Abstract Submitted
for the DFD17 Meeting of
The American Physical Society

"Magical" fluid pathways: inspired airflow corridors for optimal drug delivery to human sinuses[1] SAIKAT BASU, ZAINAB FARZAL, JULIA S. KIMBELL, Univ of NC - Chapel Hill — Topical delivery methods like nasal sprays are an important therapeutic component for sinusitis (inflammation and clogging of the paranasal sinuses). The sinuses are air-filled sacs, identified as: maxillaries (under the eyes and deep to cheeks bilaterally; largest in volume), frontals (above and medial to the eyes, behind forehead area), ethmoids (between the eyes, inferior to the frontal sinuses), and sphenoids (superior and posterior to ethmoids). We develop anatomic CT-based 3D reconstructions of the human nasal cavity for multiple subjects. Through CFD simulations on Fluent for measured breathing rates, we track inspiratory airflow in all the models and the corresponding sprayed drug transport (for a commercially available sprayer, with experimentally tested particle size distributions). The protocol is implemented for a wide array of spray release points. We make the striking observation that the same release points in each subject provide better particle deposition in all the sinuses, despite the sinuses being located at different portions of the nasal cavity. This leads to the conjecture that the complicated anatomy-based flow physics artifacts in the nasal canal generate certain "magical" streamlines, providing passage for improved drug transport to all sinus targets.

[1]Supported by NIH grant R01 HL122154

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Date submitted: 20 Jul 2017 Electronic form version 1.4