's primary level of healthcare and forms the first point of care delivery in both urban and rural areas.

### **Impacts of HEP in rural areas**

The HEP significantly increased the availability of healthcare services in Ethiopia: since 2004, the country's health workforce has more than doubled and the healthcare workforce-to-population halved (at 1:1394), owing mostly to the HEW additions. The number of healthcare facilities has also grown significantly, with over 15,000 new health posts added all over the country in the past decade (17, 19). Now, most rural Ethiopian mothers live within five kilometers of a health post (19). The Ethiopian government's continued investment in all HEP-related projects and coverage of all costs of services provided at the health post level has been crucial to its scalability (20).

#### *Improvement of health-seeking behaviours*

In rural areas, distance, as well as a lack of infrastructure and transportation, impose physical barriers to access to care. The HEP tackles this problem by bringing the healthcare system to the people: staffed by two to four female HEWs, a health post has been built in each village with a population of at least 3,000 people, serving as the first point of care and referral in the public health system (12, 17, 18). HEWs spend half of their time stationed at the health post providing basic curative and counselling services and the other half going door-to-door as part of public health education campaigns (18). Importantly, they provide maternal and child health services through community-based care management, newborn care, and long-term family planning (21).

As part of their public health campaigns, HEWs seek out and train the most welcoming households in specific health-seeking behaviours. After displaying pro-health behaviour regularly, these "early adopter" households are publicly recognized for their accomplishments, serve as role models for the community, and may also aid HEWs in providing guidance to their peers. Data suggests that as more model households become publicly recognized for exhibiting health-seeking behaviours over time, community stigma surrounding certain healthy behaviours—such as seeking antenatal care and pregnancy counseling—is reduced (12,17). Consequently, household decision makers in the community are more likely to adopt pro-health mindsets, ultimately reinforcing the scale-up and continuation of the intervention. As a result, the HEP grows community participation through



educating the community, creating behavioural change, and planning systematic community mobilization (12, 17).

Moreover, in 2016, Ethiopia's Ministry of Health (MoH) implemented its Health Development Army (HDA) to further extend healthcare coverage. Designed to engage communities in identifying local health challenges and potential strategies, the HDA recruits women from model households to aid HEWs in public health campaigns, reduce harmful traditional practices, and debunk stigma over seeking care (17). The woman-centred HDA approach increases the functional density of interventions and encourages families to expand the HEP deeper into their communities to improve overall long-term community adoption of key health behaviours, including maternal and newborn health (12, 17). In areas with advanced HDA networks, coverage of key health interventions has improved (17, 22).

### *Improvements in maternal healthcare*

HEWs also undergo specialized training in delivering maternal care services in three major areas: antenatal care, promotion of institutional delivery, and postnatal care. HEWs administer antenatal care to meet standard guidelines of care in Ethiopia, which is comprised of a thorough physical examination for every pregnant mother, blood tests, a urine test, tetanus toxoid (TT) injections, iron and folate supplements, and deworming medications (12). The rate of antenatal coverage has increased dramatically since 2004, with up to 54% of women in rural areas currently receiving antenatal care from HEWs (7). Additionally, since the MoH's main aims to promote institutionalized child births, HEWs are expected to counsel mothers on birth preparedness and refer all pregnant women to the closest health facility for delivery (12).

Moreover, HEWs are trained in assessing general health indicators in the 24 hours after birth—such as vaginal bleeding, uterine contraction, and temperature—as well as follow-ups on general physical and mental wellbeing postpartum (23). They can make home visits to women after birth to provide home-based postnatal care, especially in rural regions where healthcare facilities may be more inaccessible to women recovering from labour. Ideally, one HEW provides continuous care to a mother throughout the course of her pregnancy. In fact, the implementation of the HEP strategy marked the Ethiopian healthcare sector's first attempt to provide a continuum of care to a mother from the moment of conception to early childhood of her infant (26).

Lastly, there are indications that HEWs have increased postnatal care awareness and coverage among women: in a survey conducted in the Tigray region of Ethiopia, the

number of mothers who were informed about postnatal care services increased from 30% to 84%, with 85% of the cohort indicating that their HEWs had informed them of the services. As well, 66% of the new mothers surveyed utilized postnatal care services, with half of them using those services provided by HEWs (24). Cross-country data reflects this trend, with significant improvements seen in antenatal care coverage and postnatal care coverage since the implementation of the HEP (7, 25-27).

### **Limitations of HEP**

Despite its many successes, evidence shows that the HEP has had no significant effect on improving skilled birth attendance, a phenomenon due to a real or perceived lack of knowledge in the abilities of HEWs. For example, in their midterm evaluation, almost half of the HEWs surveyed were not able to identify or respond to severe complications during and after labour, often lacking appropriate knowledge and skills to conduct clean and safe deliveries (12, 28). In fact, qualitative analysis of HEW care delivery reveals that many HEWs still call on TBAs to assist in deliveries where the mother cannot reach a hospital or health centre. Further intervention into this challenge is pertinent as most maternal mortalities occur as a result of birth-related complications and skilled labour attendants can prevent up to 33% of maternal deaths (1, 14, 29).

Additionally, while the scale-up of the HEP has been impressive, quality of care varies between regions, with rural and pastoral areas bearing the largest burden of negligence. In some places, this shortcoming is due in part to poor oversight and coordination of HEWs with the rest of the healthcare system, improper HEW training, as well as general lack of infrastructure and resources (28). Considering that the program relies heavily on community uptake and trust, it is surprising that some neighbourhoods have reported that their HEWs were not originally from the community (30). Last but not least, lack of public infrastructure and transportation in large swaths of the country continues to render care past the level of health posts inaccessible to many. In fact, in a 2011 government survey, 71.1% of women named lack of transportation to a health facility as a major barrier to giving birth in a supervised and institutionalized setting (31).

