

The “birth hump”

A shape decomposition of perinatal excess mortality

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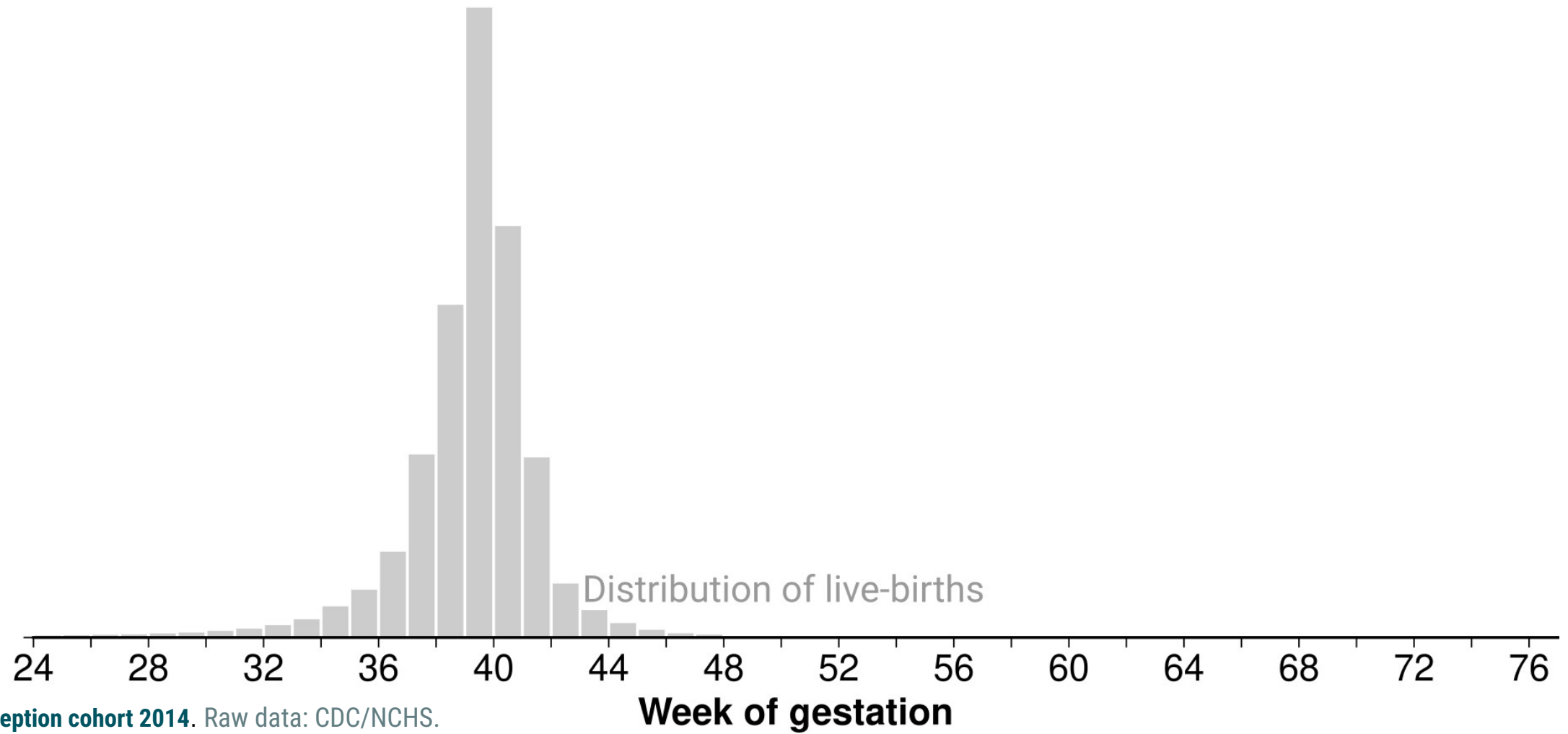
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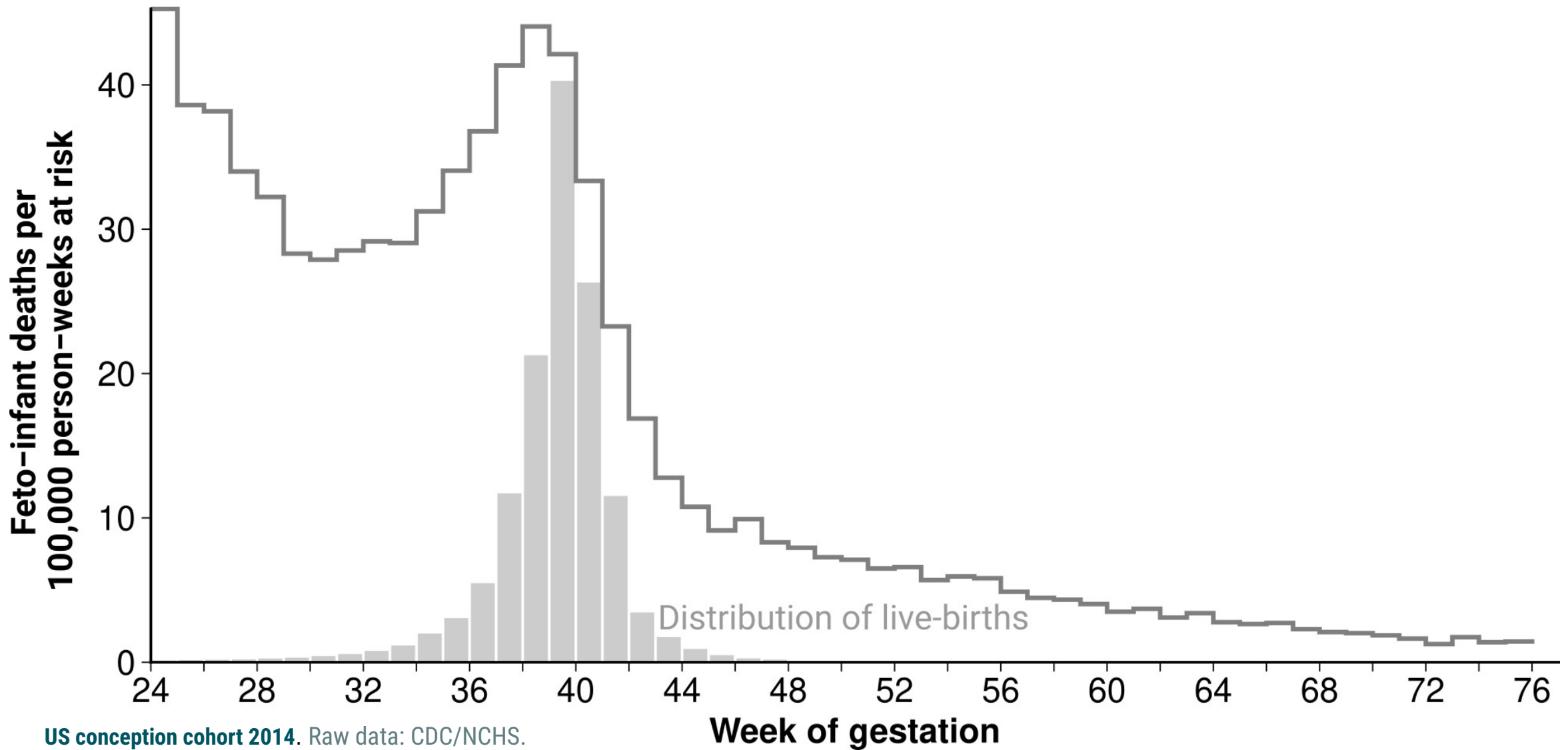


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The transitional shock of birth

