2019 Report of the Maternal and Perinatal Death Review Committee

Office of the Chief Coroner of Ontario
December 2020

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This report was prepared by
Dr. Rick Mann, Chairperson of the Maternal and Perinatal Death Review Committee,
and Ms. Kathy Kerr – Executive Lead – Committee Management.

Message from the Chair

The Maternal and Perinatal Death Review Committee (MPDRC), together with its predecessor, the Obstetrical Care Review Committee, has been providing expert advice to coroner's investigations in Ontario since 1994.

The MPDRC reviews all maternal deaths in Ontario that are reported to the coroner system that occur during pregnancy, during delivery or immediately following delivery up to 42 days post-partum. Deaths after 42 days post-delivery are reviewed if there are concerns that the cause of death is directly related to the pregnancy or a complication of the pregnancy.

The committee also reviews stillbirths and perinatal deaths investigated by the Chief Coroner's Office where issues have been identified by the family, the investigating coroner or the Regional Supervising Coroner.

The MPDRC is comprised of well-respected and experienced experts representing the fields of obstetrics, maternal-fetal medicine, midwifery, perinatal nursing, obstetrical anaesthesiology, pathology, neonatology and family medicine. Representatives from the Society of Obstetricians and Gynaecologists have been instrumental in guiding the MPDRC on collaborative efforts to promote positive changes in obstetrical change across not only Ontario, but also Canada.

Since its inception, the committee has reviewed a total of 464 cases and generated 795 recommendations towards the prevention of stillbirths and deaths involving mothers and neonates. In 2019, 34 cases were reviewed and 49 recommendations were made. The top areas of concern identified in recommendations made in 2019 related to obstetrical care providers, communications/documentation and diagnosis/testing.

Copies of full, redacted reports are available to the public by contacting occ.inquiries@ontario.ca.

As we strive towards reducing similar deaths and improving the quality of care provided to mothers and infants, the identification of these trends will help guide the direction of future recommendations and prompt action by stakeholders within the obstetrical care community.

It is an honour to participate in the work of the MPDRC and I am grateful for the commitment of its members to the people of Ontario. I would like to acknowledge the assistance of Ms. Kathy Kerr, Executive Lead of the MPDRC.

It is my privilege to present to you the 2019 Annual report of the MPDRC.

Rick Mann, MD, CCFP, FCFP
Chair, Maternal and Perinatal Death Review Committee

Committee Membership (2019)

Dr. Jocelynn Cook
Society of Obstetricians and Gynaecologists of Canada – Chief Scientific Officer

Dr. Sharon Dore
Society of Obstetricians and Gynaecologists of Canada Representative

Dr. Michael Dunn
Neonatologist (Level 3)

Dr. Karen Fleming
Family Physician (Level 3)

Dr. Robert Gratton
Maternal Fetal Medicine

Dr. Steven Halmo
Obstetrician (Level 2)

Ms. Susan Heideman
Perinatal Nurse

Dr. Robert Hutchison
Obstetrician (Level 3)

Dr. Sandra Katsiris
Anesthesiologist

Ms. Michelle Kryzanauskas
Midwife (Rural)

Dr. Dilipkumar Mehta
Neonatologist (Level 2)

Ms. Linda Moscovitch
Midwife (Urban)

Dr. Toby Rose
Forensic Pathologist

Dr. Gillian Yeates
Obstetrician (Level 1)

Dr. Rick Mann
Chairperson
Regional Supervising Coroner

Ms. Kathy Kerr
Executive Lead

Executive Summary

- In 1994, the Office of the Chief Coroner established the Obstetrical Care Review Committee. In 2004, the name of the committee was changed to the Maternal and Perinatal Death Review Committee.

- The purpose of the MPDRC is to assist the Office of the Chief Coroner in the investigation, review and development of recommendations directed towards the prevention of future deaths relating to all maternal deaths (irrespective of cause) and stillbirths and neonatal deaths where the family, coroner or Regional Supervising Coroner have concerns about the care that the mother or child received.

- Since 2004, the MPDRC has reviewed 464 cases and generated 795 recommendations aimed towards the prevention of future deaths.

- On average, 29 cases are reviewed and 50 recommendations are made each year by the MPDRC.

- The top areas of concern identified in recommendations made from 2004-2019 relate to: obstetrical care provider issues ; policy and procedures; communications/documentation; and diagnosis and testing (including electronic fetal monitoring).

- In 2019, 34 cases were reviewed and 47 recommendations were made.

- Of the 34 cases reviewed in 2019, 21 were maternal (13 executive reviews and eight full reviews), 11 were neonatal and two were stillborn.

- Deaths involving women who are pregnant, but where the pregnancy did not cause or contribute to the death, are noted and undergo an "executive" review. Maternal deaths involving a known complication of pregnancy (e.g. pulmonary embolism) *and* where there are no concerns regarding the care provided to the mother, may also undergo an executive review. The executive review is conducted by a core team of representatives of the MPDRC and includes an analysis of the circumstances surrounding the maternal death. The results of the review are discussed with the full committee for any additional investigation or comment (commencing in the 2017 Annual Report, executive reviews are included in the statistics for total number of reviews conducted).

Introduction

Purpose

In 1994, the Office of the Chief Coroner established the Obstetrical Care Review Committee. In 2004, the name of the committee was changed to the Maternal and Perinatal Death Review Committee.

The purpose of the MPDRC is to assist the Office of the Chief Coroner in the investigation, review and development of recommendations directed towards the prevention of future similar deaths relating to all maternal deaths regardless of cause. This includes all deaths during pregnancy and the post-natal period (which is considered to be up to 42 days after delivery). Any deaths after 42 days and up to 365 days post-delivery are reviewed if the cause of death is directly related to the pregnancy or a complication of the pregnancy.

The committee reviews stillbirths and neonatal deaths where the family, coroner or Regional Supervising Coroner have concerns about the care that the mother or child received.

Findings of legal responsibility or conclusions of law are not permitted under the Coroners Act.

Definition of Maternal Deaths, Stillbirths, Perinatal and Neonatal Deaths

The MPDRC reviews the deaths of all women who died "during pregnancy and following pregnancy in circumstances that could reasonably be attributed to pregnancy." Deaths involving women who are pregnant, but where the death was not attributed to pregnancy are noted for statistical purposes and a condensed, executive review is conducted.

Maternal deaths are classified by the following criteria:

- Antepartum – during pregnancy
- Intrapartum - during delivery or immediately following delivery
- Postpartum - < 42 days after delivery

This committee does *not* review late maternal deaths occurring >42 days unless the cause of death is directly related to the pregnancy or a complication of the pregnancy.

Stillbirth is defined as the complete expulsion or extraction from the mother of a product of conception either after the 20th week of pregnancy or after the product of conception has attained the weight of 500 grams or more, and where after such expulsion or extraction there is no breathing, beating of the heart, pulsation of the umbilical cord or movement of voluntary muscle. (source: *Vital Statistics Act of Ontario*)

Perinatal deaths are defined as deaths during, at the time of, or shortly after birth, including home births.

Neonatal deaths are defined as deaths within the first seven days after birth.

Aims and Objectives

1. To assist coroners in the Province of Ontario to investigate maternal and perinatal deaths and to make recommendations that may prevent similar deaths.
2. To provide expert review of the care provided to women during pregnancy, labour and delivery, and the care provided to women and newborns in the immediate postpartum period.