### **Future Directions of the HEP**

MoH's 2010/2011 Health Sector Development Plan includes furthering health infrastructure development, developing HEW capacity and knowledge, and prioritizing engaging with women as key parts of improving the HEP (17). Since 2012, the MoH has tackled transportation and infrastructure barriers by

implementing a free, 24/7, ambulance service, with at least one ambulance available per district. Today, almost 70% of ambulance users are women undergoing labour (17). Additionally, based on feedback from HEWs, the MoH has now committed to providing government-sponsored bicycles to facilitate home visits for HEWs (32). Due to the low midterm evaluation scores of HEWs, the MoH has also prioritized further training for all HEWs: between 2012 and 2013, there were 2,240 HEWs in the process of taking additional training to be upgraded from Level III to Level IV Health Extension Practitioners (12). As well, since 2010, one of the most popular HEW in-service training programs has been centered on providing clean and safe deliveries (17). As such, HEWs could also provide a talent pipeline for future midwives and nurses, with Level IV Health Extension Practitioners needing only one level of upgrading to progress to Level V Nurse Anesthetists (17). This mechanism would promote the capacity of HEWs to provide safe deliveries and thus dramatically increase the density of skilled birth attendants. Moreover, the HDA program may benefit from continuing to build the capacity of local women to advocate and educate the populace about women's health. To truly empower women to participate in major healthcare decisions, Ethiopia could allow HEWs and HDA leaders to participate in local political meetings or solicit increased funding to allow currently unpaid HDA leaders to continue their work (28, 33).

In conclusion, the HEP serves to enhance many aspects of the healthcare system, particularly as they pertain to improving maternal health care. Strong financial and government investment in this program and its offshoots ought to continue for Ethiopia to maintain its momentum in improving maternal healthcare and decreasing maternal mortality. Overall, while the impact of the more recent innovations discussed in this section will remain to be seen in the coming few years, Ethiopia is certainly moving in the right direction.

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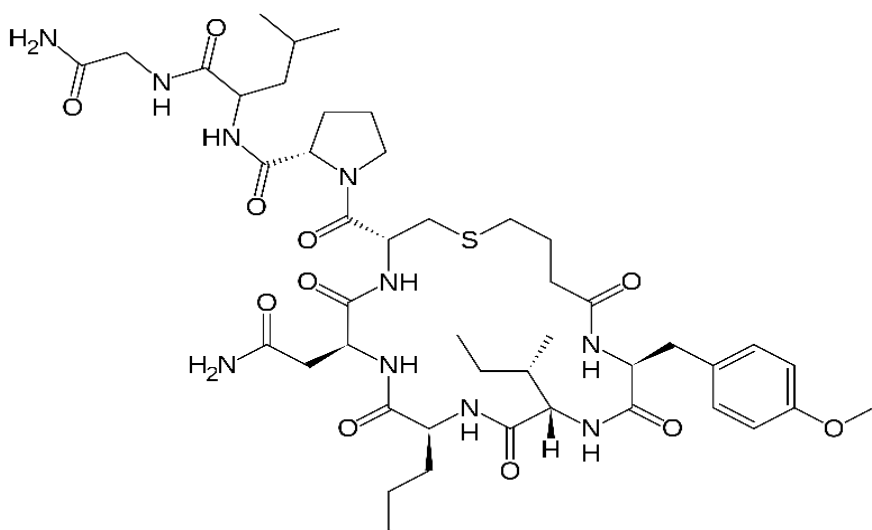
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# Beating the heat: the development and implementation of heat-stable carbetocin to prevent postpartum hemorrhage in low-income countries

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## Introduction

**A** leading threat to maternal health is complications related to pregnancy and childbirth. Though the number of annual maternal deaths declined from 532,000 in 1990 to 303,000 in 2015 (1), the global maternal mortality rate (MMR) is still quite high, and a mother dies every two minutes due to complications of childbirth (2). Postpartum haemorrhage (PPH), accounting for one quarter of maternal deaths globally, is the greatest contributor to MMR (2). PPH is classified by the World Health Organization (WHO) as blood loss of exceeding 500 ml within the first 24 hours following birth. The most common cause of PPH, accounting for nearly 80% of the cases, is uterine atony (3). Under normal physiological conditions,

oxytocin released from the pituitary gland leads to uterine contractions that prevent blood loss (4). At term, approximately 500 millimeters of blood flows to the uterus per minute, and inadequate contractions can lead to substantial blood loss (5). The use of uterotonic agents that promote contraction of the uterus, therefore, presents a mainstay treatment for PPH caused by uterine atony (3).

Injectable oxytocin is the current uterotonic recommended by the WHO for PPH (6). The drug, however, has to be injected under the administration of a medical professional, presenting a limitation to its use. In addition, oxytocin must be stored in the dark and at temperatures requiring refrigeration (2°C to 8°C), or at controlled room temperature (25°C or lower) for a restricted amount of time in order to maintain its potency (7, 8). As such, a cold chain system for storing and transporting oxytocin is required. Due to the thermal instability of the product, there are limitations to oxytocin's efficacy in field conditions, particularly in hot climates where PPH-related maternal mortality is the greatest (8, 9).

### **Intervention: the heat-stable carbetocin**

Carbetocin is a synthetic oxytocin analogue manufactured by Ferring Pharmaceutical that has similar pharmacodynamic properties to oxytocin (10). The therapy has been used in over 8.5 million women for the prevention of PPH. This alternative uterotonic agent, delivered through intramuscular or intravenous injection, has been shown in multiple studies to have fewer side effects than oxytocin (10). Owing to its longer half-life, carbetocin induces stronger and more frequent contractions than oxytocin when administered postpartum (11). Its high bioavailability paired with its long half-life allow for a single administration instead of multiple injections thus reducing the invasiveness of the treatment.

