Estimating the impact of discontinuing universal screening of donated blood for Zika virus in the 50 U.S. states

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# Key words

Blood safety, transfusion-transmitted infection, hemovigilance, Zika virus, decision-analytic modeling

# Declarations

**Funding:** WAR was funded by a Stanford Interdisciplinary Graduate Fellowship.

**Conflicts:** WAR has provided unrelated consulting services to Terumo BCT.

**Ethics/Consent:** No human subjects or primary human subjects data were involved in this analysis.

**Data and materials:** All data have been uploaded to public repository.

**Code availability:** All code has been uploaded to public repository.

**Authors’ contributions:** WAR conducted the analysis and wrote the manuscript.

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# Background

The U.S. Food and Drug Administration (FDA) mandated universal screening of donated blood for Zika virus in 2016 and allowed minipooled testing beginning in 2018 [1]. Most Zika infections are asymptomatic, but about 20% of infected persons develop mild febrile illness. Rarely, Zika can cause two serious complications: Guillain-Barré syndrome and congenital Zika syndrome, a pattern of devastating birth defects [2]. Our simulation study published January 2019 estimated that serious complications due to transfusion-transmitted Zika (TT-Zika) were unlikely and that universal screening for Zika was not cost-effective during the first year of screening in the 50 states [3]. Two months later, the Blood Products Advisory Committee (BPAC) recommended continuing universal screening, citing uncertainty in the risk of serious complications, and the committee agreed to reassess one year later [1]. The April 2020 BPAC meeting has been indefinitely postponed due to the COVID-19 pandemic. Universal screening costs blood centers in the 50 states $8 – $13 million each month [3] and yielded 3 presumed viremic donations in 2018 and zero in 2019 [4].

# Objective

I estimated the relationship between the rate of Zika-infectious donations and the rate of adverse outcomes due to TT-Zika in the 50 states without screening, and I estimated the 2018 cost-effectiveness of universal screening.

# Methods and Findings

I ran the simulation from our 2019 analysis at 13 Zika-infectious donation rates from 0.01 to 10,000 per million donations. I evaluated 10,000 unique parameter sets sampled from distributions that reflect parameter uncertainty [3], and I calculated the rate of mild febrile illness, congenital Zika syndrome, and Guillain-Barré syndrome cases in transfusion recipients and their sexual partners for each simulation. To generate **Figure 1**, I calculated the mean, 1st percentile, and 99th percentile of outcomes at each Zika-infectious donation rate and linearly interpolated. I reported outcomes at the Zika-infectious donation rates from 2018 (3 in 13.56 million donations) and from the first year of screening (56 in 13.56 million donations), defined as May 23, 2016 – November 4, 2017 to account for staggered screening implementation. To avoid underestimating risk I treated all viremic donations as infectious despite 42 of 56 viremic donations (81%) from the first year of screening having IgM antibodies that likely precluded transfusion-transmission [3]. Data and code are public [5].

Without screening, I estimated that mild febrile illness caused by TT-Zika would have occurred at a rate of one case every 1.4 months, (98% CrI every 0.9 – 2.7 months) during the first year. I estimated with 99% confidence that the rate of mild febrile illness in 2018 would have been below one case every 1.3 years without screening.

Serious TT-Zika complications were less likely. For the rate of congenital Zika syndrome to exceed one case per decade, the rate of Zika-infectious donations needed to exceed 96 per million (98% CrI 33 – 673 per million), 23 times larger than the rate observed in the first year of screening. For the rate of Guillain-Barré syndrome to exceed one case per decade, the rate of Zika-infectious donations needed to exceed 34 per million (98% CrI 23 – 54 per million), 8 times larger than the rate observed in the first year of screening. At the rate of Zika-infectious donations observed in 2018, I estimate with 99% confidence that the rate of congenital Zika syndrome cases would be below one case every 1483 years and the rate of Guillain-Barré syndrome cases would be below one case every 1035 years without screening. In 2018, universal minipooled testing cost $5.1 billion per quality-adjusted life year gained compared to no screening (98% CrI $0.77 – 16 billion; **Figure 2**).