3. To provide expert review of the circumstances surrounding all maternal deaths in Ontario, in compliance with the recommendations of the Special Report on Maternal Mortality and Severe Morbidity in Canada (Special Report on Maternal Mortality and Severe Morbidity in Canada, Health Canada, 2004).
4. To inform doctors, midwives, nurses, institutions providing care to pregnant and postpartum women and newborns, and relevant agencies and ministries of government about hazardous practices and products identified during case reviews.
5. To produce an annual report that can be made available to doctors, nurses and midwives providing care to mothers and infants, and hospital departments of obstetrics, midwifery, radiology/ultrasound, anaesthesia and emergency for the purpose of preventing future deaths.
6. To help identify the presence or absence of systemic issues, problems, gaps, or shortcomings of each case to facilitate appropriate recommendations for prevention.
7. To help identify trends, risk factors, and patterns from the cases reviewed to make recommendations for effective intervention and prevention strategies.
8. To conduct and promote research where appropriate.
9. To stimulate educational activities through the recognition of systemic issues or problems and/or referral to appropriate agencies for action.
10. Where appropriate, to assist in the development of protocols with a view to prevention.
11. Where appropriate, to disseminate educational information.

Note: All of the above described objectives and attendant committee activities are subject to the limitations imposed by the Coroners Act of Ontario and the Freedom of Information and Protection of Privacy Act.

Structure and Size

The committee membership consists of respected practitioners in the fields of specialty including: obstetrics, family practice, specialty neonatology, community pediatrics, pediatric and maternal pathology, anesthesiology, midwifery and obstetrical nursing. The membership is balanced to reflect wide and practicable geographical representation as well as representation from all levels of institutions providing obstetrical care including teaching centers to the extent possible. The chairperson will be a Deputy Chief Coroner or Regional Supervising Coroner or other person designated by the Chief Coroner.

Other individuals are invited to the committee meetings as necessary on a case by case basis (e.g. investigating coroner, Regional Supervising Coroner, other specialty practitioner relevant to the facts of the case, etc.).

Methodology

Investigating coroners and Regional Supervising Coroners refer cases to the committee for review. At least one member of the committee reviews the information submitted by the coroner and then presents the case to the other members. After discussion by the committee, a final case report is written consisting of a summary of events, discussion and recommendations (if any), intended to prevent future deaths. The report is then sent to the referring Regional Supervising Coroner who may conduct further investigation (if necessary). Recommendations are distributed to agencies and organizations that may be in a position to have them implemented or considered. Organizations are asked to respond back within six months with the status of implementation of recommendations.

Where a case presents a potential or real conflict of interest for a committee member, the committee reviews the case in the absence of the member with the conflict.

When a case requires expertise from another discipline, an external expert reviews the case, attends the meeting and participates in the discussion and drafting of recommendations, if necessary.

Limitations

This committee is advisory to the coroner system and will make recommendations to the Chief Coroner through the chairperson.

The consensus report of the committee is limited by the data provided. Efforts are made to obtain all relevant data.

The MPDRC case reports are prepared for the Office of the Chief Coroner and are therefore governed by the provisions of the Coroners Act, the Vital Statistics Act, the Freedom of Information and Protection of Privacy Act and the Personal Health Information and Protection of Privacy Act. Cases referenced in the annual report do not include identifying details.

It is important to acknowledge that these reports rely upon a review of the written records. The Coroner/Regional Supervising Coroner conducting the investigation may have received additional information that rendered one or more of the committee's conclusions invalid. Where a fact was made known to the chair of the committee prior to the production of the annual report, the case review was revised to reflect these findings.

Recommendations are made following a careful review of the circumstances of each death; they are not intended to be policy directives and should not be interpreted as such.

Responses received to recommendations are available to the public by contacting occ.inquires@ontario.ca.

This report of the activities and recommendations of the MPDRC is intended to provoke thought and stimulate discussion about obstetrical care and maternal and perinatal deaths in general in the province of Ontario.

Statistical Overview (2004-2019)

The MPDRC (and previously the Obstetrical Care Review Committee) has generated recommendations since being established in 1994. Over time, not only has the committee evolved, but so too have medical technologies, policies, procedures and public and professional attitudes towards maternal and perinatal care in the province. In order to provide an analysis that is reflective of more current values and attitudes, the statistical analysis contained within this annual report will focus on cases reviewed and recommendations made since 2004.

From 2004-2019, the MPDRC has reviewed a total of 464 cases. Of these cases, 172 (37%) were maternal, 198 (43%) were neonatal and 94 (20%) were stillbirths. These numbers reflect the policy of the Office of the Chief Coroner to review all maternal deaths. Commencing in 2015, deaths involving women who are pregnant, but where the pregnancy did not cause or contribute to the death, are noted and undergo an "executive" review. The executive review is conducted by a core team of representatives of the MPDRC and includes an analysis of the circumstances surrounding the maternal death. The results of the review are discussed with the full committee for any additional investigation or comment. If necessary and suggested by the broader committee, an executive review may result in a full review. The statistics below reflect the total number of reviews (i.e. executive and full), conducted by the MPDRC.

Neonatal and stillbirth reviews are conducted only when the family, investigating coroner or Regional Supervising Coroner have concerns about the care that the mother or child received.

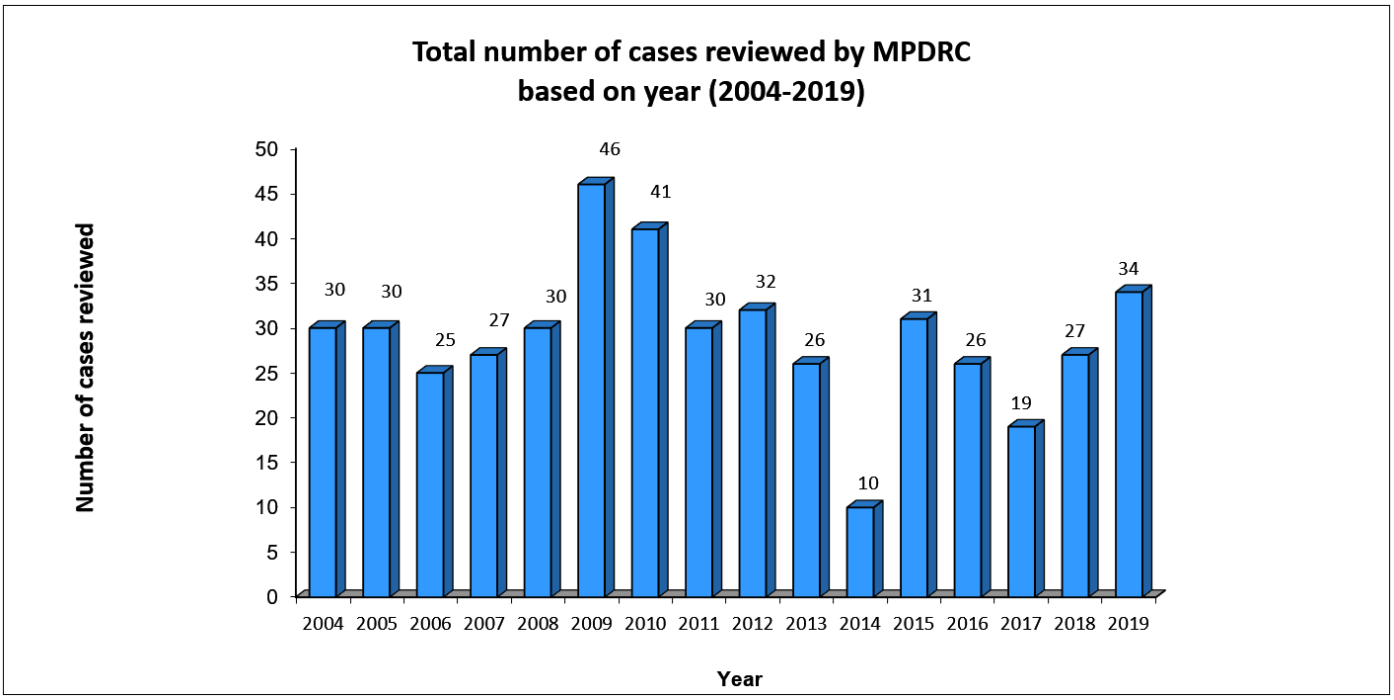
The number of cases noted in **Chart One** is based on the year the case was reviewed, which, in many cases, is not the same year in which the death occurred.

