Newborn screening project for the Old Order Amish

An interview with Dr Victoria Siu

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BACKGROUND

Amish communities can trace their roots to the Anabaptist movement, which was founded in the belief that baptism should be carried out as an adult when one can truly give consent to join the Christian community.¹ The Old Order Amish are the most conservative of the divisions of Anabaptists. McGuigan and Scholl write, “through each transition, one group has remained as the most conservative and austere guardians of strict traditional convictions; these are the Old Order Amish”.² The Amish choose to dress plainly and restrict their use of modern technology, reflecting their belief that people should live a simple life and place their focus on community and religion.² To preserve their way of living the Old Order Amish choose to live separate from other societies.² In southwestern Ontario, there are 2 main Old Order Amish communities, based in Perth County and Aylmer, Ontario. The Perth County community was founded in the 1820s and over the years has remained genetically isolated from the general population.

ROLE IN GENETIC STUDIES

There are several reasons why Old Order Amish communities are conducive to genetic studies: they are a closed population with little gene inflow, they have a small number of founding members, and their genealogical records are extensive.³ The Old Order Amish have a relatively high incidence of genetic disease in their communities.³ A simplified explanation for this is that the founder effect and a higher rate of consanguinity³ lead to an increased prevalence of autosomal recessive and polygenic multifactorial disorders. Analysis of Amish populations has enabled several rare genetic illnesses to be mapped and has demonstrated that many principles of population genetics remain relevant.³

THE NEWBORN SCREENING PROJECT

In 2003, a targeted newborn screening project was established to screen the Old Order Amish population for four specific treatable disorders: juvenile glaucoma, cystic fibrosis, galactosemia, and cystinosis.⁴ The ongoing screening project values collaboration with community elders and healthcare providers and has gained recognition and acceptance in the community: over 300 babies have been screened over 8 years.⁴ Over 90% of pregnant women referred to the project by midwives and other healthcare workers have opted to have newborn screening.⁴ This has ensured that children born with the genetic diseases being screened for are identified and treated.⁵

INTERVIEW [CONDUCTED BY JEFFREY LAW]

As the medical director of the Medical Genetics Program of Southwestern Ontario, Dr Victoria Siu has a longstanding history with Western University. She attended the University of Toronto and

earned her Arts and Science degree in 1978 followed by her MD in 1982. She completed her first year of fellowship training at the Hospital for Sick Children in Toronto and then moved to London in 1987, where she completed her postgraduate training. Dr Siu joined the Children's Hospital in 1989 and is currently ranked as an associate professor at Western University, where she has since established a rewarding and successful medical career.

Stepping into Dr Siu's office, I could not help but notice the family photographs and thank you notes that decorated her shelves. On a Wednesday morning, I was lucky enough to sit down and speak with the distinguished clinician at the London Health Sciences Center to chat about her initiative, the Old Order Amish Newborn Screening Program in southwestern Ontario.

When asked about the rationale behind the project, Dr Siu said that it didn't take a long time in her career to realize that she was seeing many patients with unique disorders from the Amish community and that there was a real need to provide aid to this population. The Amish are very knowledgeable about inherited diseases and keep excellent genealogical records. They are also interested in health maintenance and disease treatment, especially for children. However, they tend to seek medical advice late in the course of illness, when treatment may be less effective. Through previous research, Dr Siu and her colleagues had identified the specific DNA mutations causing juvenile glaucoma, cystic fibrosis, galactosemia, and cystinosis in the Amish. All of these disorders can be treated to improve or delay the onset of symptoms. Thus, in 2003, the Old Order Amish Screening Program was developed with funding from the Change Foundation to identify presymptomatic newborns at risk for these disorders.

When the project began, Dr Siu wanted to ensure that she and her team wouldn't be imposing on the Amish community and that the screening program was actually something the population wanted. As such, Dr Siu reached out to the highly regarded Amish bishops and established connections with community liaisons for their input. The goal was to establish a program that was culturally respectful and appropriate. Additionally, Dr Siu described the difficulties of finding an appropriate community liaison. Initially, a teacher from within the community was contacted to act as liaison but because she was unmarried and did not have children, the elders felt that she could not relate to the mothers in the newborn screening program. Ultimately, 3 woman elders volunteered their assistance to ensure that the project would be well integrated into the community.

Dr Siu was quick to give credit to all the different people who have been involved with the project. In terms of the initiation and ongoing promotion of the program, she spoke highly of Jane Leach, a public health nurse at the Perth District Health Unit who has established a close working relationship with Amish families. Ms. Leach

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was instrumental in introducing Dr Siu to the Amish bishops during the conception of the project and has gained the trust of the community. The project was originally coordinated by Sharon Kuepfer, a Mennonite-raised nurse who had become aware of the unique health needs of the Old Order Amish through experiences in her early life and work with the community. The community liaison leaders eagerly helped to organize the initial community education events that exposed the Amish families to the idea of the screening program. As the project gained momentum, the midwives of Countryside Midwifery services as well as other public health nurses from within the region helped to spread further information about the newborn screening program to pregnant women.