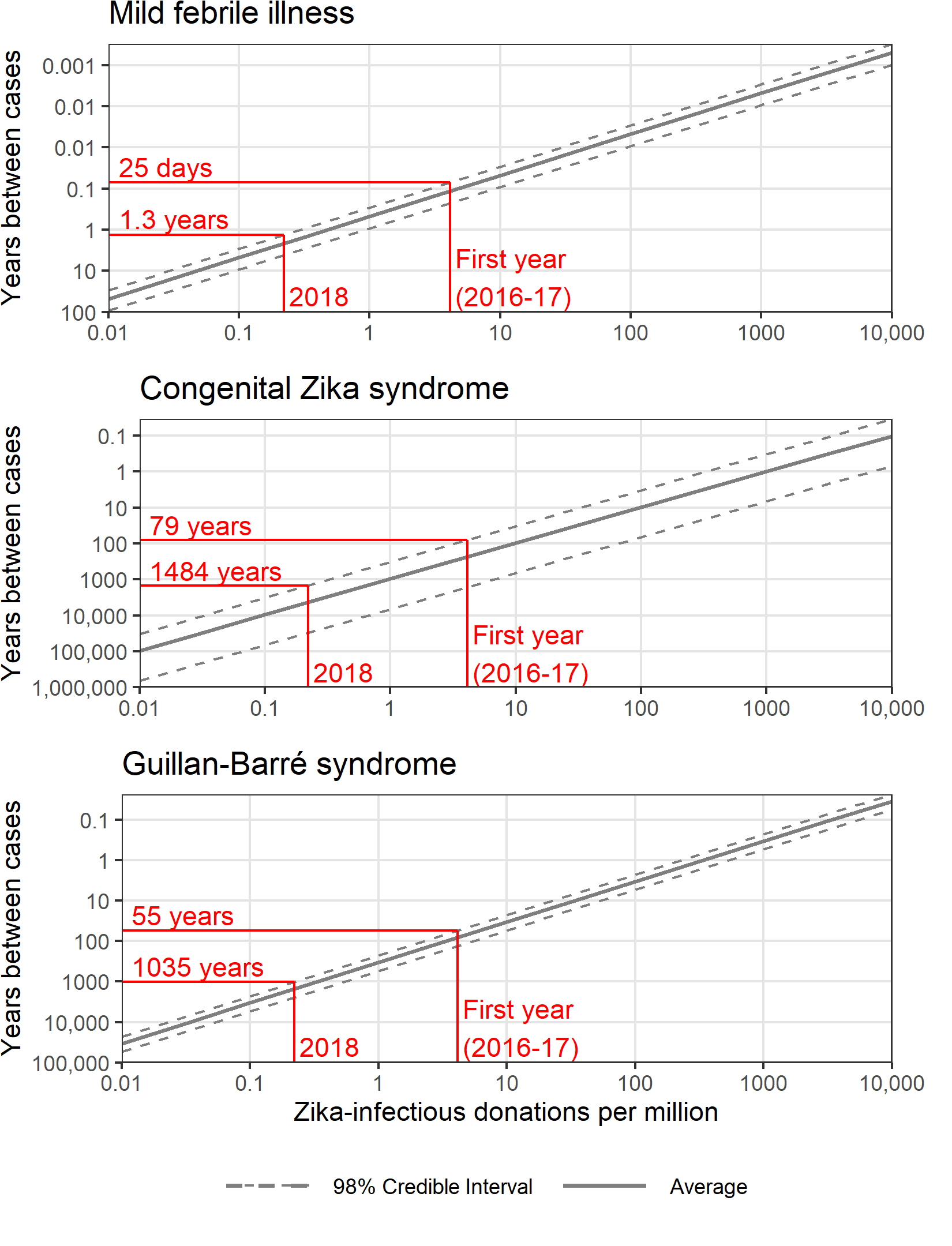
# Discussion

A larger outbreak than has been observed in the 50 states to date would be required for the rate of serious TT-Zika complications to exceed one case per decade. Potential for such an outbreak would probably be identified without screening blood donations, at which point targeted donation screening and travel-based donor deferral could be considered.

Decision-analytic modeling has played a limited role in informing blood safety policy in the United States. Our 2019 report emphasized cost-effectiveness findings but also incorporated a robust risk model. Hopefully, this report will demonstrate that decision-analytic models can be tailored to policymakers’ concerns and encourage collaboration between policymakers and modelers.