Chart One: MPDRC - # of Cases Reviewed (2004-2019)

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Total	%	avg/yr
Total # of cases reviewed	**30**	**30**	**25**	**27**	**30**	**46**	**41**	**30**	**32**	**26**	**10**	**31**	**26**	**19**	**27**	**34**	**464**	**-**	**29**
Maternal - executive review	-	-	-	-	-	-	-	-	-	-	-	7	9	7	6	13	**42**	**-**	**8**
Maternal - full review	10	12	4	15	8	21	11	3	3	11	3	5	4	3	9	8	**130**	**-**	**8**
Maternal - total	10	12	4	15	8	21	11	3	3	11	3	12	13	10	15	21	**172**	**37%**	**11**
Neonatal	12	11	13	12	12	16	19	14	20	10	5	15	10	8	10	11	**198**	**43%**	**12**
Stillbirth	8	7	8	0	10	9	11	13	9	5	2	4	3	1	2	2	**94**	**20%**	**6**

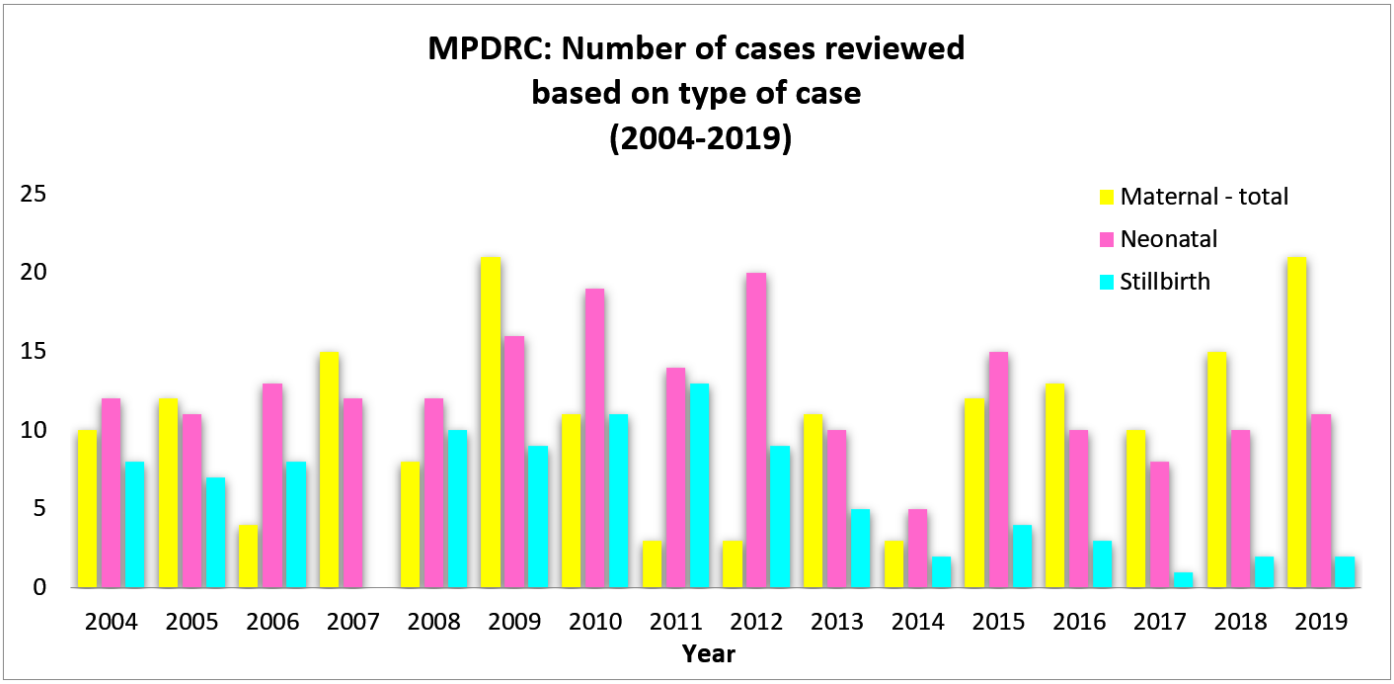
Chart One indicates that the total number of cases reviewed from 2004-2019 has varied from a low of 10 cases in 2014, to a high of 46 cases in 2009. This variance is likely reflective of committee administrative practices (e.g. time required for processing of review materials and compilation of final reports).

Graph One: Total number of cases reviewed by the MPDRC based on year (2004-2019)



Graph One demonstrates how the number of cases reviewed from 2004-2019 from a low of 10 in 2014, to a high of 46 in 2009. This variance is due to the subjective nature of referrals to the committee (i.e. only maternal deaths result in mandatory referrals and all others are at the discretion of the regional supervising coroner) and administrative issues. On average, the MPDRC reviews 29 cases per year.

Graph Two: Number of cases reviewed based on type of case (2004-2019)



Graph Two demonstrates that, overall, from 2004-2019, the majority of cases reviewed are neonatal or maternal deaths. It is the policy of the Office of the Chief Coroner to review all maternal deaths in the province. Neonatal and stillbirth cases are reviewed when issues or concerns are identified.

