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## Pediatric barrier enclosure for nasopharyngeal suctioning during Covid-19 pandemic: A simulation based-study



Nasopharyngeal Suctioning (NS) is a common procedure for upper respiratory tract infections in children. However, this procedure represents a risk of transmission of SARS-Cov-2 [1] during fall and upcoming winter seasons as flu and Covid-19 diseases are concomitant, and symptoms are similar [2].

In addition to the use of Personal Protective Equipment (PPE), plastic barrier enclosure was designed to reduce the risk of transmission during intubation of Covid-19 patients, mainly in the operating room and intensive care unit [3]. It is a large plexiglass box installed above the head and torso of a patient lying supine during advanced airway procedure. However, barrier enclosure has not been evaluated for common pediatric procedures in emergency department.

In this context, we aimed to evaluate the benefit of a pediatric barrier enclosure for NS as an additional protection for healthcare providers (HCP).

An experimental descriptive simulation-based study assessing the impact of the barrier enclosure on droplet dispersion was conducted during a NS. First, our barrier enclosure was adapted by co-investigators in this study for the pediatric context (see Appendix 1), and renamed Splash Guard for Care Givers (SG-CG):

- Smaller size and additional openings to allow for multiple HCP to intervene simultaneously on a child
- A HEPA filter port to connect to a suction with a negative flow within the box (up to 90 L/min)
- Optional press-fit plugs to close unused openings

Design is available in an open-access format to be reproduced and used by others HCP.

Ethical board approval was not required because no patients or participants were involved.

To simulate the NS procedure, we mixed a fluorescent solution of 50% Glow Germ® solution with 50% Normal Saline. We connected a 50 ml syringe to two laryngo-tracheal mucosal atomization devices (MADgic®, Teleflex Medical, Morrisville, USA) inserted under the skin until the probe reached the manikin's mouth and the right nostril. During the procedure, we intermittently pushed the plunger of the syringe, simulating sneezing and coughing through both atomization devices.

Immediately after each experience, we compared dispersion of droplets with and without the SG-CG using UV light to reveal

the fluorescent droplets. Between each procedure, PPEs were changed, and the manikin, the environment, and the SG-CG were cleaned.

In the absence of the SG-CG, we observed a significant presence of fluorescent droplets in the environment, on the HCP's PPE (Fig. 1a) face and neck. With the SG-CG, the contamination remained only on HCP's gloves and the close environment of the manikin inside the SG-CG (Fig. 1b). Video recordings of the simulations are available (Fig. 2).

To our knowledge, the present study is the first application of a pediatric barrier enclosure for common emergency procedure. We demonstrated that the SG-CG added a significant protection of HCP performing a NS on a pediatric manikin. It decreased the risk of contamination of the uncovered skin on the HCP's neck, and it may prevent risk of re-contamination during PPE removal [4] by decreasing the amount of contamination of the PPE.

Our experimentation demonstrated protection for large droplets, but we were unable to evaluate aerosol protection. Even if we expect low aerosol accumulation for short airway procedures as NS, we recommend using the SG-CG with a HEPA filter port and negative pressure in case of extended airway procedures in accordance with FDA recent alerts [5].

The SG-CG is an easy, safe, and affordable barrier protection for common procedures performed in all settings caring for children. SG-CG is currently used in the ED at our institution. It may prove to be beneficial to HCPs over the next months, considering viral respiratory infections symptoms merge with those of Covid-19 [6].

### Author's contributions

Michael Buyck designed the study, contributed to the organization, and drafted the initial manuscript, and reviewed and revised the manuscript.