Recently, a heat-stable version of carbetocin (HSC) has been developed that does not require refrigeration and can be kept at high temperatures without losing potency for at least three years. The new version of the drug contains the same active ingredients as the original therapy, but differs in its excipients in order to increase stability. This new intervention presents a promising treatment for PPH in low- and middle-income countries, where maintenance of a cold chain can be challenging and, as a result, the quality of oxytocin variable. In an effort to prevent PPH, the WHO, Ferring Pharmaceuticals, and Merck for Mothers (MFM)—an offshoot of pharmaceutical company Merck—joined together in 2011 in a project called Project CHAMPION, which aims to develop and make HSC accessible to women in low- and middle-income countries (12).

With the benefits of being heat-stable and administered in a single dose, this new

HSC drug has promising applications in settings where cold storage is infeasible and intensive monitoring of women after birth is difficult. As of the time of writing, CHAMPION trials are expected to conclude in 2018. If trial results prove positive, the collaborating organizations intend to work together to make HSC available in the public health sector of countries facing a high burden of PPH. Collaboration on the parts of many players in global health will be needed in order to guarantee that HSC will be accessible to women in low-income countries. A number of challenges exist when introducing a new drug into market and necessary changes to a number public policies will be required. These may include, among others: updating global recommendations on the prevention and management of PPH, revising national and facility level guidelines on the prevention and management of PPH, registering and marketing approval for HSC at the national level, and providing training programs for healthcare professionals on the proper administration of HSC for PPH (13).

### *Efficacy*

While carbetocin is known to be a safe and efficacious drug, the heat-stable version of the treatment must still undergo clinical trials to determine its effectiveness and safety following vaginal delivery. As part of the collaboration between MFM, the WHO, and Ferring Pharmaceuticals, the WHO is in the process of conducting a phase III clinical trial to evaluate the efficacy of HSC versus oxytocin in the prevention of PPH and severe PPH after vaginal birth (8). In addition to assessing efficacy, the safety of the drug in question will also be examined. Adverse effects will be reported whether they were described by the participant or detected by the investigator (8). The clinical trial has two primary endpoints: 1) to evaluate non-inferiority of HSC compared to oxytocin following vaginal delivery in the prevention of PPH, and 2) to assess non-inferiority of HSC compared to oxytocin in the prevention of severe PPH (defined as blood loss exceeding 1,000 millimeters or more at one hour) (8). To quantify these clinical endpoints, the WHO is assessing blood loss as measured by a calibrated drape placed under a woman's buttocks after the administration of the drug and the severance of the umbilical cord but prior to the delivery of the placenta. Blood loss will be measured for a period of one hour postpartum; if bleeding exceeds beyond the hour, measurements will be extended to two hours (8).

The key metrics for impact evaluation of the project as a whole include the quantification of maternal mortality averted, maternal morbidity averted, and the 'ripple effect' averted. As the intervention is currently in clinical trials and has not yet been scaled up, an impact evaluation has not been completed. However, as



previously mentioned, early results of the clinical trials do indicate that carbetocin may be more effective than oxytocin on a number of metrics (14). Based solely on its performance in clinical settings, it is reasonable to assume that if HSC were made available and affordable in health care settings in low- and middle-income countries, the intervention would have a significant impact in reducing PPH if only by providing a more reliable and effective treatment option. As well, this intervention could have a significant impact in terms of reducing the economic and social hardship of the ‘ripple effect’—a term often used to describe the long-term impacts of a mother’s death on families in developing countries. Studies in Malawi and Ethiopia have found that maternal death exacerbates children’s vulnerabilities to long-term negative health outcomes and social impacts related to nutrition, education, employment, early partnership, pregnancy, and caretaking (15, 16). These impacts particularly affect female children in the family, who are often forced to take over the majority of the household and child-rearing responsibilities after the death of a mother (15). Although it is difficult to assess the impact of the ripple effect on all low-income countries, it is probable that if HSC is proven to be effective and made available, a large proportion of the negative economic, health, and social impacts on families would be averted.

### *Sustainability*

A 2016 press release from Ferring Pharmaceuticals stated, “If the results of the study are positive, the collaborating organizations will work together to provide access to the treatment at an affordable and sustainable price, in countries with a high burden of maternal mortality—mainly in Africa and Asia” (19). It is not clear what a “sustainable and affordable” market price would look like for the HSC. Currently, in the U.K., Ferring sells its non-heat stable carbetocin for £10 per dose (20); otherwise, however, global prices are difficult to locate due to a lack of transparency on drug pricing worldwide. Moreover, no studies have been published to date that compare the cost-effectiveness of carbetocin versus that of oxytocin for the prevention of PPH following vaginal delivery, and without the completed WHO trial, it is not possible to determine with certainty the cost-effectiveness of the new HSC versus oxytocin. However, several studies have examined the cost-effectiveness of carbetocin versus oxytocin for the prevention of PPH following cesarean section.

The most recent and extensive cost analysis study of carbetocin was done as a prospective cohort study evaluating the cost of carbetocin compared to oxytocin when used for prevention of PPH following caesarean sections at a U.K. hospital.

This study showed that, when considering the costs associated with drugs, blood and blood products, midwifery, and time spent in recovery, the use of carbetocin translates to a total saving of £77, 201 (£68.93 per patient) per annum for the hospital unit (20). Studies in Canada, Mexico, and Poland showed that the use of carbetocin provided cost savings when compared to oxytocin. In Canada, a cost-minimization analysis of carbetocin (Duratocin label) for the prevention of PPH found that Duratocin was the cheapest treatment strategy for the prevention of PPH in elective caesarean section delivery (21). As well, the study conducted in Mexico found carbetocin to be more cost-effective than oxytocin at preventing uterine atony (22). The Polish study found that, when used following a cesarean section, carbetocin was more cost-effective than oxytocin in preventing PPH due to reduced drug costs, reduced blood product use, and faster discharge from hospital (23). Though, as mentioned earlier, none of these analyses examined cost savings associated with carbetocin use to prevent PPH following vaginal delivery, it is possible to make further extrapolations by looking at a 2017 study comparing the outcomes of high-risk patients treated with oxytocin versus carbetocin after vaginal delivery. Though not necessarily focused on cost analysis, this study found that there was no significant difference between study groups for the need of additional blood transfusions, but there was a significant difference in the use of additional uterotonics (23% vs. 37% in favor of carbetocin), and generally those in the carbetocin group fared better. For this reason, it is likely that the Merck project will also see cost-savings with respect to drug costs and length of hospital stay, but not for additional blood product use (13).

