congratulated for introducing the important concept of survival analysis and competing risks into this emerging field of prenatal care. However, further refinement of the algorithm is warranted.

In the authors' study, the observed incidence of early-onset preeclampsia was well aligned with predicted risks but lower than predicted for all preeclampsia. The authors rightly attribute this phenomenon to the fact that as pregnancies get closer to term, there is more of a chance that delivery will occur before the opportunity for onset of preeclampsia. Indeed, in the authors' model, the average gestational age at delivery with preeclampsia is 54 weeks, well beyond the time frame of normal pregnancy.

Use of the cumulative incidence function (CIF),[2] which factors in the probability that the competing event (delivery for other causes) will occur after delivery because of preeclampsia, would result in more appropriate estimates of individual-specific risks, and these risks will be more in line with observed incidence.

$$CIF = \frac{\int_{24}^{G} p(g) S_{oth}(g) dg}{\int_{24}^{\infty} p(g) dg}$$, where p(g) is described by the

authors.[3] The CIF is equivalent to the formula used by the authors except for the S_{oth} term. S_{oth} is the probability of delivery after a given gestational age for other causes (determined using survival analysis with preeclampsia cases censored). S_{oth} is near 1.0 in early gestation and close to zero near term. Thus, the risk estimate based on the CIF will be similar to the authors' estimate for early preeclampsia, while the risk estimate of all preeclampsia will be lower and more in line with observed incidence. In a subpopulation in which the risk of earlier birth is increased, there would be a further reduction in estimated all preeclampsia risk using the CIF calculation.

Use of the CIF will not only provide a more precise estimate of the risk of observing preeclampsia but also introduce a more easily understood paradigm for risk estimation. Estimate of preeclampsia risk would now not only incorporate the assumption that all pregnancies will eventually be affected by preeclampsia (in most cases at unrealistic gestational ages) but that delivery because of other causes reduces the chance of observed occurrence. ∎

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REPLY

TO THE EDITORS: The risks produced from our competing risks model[1] are for delivery with preeclampsia before a specific gestational age, assuming no other cause for delivery. Because other-cause deliveries are effectively censored observations, the actual incidence of preeclampsia would be expected to be lower than predicted. For early gestations, when there are few other-cause deliveries, the effects would be small. At later gestations, with many other-cause deliveries, the effect of censoring may be substantial.

We welcome the contribution from Krantz and Hallahan who show how, by incorporating a survival function, our model can be extended to predict the risk of birth with preeclampsia that allows for deliveries because of other causes.[2] However, we would not advocate the adjustment in general because, from the perspective of clinical management and decision-making, the risk of assuming no other-cause delivery is more meaningful. For example, the estimated risk of preeclampsia at <41 weeks gestation addresses the question of what is the risk of having to deliver with preeclampsia at <41 weeks gestation if the pregnancy were to continue. In this instance, the finding of a high risk result could lead to medically indicated delivery at an earlier gestational age, such as 38 weeks gestation, thereby avoiding the development of term preeclampsia. Consequently, the no other-cause risk is being used to modify the other-cause delivery process.

A technical issue with the method suggested by Krantz and Hallahan is the specification of $S_{oth}(g)$, which is the probability that delivery from other causes occurs after gestational age g. This should be conditional on the maternal features and biomarker data available. This presents a difficult technical challenge that is avoided by the use of no other-cause delivery risks. ∎

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Uterine legacy of open maternal–fetal surgery: preterm uterine rupture

Check for updates

TO THE EDITORS: We congratulate Goodnight et al[1] on the publication of a study in the *Journal* in March of 2019 titled, "Subsequent pregnancy outcomes after open maternal-fetal surgery for myelomeningocele." Using an international multicenter prospective observational registry, the authors' analysis of 52 subsequent pregnancies after open maternal–fetal surgery (OMFS) for fetal myelomeningocele revealed that the risk of uterine rupture was 9.6% (5/52) and the additional risk of uterine dehiscence/thinness was 17.3% (9/52). The authors concluded that "the risk of uterine rupture or dehiscence in subsequent pregnancies with associated fetal morbidity after OMFS is significant, but similar to that reported for subsequent pregnancies after classical cesarean delivery."[1] We believe this conclusion is inaccurate and trivializes the substantial risks associated with the uterine legacy of OMFS.

We acknowledge that the risk of uterine rupture after previous classical cesarean delivery varies in the literature, although the majority of studies report that risk to be less than 9.6%.[2] However, there is a fundamental difference that needs to be emphasized…and that is the *timing* of uterine rupture. Studies reporting the risk of uterine rupture after classical cesarean delivery typically describe a group of patients who underwent trial of labor and/or refused elective cesarean delivery at or near term.[2] The uterine ruptures in this study by Goodnight et al occurred at a median of 28 weeks (26.0–31.5 weeks) of gestational age. Two of these 5 cases (40%) involved fetal death. The current recommendation of elective repeat cesarean delivery, "at 36–37 weeks to reduce the risk of uterine rupture,"[1] after OMFS would fail to provide benefit to these cases of preterm uterine rupture.

Patients and physicians need to be warned. The legacy of OMFS in subsequent pregnancies is a relatively high risk of preterm uterine rupture and fetal death. ■

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