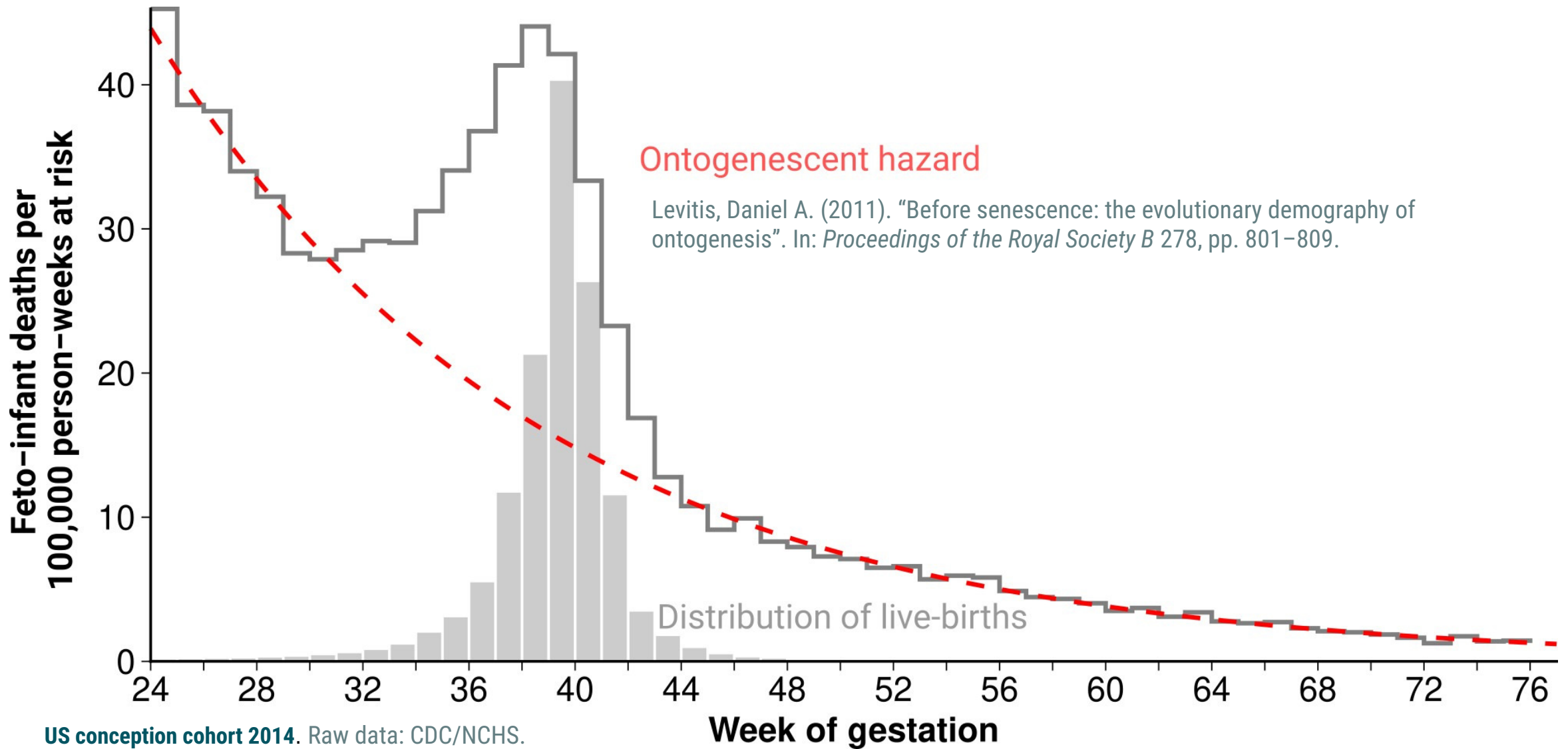


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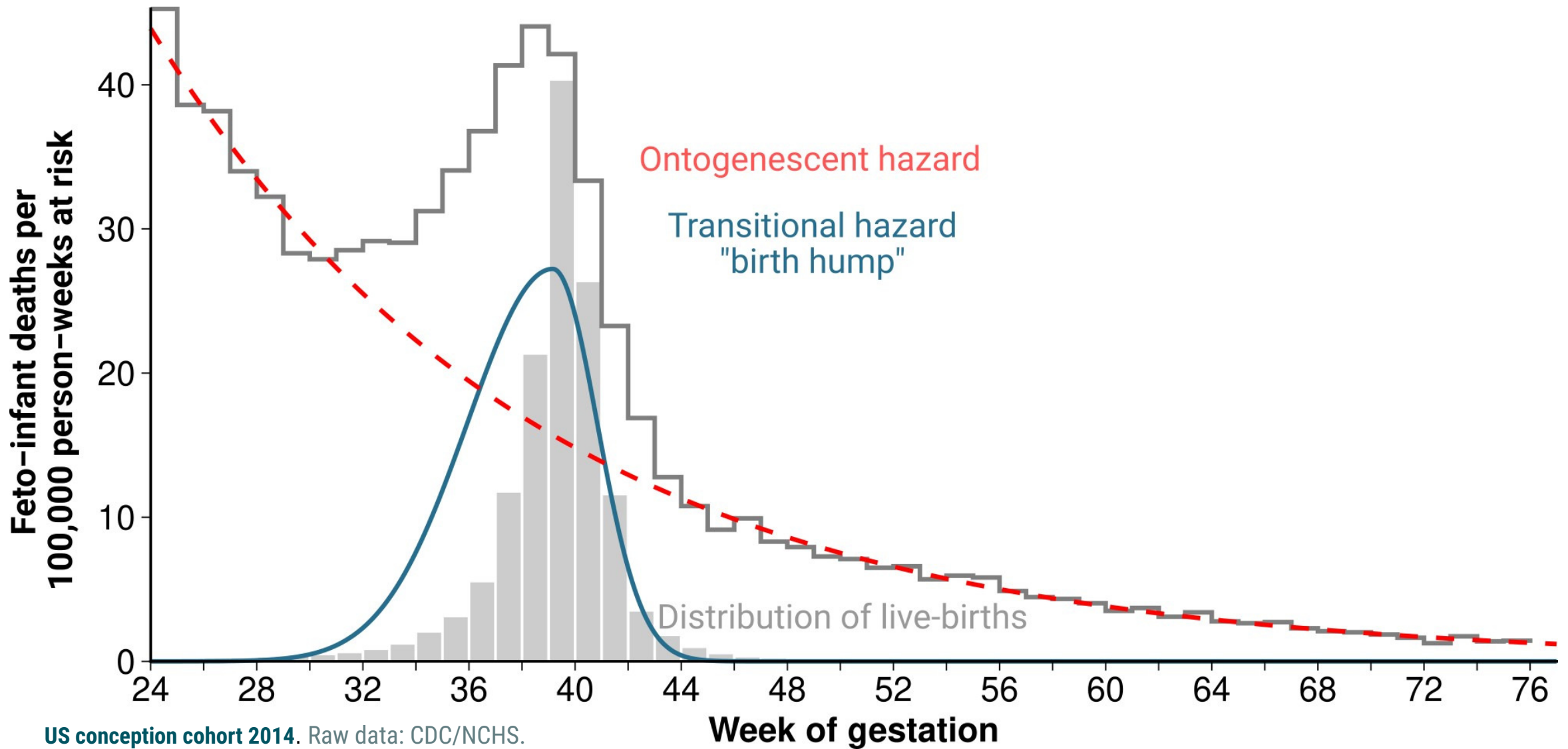


US conception cohort 2014. Raw data: CDC/NCHS.

The transitional shock of birth



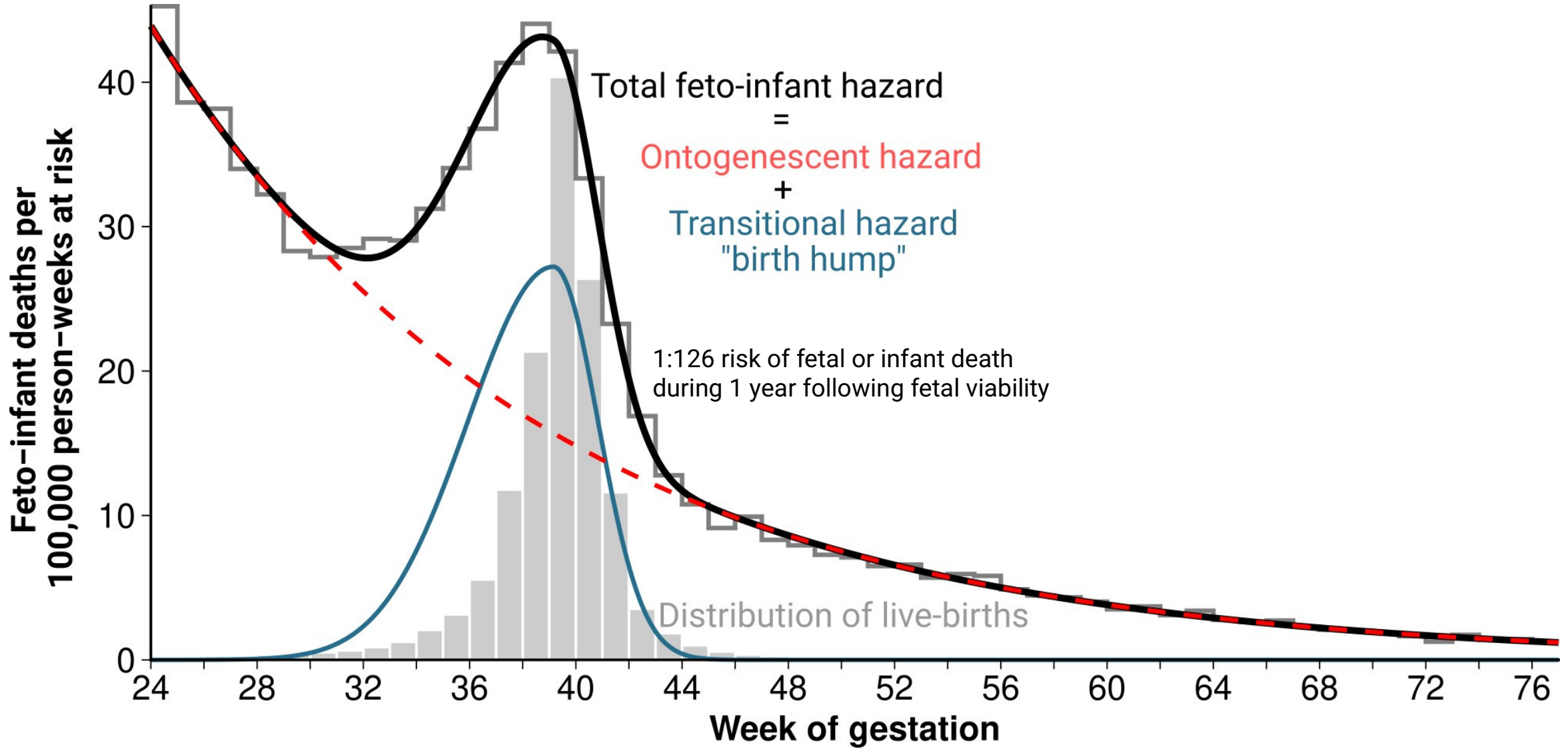
The transitional shock of birth



US conception cohort 2014. Raw data: CDC/NCHS.

The transitional shock of birth

Combined feto-infant mortality by week of gestation among conception cohort 2014. [The dynamics of ontogenescence](#). Raw data: CDC/NCHS.



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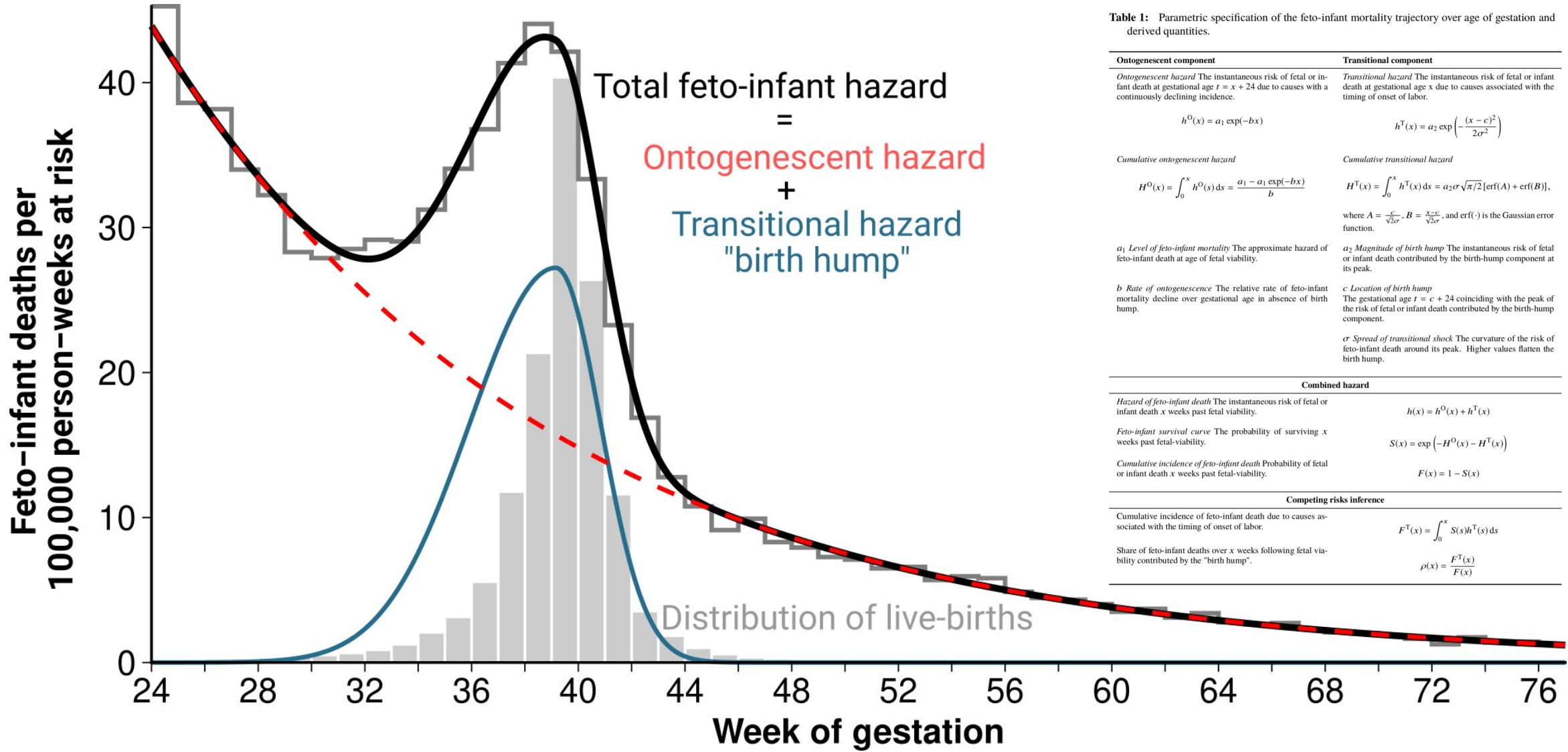
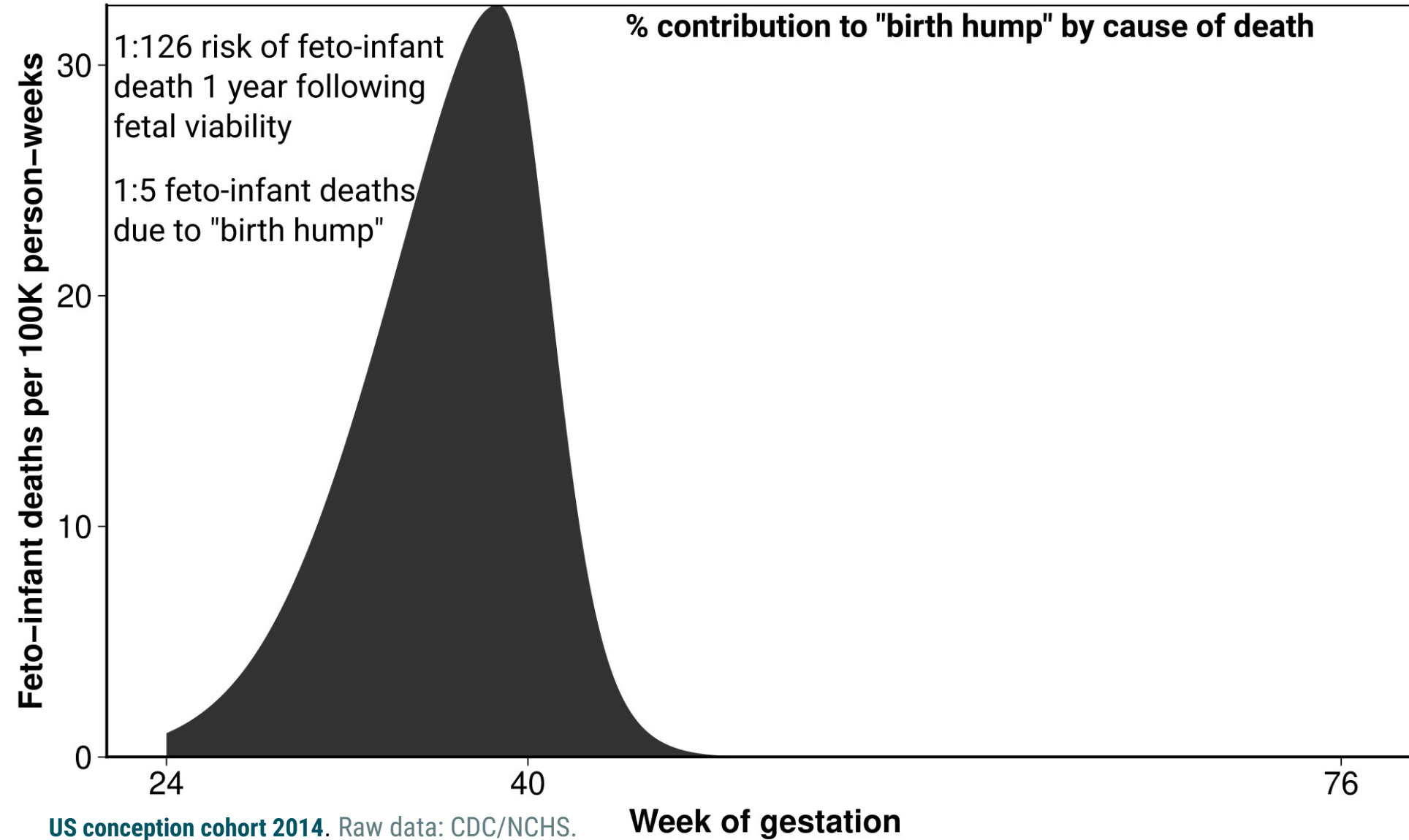