The final factor to be considered when evaluating the potential for cost-effectiveness of the MFM carbetocin project is the costs associated with cold-chain management. Oxytocin requires storage at between 2 to 8°C; this standard, however, is very hard to maintain in countries with average temperatures above 30°C and inadequate cold chain management infrastructure (24). The cold chain includes management of the personnel responsible for drug distribution, the equipment and packaging needed for storage and transport, as well as maintenance and monitoring of equipment, all presenting additional costs to patients and health care systems (25). Few studies show the exact costs of cold chain management; based on the WHO's Ebola vaccine implementation guidelines, however, they could potentially account for anywhere from 9% to 32% of vaccine costs (26). Moreover, there are also costs related to drugs rendered ineffective from poor cold chain management, translating to overuse of oxytocin in order to achieve desired effects (24). With the introduction of HSC, the cold chain management infrastructure will be unnecessary and there

could be significant savings at various points along the supply chain.

### **The possibility of scaling up**

Although, contingent on the success of the clinical trial, the project has potential for scale-up. MFM and Ferring, however, have been unclear on how the drug will be made affordable in the target countries, and have only promised to make the drug available at an affordable price in the public sector. The latter limitation could lead to inaccessibility, as in many of the target countries a large percentage of the population relies on the private health sector; in India, for example, most people rely on private healthcare providers or private pharmacies for treatment and would not have access to the drug at the discounted rate (27). As well, in a number of African countries, small communities do not have access to public hospitals and instead rely on local community health care workers whose services are not always publicly-funded (28). Making the drug affordable in both public and private sectors would allow much greater access to the lifesaving medication and ameliorate both health systems. As improving health by bettering private healthcare is one of MFM's primary goals, making HSC available at an affordable cost in the private sector seems like a reasonable mandate.

Beyond price, the actual administration of the drug may also lead to its inaccessibility. As HSC must be given through intramuscular injection, its administration will require a skilled healthcare provider to perform this task. It has been estimated that more than half of all deliveries that occur in developing countries are home births that are attended by inadequately-skilled providers. Moreover, health facilities are vulnerable to understaffing and shortages of uterotonic (29). Therefore, it is possible that even if HSC was made affordable, it may still be inaccessible to over half of the women who need it most. A better solution then, perhaps, could be the development of a heat-stable, inhalable oxytocin (30). This new drug has shown much promise but has only just succeeded in phase I clinical trial, and it is unlikely that it will be on the market anytime soon. The question about the number of deaths averted following either of these interventions still remains, and will remain, until their respective clinical trials are completed and the projects are scaled up.

Finally, it is also important to put in perspective the \$500 million contribution Merck has made for the 10-year MFM initiative. Since the commencement in 2011, Merck has netted over \$33 billion in profit worldwide, translating to approximately \$5.5 billion in profit for every year since the conception of MFM (31). The MFM initiative has provided \$50 million on average a year to improving maternal health, approximately just 1% of the pharmaceutical's total

profit, begging the question of whether Merck is really contributing enough to fulfill MFM's mandate.

## **Conclusion**

Although oxytocin is the suggested drug for the management and treatment of PPH, its thermal instability limits its effectiveness in settings where mortality caused by PPH is highest. The project to develop a heat-stable carbetocin, as such, is a promising solution to a problem that has long been neglected. Multiple studies have demonstrated the economic and pharmacological benefits of using carbetocin over oxytocin, although a formal impact evaluation of the project at hand has not yet been conducted. Still, the promise that the drug will be made affordable in the public sector, and Merck's expertise in navigating manufacturing, regulatory affairs, and supply/access, leads to optimism that the project will be effective in reducing maternal deaths caused by PPH.

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# The case of the rVSV-ZEBOV vaccine: tragic lessons from a delayed solution to the 2014 Ebola Outbreak

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## Introduction

**T**he Ebola virus disease (EVD) is a zoonotic infection that was discovered in 1976 when two of its strains, the Sudan strain and the Zaire strain, broke out in sub-Saharan Africa (1). Fruit bats are the suspected animal reservoir, and the disease can be transmitted to humans through exposure to bodily fluids or through the consumption of infected animals (2, 3). Individuals infected with EVD initially develop flu-like symptoms, vomiting, diarrhea, and, with the progression of the disease, internal and external bleeding, leading to a high possibility of mortality (1, 3). Moreover, EVD is a ‘disease of poverty’—it disproportionately affects vulnerable populations in countries with weak healthcare infrastructure, insufficient health sector workforce, and general underdevelopment.

As with most neglected tropical diseases (NTDs), EVD usually does not threaten developed countries, making research funding for vaccine development and therapies a low priority. The 2014 Zaire ebolavirus outbreak revealed the consequences of neglecting these so-called rare diseases: by its conclusion in 2016, the outbreak had killed 11,310 people in Guinea, Sierra Leone, and Liberia (4). The delayed international response was an important contributor to the epidemic's deadliness: the World Health Organization (WHO) declared EVD a Public Health Emergency of International Concern (PHEIC) eight months after its initial outbreak in December 2013, convening again in September 2014 to evaluate the state of available treatments (5). Due to the escalating crisis, the WHO approved experimental vaccine clinical trials as potential prevention measures in West Africa. One of these vaccines was the joint Merck-Canadian vaccine, known as rVSV-ZEBOV.

