Appendix

Following Kaplan et al. (1), the probability $D(\tau)$ of finding at least one positive blood donation and detecting the attack within time τ **,** after a single bioterror attack initially infecting a proportion p of an exposed population of size N, is given by $D(\tau) = 1 - \exp\left\{-kN\int_0^{\tau} \pi(t)dt\right\}$, where k is the mean number of blood donations per person and per unit of time and $\pi(t)$ is the probability that, within the blood screening window period of ω days, a randomly selected member of the population would test positive t days after the attack, $\pi(t) = p\left[1 - e^{-\omega t}\right] + (rR_0 / N)\int_0^{t}\left[1 - e^{-\omega(t-u)}\right]I(u)du$. As cited (1), the progression of the number of infected persons $I(t)$ is described using the differential equation (2), $dI / dt = (rR_0 / N)(N - I) - rI$, with the initial condition $I(0) = I_0 = Np$. From this, we have,

$$I(t) = \frac{I_0(R_0 - 1)}{pR_0 + (R_0 - 1 - pR_0)\exp\{-(R_0 - 1)rt\}} \quad [1]$$

When $R_0 > 1$, this logistic function increases, remains constant or decreases from the initial value $I(0) = I_0$ towards the steady state $I(t \to \infty) = I_\infty = (R_0 - 1)N / R_0$ for $I_0 < I_\infty$, $I_0 = I_\infty$, or $I_0 > I_\infty$, respectively. In particular, in the limit of $p << (R_0 - 1)/ R_0$, this expression reduces to the early approximation solution, $I_{es}(t) = I_0 \exp\{-(R_0 - 1)rt\}$, and the resulting probability $D_{es}(\tau)$ of attack detection is instead,

$$D_{es}(\tau) = 1 - \exp\{-I_0[af(\tau / \omega) - bf[(R_0 - 1)r\tau]]\} \quad [2]$$

where the function, $f(x) = x - 1 + \exp(-x)$, and the constants are, $a = k\omega[1 - r\omega(2R_0 - 1)]/[1 - r\omega(R_0 - 1)]$ and $b = kR_0 / \{r(2R_0 - 1)^2[1 - r\omega(R_0 - 1)]\}$. This $D_{es}(\tau)$ increases when any of the parameters increase.