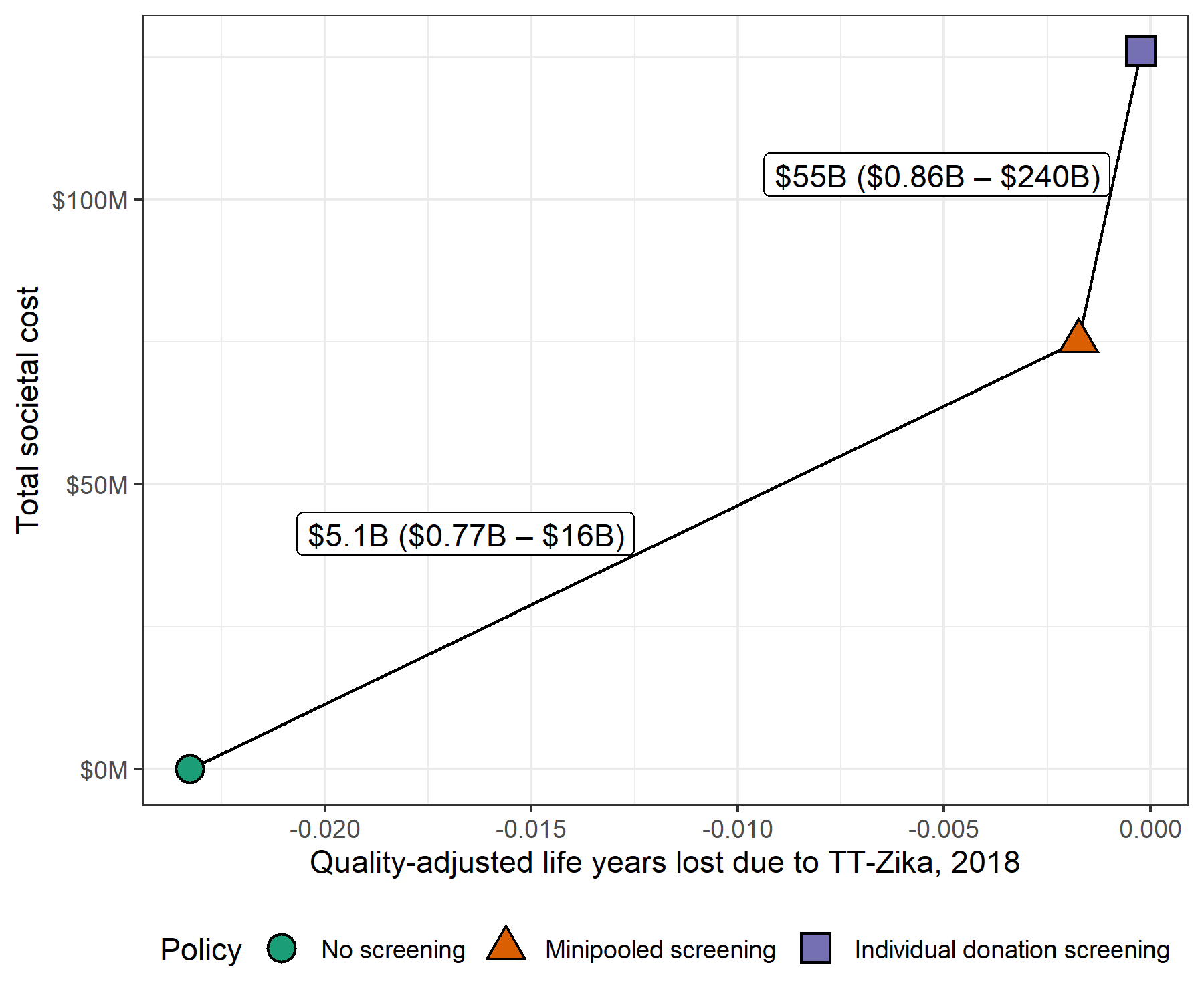
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**Figure 1** The expected rate of TT-Zika adverse outcomes based on the rate of Zika-infectious donations. In red, two example Zika-infectious donation rates are indicated with the corresponding 99th percentile estimates of the rate of adverse outcomes.



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**Figure 2** Incremental cost-effectiveness ratio (ICER) in cost per quality-adjusted life years gained of minipooled screening compared to no screening and of individual donation screening compared to minipooled screening based on the 2018 rate of Zika-infectious donations. The average cost and effectiveness of 10,000 simulations are plotted. Connecting ICER lines are labeled with the average and 98% credible interval ICER estimates.



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