### *Canada's contribution*

The rVSV-ZEBOV vaccine was originally created in 2005 at National Microbiology Laboratory (NML), located in Winnipeg, Manitoba (6). While researching the role of glycoproteins at the surface of the virus, NML scientists discovered that mice exposed to an inactivated virus were subsequently immune to active Ebola. Though researchers at the U.S. National Institutes of Health (NIH) were developing their own vaccine, the Canadian vaccine required only one dose versus the NIH's two-dose regimen, and, unlike the U.S. vaccine, had been shown to be capable of reducing disease severity for those infected after immunization (7).

Though Canada's funding was focused on local public health issues, Dr. Heinz Feldmann, the NML's special pathogen chief, and Dr. Gary Kobinger, his successor, pushed hard and successfully convinced policymakers that their findings were relevant to the NML's mandate (8). The Public Health Agency of Canada (PHAC) funded the initial development of rVSV-ZEBOV. Though funding for EVD and other NTD treatments were limited until early 2000s, there emerged a surge in funding in relation to defence against bioterrorism—the use of biological weapons, such as viruses, to incite terror by causing disease and death—following 9/11 and the 2001 Anthrax attacks. This 2001 momentum propelled the Canadian Department of National Defence to, from 2002 to 2014, allocate \$7 million towards biodefence research, and \$4 million towards experimental therapies and vaccine development for Ebola (9, 10).

Still, Canada's options for commercializing the vaccine were limited due to the low risk of Ebola to Canadians and considerable costs associated with vaccine



development and licensing. Hence, following the creation of the vaccine, licensing rights were sold to U.S.-based pharmaceutical company NewLink Genetics in 2010 for a meager \$205,000 (11). As part of this sale agreement, NewLink was expected to start clinical testing and mass produce the vaccine (12). In hindsight, the sale to NewLink was problematic: they did not have the manufacturing capacity nor resources to properly test the vaccine and prepare it for regulatory approval (13). In fact, PHAC had to allocate nearly a million dollars for a German company, IDT Biologika, to manufacture 1500 vials of the vaccine for human trials in 2013 (14). Seeing an opportunity with the 2014 Ebola outbreak, the pharmaceutical company Merck licensed the worldwide commercial rights for the vaccine from NewLink for \$50 million to accelerate vaccine trials and expand the vaccine program (15).

## **Implementing rVSV-ZEBOV**

### *Clinical trials*

By the Ebola outbreak in late 2013, clinical trials had not yet begun. In 2015, phase 1 and phase 2 of the trials showed that the experimental rVSV-ZEBOV vaccine was effective in inducing a protective immune response with only minor adverse events after a single intramuscular injection (1, 16, 17).

After approval from the WHO, phase 3 trials began in Guinea in March 2015 (18). The trial employed a cluster-ring design in which direct and secondary contacts of EVD patients were randomized to receive the rVSV-ZEBOV vaccine either immediately or 21 days after a new case was reported (19). The trial excluded pregnant or breastfeeding women, those with a severe illness, and individuals under 18 years of age. In total, there were roughly 50 clusters with 2,000 people in each cluster. Individuals in the trial who were diagnosed with Ebola 10 days after randomization were considered confirmed Ebola cases. Among the immediate-vaccination group, no cases of Ebola were recorded, and interim trial results reported 100% efficacy (19). With the positive interim results, the delayed vaccination arm was discontinued and children over six years of age were included in the trial in order to maintain clinical equipoise. Compared to conventional clinical trials, the trial ended exceptionally fast by January 2016, and the final results were published a few months later, just over a year after the start of the trial (20).

The Guinea ring trial, having confirmed the vaccine's effectiveness in protecting against Ebola, can generally be considered as an overall success. The rVSV-ZEBOV vaccine was also the first proven single dose Ebola vaccine whereas none previously existed, making it a scientific breakthrough. Furthermore, the vaccine was shown to

provide an overall trial population effectiveness of 70.1% with only 52.1% of the trial population vaccinated, and the clinical trial itself helped stop the transmission of Ebola in Guinea near the end of the epidemic. In total, just under 6,000 people benefited from the vaccine. (19).

While overall the data suggests the vaccine to be highly effective and safe, there are still some shortcomings in regards to the trial results and methodology. The results of the Guinea Ring Trial, especially the report of 100% efficacy (95% CI 68.9-100.0  $p=0.0045$ ), should be examined beyond face value (19). First, the sample size entails some limitation. There were only 16 cases of EVD in the delayed vaccination group; while a statistically significant result was found, not enough cases existed to reliably estimate the vaccine's effectiveness. Secondly, the trial was conducted as the Ebola epidemic was waning, which may have inflated the efficacy results. Finally, it is important to consider the ways in which the initial exclusion of pregnant women, children under six years of age, and the severely ill affected the trial results. Although the trial population suited WHO requirements, ideally an EVD vaccine should protect anyone susceptible to acquiring the disease in the midst of an outbreak; thus, trial results lack a certain level of generalizability (20).

### *An Uncertain Future*

In 2016, after the success of the Guinea trial, pharmaceuticals GAVI and Merck signed a purchase agreement worth \$5 million to push rVSV-ZEBOV through initial licensing and to stockpile doses for clinical trials and emergency use. As of May 2016, 300,000 doses were to be available for emergency use in case of an outbreak (21). A small number of doses—800 to 1,000—are also currently stockpiled in Geneva for deployment in case of future outbreaks (27). Moreover, Merck is working to register the vaccine with the U.S. Food and Drug Administration (FDA) and the European Medicines Agency (EMA). However, as of the time of writing, the vaccine is not yet commercially available, and the FDA approval process has been pushed back to 2018 (28). Furthermore, an important hurdle in ensuring the availability of the vaccine is in acquiring approval for its usage in African countries with high risk for Ebola. Each country has its own National Regulatory Authorities (NRA) and Merck would need to apply to each individually. Nonetheless, since Merck submitted the vaccine to WHO's Emergency Use and Assessment Listing (EUAL), the vaccine can still be used in an emergency setting during declared PHEICs (29).

