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Letter to the Editor

Transparency of disinfectant and hand sanitizer contents in the context of COVID-19

Dear Editor,

Soave et al[1] have provided a review of disinfectant exposure during the COVID-19 pandemic and related concerns. One of the practical aspects for infection control of COVID-19 is the role that the environmental presence of virus may play in transmission from whatever source and under whatever conditions. Spread from several sources is an accepted mode of transmission albeit it has proven challenging to quantitate the same comparatively[2]. In this regard, it is yet imperative that disinfection and hand sanitization should garner careful consideration in healthcare settings and in the environment of those infected. Many countries have established simplified protocols for efficacy and suitability of disinfectants and hand sanitizers. Public postings are often used by industry, scientific communities, and public to determine applications or to better understand the science. Any presumed approval by regulatory authorities has the tendency to make the community believe that products should be efficacious even if endorsement is waived.

A web-based national listing of hard-surface disinfectants and hand sanitizers in Canada exemplifies some issues[3]. Those for approval are designated with drug identification numbers. The listing so made is also said to be effective for SARS-CoV-2. When first reviewed in May 2020, 414 products were listed, and 60.1% were deemed to have quaternary ammonium compounds as sole active ingredients. Another 8.7% included quaternary ammonium compounds with other concomitant active agents. Other active agents included alcohols, peroxides, phenolics, citric acid, chlorhexidine, hydrogen peroxide, acetic acid, peracetic acid, chlorine dioxide, sodium hypochlorite, hypochlorous acid, hydrochloric acid, lactic acid, silver dihydrogen citrate, thymol, sodium dichloroisocyanurate, and potassium peroxymonosulfate. For 21/414 (5.1%), published scientific evidence of efficacy against one or more coronaviruses was lacking.

At the same time, a smaller representative sample of 58 (90% confidence level ± 10%) was chosen with random numbers for further analysis. For 3/58 (5.1%), no data were accessible on-line. Of the remaining, 36/58 (62.1%) were available in liquid containers for direct use or dilution, 8/58 (13.8%) were surface wipes, and 11/58 (19%) were sprays. None of the products listed working temperatures. Ready-to-use status was apparent for one-half. For nine solutions, there was either no access data or no working dilutions listed on instruction or material safety data sheets. Product pH was commonly stated – alkaline, acidic, and neutral pH ranges for 27/58 (46.6%), 1/58 (1.7%), and 19/58 (32.8%). Of those with neutral pH, 16/19 (84.2%) were viewed as only containing quaternary ammonium-based disinfectants. Alcohol ethoxylates or other surfactants and EDTA were occasionally found as quantitatively significant constituents although the database did not cite them. In December 2020, 551 such products were listed, and a sample of 77 (90% confidence level ± 10%) were randomly assessed in similar fashion. For 12/77 (15.6%), again no reliable data were accessible on-line. The frequency of formulations, ready-to-use status, temperature use indications, and pH variation were essentially the same in comparison to the first sample assessment.

Disinfectants and decontamination agents have been assessed for coronaviruses generally[4]. Higher temperature and adverse pH favor inactivation. Working diluent temperatures

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are not usually detailed, but temperatures at or above room temperature theoretically favor better activity albeit high extremes of temperature raise concern over chemical volatility. Most adverse pH were alkaline and usually greater than 10. In combination with disinfectants, adverse pH would theoretically add another measure of presumed efficacy. Neutral quaternary ammonium or phenolic products have raised some concern for lesser efficacy.

Potential for SARS-CoV-2 presence in the environment of patients is now clearly evident[5-9]. This is not surprising given the same for other respiratory viruses[10]. Most of the studies used RNA amplification for virus detection among environmental samples and thus will have overstated the presence of putative infectious virus. Nevertheless, some have found that the environmental burden of virus increases with patient disease severity and thus patterns of and burdens for dissemination have variable influence[11]. Environmental contamination can occur from symptomatic or asymptomatic patients[12]. Public domains may also be at risk[13]. Viable virus can remain on surfaces even when dessicated or under various adverse conditions[4,14]. Survival on human skin has also been modeled[15].

Experimental assessments of disinfectants and antiseptics are at best estimates, and it is often difficult to simulate variability that will occur in real-life applications[4]. Variability is influenced by virus species, temperature, relative humidity, contact time, concomitant organic load, viral load, precision of disinfectant stock dilution, effects of mechanical lavage, nature of the environmental surface, and inactivation of the test agent by the materials. In situ field assessments are uncommon. Several assessments have examined non-SARS-CoV-2 coronaviruses. For cleaning and disinfection (quaternary ammonium compounds and ethanol ethoxylates mixture – pH 9) of toys in a daycare nursery, viral load was determined with quantitative amplification[16]. RNA of several respiratory viruses was reduced, but coronavirus RNA was stable regardless of control or intervention group. Others assessed daily morning interventions with a cleaner (an anionic surfactant and ethanol ethoxylate mixture – unknown pH) in a university classroom[17]. Although there was a reduction in cultivable virus counts after one week, coronavirus 229E remained viable on environmental surfaces. Whereas most disinfecting or antiseptic agents are associated with benefit if not only from the mechanical application and removal, there are also product-specific ingredients which may vary in efficacy[18].

SAR-CoV-2-specific publications have emerged and several themes prevail[19-30]. Most such studies have also used viral RNA as the determinant for outcome, and success has been achieved in either lowering the burden of viral RNA or eliminating its detection altogether. Frequencies of disinfection and their timings have been variable as have concentrations of the same chemical. There have been diverse products used, but complex solutions have generally been more efficacious. The greater the intensity of disinfection efforts, the greater the reduction of environmental viral RNA. Full product disclosure is often missing, and it is clear that studies would benefit from assessing the full composite of a commercial product in its prescribed working dilution.

Variability in studies and outcomes raises risks for scientist and consumer. Safety is also a potential concern with some products. Studies referable to coronaviruses provide a measure of confidence but may exclude other microbial pathogens that products should affect. More consistency is required for creating measurable standards. From a consumers' perspectives, more information, ease of application, and practical efficacy are desirable. In the least, commercial products should list their active ingredients, pH, recommended temperatures for use, working dilutions, and application standards. As well, electronic media provide ample opportunity for safety data sheets to be widely accessible. In the current environment with COVID-19, there is considerable potential for trial studies of efficacy.

Conflict of Interest

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