To the Editor, JOEM:

The use of alcohol based hand sanitizers is the currently recommended procedure for the control of infection in healthcare settings. The American College of Obstetricians (ACOG) advises that “women should avoid alcohol entirely while pregnant or trying to conceive”. Is the use of alcohol hand sanitizers by pregnant healthcare workers a risk to their unborn fetuses?

A review of the literature revealed that few studies have been done to measure blood alcohol concentrations following the use of these alcohol based hand sanitizers. Miller, et al 1 had 5 volunteers (all men) apply hand sanitizer (62% ethanol) fifty times over a 4 hour period, and found all blood alcohol concentrations to be below 5mg/dL.

Kramer, et al 2 had 12 volunteers (6 men and 6 women) use three different hand sanitizers (95%; 85%; and 55% ethanol) for a Basic Hand Hygiene application regimen. The volunteers applied 4cc of hand sanitizer for 30 seconds each time, 20 times over the course of 30 minutes, with 1 minute breaks between applications. They then measured blood alcohol levels immediately after the last applications, and at intervals up to and including 90 minutes after the last application. This group reports peak blood alcohol levels to occur 30 minutes after the last application. They report levels from 0.69-2.1mg/dL for the different strengths of alcohol hand sanitizers.

Though the CDC reports averages of 5-30 hand rubs/healthcare worker/shift.3, Dr. Michele Walsh4 estimates that a healthcare worker in the NICU at Case Western Reserve’s Rainbow Babies and Children’s Hospital, often uses a hand sanitizer as many as 100 times over an 8hr shift. Using Kramer’s data and Walsh’s maximum use information, a predicted blood alcohol level for a real life ICU healthcare worker using alcohol rubs even at the 95% ethanol composition to sanitize hands would be 0.65mg/dL.

Bessonneau, et al5 published a mathematical model to predict inhalation exposure to ethanol from an alcohol based hand sanitizer. They postulated a Health Care Worker uses an alcohol sanitizer thirty times in an 8 hour shift. Assuming no room air exchanges, they calculated an inhalation exposure of 5500mg/m³/8hr shift, which is above the OSHA PEL and NIOSH REL limit of 1900mg/m³.6 This would translate to an exposure of 687.5 mg/m³/hour, and with a standard ventilation factor of 6 exchanges per hour, the projected worker exposure would be 114.58mg/m³/hour.

2 Kramer, et al, Quantity of ethanol absorption after excessive hand disinfection using three commercially available hand rubs is minimal and below toxic levels for humans, BMC Infect Dis. 2007 Oct 11;7:117
4 Walsh, Michele MD Director, Division of Neonatology, Case Western Reserve University, Rainbow Babies’ and Children’s Hospital, personal communication.
The excessive use of alcohol during pregnancy is well documented to cause fetal alcohol syndrome and more recent studies are showing that lower levels of alcohol during pregnancy may also result in adverse effects on the developing neurologic system of the fetus.

Bearer, et al\(^7\) studied the effect of ethanol on normal neurological development using animal models, and have found adverse effects at a concentration as low as 4.6mg/dL although a NOAEL (no observed adverse effect level) was not identified.

Sood, et al\(^8\), in a study at an urban university-based maternity clinic, screened women at their first prenatal visit for alcohol use. They stratified these women into none; <0.3oz; and > 0.3 fl oz absolute alcohol a day. Six years later, they contacted and tested the children’s behavior using the Achenbach Child Behavior Checklist. They found that the odds ratio of scoring in the range for delinquent behavior was 3.2 in children with any exposure to alcohol. Further statistical tests suggested that “adverse effects of prenatal alcohol exposure on child behavior at age 6 to 7 years are evident even at low levels of exposure.”

As to available alternatives, Larsen, et al, compared the effect of 2 hand hygiene regimens, traditional antiseptic hand wash and an alcohol hand sanitizer in two neonatal intensive care units.\(^9\) They found that infection rates and microbial counts on nurses’ hands were equivalent, although they acknowledge that “other practices such as frequency and quality of hand hygiene are likely to be as important as product in reducing risk of cross-transmission”.

In conclusion, the blood alcohol levels found in Kramer’s study for all strengths of alcohol hand sanitizers are all well below the 4.6mg/dL found to cause adverse neurologic developmental effects in lab animals and Bessonneau’s study does not suggest a significant inhalation exposure to health care workers. These data are reassuring that exposure to alcohol hand sanitizers would, at most, lead to very low blood alcohol levels, yet no NOAEL for adverse effects of fetal alcohol has been identified. We suggest therefore that if an additional risk reduction is desired by pregnant healthcare workers, work practices should be modified to allow the use of soap and water as a substitute for the alcohol hand sanitizer.

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\(^8\) Sood, et al, Prenatal Alcohol Exposure and Childhood Behavior at Age 6 to 7 Years: I. Dose-Response Effect, Pediatrics Vol. 108 No. 2 August 1, 2001 pp. e34 http://pediatrics.aappublications.org/content/108/2/e34.full.pdf+html