Even when rVSV-ZEBOV is commercially licensed for use by the FDA and EMA, financial limitations are unlikely to justify the use of a manufacturing plant, and

the uncertainty about the amount of vaccine required in the future may cause challenges for manufacturing and storage once an outbreak does occur (30). Moreover, as the vaccine is not yet commercially available, the current cost of each dose is unknown. A WHO draft of an outbreak scenario has detailed a single dose to cost USD 20\$, but this price increases to USD \$135 when including all associated storage and deployment costs (31).

## **Discussion**

### *The Need for Continued Research and Development*

The development of rVSV-ZEBOV changes how future Ebola outbreaks will be fought. The vaccine, while currently used only in emergency responses, may pave the way for future prophylactic Ebola vaccines and vaccines for other strains of Ebola. Prophylactic Ebola vaccines will protect crucial front-line healthcare workers in future outbreaks. This is especially important given the fact that healthcare workers, who were in contact with Ebola patients throughout the crisis, were amongst the first fatalities. The loss of primary healthcare workers left the already weak West African healthcare system in shambles, allowing the virus to decimate local populations. The Center for Disease Control (CDC) reported that, from the outset of the outbreak to November 2015, a total of 881 healthcare workers were infected in Guinea, Liberia and Sierra Leone (32). Of those infected, 513 died, leading to Liberia, Sierra Leone, and Guinea losing 8%, 7%, and 1% of their healthcare workers, respectively (32). The loss of healthcare workers and deterioration of healthcare services also had an indirect impact on the treatment of HIV, tuberculosis, and malaria. It was estimated that an additional 10,600 lives were lost due to the inability to access healthcare services as the epidemic and loss of healthcare workers had caused a 50% reduction in healthcare services in the three countries (32). Even after the outbreak, the World Bank estimated the economic loss to these three countries to be around USD \$2.2 billion (32). To put this into perspective, the combined GDP of Guinea, Sierra Leone and Liberia was a total of USD \$14 billion in 2016 (33-35). It may take decades before these three countries fully recover and stabilize their healthcare system.

Additionally, an effective vaccine that minimizes the risks to healthcare workers would encourage more foreign aid workers from NGOs such as Médecins Sans Frontières (MSF) as well as government agencies to assist affected countries during future outbreaks. Stockpiling the EVD vaccine in Geneva may quicken and consolidate the global response in future epidemics, and help train foreign aid workers in its deployment. At the same time, not stockpiling the vaccine in high-risk

countries may slow down the deployment of the vaccine in response to isolated cases of Ebola. This can be detrimental to containing the spread of the virus and protecting frontline healthcare workers; hence, an emergency supply of the vaccine should exist in high risk countries for safekeeping.

Lastly, one of the major challenges in global health is the last mile problem: financially and logistically, the last ‘mile’ of supply chain distribution is the most difficult to traverse. Solving this hurdle requires a broad reinforcement of infrastructure such as healthcare and transportation to reduce the difficulty of healthcare access. Moreover, since many affected countries lack the necessary cold storage for vaccine distribution, heat stability of treatments should be of paramount concern. The University of Hawaii is currently developing an EVD vaccine that is both heat-stable and orally available, making its foreseeable distribution to patients easier and more cost-effective (36). There is also a need for innovative solutions that address a weak or non-existent supply chain in reaching difficult-to-access and remote areas.

#### *Ethical Considerations for Future Research and Development*

The implementation of the Guinea ring trial was considered an overall success by both the public and academic communities, and the WHO considered the intervention of unregistered vaccines for clinical trials to be ethical. Still, certain questions about ethics merit discussion. In particular, the trial’s participants were incentivized by access to quality healthcare, which was unlikely to be available to them if they declined to enroll in the study. Hence, participants may have felt pressured to participate due to their vulnerable circumstances (37).

In addition, the MSF requires investigators to indicate if blood samples will be destroyed after use and to inform patients about the storage and potential use of their data in other studies; however, given the lack of safe, cold storage, third-party laboratories that collected the trial samples exported them to other countries, and did not request explicit consent for the use of collected specimens. There is now a biobank of 80,000 specimens in an unreported location where the nature of the use of and access to these samples is still unclear (36). Informed consent and understanding of the possible risks may also be broken by a lack of communication due to language barriers (35). Furthermore, pregnant women were excluded from the trial despite their elevated risk of infection and health complications and a reported 100% fatality rate for their fetus. Given the need to prioritize pregnant populations in EVD vaccine development, wholesale exclusion denies access to the benefits of participation in research, leaving them more vulnerable to off-label or unguided use of medication.

In fact, the MSF ethics review board saw “no strong justification” for their exclusion from the trials (36).

### *The Broken Paradigm in NTD Drug Development*

While Canadian scientists successfully developed an effective Ebola vaccine, the question remains as to why it took 10 years to begin clinical trials (38). One hurdle was in a lack of participants for phase 3 trials prior to the large-scale outbreak (4). Moreover, pharmaceutical companies had little financial incentive to put a risky EVD vaccine through years of clinical trials. Even now, four years after it has passed phase 3 clinical trials, rVSV-ZEBOV remains unregulated and unavailable for commercial use. Since the virus only primarily affects African countries, the general attitude of pharmaceutical companies towards NTDs is that there are no profits to be made, hence no need for vaccine development.