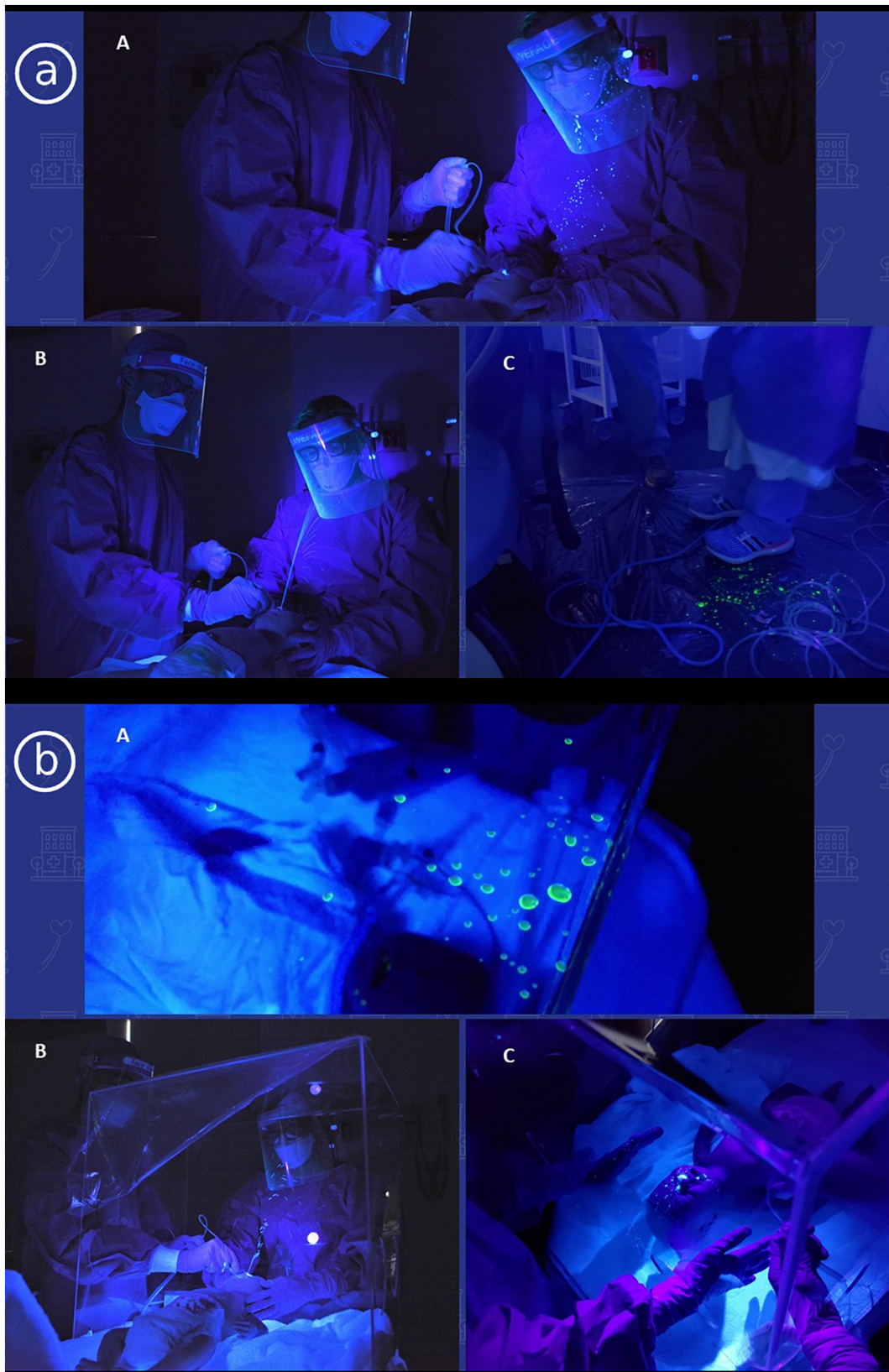
Arielle Levy, and Florent Baudin conceptualized the study, initiated the study, designed the study, contributed to the organization, and reviewed and revised the manuscript.

Laurence Tabone, Carl-Eric Aubin, and Philippe Jovet designed the study, and reviewed and revised the manuscript.

