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**TRANSPORT THEORY FOR HIV MIGRATION THROUGH *IN VIVO* DISTRIBUTIONS
OF MICROBICIDE EPITHELIAL COATING LAYERS**

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Topical microbicide products are being developed for preventing HIV transmission. These include vaginally applied gels that deliver anti-HIV molecules. Gels may also provide partial barriers that slow virion diffusion from semen to vulnerable tissue, increasing the time during which anti-HIV molecules can act. Previously, our group developed a mathematical model for HIV transport and neutralization for a uniform layer of microbicide gel. Hindrance of HIV diffusion was found to have significant potential to impact efficacy. *In vivo*, however, gels do not deploy to form complete, uniform layers – not all tissue is coated, and thickness is not constant. Here, we further developed our model to assess salient parameters that determine a gel's ability to hinder HIV diffusion *in vivo*. We applied this model to experimental data for coating distributions of two vaginal gels in women. Time required for a threshold number of virions to reach the tissue surface was used as a metric to compare different hypothetical and experimental scenarios. We found that time-to-threshold increased with increasing gel layer thickness and with decreasing diffusion coefficient. For gel layers with average thickness > 100um, fractional area coated rather than gel layer thickness was the primary determinant of time-to-threshold. For gel layers < 100um, time-to-threshold was brief, regardless of fractional area coated. Application of the model to experimental data showed little difference in time-to-threshold between the gels tested. However, the protocol (i.e., +/- simulated coitus) following gel application had a much more significant effect. This study suggests that it is important for microbicide gels to distribute in layers of thickness $\geq 100\mu\text{m}$, and that the fractional area coated is critical in determining gel ability to hinder HIV diffusion (NIH-AI077289).