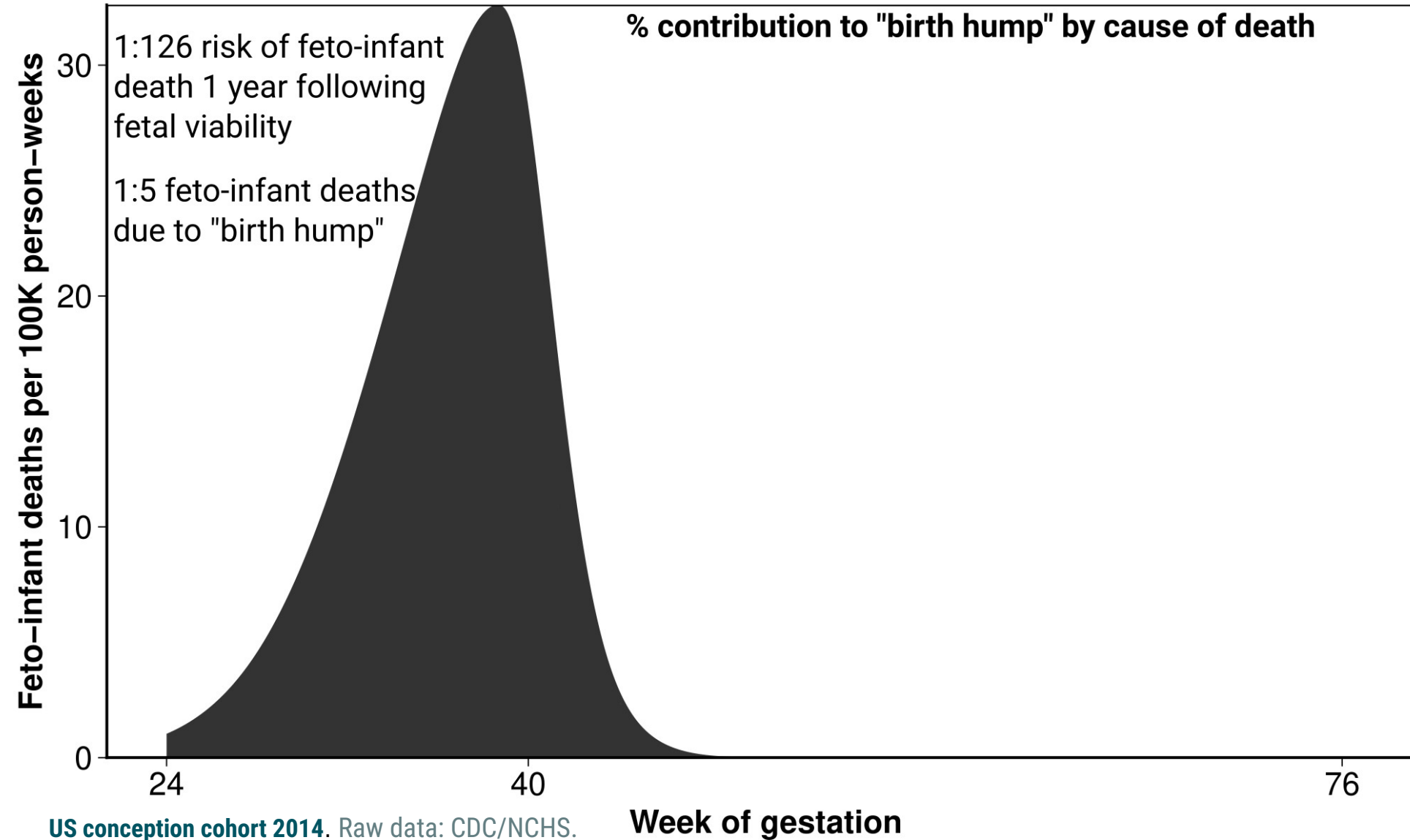
Table 1: Parametric specification of the feto-infant mortality trajectory over age of gestation and derived quantities.

Ontogenescent component	Transitional component
<p><i>Ontogenescent hazard</i> The instantaneous risk of fetal or infant death at gestational age $t = x + 24$ due to causes with a continuously declining incidence.</p> $h^O(x) = a_1 \exp(-bx)$	<p><i>Transitional hazard</i> The instantaneous risk of fetal or infant death at gestational age x due to causes associated with the timing of onset of labor.</p> $h^T(x) = a_2 \exp\left(-\frac{(x-c)^2}{2\sigma^2}\right)$
<p><i>Cumulative ontogenescent hazard</i></p> $H^O(x) = \int_0^x h^O(s) ds = \frac{a_1 - a_1 \exp(-bx)}{b}$	<p><i>Cumulative transitional hazard</i></p> $H^T(x) = \int_0^x h^T(s) ds = a_2 \sigma \sqrt{\pi/2} [\text{erf}(A) + \text{erf}(B)],$ <p>where $A = \frac{c-x}{\sqrt{2}\sigma}$, $B = \frac{x-c}{\sqrt{2}\sigma}$, and $\text{erf}(\cdot)$ is the Gaussian error function.</p>
<p>a_1 <i>Level of feto-infant mortality</i> The approximate hazard of feto-infant death at age of fetal viability.</p>	<p>a_2 <i>Magnitude of birth hump</i> The instantaneous risk of fetal or infant death contributed by the birth-hump component at its peak.</p>
<p>b <i>Rate of ontogenescence</i> The relative rate of feto-infant mortality decline over gestational age in absence of birth hump.</p>	<p>c <i>Location of birth hump</i> The gestational age $t = c + 24$ coinciding with the peak of the risk of fetal or infant death contributed by the birth-hump component.</p>
	<p>σ <i>Spread of transitional shock</i> The curvature of the risk of feto-infant death around its peak. Higher values flatten the birth hump.</p>
Combined hazard	
<p><i>Hazard of feto-infant death</i> The instantaneous risk of fetal or infant death x weeks past fetal viability.</p>	$h(x) = h^O(x) + h^T(x)$
<p><i>Feto-infant survival curve</i> The probability of surviving x weeks past fetal-viability.</p>	$S(x) = \exp(-H^O(x) - H^T(x))$
<p><i>Cumulative incidence of feto-infant death</i> Probability of fetal or infant death x weeks past fetal-viability.</p>	$F(x) = 1 - S(x)$
Competing risks inference	
<p>Cumulative incidence of feto-infant death due to causes associated with the timing of onset of labor.</p>	$F^T(x) = \int_0^x S(s)h^T(s) ds$
<p>Share of feto-infant deaths over x weeks following fetal viability contributed by the "birth hump".</p>	$\rho(x) = \frac{F^T(x)}{F(x)}$

Deconstructing the "birth hump"

