Risk Factors and Newborn Outcomes Associated With Maternal Deaths in the UK From 2009 to 2013: A National Case-control Study

M. Nair, M. Knight, and J.J. Kurinczuk

*BJOG*. 2016;123:1654–1662

Nuffield Department of Population Health, National Perinatal Epidemiology Unit, University of Oxford, Oxford, UK

Copyright © 2017 Wolters Kluwer Health, Inc. All rights reserved.
DOI: 10.1097/AOA.0000515737.97802.CC

**Topics:** Maternal Morbidity and Mortality, Neonatal Morbidity and Mortality

Studies have identified several factors associated with the progression of serious pregnancy complications to maternal death, including medical comorbidities, inadequate antenatal care, and sociodemographic factors. However, identification of differences between the normal pregnant population and those who die from complications during pregnancy or childbirth could be valuable when working to update and improve current pregnancy care pathways focused on the management and/or prevention of risks and complications during pregnancy and childbirth. This current study aimed to determine the risk factors for maternal deaths from direct and indirect causes in the UK between 2009 and 2013 as well as any adverse fetal and newborn outcomes associated with the deaths.

An unmatched case-control analysis was conducted by comparing data from women who died (n = 383) due to direct (obstetric) causes or indirect (preexisting medical conditions exacerbated by pregnancy) causes during pregnancy or within 42 days of pregnancy termination against data from 1516 controls. Women used as controls were identified from the UK Obstetric Surveillance System (UKOSS) between 2010 and 2012 and did not have life-threatening complications during pregnancy or childbirth (defined as uncomplicated pregnancy). Information about the maternal deaths was obtained from the United Kingdom’s Confidential Enquiry into Maternal Deaths database. The association between maternal death and 13 possible risk factors was investigated. Data regarding these risk factors were available from both of the databases used in the study. These potential risk factors included: gestational diabetes, anemia, multiple gestation, inadequate utilization of antenatal care, smoking, substance misuse, prior pregnancy problems, preexisting medical conditions, body mass index, parity, age, ethnicity, and employment status. A multivariable logistic regression model was used to identify those factors associated with increased odds for maternal death. Patients were assigned a risk factor score based on the number of significant risk factors they possessed, and this was used to determine incremental odds of maternal mortality. In addition, the odds ratios (OR) of 3 adverse newborn outcomes, namely stillbirth, admission to neonatal intensive care unit, and early neonatal death among women who died were compared with those in women with uncomplicated pregnancies by performing exact logistic regression analyses for each of these adverse event categories.

Seven factors were found to be independently associated with increased odds of maternal death. These included presence of a preexisting medical condition [adjusted OR (aOR), 8.65; 95% confidence interval (CI), 6.29-11.90]; presence of anemia (aOR, 3.58; 95% CI, 1.14-11.21); inadequate use of antenatal care (aOR, 46.85; 95% CI, 19.61-111.94); history of previous pregnancy problems (aOR, 1.85; 95% CI, 1.33-2.57); substance misuse (aOR, 12.21; 95% CI, 2.33-63.98); unemployment status (aOR, 1.81; 95% CI, 1.08-3.04), and increasing maternal age (6% increase). Analyses of risk factor scores demonstrated that 5% (n = 19) of the cases had none of the 7 identified risk factors compared with 33% (n = 506) of the controls. For the maternal death group 21% (n = 79), 34% (n = 131), 26% (n = 101), and 11% (n = 43) had 1, 2, 3, and 4 of these risk factors, respectively, compared with 44% (n = 671), 18% (n = 273), 4% (n = 63), and 0.2% (n = 3) for the controls. A nearly 4-fold increase was observed in the odds of death for each increase of one in the number of risk factors (aOR, 3.82; 95% CI, 3.28-4.45; P < 0.001). From a population standpoint, 87% of the increased risk of maternal death could be explained by the presence of the 7 independent risk factors. In terms of fetal and neonatal outcomes, the risk of all 3 adverse outcomes were higher among women who died compared to controls with aORs of 43.1 for stillbirth, 7.0 for admission to neonatal intensive care unit, and 38.8 for death during the early neonatal period.

On the basis of their results, the authors emphasized the need to provide optimal care for women with medical comorbidities and increasing maternal age, as well as the value of developing strategies within the health care system to ensure parturients adequately utilize the antenatal care services available to them. These initiatives could help improve maternal mortality rates.

**COMMENT**

In performing this study, the authors ask the important question “Are women who die during pregnancy or childbirth different from the normal pregnant
population?” The expectation may be that women without risk factors, that is, women with uncomplicated “normal” pregnancies, can be managed with fewer resources, while dedicating more resources to those with complicated pregnancies. This search for the optimal level of care requires the knowledge gained from such studies. Although not specifically addressed in the current study, the question must ultimately include risk factors for maternal and fetal morbidities, particularly since it is severe morbidities and “near misses”, rather than mortalities, which strain the health system resources and limit our ability to provide equitable care for all.

