Injury-related maternal mortality

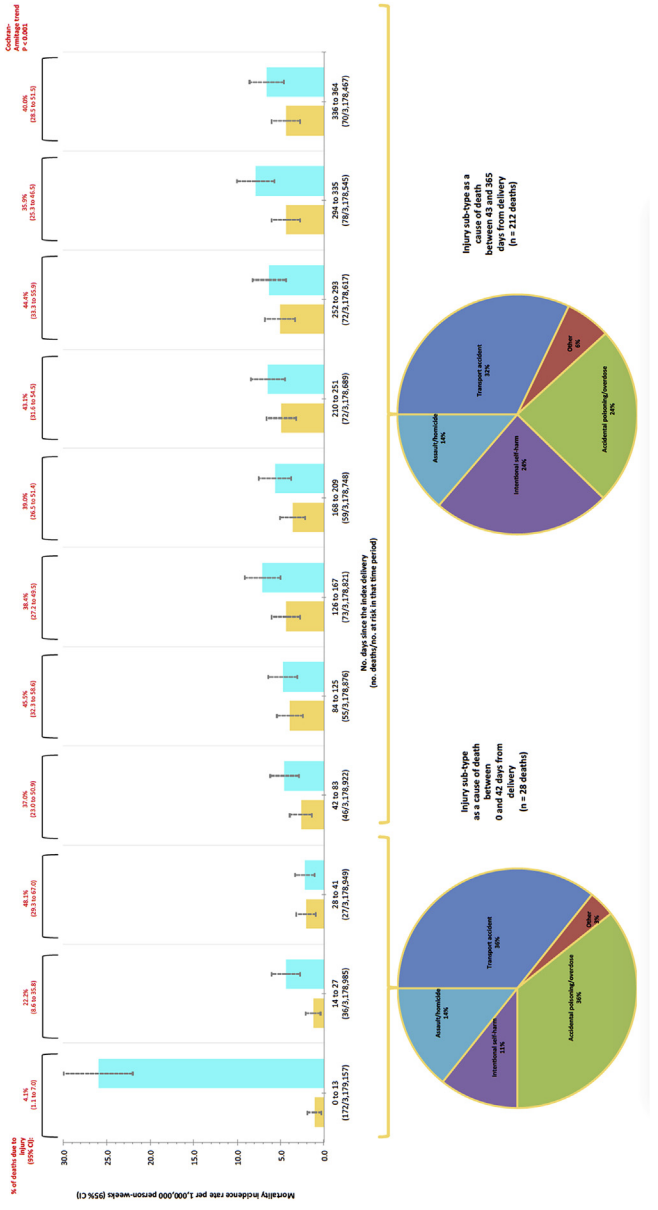
OBJECTIVE: Prior studies on maternal mortality largely focused on deaths in the conventional time frame of 42 days after a live-birth delivery, often excluding women with a stillbirth.[1] Others relied on a pregnancy checkbox on the death certificate and then submitted to a central repository[2] or did not evaluate injury,[3] which has emerged as an important cause of late maternal death 43–365 days postpartum.[4] Herein we included stillbirths and provided more discrete time intervals to evaluate injury-specific causes of maternal mortality.

STUDY DESIGN: We studied live births and stillbirths from 20 weeks' gestation onward, from 1990 through 2015, in Ontario, Canada, where health care is universally available. Provincial databases of all hospital deliveries and Vital Statistics, including mandatory completed death certificates,[5] were linked using unique encoded identifiers at the Institute for Clinical Evaluative Sciences. The Research Ethics Board of the Sunnybrook Health Sciences Centre granted ethics approval. Incidence rates (IRs) were separately calculated for injury and noninjury maternal deaths. IRs were shown across 11 time intervals within the 365 days after birth: biweekly from 0 to 42 days (when deaths are most common) and every 6 weeks thereafter. To account for the changing number of women at risk in each interval and the time at risk therein, IRs were presented per 1 million person-weeks, with 95% confidence intervals (CIs). The proportion of deaths caused by injury in each interval was also calculated and the corresponding trend tested by a 2-sided Cochrane-Armitage test. Maternal deaths caused by injury at 0–42 and 43–365 days were presented by injury subtype: transport accident (International Classification of Diseases, ninth edition [ICD-9] E800–E849); accidental poisoning/overdose (ICD-9 E850–E854); intentional self-harm (ICD-9 E950–E959); assault/homicide (ICD-9 E960–E969); or other (ICD-9 E855–E949 and E970–E999).

RESULTS: Of 3,179,157 births, there were 760 maternal deaths within 365 days of delivery (23.9 per 100,000, 95% CI, 22.2–25.6), including 720 deaths among 3,159,762 livebirths (22.8 per 100,000, 95% CI, 21.1–24.5), and 40 deaths among 19,395 stillbirths (206.2 per 100,000, 95% CI, 142.4–270.1). There were 235 maternal deaths within 42 days of birth (IR, 12.3 per 1 million person-weeks, 95% CI, 10.7–14.0) and 525 deaths from 43 to 365 days (IR, 3.6 per 1 million person-weeks, 95% CI, 3.3–3.9) (Figure 1, bars). In the first 14 days after birth, injuries caused 4.1% of maternal deaths; by 28 days, they accounted for 35–48% of all deaths ($P < .001$) (Figure 1, top red). Greater than 60% of injury-related deaths were from self-harm, poisoning/overdose, and homicide (Figure 1, bottom circles).