Chart Two: MPDRC - # of Recommendations (2004-2019)

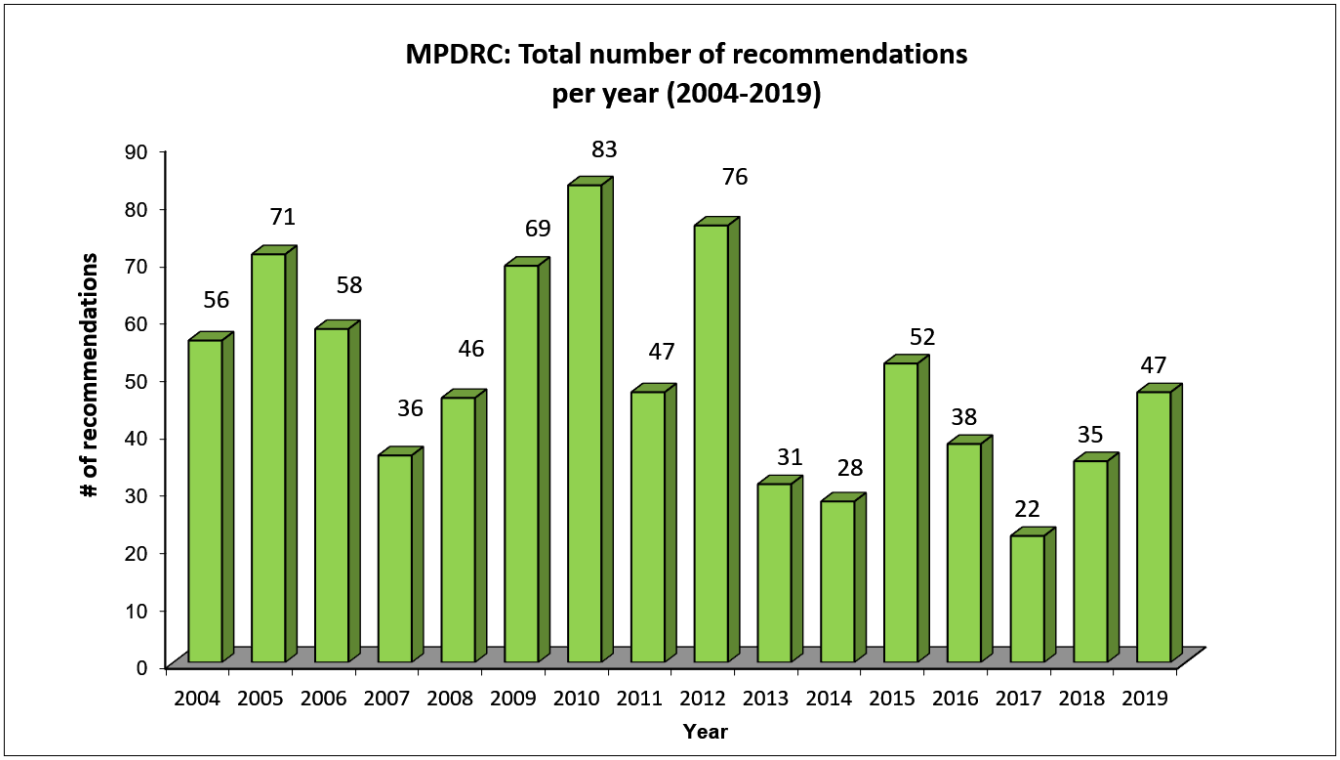
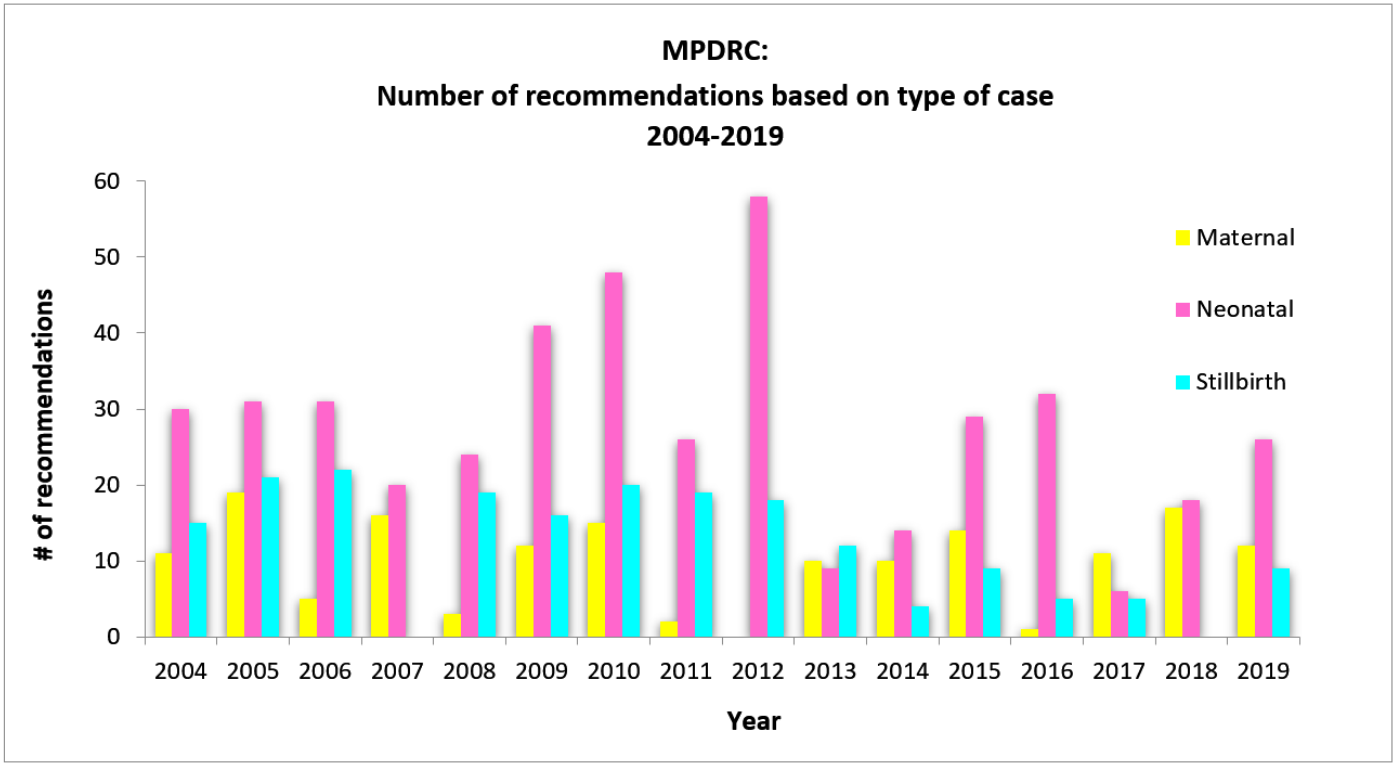


Chart Two indicates that the MPDRC has generated a total of 795 recommendations from 2004-2019. From this total, 158 (20%) were related to maternal cases, 443 (56%) from neonatal cases and 194 (24%) from stillbirth cases. Consistently over the years, the majority of cases and recommendations relate to reviews of neonatal deaths. On average, 50 recommendations are made per year.

Upon reviewing the recommendations that have been made, certain areas of concern have consistently emerged over time. The following general areas of concern have been identified:

- medical (e.g. obstetrical care provider decisions)
- policy and procedure (e.g. adherence or development of policy and procedures)
- communication/documentation (e.g. sharing and documenting information)
- quality (e.g. quality of care reviews)
- diagnosis and testing (e.g. interpretation of laboratory results)
- diagnosis and testing – specifically electronic fetal monitoring (EFM) (e.g. interpretation of results)
- education/training (e.g. continuing education)
- resources (e.g. access and allocation of resources)
- transfer (e.g. movement of patients)
- other (e.g. referral to another committee for review)

Graph Three: Number of recommendations based on type of case 2004-2019



Graph Three demonstrates that from 2004-2019, most recommendations pertained to neonatal cases.