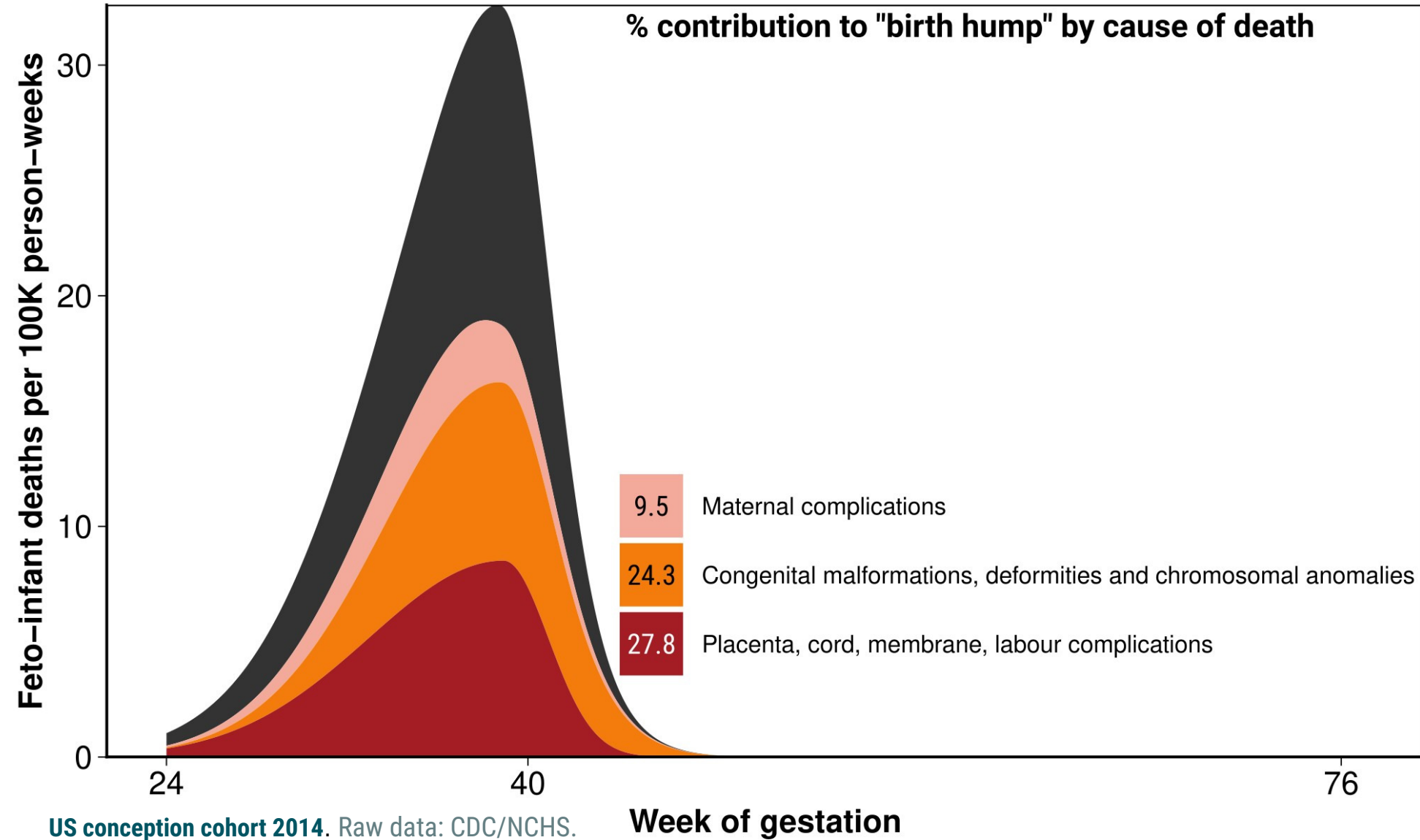


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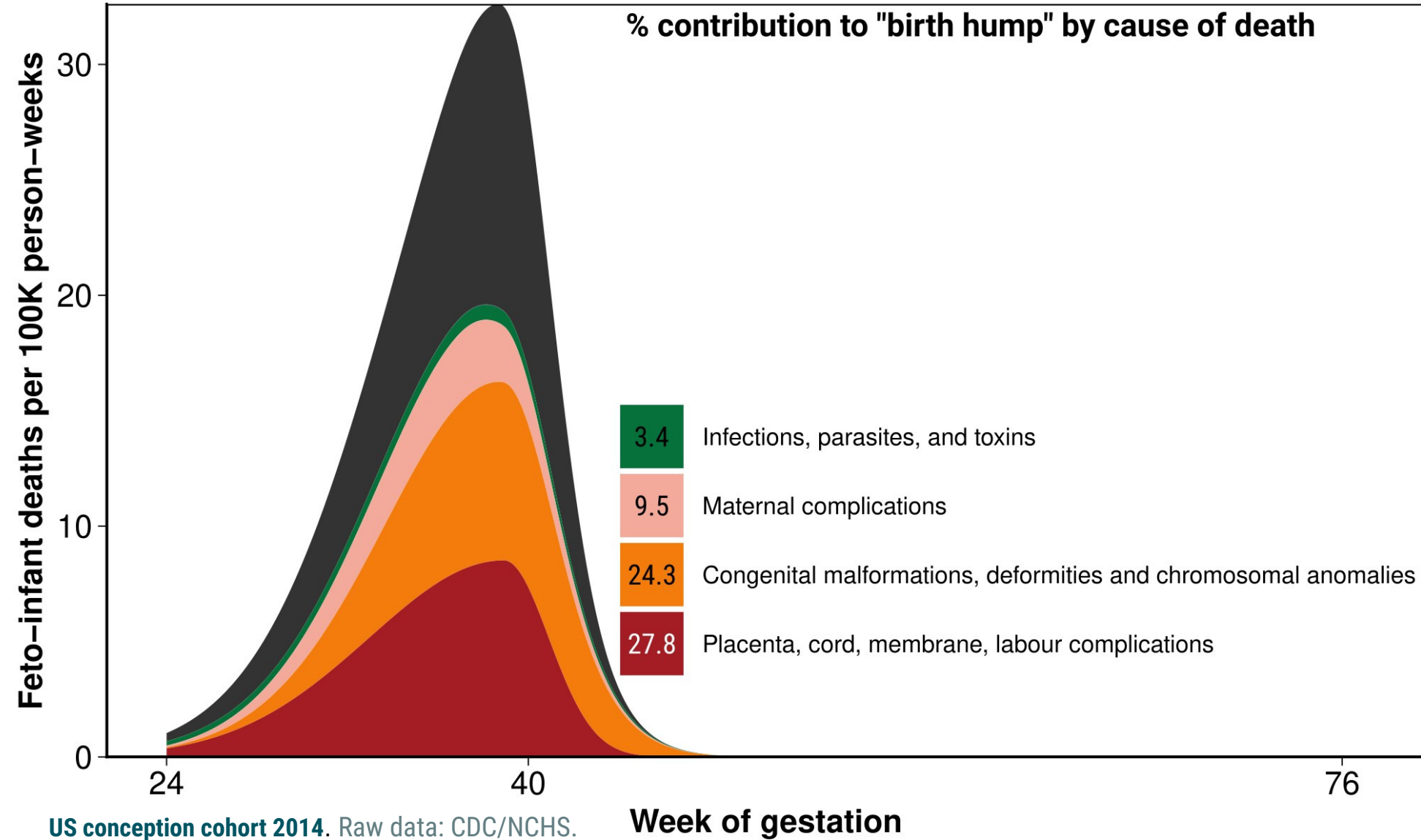
If a child dies in relation to the transition of birth, **what do they die of?**

Deconstructing the "birth hump"