Moreover, the lack of concern about NTDs has implications for international security. Media hysteria revealed the cycle of panic and neglect in the crisis as the U.S. response to the outbreak was to enact travel bans from the three African countries—yet only one EVD case ever crossed onto American soil during the outbreak (39). This is an example of an overreaction by the West to health threats domestically while displaying general neglect for severe outbreaks internationally. However, in this era of porous borders, Ebola and other NTDs are a matter of national security as air travel makes fast cross-continental transmission very easy, and the only option to contain this risk is tackling the problem at the source.

### *Implications for Canada*

Lastly, it is important to bring the attention back home: as mentioned earlier, Canada sold the licensing rights for rVSV-ZEBOV to NewLink Genetics for a meagre sum, and is only receiving “single-digit” royalties for the vaccine (7). Though the Ebola vaccine was funded primarily by public agencies, its commercialization and profits continue to fill private coffers. The reliance of pharmaceutical companies on publicly-funded research before commercializing the products derived from this research is not unprecedented. Still, in light of NewLink’s technical failures and tremendous profit from the subsequent sale of the vaccine rights, Canadian taxpayers should be informed of this arrangement and its underlying reasons. Ideally, taxpayers ought not to bear the costs of research and development while multinational pharmaceutical companies reap all the benefits of commercialization.

## Conclusion

The 2014 Ebola outbreak in Guinea, Sierra Leone and Liberia should be viewed as a major wakeup call for the world. As was the case at the time, complacency towards NTDs and development of NTD therapies by pharmaceutical companies has resulted in the loss of thousands of lives and massive economic damage. Moreover, the outbreak demonstrated a cycle of panic and neglect: though characterized by mass media hysteria and billions of funding at the time, interest and scientific development around EVD has waned after the crisis. To truly eradicate NTDs, Western governments must react swiftly and preventatively to outbreaks, continually provide resources for developing and strengthening healthcare systems, and supply an equitable access to life-saving drugs and therapies. With the rise of air travel, this approach is especially important as diseases are no longer constrained by borders, making disease transmission a global security risk. The slow global response present in the 2014 Ebola outbreak and dismissal of outbreaks needs serious reconsideration. The WHO has now set forth a blueprint to streamline further development of vaccines, diagnostics, and therapies during emergencies (40). The effect of this policy remains to be seen.

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# The need for increased access to early behavioural intervention programs for autism spectrum disorders

Emilie Poitout



According to the Diagnostic Manual for Mental Disorders, Fifth Edition (DSM-5), autism spectrum disorder (ASD) is a neurodevelopmental disorder affecting ten million people worldwide; it is characterized by pervasive deficits in social communication and interaction, and may be accompanied by language and behaviour disorders, as well as intellectual delays. Moreover, ASD is a new diagnostic category in the DSM-5, as it now includes conditions previously identified as early infantile autism, childhood autism, and Asperger's disorder, among others (1, 2). As a senior medical student doing clinical rotations, I have observed that ASD is indeed a spectrum: patients tend to present with varying levels of functioning—while some complete high school and maintain stable jobs, others have serious language delays and never complete primary school. In spite of these

wide variations in clinical presentation, we are now able to detect and diagnose ASD earlier than ever before. Such early interventions, particularly those prior to six years of age, have demonstrated significant improvements in global level of functioning for these patients (3-5).

The prevalence rates of ASD have drastically increased in the last decade. For instance, while in 2000 one in 150 children had been diagnosed with ASD, this proportion has increased to one in 110 in 2006, and to one in 68 in 2012 (6,7). Some have attributed this rapid increase in prevalence rates to increased capacity in diagnosis as well as to ASD's characterization as a 'spectrum.' Even when these confounding factors are taken into account, however, experts maintain that an increase in the true prevalence rates of ASD cannot be ruled out, suggesting environmental toxins, genetic factors, and advanced maternal age as potential culprits (2). Certain vaccines were also originally incriminated, but the evidence in favour of the vaccination hypothesis has since been refuted (8,9).

In Quebec, a diagnosis of ASD can be made by a psychiatrist or a psychologist, and patients are then usually referred to the Centre de Réadaptation en Déficience Intellectuelle (CRDI) of their local Centre Intégré Universitaire de Santé et Services Sociaux (CIUSSS). Services provided at the CRDI are tailored to each patient's needs and can include accommodation consultation, management, and early childhood intervention (10). The CRDIs are the only publicly-funded organizations delivering services to patients with ASD in Quebec; though certain non-profit organizations also offer services to patients and their families, their funding is usually dependent on philanthropy and hence their sustainability is often uncertain (2). There are, as well, private resources accessible to families who can afford them. Yet, with the recent increase in ASD prevalence in Quebec, all of these resources have experienced a rapid surge in demand. Unfortunately, government funding of CRDIs has not followed the increasing ASD prevalence and patients now have to wait an average of two years before accessing any type of services in the province. Even in the private system, waiting times have been rapidly increasing. In fact, in some jurisdictions, seeing a psychiatrist or psychologist for diagnosis can now take up to twelve months, resulting in a three-year wait for ASD patients and families before interventions can be initiated (11). These delays have not only had detrimental impacts on the quality of life for patients and their families, but they have also negatively affected the potential efficacy of early interventions on social adaptation and functioning level (3-5, 12).

Early Intensive Behavioural Intervention (EIBI), a 20-hour per week program with demonstrated efficacy for children under six years of age with neurodevelopmental disorders, is a key intervention offered by the CRDI system. Recent meta-analyses have reported EIBI and its equivalents can lead to improvements in adaptive behaviour, Intellectual Quotient (IQ), non-verbal IQ, expressive language, receptive language, communication, daily living skills, and socialization (3-5). Such improvements point to the ability of more patients with ASD to function successfully in society, in turn increasing the global quality of life for these patients and their families.