Chart Three: MPDRC – Number and percentage of recommendations based on area of concern/theme and type of case (2004-2019)

Area of concern/theme	Maternal	Neonatal	Stillborn	Total	% of Total
Obstetrical care provider	64 38%	85 18%	46 23%	195	23%
Policy and procedure	30 18%	86 18%	35 17%	151	18%
Communications/documentation	16 9%	78 17%	36 18%	130	15%
Quality	18 11%	40 9%	13 6%	71	8%
Diagnosis and testing	20 12%	69 15%	28 14%	117	14%
Diagnosis and testing - EFM	1 1%	50 11%	28 14%	79	9%
Education/Training	4 2%	28 6%	9 4%	41	5%
Resources	3 2%	15 3%	3 1%	21	3%
Transfer	7 4%	13 3%	5 2%	25	3%
Other	6 4%	3 0.6%	1 0%	10	1%

*Some recommendations touch on more than one theme.

Chart Three demonstrates that 23% of all recommendations made by the MPDRC from 2004-2019 relate to improving or addressing obstetrical care provider issues. An additional 18% of the recommendations pertain to the development of, or adherence to, policies and procedures and 15% to communication and/or documentation and in particular, the timely and accurate sharing of information between healthcare providers and with the patient.

Chart three also demonstrates the following key areas (based on type of case and theme):

- 18% of all recommendations from neonatal cases had an obstetrical care provider or policy and procedure theme, followed closely by 17% for communication and documentation
- 38% of all recommendations from maternal cases had the theme of obstetrical care provider (i.e. medical decisions)
- 23% of all recommendations from all cases had the theme of obstetrical care provider.

One area of specific concern that has been identified over the past few years relates to the use of electronic fetal monitoring (EFM) technology, how EFM results are interpreted by obstetrical care providers and what follow-up actions are taken in response to the findings. From 2004-2019, there have been 79 (9% of the total) recommendations made specifically pertaining to EFM.

Executive Summary of Cases Reviewed in 2019

Cases reviewed by the MPDRC in 2019 may involve deaths that occurred in previous years.

Total number of cases reviewed (executive and full reviews): 34

Total number of recommendations: 49

Number of maternal full case reviews: 8

Number of maternal executive reviews*: 13

Number of recommendations from the maternal deaths reviewed: 12

Number of neonatal cases reviewed: 11

Number of recommendations from the neonatal deaths: 28

Number of stillborn cases reviewed: 2

Number of recommendations from the stillborn cases: 9

* Deaths involving women who are pregnant, but where the pregnancy did not cause or contribute to the death, are noted and undergo an "executive" review. The executive review is conducted by a core team of representatives of the MPDRC and includes an analysis of the circumstances surrounding the maternal death. The results of the review are discussed with the full committee for any additional investigation or comment.

A summary of all cases reviewed and subsequent recommendations made in 2019, is included as Appendix A.

Lessons Learned from MPDRC Reviews

Over the years, the MPDRC has identified trends in issues identified through the review process. This year, recognition of early warning signs, the importance of fetal monitoring, challenges for transportation of obstetrical emergencies, and the need for increased data collection and research on maternal death have been identified in the reviews conducted by the MPDRC.

As we strive towards reducing similar deaths and improving the quality of care provided to mothers and infants, the identification of these trends has helped guide the direction of recommendations and prompt action by stakeholders within the obstetrical care community.

Thoughts from the Society of Obstetricians and Gynaecologists Of Canada (SOGC)

Prevention of Maternal Mortality: Canada's Toolkit for Confidential Enquiry #savingmoms #savingbabies

The Society of Obstetricians and Gynaecologists of Canada (SOGC) has been working toward developing a foundation for preventing maternal and perinatal morbidity and mortality in Canada. The mission is to increase awareness of the issues surrounding pregnancy-related death and to promote change among individuals, healthcare systems, and communities in order to reduce the number of deaths.

The maternal mortality ratio (MMR) is a critical measure of a nation's health, and thus a key performance indicator of the strength and quality of health care. In Canada, maternal mortality is an infrequent yet often preventable event with devastating consequences to families and care providers. There have been reports of a rise in maternal mortality from the 1990s (5.1 to 11.9 per 100, 000 live births). Despite this concerning statistic, monitoring maternal deaths, and particularly identifying cases of preventable death, has been difficult and inconsistent in Canada.

In Canada, maternal mortality-related data sources have traditionally been based on death registrations and hospitalization data, neither of which provides the clinical and social context required to identify intervention points for preventable maternal death. Furthermore, these data sources consistently under-ascertain and misclassify maternal deaths, leading to an underestimation of Canada's MMR.

Since 2010, the Society of Obstetricians and Gynaecologists of Canada (SOGC) has been working with partners to review national maternal mortality surveillance programs. During the process, it became apparent that not all provinces/territories in Canada have established maternal mortality review committees, and on a national level there is no system to synthesize and report on maternal mortality. Jurisdictions all differ with respect to definitions, data collected, ascertainment and the maternal mortality review process.

Canadian provinces and territories have a critical role to play in the design and implementation of this system, as do coroners/medical examiners, vital statistics, and maternal mortality review committees. The SOGC has been engaging with relevant federal and provincial leaders as well as multi-disciplinary clinical experts since 2016 to develop the foundation for the process and to draft standardized definitions and a common minimum dataset of indicators that can be rolled up to tell a national story about maternal deaths in Canada. In addition, over the past year, leaders of the perinatal programs of four provinces (BC, AB, ON and NS) have been participating in a pilot project to develop a toolkit that includes policies and procedures, as well as standardized data/information fields, maternal mortality review best practice, reporting templates, tools, resources and knowledge translation materials that align with a confidential enquiry-type system, with the ultimate goal of capturing and reviewing all maternal deaths to one year post-delivery, identifying contributory factors and opportunities for prevention. The ultimate goal is to eliminate all future preventable deaths in Canada.

The Toolkit consists of materials that are standardized enough to provide useful templates for maternal mortality review, but flexible enough for each jurisdiction or committee to adapt them for their own context. It is anticipated that those who are new to maternal mortality review will have the materials, tools and resources that they need to be able to initiate a process without a lot of difficulty, and with a lot of guidance from a very experienced group who are motivated and excited to provide leadership. The toolkit has elements that are based on the United States' MMRIA and the UK's EMBRRACE programs and includes the World Health Organization (WHO) Maternal Death Surveillance Response Technical Guidance, which is an excellent resource for all participating in Maternal mortality reviews.

The MMR Toolkit will be released in December 2020 and the SOGC will host webinars for coroners/medical examiners, clinicians, provinces/territories (including perinatal programs), researchers and policymakers to talk about the program, to share experiences and to start the process of regular sessions for engagement, networking and sharing experiences.

Identifying every single maternal death is a critical factor to improving Canada's surveillance programs – if deaths are not identified as "maternal," they will not be picked up by our existing federal and provincial/territorial surveillance systems. More complete ascertainment by implementing a confidential enquiry component to maternal death reviews, will provide accurate prevalence and allow us to determine trends, to identify priorities for recommendations and to report on the effectiveness of interventions. Identifying factors that could contribute to prevention will ultimately not only save pregnant/post-partum women, but it will also mitigate maternal morbidities and improve perinatal outcomes.

The SOGC is also leading a research project to map the recommendations from the MPDRC that are relevant to the SOGC's practice as well as to the level of evidence for the recommendations over the last five years in order to determine gaps in practice and evidence, required updates, or opportunities for focused educational/training initiatives.