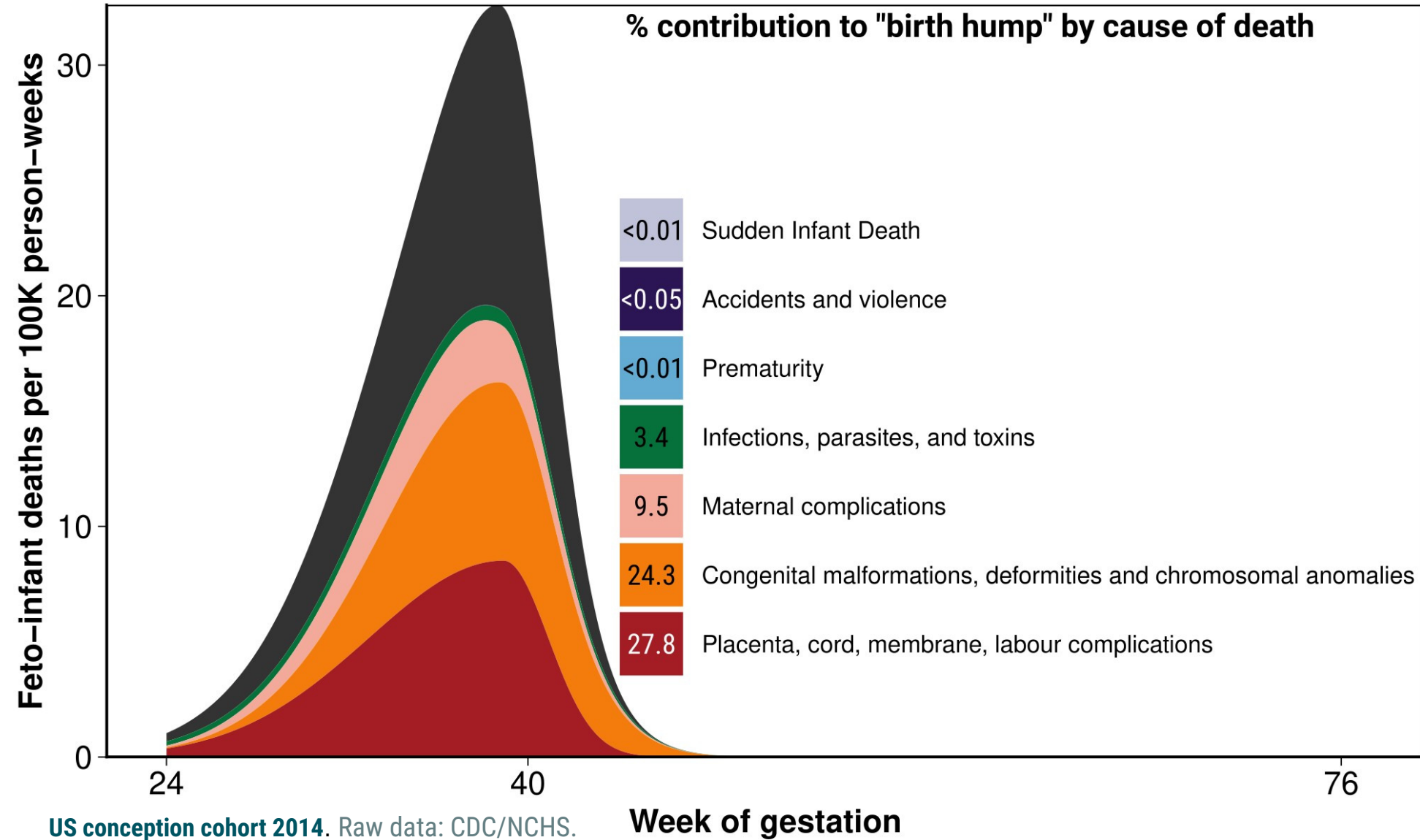
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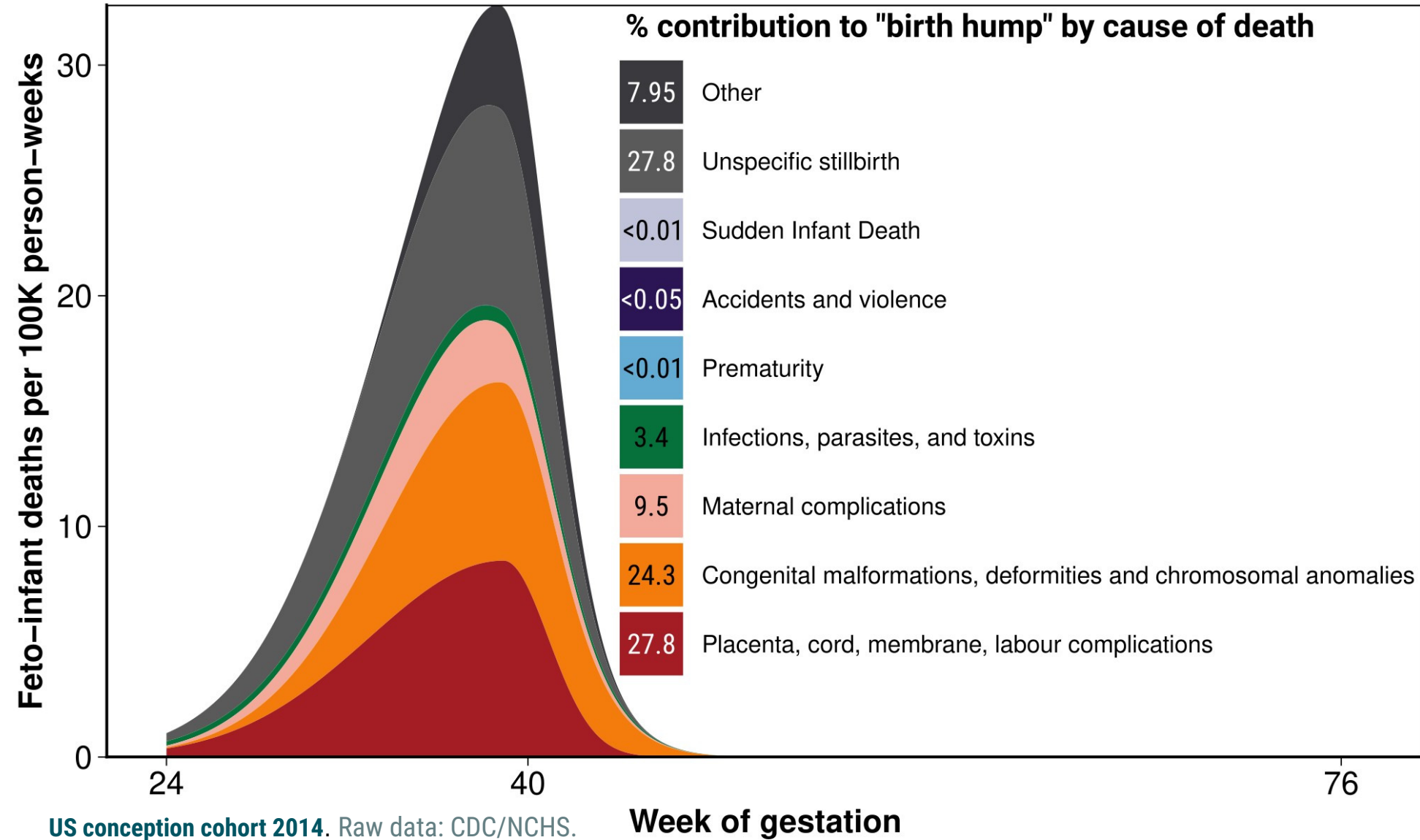
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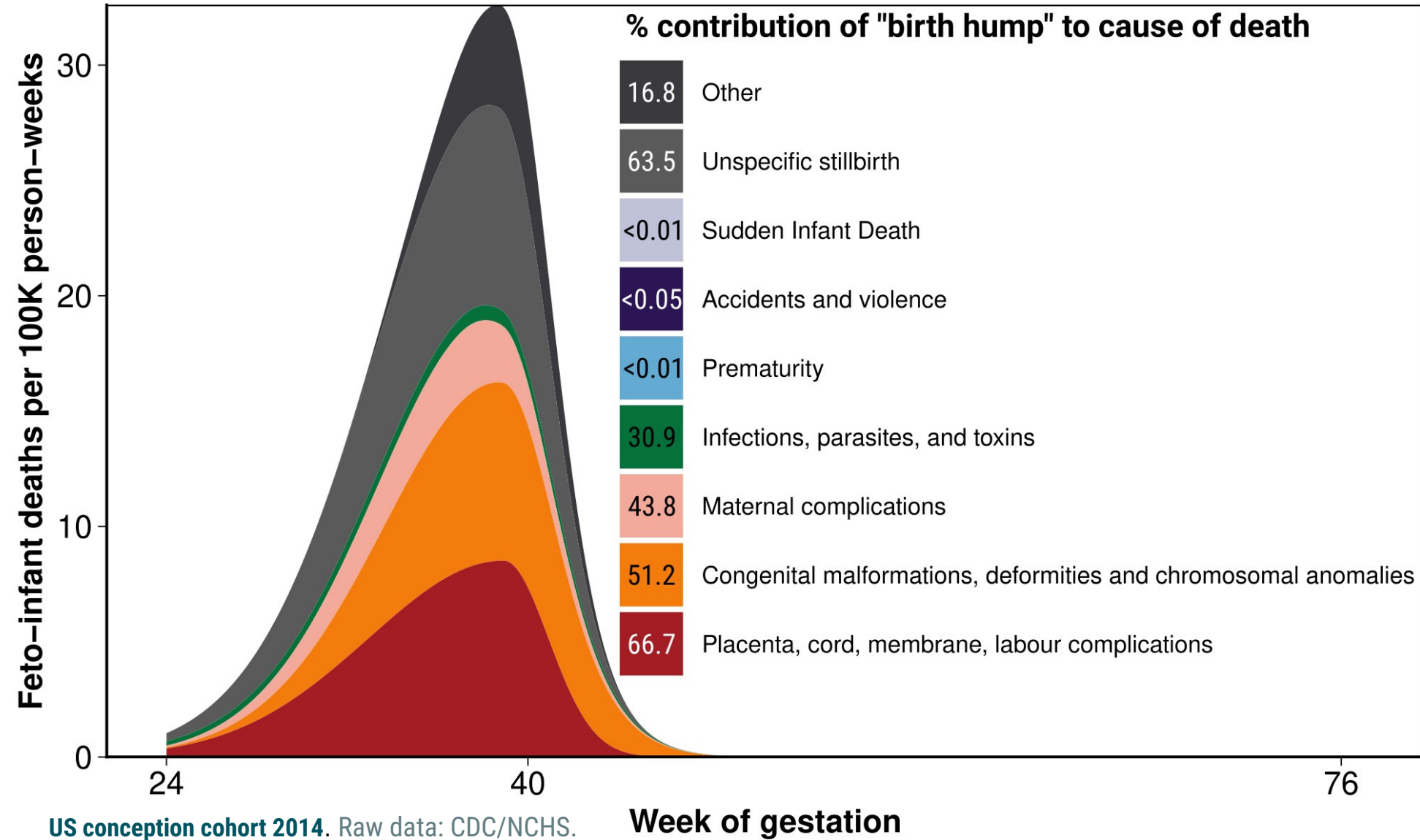
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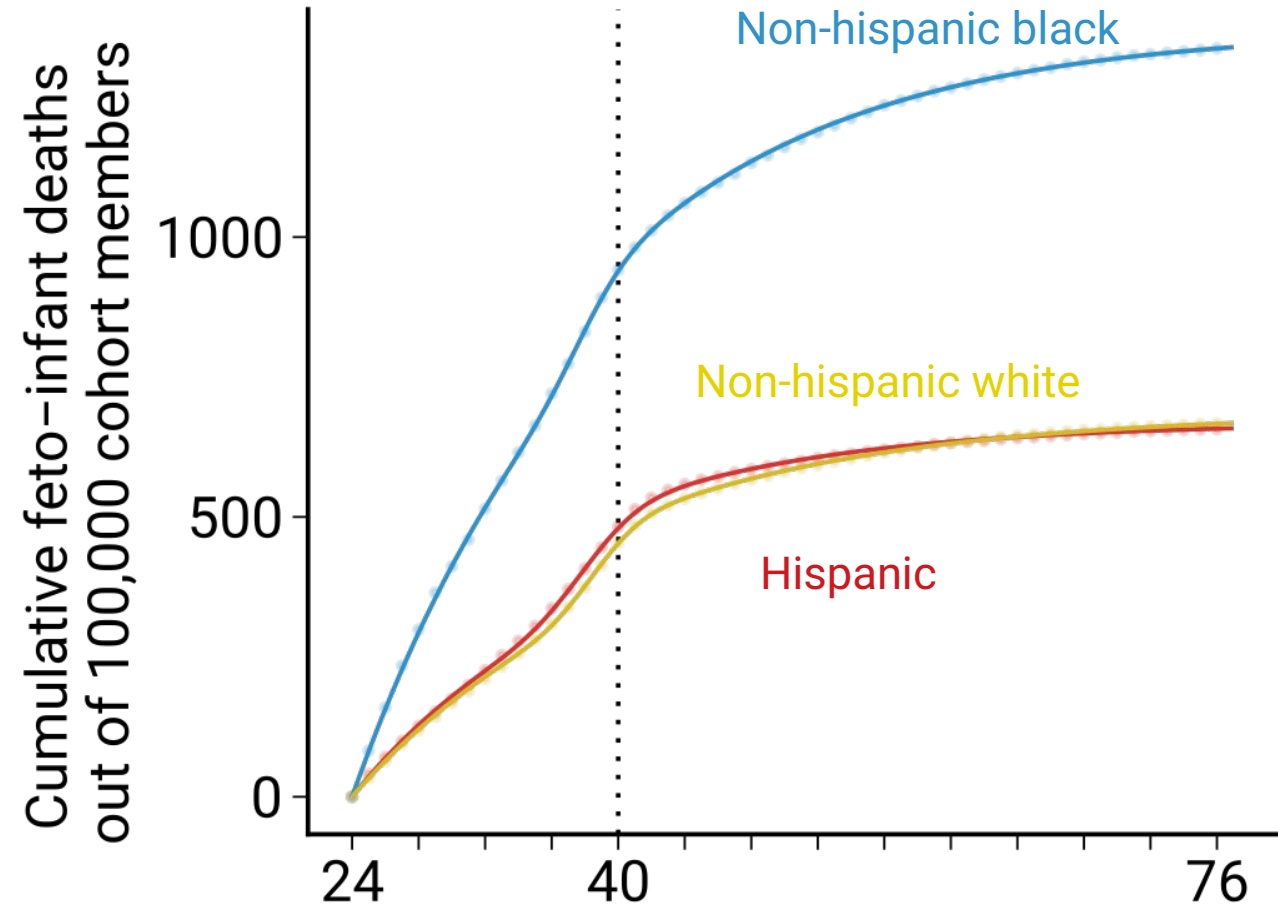
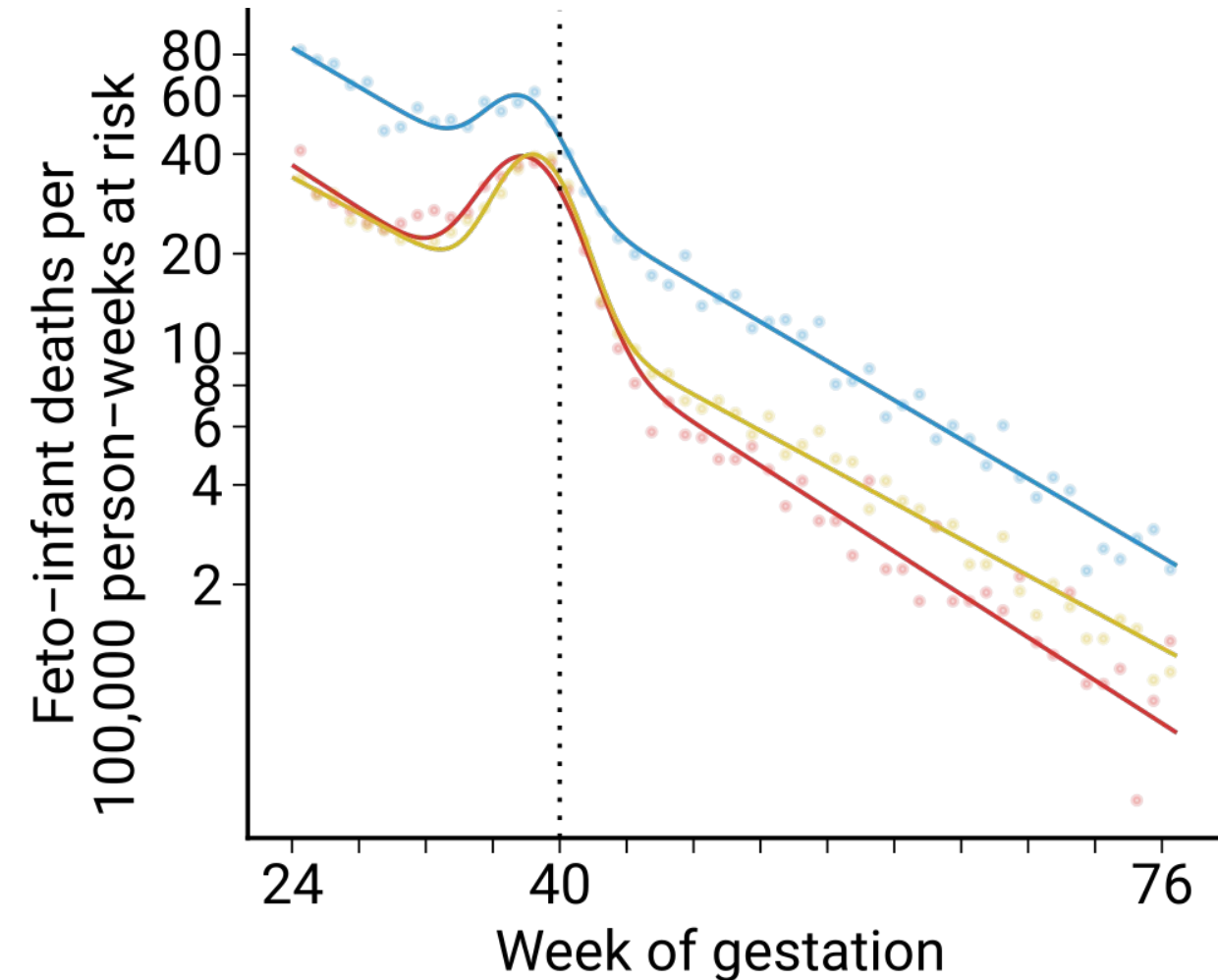
Deconstructing the "birth hump"



