



HHS Public Access

Author manuscript

Epidemiology. Author manuscript; available in PMC 2019 July 01.

Published in final edited form as:

Epidemiology. 2018 July ; 29(4): e31–e32. doi:10.1097/EDE.0000000000000828.

Validation of Severe Maternal Morbidity on the US Certificate of Live Birth

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To the Editor

Severe maternal morbidity, unexpected outcomes of labor and delivery that have substantial short- or long-term health consequences, has been steadily increasing in recent years, affecting more than 50,000 women in the United States in 2013–14 (1). It has been suggested that the rise is related to changes in the overall health of the childbearing population, including increases in maternal age (2), pre-pregnancy obesity (3), preexisting chronic medical conditions (4), and cesarean delivery (5). The 2003 revision of the US Certificate of Live Birth added specific checkbox items on severe maternal morbidity occurring within 24 hours of delivery to facilitate national surveillance of these outcomes, as well as research on maternal complications of pregnancy. The items included maternal transfusion, third- or fourth-degree perineal laceration, ruptured uterus, unplanned hysterectomy, and admission to the intensive care unit. Massachusetts implemented the 2003 revision in 2011. As part of a larger study evaluating subfertility and maternal–child health, we evaluated the accuracy of severe maternal morbidity reported on the birth certificate, using hospital discharge data as the reference.

We designed a population-based study of all live births in Massachusetts between 2011 and 2013 linked to hospital discharge data. We used International Classification of Diseases, 9th revision (ICD-9) codes in the hospital discharge data to identify maternal blood transfusion (procedure codes 99.x), unplanned hysterectomy (procedure codes 68.3–68.9), ruptured

Barbara Luke is a research consultant to the Society for Assisted Reproductive Technologies; all other authors report no conflicts of interest.

uterus (diagnosis codes 665.0 and 665.1) and, among vaginal births, 3rd- or 4th- degree perineal laceration (diagnosis code 664.2 and 664.3); intensive care unit (ICU) admission was identified by Uniform Billing (UB-04) revenue codes 0200–0209. The rates for each severe maternal morbidity measure were calculated per 100,000 deliveries. Sensitivity (probability of being included on the birth certificate when it was reported on the hospital discharge) and positive predictive value (PPV, probability of being on the hospital discharge when it was reported on the birth certificate), specificity, and negative predictive value (NPV) were calculated to measure the reporting of severe maternal morbidity measures by mode of delivery (vaginal, cesarean), except for 3rd or 4th degree perineal laceration (vaginal births only). We obtained institutional review board approval from the Massachusetts Department of Public Health, Dartmouth College, and Michigan State University.

The study population included 208,819 live births (142,923 vaginal births and 65,606 cesarean births). The most frequent morbidity was perineal laceration, followed by transfusion. Transfusion was the only severe maternal morbidity that regularly occurred with other severe maternal morbidities: 64% of hysterectomies, 56% of ICU admissions, and 21% of ruptured uteri reported transfusions; 15% of ICU admissions were for an unplanned hysterectomy. The birth certificate greatly underreported severe maternal morbidity, with sensitivities ranging from 0.11 (transfusion in vaginal births) to 0.52 (hysterectomy after cesarean delivery). The PPV ranged from 0.03–0.90, with highest values for transfusion and perineal lacerations. The numerator for sensitivity and PPV is given in the Table. The specificity was >99% and the NPV was >98% in all cases.

These results indicate that, compared to hospital discharge data, the birth certificate items greatly underreport severe maternal morbidity, although when blood transfusion, unplanned hysterectomy, or perineal laceration was reported on the birth certificate it was very likely to be reported in the hospital discharge. With the implementation of the ICD-10 coding, these results may improve. A limitation of using hospital discharge data as the reference is that the ICD-9 coding is done primarily for billing purposes, and thus is susceptible to under-ascertainment or misclassification, as well as differences in the way individual hospitals record these data.

Acknowledgments

Supported by the National Institute of Child Health and Human Development, National Institutes of Health (grant R01 HD067270). The views expressed in this paper are those of the authors and do not necessarily represent the official views of the National Institute of Child Health and Human Development or the National Institutes of Health.

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Reporting of Maternal Morbidity on the Birth Certificate versus Hospital Discharge Massachusetts, 2011–13

Table

Maternal Morbidity	Mode of Delivery		Rate/100,000 deliveries		Numerator Present in both sources	Sensitivity	Positive Predictive Value
	Birth Certificate	Hospital Discharge	Birth Certificate	Hospital Discharge			
Blood Transfusion	All	1,053	171	261	0.12	0.73	
	Vaginal	637	92	97	0.11	0.75	
	Cesarean	1,962	343	162	0.13	0.72	
Ruptured Uterus	All	71	102	39	0.26	0.18	
	Vaginal	6	45	2	0.22	0.03	
	Cesarean	213	229	37	0.26	0.25	
Unplanned Hysterectomy	All	75	58	80	0.51	0.66	
	Vaginal	16	22	11	0.48	0.35	
	Cesarean	203	137	69	0.52	0.77	
Admission to Intensive Care	All	194	132	81	0.20	0.29	
	Vaginal	60	92	18	0.21	0.14	
	Cesarean	485	219	63	0.20	0.44	
3 rd or 4 th degree Perineal Laceration	Vaginal	2,746	928	1,190	0.30	0.90	