The SOGC continues to also work nationally with the Canadian Perinatal Surveillance System for alignment and coordinated efforts for national reporting of severe maternal morbidity and mortality. The SOGC is also partnering on several research projects related to measurement of maternal morbidity and mortality.

Appendix A

Summary of 2019 Case Reviews

Case	Type	Summary	Themes	Recommendations
EX-01	Maternal Executive	The decedent was a 35-year-old woman who had a witnessed arrest 12 days after the delivery of her second child. She had a history of gestational hypertension and obesity. Cause of death was intra-abdominal bleeding from an unknown source during the postpartum period.	-	None
EX-02	Maternal Executive	The decedent was a 34-year-old woman who had gestational diabetes. She was two months post-partum with her first baby when she developed shortness of breath and a cough. The decedent had a severe presentation of peripartum cardiomyopathy and that she may have had a concurrent pulmonary infection. Cause of death was peripartum cardiomyopathy.	OCP, Transfer OCP, transfer	1. Obstetrical care providers are reminded to consider early transfer to a tertiary cardiac centre when patients present with severe left ventricular dysfunction, cardiogenic shock and/or cardiac arrest secondary to peripartum cardiomyopathy. 2. Obstetrical care providers are reminded that transfer considerations and communications should be documented in the medical notes. A transfer consideration documentation tool could be established to better record this aspect of patient care.
EX-03	Maternal Executive	The decedent was a 37-year-old G3P1. Emergency Caesarean section was performed after she collapsed and became unresponsive. Cause of death was attributed to amniotic fluid embolus.	-	None
EX-04	Maternal Executive	The decedent was a 34-year-old woman who had delivered a normal full-term pregnancy approximately seven weeks previously. She had suffered a superficial clot in her right leg about one week post-partum and Doppler testing showed no	-	The next-of-kin were advised to be assessed in a cardiovascular genetic clinic.

Case	Type	Summary	Themes	Recommendations
		deep vein thrombosis. Her routine six week post-partum check-up was normal and she was given a requisition to have a follow-up Doppler. The day prior to her death she saw her family physician regarding a possible nipple infection. She was found unresponsive, sitting in a padded chair in the baby's room, with the baby in her lap. It appeared that she was breast-feeding when her death occurred. Cause of death was undetermined.		
EX-05	Maternal Executive	The decedent was a 35-year-old woman. When admitted to hospital for induction of labour, she began to vomit. Emergency Caesarean section was performed due to fetal bradycardia. Cause of death was amniotic fluid embolism.	-	None
EX-06	Maternal Executive	The decedent was a 33-year-old woman who was in her first trimester of pregnancy. The decedent had a long-standing history of mental health issues which began when she was a teenager. Approximately five years prior, she had been treated for trauma and a substance use disorder. Cause of death was noted as fentanyl toxicity.	-	None
EX-07	Maternal Executive	The decedent was a 33-year-old G4P2 with a history of asthma for many years and had been experiencing more pronounced dyspnea in the previous month. Cause of death was Intrapartum Hemorrhage due to Caesarean Section/Emergent Hysterectomy for the Management of Placenta Increta.	-	None
EX-08	Maternal Executive	The decedent was a 24-year-old G1P1 with type 1 myotonic dystrophy. On post-partum day 5, she presented to her family physician with retrosternal	-	None

Case	Type	Summary	Themes	Recommendations
		chest pain and was diagnosed with acute coronary syndrome. She was transferred to the heart institute where she underwent urgent cardiac catheterization that showed multiple areas of spontaneous coronary artery dissection. Cause of death was multi-organ failure due to left ventricular dysfunction due to healed myocardial infarctions due to healed spontaneous coronary artery dissections in the context of myotonic dystrophy (Type 1) cardiomyopathy.		
EX-09	Maternal Executive	This case involved the death of a 33-year-old G2P0. Her pregnancy had been unremarkable until the development of elevated blood pressure in the third trimester. She was diagnosed with preeclampsia at 37 weeks. Cause of death to be acute post partum blood loss in a woman with idiopathic pulmonary arterial hypertension. Genetic testing revealed a variant of uncertain significance in GDF2.	-	None
EX-10	Maternal Executive	The decedent was a 31-year-old woman who was in her first trimester of pregnancy when she was the victim of an assault that resulted in her death.	-	None
EX-11	Maternal Executive	The decedent was a 32-year-old woman with a long-standing history of intravenous drug use and who was on a methadone program. She had no fixed address and did not have any prenatal care. Cause of death was attributed to Staphylococcal septicemia due to infective endocarditis due to intravenous drug use.	-	None
EX-12	Maternal Executive	The decedent was a 37-year-old woman who was 44 days postpartum following a delivery that was complicated with shoulder dystocia and lateral	-	None

Case	Type	Summary	Themes	Recommendations
		vaginal wall tear. Post partum haemorrhage began during repair of the vaginal wall tear. A cardiac arrest occurred during attempts to remove retained products of conception and effect tamponade. Amniotic fluid embolism was the cause of the shock and postpartum bleeding.		
EX-13	Maternal Executive	The decedent was a 42-year-old G2P1 with a past medical history of metastatic breast cancer. In 2015, bilateral metastases to her lungs was found and she underwent resection. The woman died from tumour lysis syndrome secondary to acute leukemia, with secondary contributing condition of metastatic breast cancer; specific relationship to her pregnancy was not identified.	-	None
M-01	Maternal	The decedent was a 37-year-old G4P3. History of previous deep vein thrombosis (DVT). She died from a pulmonary embolus and right leg DVT. Thrombo-prophylaxis was indicated, but was not implemented.	OCP, diagnosis and testing OCP, diagnosis and testing	1. Obstetrical care providers are reminded that venous thromboembolism (VTE) remains an important cause of maternal morbidity and mortality in Canada with an overall incidence of deep vein thrombosis and pulmonary embolus of 12.1 per 10000 and 5.4 per 10000 pregnancies respectively. 2. Obstetrical care providers are reminded of the management of venous thromboembolism and the need for close collaboration and communication with all teams involved in the maternal care as outlined in the Clinical Practice Guidelines.
M-02	Maternal	The decedent was a 32-year-old primigravida. Risk factors included: pre-pregnancy BMI 34.4 (height 6'1" and weight	OCP, diagnosis and testing	1. Obstetrical care providers are encouraged to consider the use of an obstetrical early warning system (manual or computerized)

Case	Type	Summary	Themes	Recommendations
		250 lb), polycystic ovary syndrome (PCOS), low lying placenta (1.8 mm, repeat ultrasound in October 2016, clear of cervix), urinary tract infection (at 17 weeks treated with Macrobid), Group B streptococcus positive and it was noted on her anaesthetic questionnaire that she bruised easily. Cause of death was pulmonary arterial hypertension.	Training/ Education, Quality	to better identify changing patterns. 2. The obstetrical department of the hospital involved should conduct a lessons-learned case review of the circumstances surrounding this woman's death. The review should include: • Monitoring of unstable post partum patients • Documentation • Ongoing blood loss with no identified source
M-03	Maternal	The decedent was a 33-year-old G3P2. A non-invasive prenatal test (NIPT) was done and was subsequently reported as concerning for Klinefelter syndrome. Amniocentesis was declined. Death was attributed to hemoperitoneum due to placenta percreta invading through the previous Caesarean section scar.	OCP, Diagnosis and testing Diagnosis and testing	1. Obstetrical care providers are reminded that placenta accrete spectrum is a serious pregnancy condition at any gestational age. Immediate and direct communication between the ultrasounographer and the healthcare provider(s) is required. 2. Diagnostic imaging facilities should establish an effective and timely system of recognizing and reporting critical findings to other members of the healthcare team.
M-04	Maternal	The decedent was an obese (pre-pregnancy BMI of 36) 37-year-old G3 TPAL 1011 who had a dichorionic diamniotic twin pregnancy by in vitro fertilization. The cause of death was determined to be "hemorrhagic shock" due to "intrauterine hemorrhage, post Caesarean twin delivery with concurrent myomectomy for uterine leiomyoma (fibroid).		None
M-05	Maternal	The decedent was a 20-year-old G2P0 who died suddenly at 34		None.