Data from this and similar studies may be incorporated into calculated risk of death scores that are used to compare patient populations to determine the appropriateness of resources dedicated to that population. Such calculations are often used to compare quality of care among institutions. Why, for example, does hospital A with a similar patient population and risk scoring to hospital B, have a cesarean section rate that is double that of hospital B? Is hospital A wasting resources? Should hospital A receive similar reimbursements to hospital B? These pay-for-performance questions will be increasingly dependent on the data obtained by these studies.

Although the focus of most studies is at the hospital care level, in fact, by far the most significant risk factors for death in this study were inadequate use of antenatal care and substance misuse (aOR of 46.84 and 12.21, respectively). This strongly suggests that societal changes outside the hospital will be far more impactful on outcomes than will improved medical care at the hospital. Although this is no surprise, it poignantly demonstrates that patients must take more control of their health and that hospital systems cannot be relied upon to rescue those who fail to help themselves. (If you do not have a car wreck, you probably are not at risk for an adverse outcome in the trauma department!) Because we know that many in our society are unable, unwilling or ignorant of the health care measures they should take for themselves, public health services that reach outside the medical system per se, must take a larger role in reducing these risk factors among pregnant women. Ideally, public health measures exclude the active participation of the individual (eg, folate supplementation in foods, water chlorination/fluoridation, safer cars, etc.) but the most vulnerable of our population will still need programs that reach out to them. In turn, the success of such programs in affecting these outcomes must be studied.

One reassuring finding in the current study was that ethnicity was not a risk factor for these adverse outcomes. This may speak highly to the changes in British health care and probably British society in general and it is a finding unlikely to be extended to the US population at this time. However, the authors noted that while ethnicity was not an independent risk factor for mortality, the associated comorbidities in ethnic populations might still make them a high-risk group. In contrast, unemployment (a likely measure of poorer socioeconomic status) remained an independent risk factor.

In conclusion, in-hospital medical care is highly regulated and measured, yet is only the tip of the iceberg with respect to the health outcomes of pregnant women. We must expand our health care system to reach those not actively participating in the system. This expansion can be supported by better matching resource use to the inherent healthcare risk both within and outside the walls of the hospital.

Comment by Robert S.F. McKay, M.D.

REFERENCE

1. Knight M, Acosta C, Brocklehurst P, et al. Beyond maternal death: improving the quality of maternal care through national studies of “near miss” maternal morbidity. Programme Grants Appl Res. 2016;4. Doi:10.3310/pgfar04000.

Effect of Pregnancy on Insulin Requirements Differs Between Type 1 and Type 2 Diabetes: A Cohort Study of 222 Pregnancies

S. Padmanabhan, S. Jiang, M. Mclean, and N.W. Cheung

(Aust N Z J Obstet Gynaecol. 2016;56(4):352–357)

Department of Diabetes and Endocrinology, Westmead Hospital, Westmead, NSW, Australia

Copyright © 2017 Wolters Kluwer Health, Inc. All rights reserved. DOI: 10.1097 /OAJOA.0000515738.91964.e4

Topics: Nonobstetric Maternal Disease

The occurrence of type 1 (T1DM) and type 2 diabetes (T2DM) during pregnancy is increasing around the world. An understanding of the differences in insulin requirements between the 2 groups may have vital clinical consequences in enabling clinicians to respond effectively to gestation-specific glycemic alterations, avoid hypoglycemia, and identify subgroups for whom additional intervention would be beneficial. This study was a retrospective review conducted to examine the patterns of insulin requirements in women with preexisting diabetes during pregnancy.

Data on women with preexisting T1DM or T2DM requiring insulin during pregnancy were obtained between 2010 and 2015. The differences between the 2 groups were determined by the Mann-Whitney U test. The primary outcomes were insulin dose at the end of each trimester, the percentage increase in insulin requirement per trimester, and the percentage decrease in insulin requirements from the peak to delivery, while secondary outcomes included the presence of one or more hypoglycemic occurrences in each trimester, weight gain per trimester and HbA1c obtained at the end of each trimester. Of a total of 222 pregnancies, 67 were found to have T1DM and 155 were found to have T2DM. Women with T1DM had a longer duration of diabetes than women with T2DM [5 (4 to 16) vs. 3 (1 to 9.5) y, P < 0.001]. Excluding the prepregnancy insulin, it was observed that 68.6% of T1DM women began taking insulin by the end of trimester 1, 92.6% by trimester 2 and 100% by trimester 3. Although women with T1DM required more insulin in the first 2 trimesters than women...