CONCLUSION: Greater than 95% of maternal deaths before 14 days postpartum were due to noninjury causes, as described

FIGURE 1
Maternal mortality incidence rates for injury and noninjury deaths



Maternal mortality incidence rates for injury (*orange bars*) and noninjury (*blue bars*) deaths occurring at various intervals from birth to 42 days (early deaths) and from 43 to 365 days (late deaths). Incidence rates and 95% confidence intervals (CI) are presented per 1 million person-weeks by women at risk in the denominators. The proportion of deaths caused by injury are shown in each time interval and tested by the Cochrane-Armitage test for trend (*top red*). Injury-related deaths are further broken down by subtype at 0–42 and 43–365 days (*lower circles*).

Ray JG. Injury-related maternal mortality. Am J Obstet Gynecol 2018.

elsewhere.[1–3] Thereafter, injury-related deaths rose significantly, with more than one third of injuries being intentional, a similar proportion to that in a study of 129 maternal deaths in Australia.[4] This study did not capture out-of-hospital births, which are less than 1% of births in Ontario, or maternal deaths occurring antepartum. Although direct and indirect causes of death were not differentiated herein, the striking difference in maternal mortality rates following a stillbirth vs a livebirth deserves further study. Future studies should further classify maternal deaths by injury subtypes, including overdoses, and additionally evaluate antepartum deaths. ■

ACKNOWLEDGMENT

Author contributions included the following: Joel G. Ray and Allison L. Park developed the study concept, analysis and interpretation of the data, drafting of the manuscript, manuscript revision, and approval of final version. Jonathan Zipursky was responsible for the interpretation of the data, manuscript revision, and approval of final version.

Joel G. Ray, MD, MSc
Departments of Medicine
Health Policy Management and Evaluation, and
Obstetrics and Gynecology
St Michael's Hospital
University of Toronto
30 Bond Street
Toronto, Ontario, Canada M5B 1W8
rayj@smh.ca

Jonathan Zipursky, MD, FRCPC
Department of Medicine
Division of Clinical Pharmacology and Toxicology
University of Toronto
Toronto, Ontario, Canada

Alison L. Park, MSc
Institute for Clinical Evaluative Sciences
University of Toronto
Toronto, Ontario, Canada

The views expressed therein are those of the author and do not necessarily reflect those of the Ontario Registrar General or the Ministry of Government Services.

The opinions, results, and conclusions reported in this paper are those of the authors and are independent from the funding sources. No endorsement by the Institute for Clinical Evaluative Sciences or the Ontario Ministry of Health and Long-Term Care is intended or should be inferred.

The funders had no role in the study design, data collection and analysis, decision to publish, or preparation of the manuscript. Parts of this report are based on Ontario Registrar General information on deaths, the original source of which is Service Ontario.

This work was supported by a grant from the Canadian Institutes of Health Research and by the Institute for Clinical Evaluative Sciences, which is funded by an annual grant from the Ontario Ministry of Health and Long-Term Care.

The authors report no conflict of interest.

REFERENCES

1. Cristina Rossi A, Mullin P. The etiology of maternal mortality in developed countries: a systematic review of literature. Arch Gynecol Obstet 2012;285:1499–503.
2. MacDorman MF, Declercq E, Thoma ME. Trends in maternal mortality by sociodemographic characteristics and cause of death in 27 states and the District of Columbia. Obstet Gynecol 2017;129:811–8.
3. Schutte JM, Steegers EA, Schuitemaker NW, et al. Rise in maternal mortality in The Netherlands. BJOG 2010;117:399–406.
4. Thornton C, Schmied V, Dennis CL, Barnett B, Dahlen HG. Maternal deaths in NSW (2000–2006) from nonmedical causes (suicide and trauma) in the first year following birth. Biomed Res Int 2013;2013:623743.
5. Chiu M, Lebenbaum M, Lam K, et al. Describing the linkages of the immigration, refugees and citizenship Canada permanent resident data and vital statistics death registry to Ontario's administrative health database. BMC Med Inform Decis Mak 2016;16:135.

 https://doi.org/10.1016/j.ajog.2018.05.025

Human term amniotic fluid: a novel source of stem cells for regenerative medicine

Check for updates

OBJECTIVE: Our objective was to characterize term amniotic fluid stem cells and compare them with previously described mid-trimester amniotic fluid stem cells. Stem cells are undifferentiated cells with the ability to self-replicate without differentiation. Mid-trimester amniotic fluid stem cells have been well-characterized as multipotent, but scant data exist for term amniotic fluid.[1] With the advent of noninvasive prenatal diagnosis, mid-trimester amniotic fluid will become less available from normal patients. In contrast, term amniotic fluid is available in large quantities from normal pregnancies and might be a resource for clinical transplantation.

STUDY DESIGN: Institutional Review Board approval and informed consent were obtained before research began. Amniotic fluid was collected from uncomplicated, scheduled term cesarean deliveries with a small uterine incision and a soft catheter to collect fluid before the attempt to deliver the baby. Immediately after collection, cell viability from each fresh sample was assayed before culture with the use of Trypan Blue staining; cells were counted via hemocytometer. Cells were then cultured for expansion; aliquots were taken and frozen from each subsequent passage. Cells were seeded on gridded culture dishes and counted daily for 4 days to assess proliferation. Flow cytometry for surface markers