Case	Type	Summary	Themes	Recommendations
		weeks and one day gestation. It was subsequently reported by the family that the woman had been experiencing swelling and tingling of her hands and feet in the last 1-2 weeks and a headache for three days prior to her death. Cause of death was sudden unexpected death in pregnancy with findings suggestive of a hypertensive disorder of pregnancy (preeclampsia).		
M-06	Maternal	The decedent was a 31-year-old G6P6. Cause of death was noted as complications of endometritis and retained products of conception. She was five days post partum.		None
M-07	Maternal	The mother was a 23-year-old G7 TPAL 2224 First Nations woman. Cause of death was septic and hemorrhagic complications of acute chorioamnionitis due to preterm premature rupture of membranes and ascending infection with Escherichia Coli. It was felt that the fetus had a "rare but distinctive pattern" of severe, fulminant intrauterine E. coli infection due to the ruptured membranes. The infection went from fetus to placental villi without significant infection of the membranes as would be typical of chorioamnionitis.	Other Other Other	1. The SOGC should develop a rigorous, national database on maternity care. This would include data from all provinces and territories, including information pertaining to race/ethnicity, including First Nations, Inuit and Metis, key factors related to maternal health status and outcome. Data should capture all maternal deaths from all causes in Canada, including sepsis. Data should ideally include all deaths out to 365 days after the pregnancy. 2. Health Canada/The Public Health Agency of Canada should dedicate funding into supporting better data collection and research related to Canada's maternal deaths and their circumstances, with a focus on deaths due to sepsis. 3. Health Canada/The Public Health Agency of Canada should promote and provide support for

Case	Type	Summary	Themes	Recommendations
				implementation of the recommendations made by the SOGC to return births to rural, First Nation and Inuit communities.
M-08	Maternal	The decedent was a 37-year-old G6P4A1 with a history that included multiple trauma's, chronic pain syndrome, depression, hepatitis B and past hepatitis C and opioid use disorder. Cause of death from gestational Staphylococcus aureus septicemia. The septicemia resulted in the in utero fetal demise through the overall process of multi-organ damage. Although the skin culture grew different organisms, the puncture of the upper left arm showed histologic features of a drug injection site, with evidence of healing, and was likely the original entry point for the bacteria.	OCP, Diagnosis and testing	1. Obstetrical care providers are reminded of the risks associated with opioid use disorder and the need for a comprehensive integrated care plan for pregnant women with opioid use disorder. The comprehensive integrated care plan should consider the patient's social determinants of health including nutrition, safe housing, and other psychosocial supports.
N-01	Neonatal	The mother of the deceased infant was a 26-year-old G2P0. Cause of death was multi-organ hypoxic-ischemic complications of perinatal asphyxia of undetermined cause.		None
N-02	Neonatal	The mother of the deceased infant was a 24-year-old G3 TPAL 0110. Newborn exam revealed a morphologically normal, appropriately grown 23 weeks 2 days' gestational age fetus with fused eyelids. Previable Delivery Occurring at 23 Weeks, (a) Maternal Cervical Incompetence	Transfer OCP, Diagnosis and testing	1. Ontario ambulance services should develop a procedure for transportation of pregnant women in suspected preterm labour such that routing takes the woman to the closest hospital with appropriate neonatal care whenever possible. 2. It is recommended that obstetrical care providers obtain pre-pregnancy consultation with a high-risk obstetrician in cases at risk for incompetent cervix.

Case	Type	Summary	Themes	Recommendations
N-03	Neonatal	The mother of the deceased infant was a 33-year-old G2P1 receiving care from a midwifery practice. Cause of death was Hypoxic-Ischemic Encephalopathy at three days of age.	OCP, Diagnosis and testing OCP, Transfer Quality	1. Obstetrical care providers should be aware of the signs associated with impending or actual uterine rupture, especially with a trial of labour after Caesarean (TOLAC). 2. Obstetrical care providers should ensure that there is a thorough and complete transfer of accountability between care providers. 3. The midwifery practice involved should conduct a review of their protocol surrounding off-call and call coverage and remind midwives about the importance of documenting discussions and courses of care.
N-04	Neonatal	This case involved the death of a four-day-old male infant from hypoxic ischemic encephalopathy due to perinatal asphyxia. Concerns were raised about the obstetrical care provided to the infant's mother.	OCP, Training/ education OCP, Diagnosis and testing OCP, Diagnosis and testing	1. Obstetrical care providers are reminded of the 2007 Antenatal Fetal Surveillance Guidelines. 2. Obstetrical care providers are reminded that a significant decrease in weight percentile should trigger further ongoing vigilant monitoring. 3. Obstetrical care providers and medical imagers are reminded that if the estimated fetal weight is less than the 10th percentile (IUGR), then umbilical artery Dopplers are necessary.
N-05	Neonatal	The mother of the deceased female infant was a 19-year-old G2 TPAL 1001. This baby died due to cardiac changes resulting from a narrowing of the aorta known as coarctation. Metabolic and cardiovascular genetic testing indicated variants of undetermined significance. Toxicology was positive for methadone,	Diagnosis and testing Other	1. Most responsible care providers are reminded that they must verify the physical findings of undergraduate medical learners. 2. The Regional Supervising Coroner should communicate with the mother to recommend that in subsequent pregnancies, a fetal

Case	Type	Summary	Themes	Recommendations
		diphenhydramine and tetrahydrocannabinol (cannabis).		ECHO be done at the time of the anatomy scan and in the third trimester.
N-06	Neonatal	The deceased infant was born at 38 weeks and five days' gestational age (GA) to a 26-year-old G1 TPAL 0000. The cause of death was determined to be due to the extensive blood loss and multiorgan failure from a large subgaleal hemorrhage caused by the vacuum used to assist in the vaginal delivery.	OCP, Comm/Doc Training and education OCP, Diagnosis and testing Policy and procedures Comm/Doc Diagnosis and testing	1. Obstetrical care providers are reminded of the importance of proper documentation of fetal heart rate findings in labour. This should include documentation of the maternal heart rate to ensure differentiation of maternal and fetal rates. 2. All centers delivering obstetrical care and thus providing neonatal resuscitation, especially primary level centres where the frequency of resuscitation is low, should institute regular interdisciplinary training with rapid cycle deliberate practice for neonatal resuscitation. 3. Obstetrical care providers are reminded: • to be more vigilant of subgaleal hemorrhage after vacuum (instrumental) delivery when scalp swelling is noted, and • that with scalp swelling, early imaging (ultrasound) is helpful in diagnosis. 4. The hospital should establish an observational protocol for neonates who have had forceps or vacuum applied at the time of their delivery.