Among those dying one year post fetal viability due to a given cause, **what share dies in relation to the birth hump?**

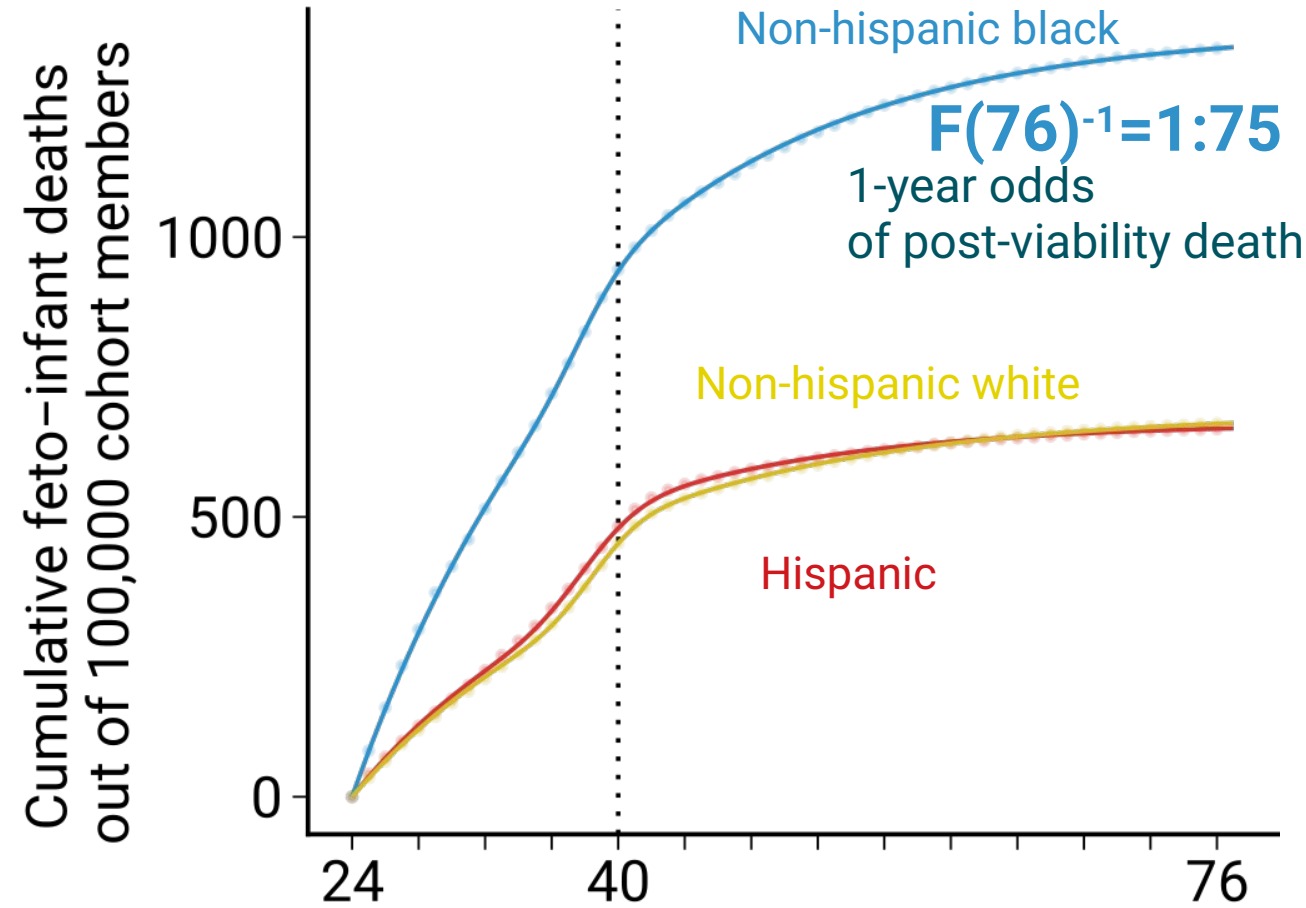
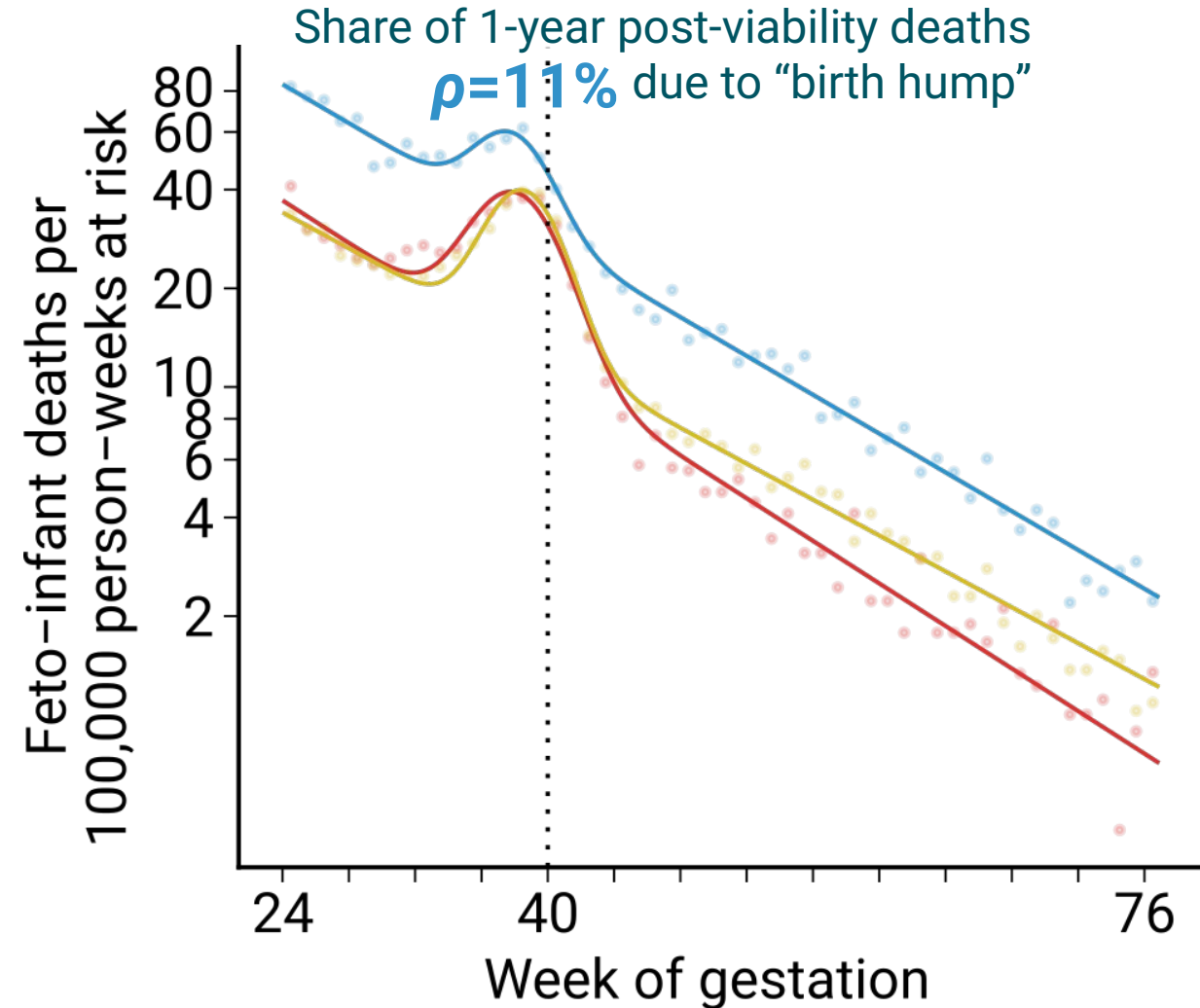
Deconstructing the “birth hump”

Combined feto-infant mortality by maternal origin among conception cohort 2014. *The dynamics of ontogenescence*. Raw data: CDC/NCHS.



