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Reply to: “Personal protective equipment recommendations based on COVID-19 route of transmission”



To the Editor: We thank Gupta and Lipner¹ for the comments and for the opportunity to further clarify the risks of hand irritation from excessive handwashing among health care workers, and we agree that alcohol sanitizers are practical, safe, and possibly more effective in neutralizing the virus from hand skin.

As an insight for an effective coronavirus handwashing agent, hexachlorophene, a very potent bisphenol antiseptic agent, was the active ingredient of 2 discontinued hospital hand-washing soaps: Septisol (STERIS, St. Louis, MO) and pHisoHex (Sanofi, Bridgewater, NJ). In a screen for small molecules, hexachlorophene and nitazoxanide demonstrated inhibition to Middle East respiratory syndrome coronavirus.² Nitazoxanide is currently being tested in clinical trials for severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) (NCT04541493, NCT04343248, NCT04359680, NCT04348409, NCT04351347, NCT04360356), and exhibited similar inhibitory potential of remdesivir in vitro.³ If not discontinued for important environmental and newborn toxic risks, hexachlorophene could have represented an ideal candidate for a handwashing product in high-risk COVID-19 hospital areas due to residue on the skin after rinsing.

About viral entry mechanism through the skin, serine proteases including, TMPRSS2 (transmembrane protease, serine 2), are expressed in capillary morphogenesis and angiogenesis.⁴ Messenger RNA transcripts were found in human blood vessels specimens. As such, the presence of TMPRSS2 in skin capillaries may be a possibility, allowing the transmission of SARS-CoV-2. Because *TMPRSS2* expression is androgen receptor-dependent, hormonal expression might be the key gateway for vulnerability to SARS-CoV-2.⁵ Currently, the need for external hormones could be re-evaluated in health care workers, such as the use of progestins with androgenic activity (eg, levonorgestrel or medroxyprogesterone) and the use of androgen-replacement therapy, because of the likelihood of increased *TMPRSS2* expression in all tissues where it is expressed, including airways and blood vessels.

Furthermore, coronaviruses can display shedding in plasma or serum, making the transmission of coronaviruses through labile blood products still theoretically possible.⁶ Fissures are known to be a

transmission route for many pathogens, including other positive-sense, enveloped, RNA viruses such as HIV and hepatitis C.⁷ Fissures and erosions represent discontinuity of the epithelium coverage, making damaged mucosa and skin functionally equivalent for the purposes of the transmission we hypothesize as possible.

Although SARS-CoV-2 seems to be transmitted primarily through respiratory droplets, not enough is known about the virus to assume that it does not infect through open wounds. As such, a cautious approach to skin health and hygiene is needed at this time.

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REFERENCES

1. Gupta MK, Lipner SR. Personal protective equipment recommendations based on COVID-19 route of transmission. *J Am Acad Dermatol.* 2020;83(1):e45-e46.
2. Cao J, Forrest JC, Zhang X. A screen of the NIH Clinical Collection small molecule library identifies potential anti-coronavirus drugs. *Antiviral Res.* 2015;114:1-10.
3. Wang M, Cao R, Zhang L, et al. Remdesivir and chloroquine effectively inhibit the recently emerged novel coronavirus (2019-nCoV) in vitro. *Cell Res.* 2020;30(3):269-271.
4. Aimes RT, Zijlstra A, Hooper JD, et al. Endothelial cell serine proteases expressed during vascular morphogenesis and angiogenesis. *Thromb Haemost.* 2003;89:561-572.
5. Wambier CG, Goren A. SARS-COV-2 infection is likely to be androgen mediated. *J Am Acad Dermatol.* 2020;83:308-309.
6. Chang L, Yan Y, Wang L. Coronavirus disease 2019: coronaviruses and blood safety. *Transfus Med Rev.* 2020. <https://doi.org/10.1016/j.tmr.2020.02.003>.
7. Ogunremi T, Defalco K, Johnston B, et al. Preventing transmission of bloodborne viruses from infected healthcare workers to patients: summary of a new Canadian guideline. *Canada Commun Dis Rep.* 2019. <https://doi.org/10.14745/ccdr.45i12a03>.

<https://doi.org/10.1016/j.jaad.2020.04.102>