Supporting information

Note: Additional information, including model data inputs, outputs, and methodology, is available upon request.

Appendix 1. Calculation of PPH-associated productivity loss

To estimate mortality-associated productivity loss, we adapted the following equation to fit the TreeAge Pro Healthcare 2020 platform. This allowed us to incorporate estimates of paid and unpaid economically productive work for women within and outside of the labor force during a given year of life into our secondary analysis. To estimate morbidity-associated productivity loss, we divided the yearly estimate for mortality-associated productivity loss by 365 days per year. In this way, we estimated morbidity and mortality associated productivity losses as being equivalent to the number of days and years of economically productive work lost, respectively.

$$NPVE\text{-}_{y,g} = \sum p_{y,g}(n)\{[Y_g(n)E_g(n)+U_g(n)E_g(n)]+[U_g^h(n)E_g^h(n)]\}*\frac{1}{(1+r)^{n-y}}$$

Where:

$NPVE\text{-}_{y,g}$ = *net present value economic productivity*

$P_{y,g}(n)$ = *probability that a person of age y and gender g will survive to age n*[1]

y = *starting age of person*

n = *age of person at a future moment*

g = *gender*

$Y_g(n)$ = *mean yearly earnings of an employed person of gender g and age n*[2]

$E_g(n)$ = *labor force participation rate (LFPR) of a person of gender g and age n*[3]

$U_g(n)$ = *value of unpaid, economically productive work of a person of gender g and age n within the labor force (federal minimum wage*hours per year)*[4,5]

$U_g\text{-}^h(n)$ = *value of unpaid, economically productive work of a person of gender g and age n outside of the labor force (federal minimum wage*hours per year* [4,5]

$E_g^h(n)$ = *portion of people of gender g and age n outside of labor force (1-LFPR)*[3]

$1/(1+r)^{n-y}$ = *discount factor*

Appendix 2. Calculation of composite health state utility weights

As pregnant patients progress through our model, they approach a branching point within the tree structure that directs them through one of two mutually exclusive subtrees for vaginal and cesarean delivery (VD and CD, respectively). Patients progressing through these subtrees may experience some or all of the medical events and interventions within those subtrees as they transition between health states, as dictated by probability and the Markov process. Each event experienced during the cycle necessarily impacts the payoff of that cycle, as each event carries with it important cost and quality of life implications for the patient that may be additive. To account for these combined effects on quality of life for the patient, we employed a multiplicative approach for combining utility weights into a composite health state utility weight.[6]

Several factors influenced our implementation of the multiplicative approach. While interventions used to treat postpartum hemorrhage (PPH) generally proceed from less invasive to more invasive depending on the tractability of the hemorrhage, the interventions employed by individual providers may also be influenced by provider preference and clinical setting.[7] *While treatment algorithms guide medical decision-making, it is conceivable that providers may transition to invasive means for treating PPH abruptly rather than progressively in more emergent cases. Because severe and intractable PPH is often managed surgically, there may be overlap in the utility decrements associated with conservative surgeries and hysterectomies associated with surgical access, meaning that by combining these weights we may increase the risk of double counting. The risk of double counting may also be magnified by relying on literature estimates for utility weights, as the populations these weights were derived from may have also undergone other interventions that influenced their estimates, including those also accounted for in our model.*

To address these concerns, we elected to make the inclusion of utility weights associated with balloon tamponade, conservative surgery, and hysterectomy mutually exclusive, while the utility weights associated with mode of delivery and PPH were consistently included. This can be seen below. This decision likely underestimates the quality of life decrement associated with severe PPH, thus underestimating the payoff associated with its prevention. We viewed this tradeoff as preferable to the risk of double counting.

Composite health state utility weights, by estimate and input			
Parameter	**VD Estimate**	**CD Estimate**	**Inputs**
Death Other Cause/Collecting State	**		
Death PPH	0.414	0.405	0.5*uVCD*uPPH
Death PPH + Balloon Tamponade	0.372	--	0.5*uVD*uPPH*uBT
Death PPH + Conservative Surgery	0.347	0.372	0.5*uVCD*uPPH*uCS
Death PPH + Hysterectomy	0.318	0.312	0.5*uVCD*uPPH*uHyst
Alive PPH	0.827	0.810	uVCD*uPPH
Alive Balloon Tamponade	0.744	--	uVD*uPPH*uBT
Alive Conservative Surgery	0.695	0.745	uVCD*uPPH*uCS
Alive Hysterectomy	0.637	0.623	uVCD*uPPH*uHyst

Abbreviations:

- *uVCD – utility weight for vaginal or cesarean delivery*
- *uVD – utility weight for vaginal delivery alone*
- *uPPH – utility weight for postpartum hemorrhage*
- *uBT – utility weight for balloon tamponade*
- *uCS – utility weight for conservative surgery*
- *uHyst – utility weight for hysterectomy*

*Symbols: **, variable; --, not applicable*

References:

1. Arias E, Xu J. United States Life Tables, 2017. U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES; 2019:66. https://www.cdc.gov/nchs/data/nvsr/nvsr68/nvsr68_07-508.pdf

2. U.S. Bureau of Labor Statistics. Household Survey Data, 2018 Annual Averages. U.S. Bureau of Labor Statistics; 2019:127. https://www.bls.gov/cps/cpsa2018.pdf

3. U.S. Bureau of Labor Statistics. Civilian Labor Force Participation Rate by Age, Sex, Race, and Ethnicity. U.S. Bureau of Labor Statistics; 2019. https://www.bls.gov/emp/tables/civilian-labor-force-participation-rate.htm

4. Wage and Hour Division. Minimum Wage. Published online 2020. https://www.dol.gov/agencies/whd/minimum-wage

5. Hess C, Ahmed T, Hayes J. Providing Unpaid Household and Care Work in the United States: Uncovering Inequality. Published online January 2020. https://iwpr.org/wp-content/uploads/2020/01/IWPR-Providing-Unpaid-Household-and-Care-Work-in-the-United-States-Uncovering-Inequality.pdf

6. McIntosh CN. Utility Scores for Comorbid Conditions: Methodological Issues and Advances. In: Preedy VR, Watson RR, eds. *Handbook of Disease Burdens and Quality of Life Measures*. Springer New York; 2010:359-380. doi:10.1007/978-0-387-78665-0_20

7. Likis FE, Sathe NA, Morgans AK, et al. Management of Postpartum Hemorrhage. Agency for Healthcare Research and Quality (US); 2015. https://www.ncbi.nlm.nih.gov/books/NBK294453/