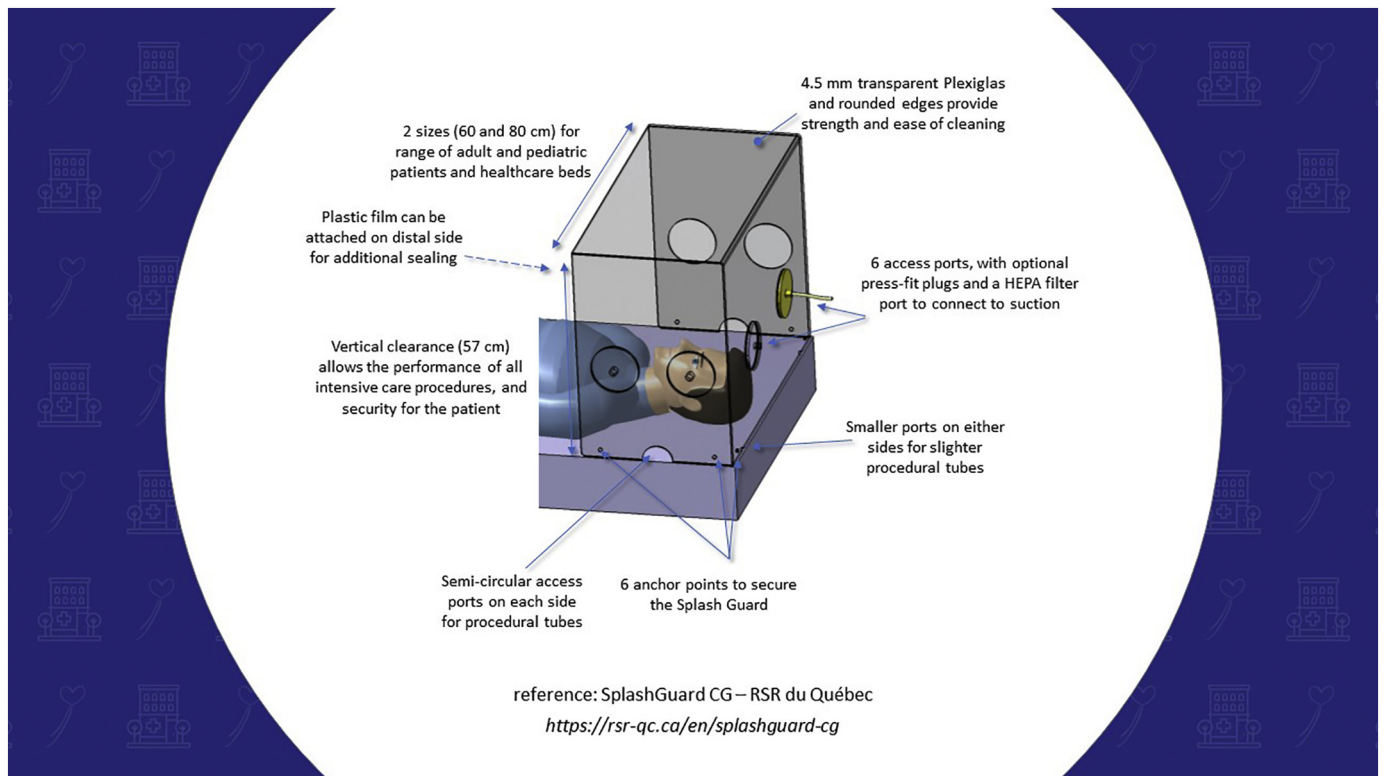
All the authors approved the final manuscript and agree to be accountable for all aspects of the work.

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**Fig. 1.** a. Views of the results of the experiment without the Splash Guard for Care Givers. A: droplets on HCP's PPE face. B: during the simulation of the nasopharyngeal suctioning. C: droplets on the floor. b. Views of the results of the experiment with the Splash Guard for Care Givers. A: droplets on the top of the barrier enclosure. B: during the simulation of the nasopharyngeal suctioning. C: absence of droplets on HCP' PPE outside the barrier enclosure. HCP Healthcare Providers, PPE Personal Protection Equipment.



**Design of the Splash Guard for Care Givers.**

## Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.ajem.2020.11.077>.

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