Luckily enough, in March 2017, the Quebec Minister of Health and Social Services announced a \$29 million investment aimed at decreasing waiting times for patients with ASD (13). Given the evidence presented above, I believe that it would be highly beneficial if these sums were invested to improve the availability of early childhood interventions for ASD patients. However, since accessing EIBI services first requires a correct diagnosis, the Ministry should also consider increasing the number of healthcare professionals who can diagnose ASD. Quebec is not alone in enacting these policies: in June 2017, Ontario launched its New Ontario Autism Program, with focus on increasing diagnostic capacity, improving access to resources, and decreasing waiting lists for services. The program also aims to improve the quality of life of patients and families through the aforementioned ways, maximizing the potential and success of patients, increasing active participation in society, and providing the best care in a cost-effective manner (14). It will be essential to closely monitor the impact of these promising initiatives on the populations of patients with ASD, and to ensure that the funds are invested towards evidence-based interventions with established benefits.

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# About the editors

## **Samantha Ghanem, MScPH**

Samantha is pursuing a Master of Science in Public Health (MScPH) at McGill, and holds an Honours Bachelor in Health Sciences (BHSc) from the University of Ottawa. During her time at the U of O, she conducted global health research with focus on: 1) exploring women's perception of the availability, acceptability, and use of abortion medication in geographical regions where abortion is illegal or legally restricted; and 2) identifying and addressing the reproductive health needs of vulnerable populations. She is passionate about research that addresses chronic diseases, HIV/AIDS, and reproductive and sexual health. As Samantha continues her studies, she will be conducting research on the contribution of physical inactivity to major chronic diseases in Canada.

## **Carly Heck, MSc Nursing**

Carly completed her Bachelor of Science in Biology at the University of Alberta in 2016. Throughout her undergraduate career, she was involved in a wide scope of research projects, ranging from a study of tropical plant conservation to human aesthetic perception of beauty. She has worked as a research assistant for the Alberta Centre for Sustainable Rural Communities under the direction of Dr. Lars K. Hallstrom, focusing on topics such as youth engagement and rural broadband support. Carly has a personal interest in research ethics, Indigenous health, and rural development. After completing her nursing education, she aspires to work with Canadian rural communities to develop relevant and accessible healthcare services for underserved populations.

## **Paniz Khosroshahy, BA Hons**

Paniz is in her final year of her Bachelor of Arts in Women's Studies at McGill. In 2017-2018, she worked as the editor-in-chief of the Prognosis as part of her internship with the Institute for Health and Social Policy and McGill Global Health Programs. Throughout her studies, Paniz has focused on reproductive and sexual health, and has given numerous workshops on sexual health to Montreal youth through organizations such as Head & Hands, Rock Camp for Girls, Centre for Gender Advocacy, and Project 10. Her interest in working on The Prognosis also stemmed from her prior experience serving as the editor-in-chief of Intersections, McGill's student gender studies journal, as well the sports editor at The McGill Daily. She begins her JD degree at University of Toronto Faculty of Law in fall 2018.

### **Kayla Míguez, MSc**

Kayla completed both her Honours Bachelor of Science in Kinesiology and her Master of Science in Exercise Physiology at McGill's Department of Kinseology and Physical Education. Her MSc research focused on the skeletal muscle mitochondrial and neuromuscular impact in chronic tobacco-smoking conditions. After completing her MSc, Kayla worked as a research assistant in the Meakins-Christie Laboratories at McGill's Faculty of Medicine, while enrolling in courses on public health, health-care, and social services. Kayla's strong interest in public and population health, and in particular in the quality and accessibility of health services, has led her to seek further education in professional programs for the upcoming academic year, focusing on the medical and legal aspects of health and social services systems.

### **K Srikanth Reddy, PhD**

Holding a PhD from the University of Pune, India, Srikanth is a medical anthropologist with research interests and training in global health policy, governance, and diplomacy. Currently at McGill University, he has been conducting research on the political economy of global health and applying institutional theories to health policy research. Earlier, he received postdoctoral research training in global health governance and diplomacy at the Global Health Centre, the Graduate Institute, Geneva. He has also been an Indian Council of Medical Research (ICMR) fellow, JN Tata Scholar, and has received awards and honours from University Grants Commission, JN Tata Endowment, International AIDS Society, and Canadian Society for International Health. He received research grants from ICMR, Swiss Network for International Studies (SNIS), and Steinberg Foundation.

### **Anna de Waal, BA**

Anna is a third year student majoring in psychology, with minors in microbiology and immunology, and social studies of medicine. She is passionate about human rights, social stratification, and Indigenous health, with previous research focusing on HIV self-testing in South Africa. She currently holds a junior research assistant position with Dr. Nitika Pant Pai's lab in Clinical Epidemiology and Infectious Diseases. She is excited to be part of the Prognosis team to explore the intersection of society, politics, and the environment in shaping global health challenges.



## **Sarah Williams, MScPH**

Sarah is a first year student in Master of Science Public Health (MScPH) at McGill. Originally from St. John's, Newfoundland and Labrador, she holds a Bachelor of Science in Psychology and Biology from the Memorial University of Newfoundland, where she completed her honours thesis in developmental psychology. Her interest in global health stems from working as a research assistant at the Center for Rural Health Studies at Memorial's Faculty of Medicine, which culminated in a publication in the *Canadian Journal of Rural Medicine*. She is also interested in child health and development, chronic disease, and social determinants of health.

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GHP partners with various departments at McGill to promote human well-being, productivity and economic development, and is actively involved in research and training around the world. Committed to collaborative projects that improve health through educational, clinical, developmental and research programs, McGill Global Health Programs is excited about new avenues to enrich the education of students interested in global health. The IHSP conducts interdisciplinary research on the impact of social conditions on health and welfare. The IHSP aims to translate findings from research in social inequalities and health outcomes into concrete provincial, national, and international policies. The IHSP is keen to develop additional opportunities to spread research findings that improve population level wellbeing.



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