The newborn screening project focuses on the Amish families in Perth County. Currently, screening occurs in homes where deliveries occur and blood samples are obtained through umbilical cord sampling after delivery. Dr Tony Rugar has been involved in the identification of the causative mutations for several Amish disorders and is an enthusiastic proponent of newborn screening. Relevant DNA mutation and enzyme analyses are carried out in Dr Tony Rugar's biochemical genetics laboratory at LHSC.

When asked about some of the challenges faced when working with a rural population, Dr Siu spoke of the barriers that the Amish face in accessing medical care. Amish women do not give birth in hospitals, where conventional newborn screening occurs. The Amish instead seek out midwives for at-home delivery. They prefer to receive their healthcare from family physicians or nurse practitioners who are located within their communities. It is time-consuming for the Amish to travel long distances by horse and buggy. Poor weather conditions, especially during the winter months, present additional challenges. Buggies can have sled runners attached, but the horses must get through snow and ice. Travel to the London Health Sciences Centre necessitates the hiring of a driver which typically costs about \$150 a trip. In order to overcome this issue of distance, the newborn screening program relies on the midwives who do the home deliveries to collect blood samples, which are subsequently sent by courier to London. As such, screening is brought to the targeted population and the issues of distance, transportation and weather are minimized.

Dr Siu explained that the process of newborn screening has revealed an extremely high carrier rate of the genetic mutations tested. For example, it was found that 1 in 5 newborns are carriers for cystinosis, a figure that is 30 times higher than the carrier frequency in the general population. Since the initiation of the program, 4 infants, one affected with each of the disorders tested, have been identified. Married couples from the Old Order Amish community have come forward to request carrier testing. One of the current limitations of newborn screening is that the turnaround time for DNA results is long—the analyses are done in batches rather than continuously, so therapy for affected newborns may not be initiated until later than ideal. With testing of married couples, the hope is for carriers to receive proper genetic counseling so that genetic screening of their newborns can expedited in order to provide them with the best care possible.

Healthcare providers in Perth County are quick to contact Dr Siu if they identify a newborn with congenital anomalies. Through collaboration with Dr Robert Hegele at the Lawson Research Institute

and the FORGE (Finding of Rare Disease Genes in Canada) consortium, the specific mutations associated with several rare disorders in the Ontario Amish and Mennonite population, such as ECO syndrome,⁶ which was first described by Dr Piya Lahiry (Schulich MD graduate 2013) and congenital sodium diarrhea,⁷ have been identified. As well, an online database for genetic disorders in the Amish, Mennonite, and Hutterite population was created in 2006 by Dr Siu's son, Geoffrey, and Dr Michael Payne (Schulich MD graduate 2010). This is publicly accessible at <http://www.biochemgenetics.ca/plain-people/index.php>.⁸

Seeing how successful the Amish newborn screening program has been, I couldn't help but ask Dr Siu whether she and her team had any plans to expand the initiative beyond Perth County. She noted that other Amish communities which are related to the Perth County families have already adopted Amish newborn screening. Dr Siu also described with enthusiasm a Mennonite community in Grey-Bruce County that has expressed interest in newborn and carrier screening. This is of great fascination to Dr Siu because there are several other genetic disorders which have been identified only in the Old Order Mennonite community and not in the Amish community. She and Dr Rugar are currently investigating new technology to provide rapid screening for multiple disorders in the Mennonite community, taking into account their unique disorders. Interestingly, there are many opportunities for direct genetic flow when an individual leaves the Amish community to join the somewhat less conservative Old Order Mennonite church. Therefore, it may be predicted that some of the disorders originally seen in high frequency in the Amish community may start to show up in the Mennonite community, and eventually the general population.

In concluding the interview, we asked Dr Siu whether she felt changed by her experience working with the Old Amish community. Dr Siu expressed her admiration for the Old Order Amish—their approach to life, their hard working attitudes and their down-to-Earth personalities. Dr Siu also expressed appreciation for their gratitude towards healthcare providers, their genuine sense of family, and the strong faith that they express in their beliefs. These are all reasons, she says, why she treasures the opportunities to work with such a population.

Dr Victoria Siu embodies how far-reaching a physician's contribution to medicine can be. Her passion is evident through her dedication to her patients and students. It is clear that Dr Siu loves what she does and her patients and students clearly appreciate all the time she gives.

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