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Dear Editors of The Laryngoscope,

Please find enclosed our reply to the Letter to the Editor, by Kleebayoon A. and Wiwanitkit V., who shared their reaction to our recently published article entitled “Factors Influencing Nasal Irrigation Efficacy in Infants: An Exploratory 3D Model Study”.

The authors acknowledge the inherent constraints of using a 3D-printed resin model, already mentioned in our discussion, and the current gaps in the literature regarding pediatric mucus rheology. However, by providing a detailed rheological analysis of the experimental mucus used, we believe our study contributes valuable groundwork for future research in this area. We also clarify our rationale for choosing a healthy infant model as a first step before exploring pathological conditions in subsequent work.

We further address the suggestions for additional physiological measurements and temperature considerations, explaining how our methodological choices were informed by published recommendations, clinical practice, and the technical limitations of the model. Finally, we respond to the comments on statistical reporting by emphasizing the controlled nature of the study, the reproducibility of the model, and the involvement of a senior institutional statistician in validating our analyses.

We appreciate the opportunity to engage in this scientific dialogue and hope our reply will contribute to a clearer understanding of the scope, intentions, and limitations of our preliminary study. All authors have approved the manuscript and agree with its submission to The Laryngoscope.

Thank you for your consideration of this manuscript.
Yours Sincerely,
For the Authors,

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Authors' Reply to Letter - Factors Influencing Nasal Irrigation Efficacy in Infants: An Exploratory 3D Model Study

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The authors would like to thank A. Kleebayoon and V. Wiwanitkit for recognizing the interesting nature of our original and preliminary research in their Letter to the Editor.

This letter states that significant limitations to the methodology and statistics need to be addressed to increase confidence in the conclusions. The authors hereby expand on the limitations for this study, mentioned in the discussion.

Regarding the methods, as mentioned in the discussion section, this model has limits directly linked to the nature of the 3D-printed resin model, and the lack of data regarding infant mucus rheological properties. However, by being the first study providing a comprehensive rheological analysis of the mucus used in such an experiment, this study will be able to reflect on future studies investigating pediatric mucus rheology. Regarding the clinical relevance of the study in children with specific conditions, the authors decided to perform the study on a healthy infant model first, as it will then allow comparisons with further research performed on models mimicking upper airway conditions. Also, the authors agree that this study could be broadened by incorporating additional measures such as the mucus discharge flow across the airways, but do not think that it would add clinical relevance, as desired the reply. In contrast, we provided the readers with the irrigation flow applied during the nasal irrigation, so that it can easily be transposed into other research protocols and/or clinical practice. Regarding the temperature choice (room temperature), this also reflects clinical practice[1]. The authors do not believe that bringing the temperature up to the recommended body temperature[2] could yield significant differences in airway clearance in a resin, upper airway model, but could in realistic airway epithelium. In clinical practice, a temperature closer to 37°C also appears to improve comfort.

Regarding statistics, the response letter mentions that mean and standard deviation may not be sufficient, as data may vary according to uncontrolled factors such as infant responses or postural alterations. The authors agree on this comment, although highlighting that this study featured a single upper airway, 3D-printed model. No form of response could be expected from such model and thus could have been taken into account in the statistical analysis. Also, the mean and standard deviation for upper airway clearance extent were reported, and Table 2 provides mean (min. – max.) volumes (in mL) retrieved in each combination of variables, which can provide the readers with a description of the distribution variation. The present statistical analysis could not feature any association between age, body weight, or other health issues as the same infant model was used for reproducibility purposes between the trials. The authors would like to mention that data and statistics were reviewed by a senior statistician.

1. Cnockaert P, Audag N, Poncin W. Nasal irrigation practice habits in infants: A Belgian survey. *Archives de Pédiatrie*. 2022 Jan;S0929693X22000112.
2. Audag N, Cnockaert P, Reyckler G, Poncin W. Consensus on Nasal Irrigation in Infants: A Delphi Study. *Ann Otol Rhinol Laryngol*. 2022 Jul 14;000348942211125.