Case	Type	Summary	Themes	Recommendations
				5. The center should establish a template to assist in thorough documentation in assisted vaginal delivery. 6. Measurement of the serial head circumference is not adequate to rule out significant bleeding. Closer monitoring of the hemoglobin and scalp examination should be part of the protocol. A minimum of eight hours of monitoring is recommended.
N-07	Neonatal	The mother of the deceased infant was a 36-year-old G1P0. This pregnancy was conceived through in vitro fertilization (IVF). Cause of death was attributed to multiple placental pathologies and subgaleal and intracerebral hemorrhages in the context of arrested second stage of labour and instrumentation.	OCP, Comm/Doc Policy and procedure OCP, Policy and procedure OCP, Diagnosis and testing OCP, Transfer, Diagnosis and testing Quality	1. Obstetrical care providers are reminded of the SOGC Guideline No. 197 for intrapartum fetal monitoring. This guideline provides recommendations pertaining to the application and documentation of fetal surveillance in the antepartum period that will decrease the incidence of birth asphyxia while maintaining the lowest possible rate of obstetrical intervention. (JOGC September 2007) 2. Obstetrical care providers are reminded of the SOGC Guideline No. 148 for operative vaginal birth in the management of the second stage of labour. (JOGC November 2017) 3. Obstetrical care providers are reminded to decrease or stop oxytocin when the fetal heart rate tracing is abnormal. 4. Obstetrical care providers are reminded to consider the possible need for Caesarean section if operative vaginal delivery is unsuccessful.

Case	Type	Summary	Themes	Recommendations
				Transferring the mother to the operating room and advanced notice to the anaesthetist for operative vaginal birth may be prudent. 5. The hospital involved should undertake a lesson's learned case review of circumstances surrounding this death. Topics for discussion could include: • intradisciplinary communication • management of Caesarean delivery of an impacted head • management of instrument assisted delivery
N-08	Neonatal	The mother of the deceased was a 33-year-old G6 P4 woman with four previous full-term deliveries. Lab results and post mortem examination revealed the cause of death to be disseminated herpes simplex infection with sepsis syndrome. Herpes simplex Type II was detected in the baby's blood as well as post-mortem specimens from lung, liver and brain.	Education and training Comm/Doc	1. Neonatal healthcare providers are reminded of the need to provide general and targeted education to parents or guardians prior to the discharge of healthy newborns from hospital. Topics should include infant feeding, normal newborn behaviour and recognition of early signs of illness. Parents of infants with risk factors for sepsis should understand the signs of infection and when to seek medical help. 2. Those caring for hospitalized newborns should ensure that there is an appropriate discharge plan in place for each infant that includes identification of the infant's primary health care provider and assessment 24-72 hours after discharge.

Case	Type	Summary	Themes	Recommendations
N-09	Neonatal	The mother of the deceased infant was a 19-year-old unemployed single woman with financial difficulties. Cause of death was complications of perinatal asphyxia.	Diagnosis and testing Diagnosis and testing Comm/ Doc Training and education	1. Neonatal healthcare providers are reminded of the importance of endotracheal tube (ETT) placement and the use of a CO2 detector and chest x-ray. Nasogastric tube placement is critical for better ventilation. 2. Neonatal healthcare providers are reminded of the importance of early fluid resuscitation and of the neonatal resuscitation algorithm. 3. Neonatal healthcare providers are reminded of crucial monitoring and documentation of neurological status during resuscitation. 4. Hospitals with low volume deliveries should consider ongoing, local practice in obstetrical/neonatal emergency situations (e.g. computer assistance).
N-10	Neonatal	The mother was a 27-year-old G4T3P0A0L2S0N1 0-positive Indigenous woman . Cause of death was determined to be natural recurrent fetal maternal hemorrhages with secondary brain injury, in the context of in utero growth restricting at full term gestation.		None
N-11	Neonatal	The mother was a 29-year-old G1P0. Cause of death was hypoxic-ischemic encephalopathy due to perinatal asphyxia of undetermined cause.	OCP, Diagnosis and testing	1. Obstetrical care providers are reminded that maternal heart rate artifact can occur with external fetal heart rate monitoring and the simultaneous use of a fetal scalp clip and continuous maternal pulse oximetry should be considered for clarification. (see SOGC 2019

Case	Type	Summary	Themes	Recommendations
				Guidelines on Intrapartum Fetal Surveillance)
S-01	Stillbirth	The mother was a 31-year-old healthy G1 TPAL 0000. The mother wanted to have a vaginal breech delivery and sought out the care of a midwife that would provide the service. However, after the delivery, the mother expressed concerns about the lack of understanding of the risks of vaginal breech delivery.	OCP, Diagnosis and testing OCP, Diagnosis and testing OCP, Diagnosis and testing OCP, Diagnosis and testing	1. Obstetrical care providers are reminded that fetal growth restriction is a contraindication to trial of labour for the vaginal breech. (Vaginal Delivery of Breech Presentation. SOGC Clinical Practice Guideline, No. 226, June 2009) 2. Obstetrical care providers are reminded that continuous external fetal monitoring should be universal in the second stages of a breech labour and is recommended in the active phase of labour. (Vaginal Delivery of Breech Presentation. SOGC Clinical Practice Guideline, No. 226, June 2009) 3. Maternal movement can provide artifact that makes it difficult to accurately assess the fetal heart rate. Obstetrical care providers are reminded to use additional measures such as checking maternal heart rate in labour to ensure that the heart rate being monitored is indeed that of the fetus. 4. Obstetrical care providers are reminded to proceed to Caesarean section delivery after sixty minutes of active pushing in the second stage even if the fetal buttocks are visible on the perineum. (Vaginal Delivery of Breech Presentation. SOGC Clinical Practice Guideline, No. 226, June 2009)

Case	Type	Summary	Themes	Recommendations
S-02	Stillbirth	The mother of the stillborn was a 41-year-old G11T10P0A0 L10. The mother presented to hospital with a placental abruption. She had sustained significant hemorrhage, having lost an estimated 1L of blood at home. She continued to bleed in hospital.	OCP, Diagnosis and testing OCP, Diagnosis and testing (EFM) Diagnosis and testing, Comm/Doc Quality	1. 1.Obstetrical Care Providers are reminded to enact timely interventions for patients with life-threatening conditions. 2. Obstetrical Care Providers are reminded that electronic fetal heart rate (FHR) monitoring should continue until delivery when the FHR tracing is concerning or the clinical situation is concerning. 3. Anesthesia care providers are reminded to employ various strategies, including type of anesthetic, for optimizing critically ill patients throughout the intraoperative course. Use of medications must be in appropriate dosages to achieve effect. 4. Anesthesia care providers are reminded to accurately document all aspects of intraoperative care of the patient. 5. The Chief of Anesthesia/Chief of Staff at the hospital involved should conduct a lessons learned review of this case. Topics for review could include: • documentation (nursing and physician) • fetal monitoring • preparedness for obstetrical emergencies including antepartum hemorrhage.

Full, redacted versions of reports and responses to recommendations are available to the public by contacting: occ.inquiries@ontario.ca.

Questions and comments regarding this report may be directed to:

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