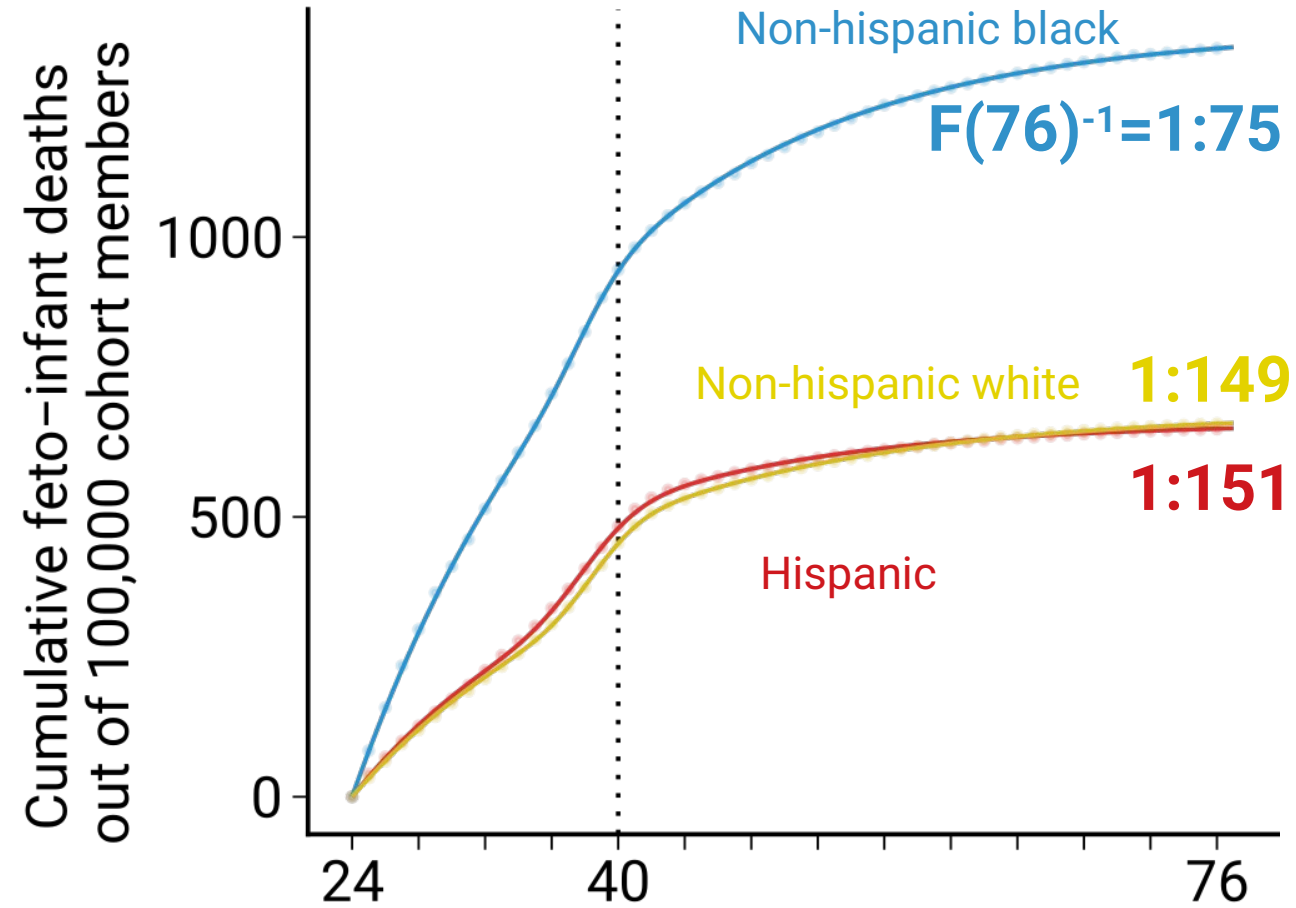
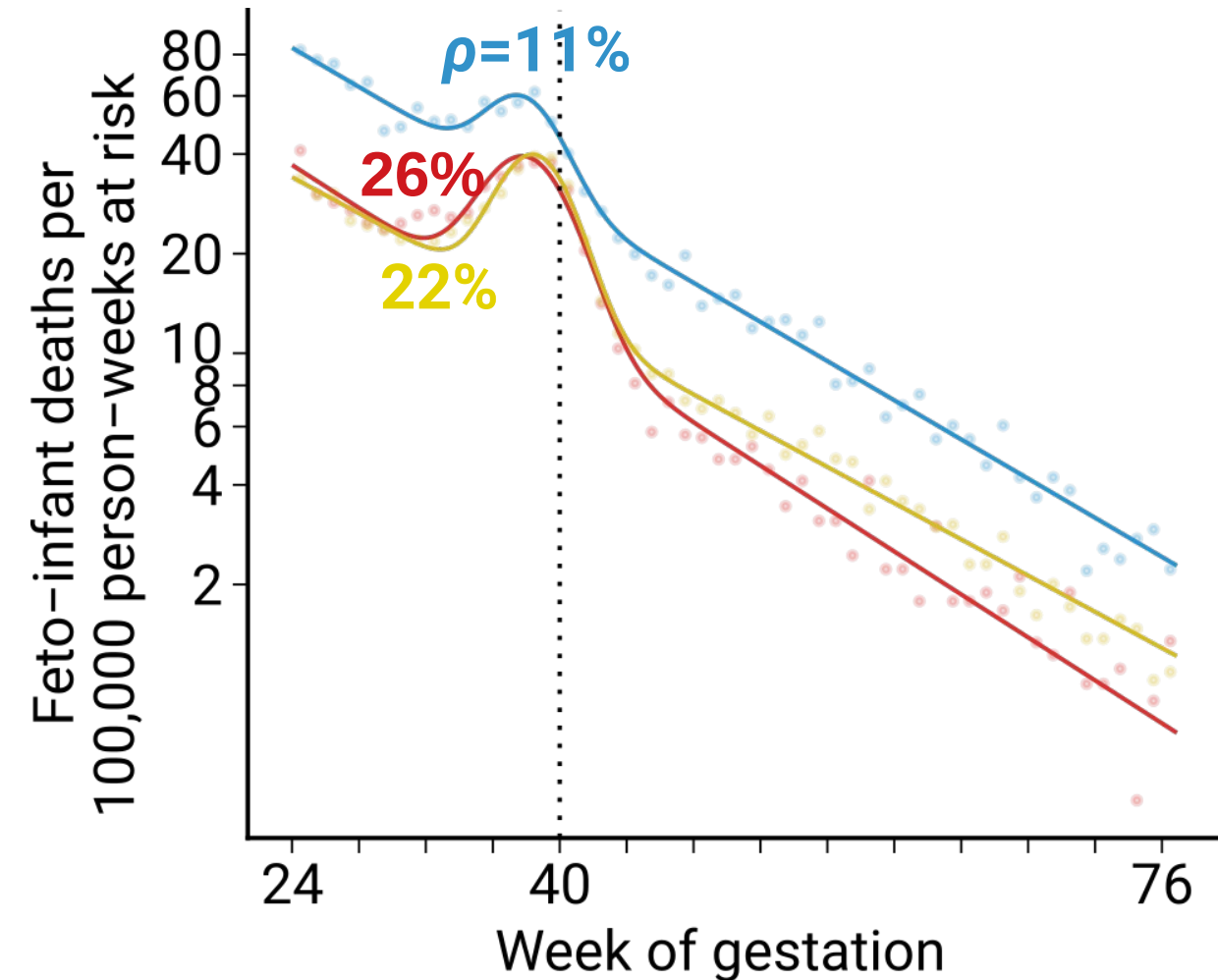
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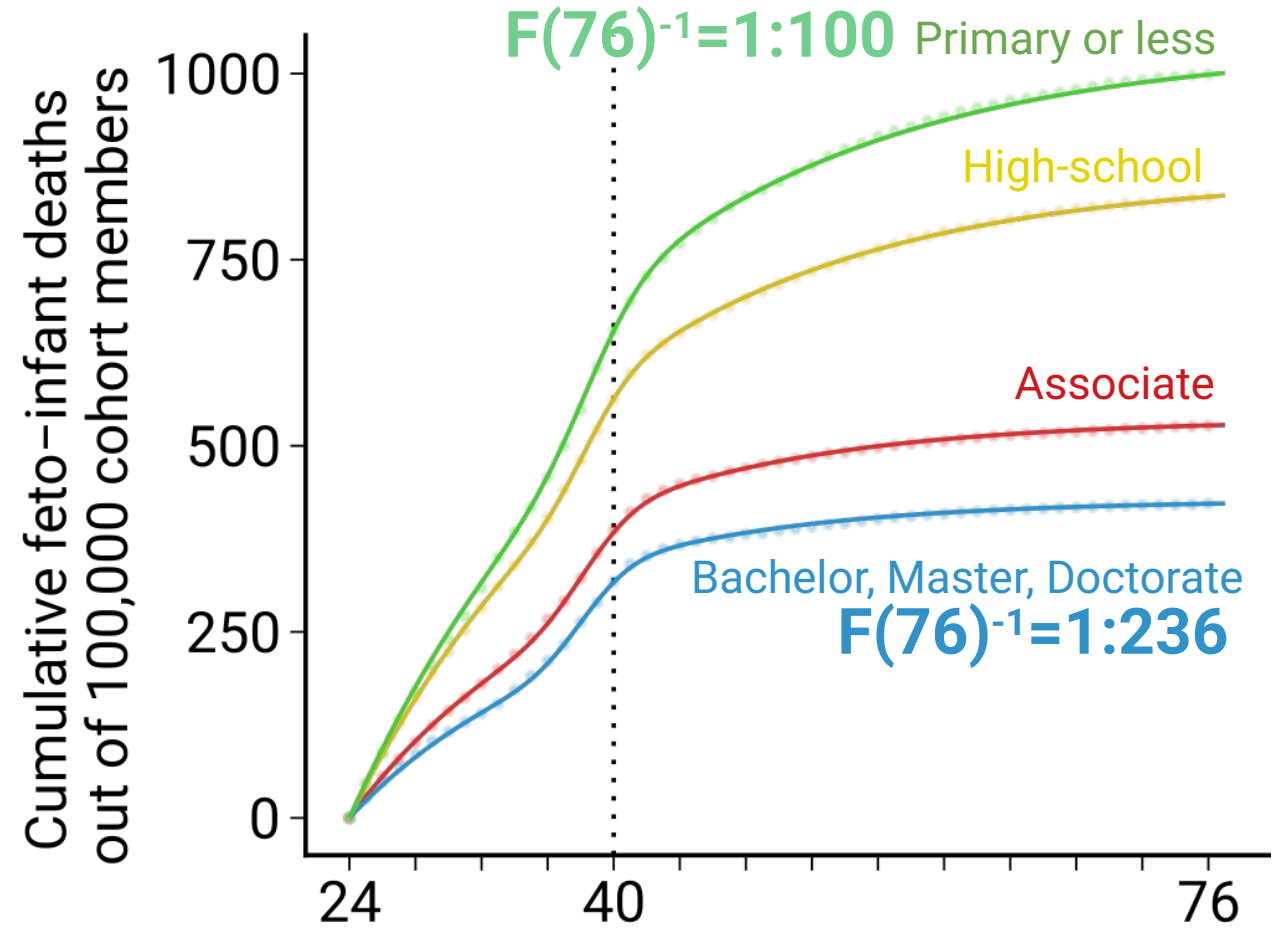
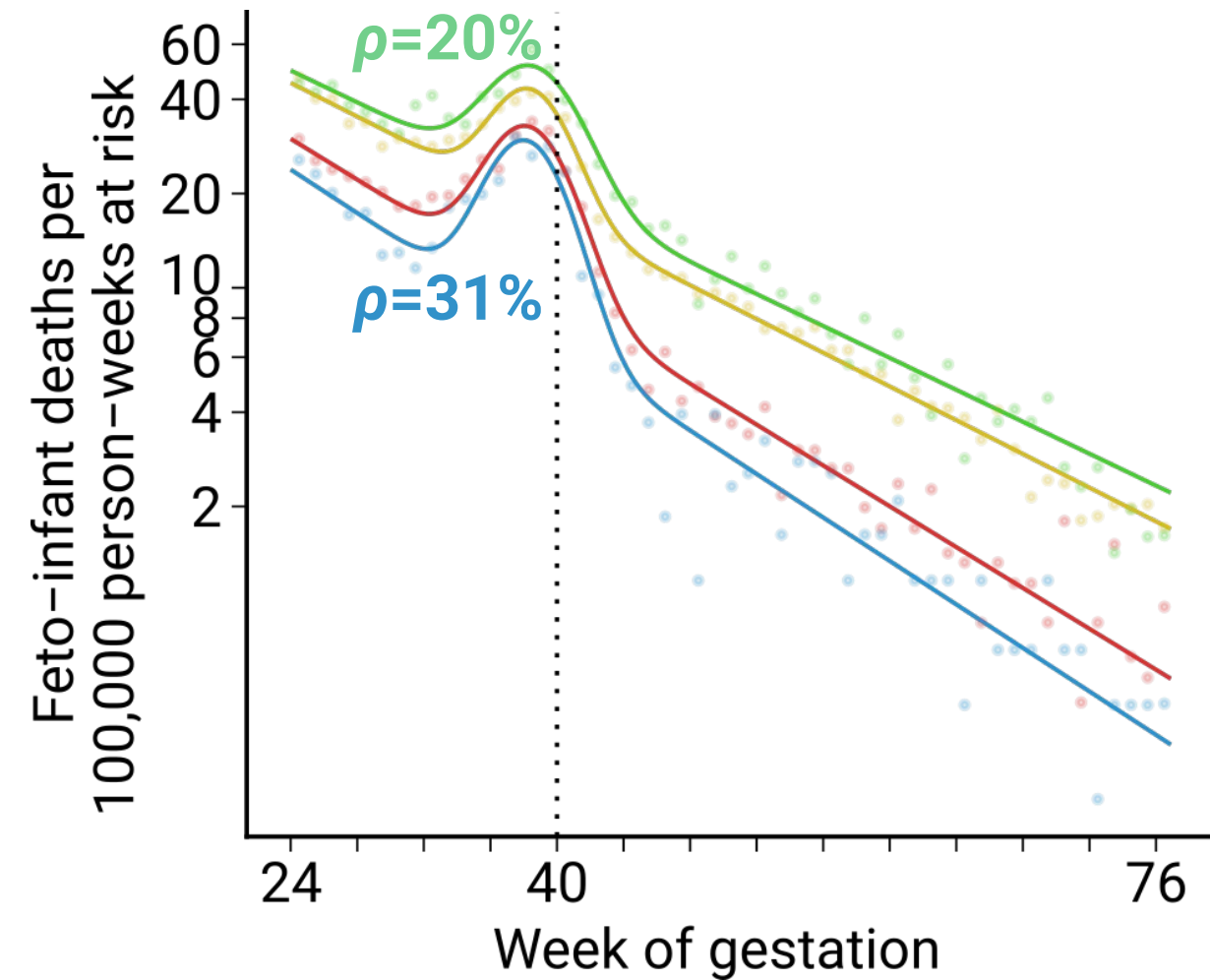
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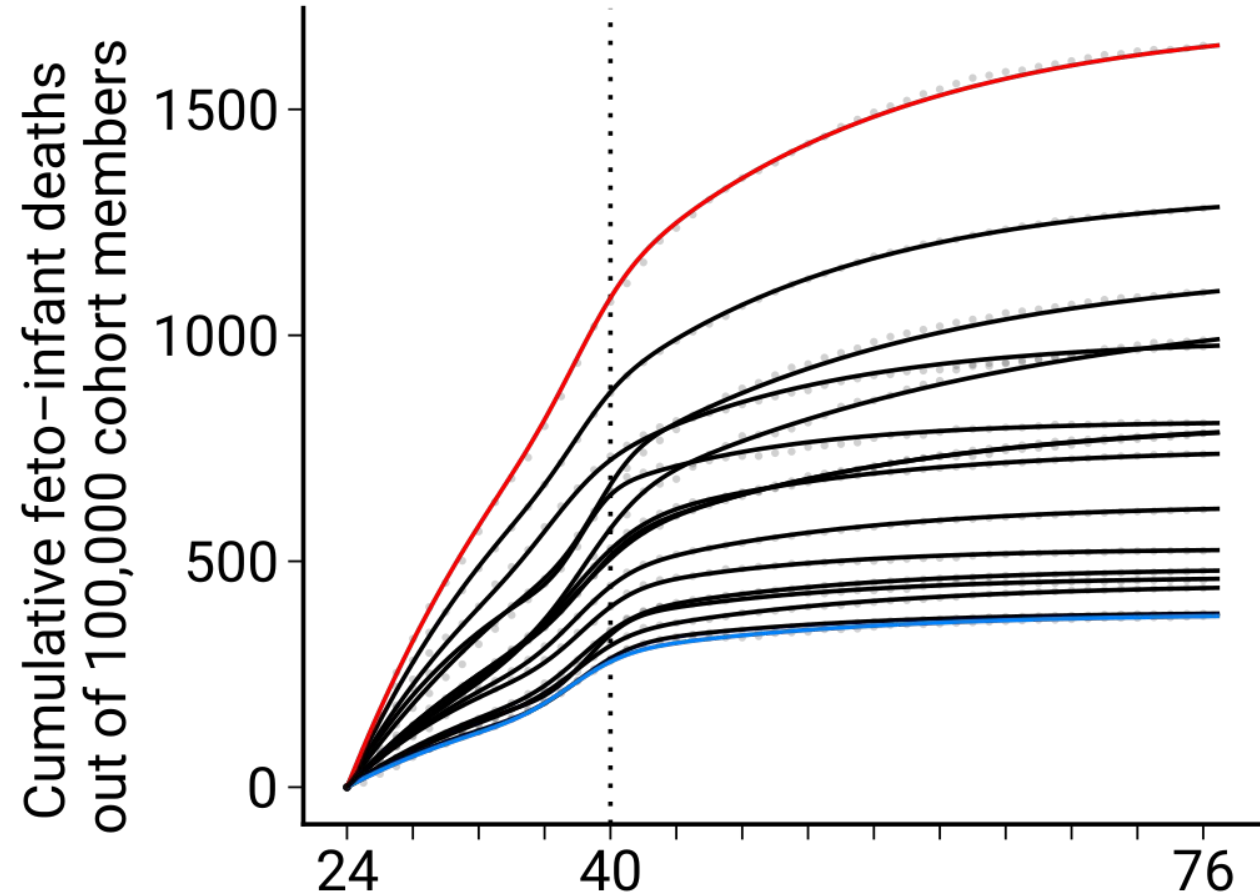
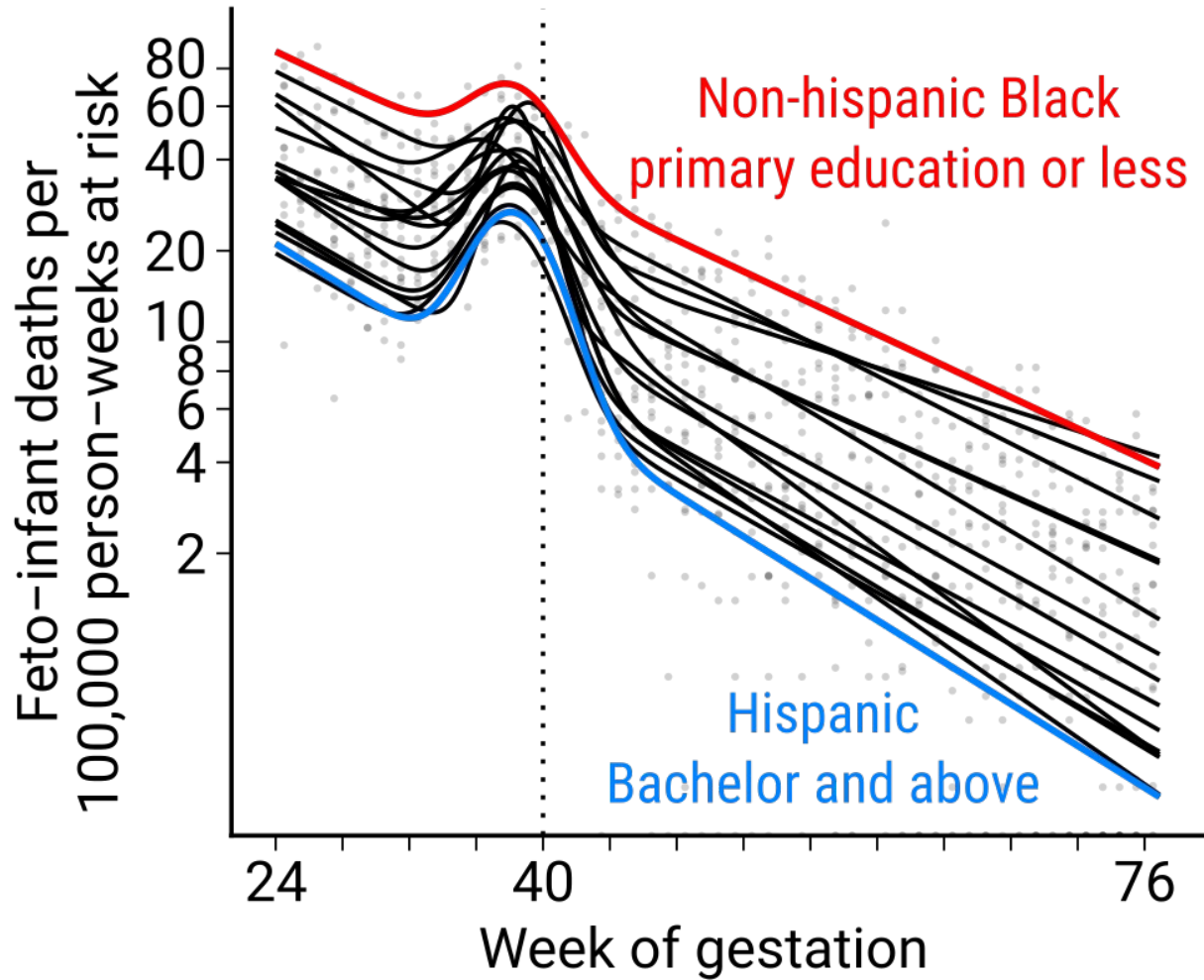
Deconstructing the “birth hump”

Combined feto-infant mortality by maternal education among conception cohort 2014. Raw data: CDC/NCHS.

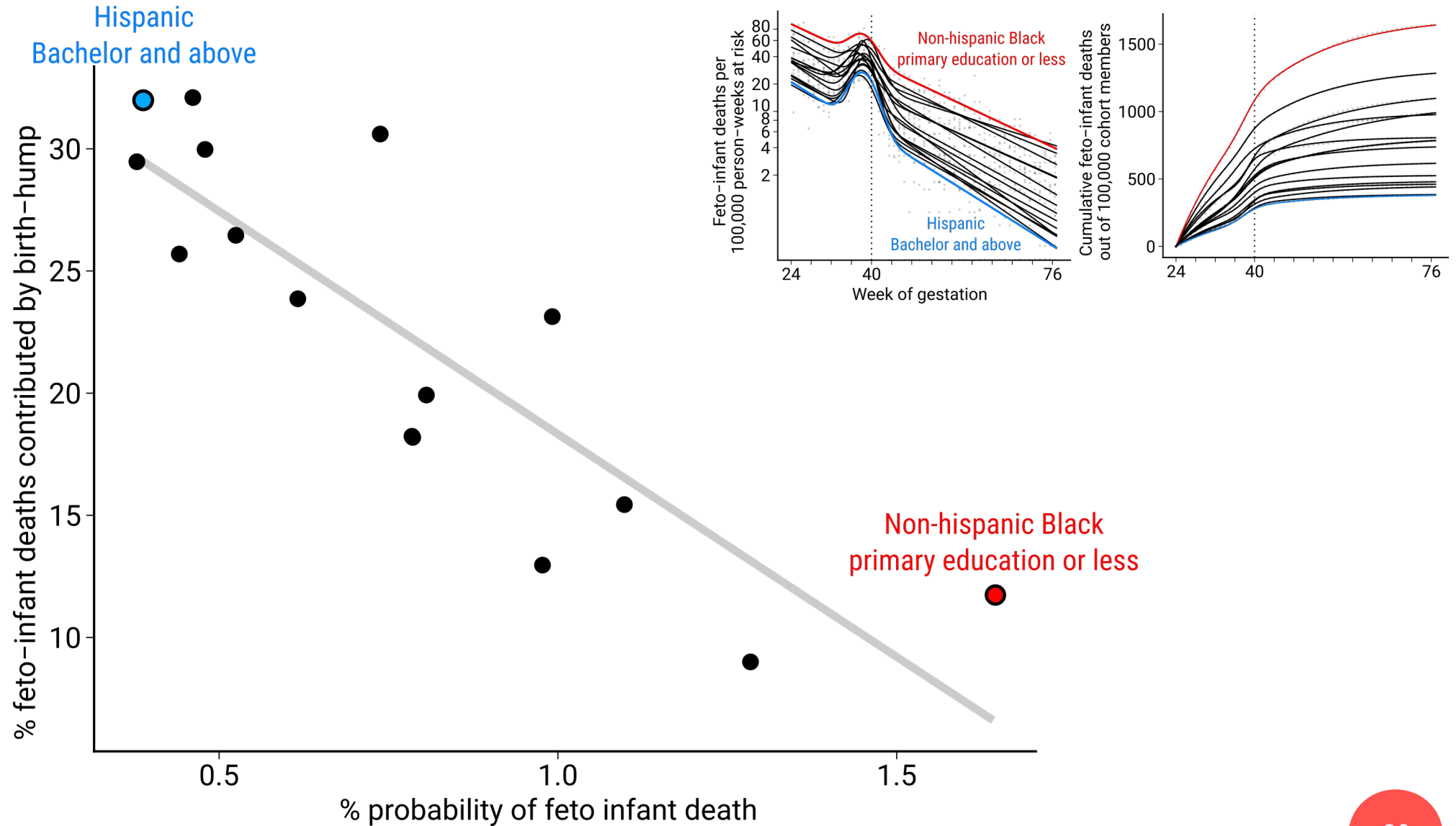


Mortality compression towards birth

Combined feto-infant mortality by maternal origin and education among conception cohort 2014. Raw data: CDC/NCHS.



Mortality compression towards birth



Reproducible analysis

github.com/jschoeley/bhump

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