

Yale *Environmental Health & Safety*

Glove Leak Rates

In 1985, a clinical chemist working in New Haven passed away from an acute case of Hepatitis B virus infection. Today, with the highly successful and safe Hepatitis B virus immunization, this would not have likely happened if the clinician was vaccinated.

However, their manager rigorously investigated the lab acquired infection and discovered some unnerving facts regarding the lab exam gloves you wear every day. Here is what he discovered.

1) Lab gloves are not leak proof

The clinician had a case of poison ivy, which manifested itself on their hands, resulting in breaks in their skin, or unhealed wounds. The condition also created a situation that made the clinician's hands itchy. The manager identified this as the route of exposure, but wanted to find out how the gloves, which they felt were leak proof, allowed any viruses to get through to their skin.

Their first phone call was to the glove manufacturer who informed the manager that they were allowed to manufacture gloves with a leak rate of 3.5% (in 1985, today it is 2.5%). They then called the United States Food and Drug Administration (FDA) who confirmed that manufacturers were allowed the 2.5% leak rate, also adding that the cost of lab gloves that were 100% leak proof would be very costly for researchers and manufacturers.

Doing quick math, this means that for those working in labs, one out of every 20 pairs of gloves that you put on during your life of lab research, will have a hole or leak in one of the gloves in the pair.

EHS collected glove leak rate data in 2018 during a campus safety fair held at the School of Medicine, Science Hill, and Yale West Campuses. Over 200 visitors to the glove booth participated in a glove removal exercise where new gloves were put on then rubbed with a fluorescent dye (GloGerm). After leaving the dye on for two minutes, those who participated were asked to remove their gloves aseptically and instructed to take care to NOT touch the outside of the gloves with their bare skin. EHS monitored the process and found that there were leaks around the wrists on palms, where researchers contaminated themselves removing their gloves. However, there were also leaks found in between fingers, and in spots that the researchers never touched at all. These were attributed to the "glove leak rate." Although we only did slightly over 200 such exercises, we saw a leak rate closer to 10% than 2.5%.

2) Lab gloves will develop leaks over time with use

Many other studies, from high school science fairs to peer-reviewed published studies, have identified that glove use will also contribute to increasing the leak rates in lab exam gloves. Brian Boyle, a high school sophomore, collected gloves from a clean animal research facility after use by the animal technicians. Boyle used an American Society for Testing Materials (ASTM) test to determine the leak rates of exam gloves worn by the animal care and use staff. He found leak rates of 21% (small gloves), 27% (medium gloves), and 35% (large gloves). Studies testing the leak rates of surgeons' gloves after use also identified leak rates around 15% after 30 minutes of use. Many healthcare facilities will request that their staff remove gloves every 20 minutes or so as a precaution because of these studies.

Boyle, B & Boyle, T, "Loss of Glove Integrity During Laboratory Animal Care Providers Daily Tasks," Lenape Regional High School, Medford NJ, Science Fair Poster Presentation, 2017

Makama, J.G. et al, "Glove Perforation Rate in Surgery: A Randomized, Controlled Study to Evaluate the Efficacy of Double Gloving," Surgical Infections, Vol. 17 No. 4, pp 436-442, March 16, 2016

3) Double gloving is highly protective

The good news is that double gloving when working with moderate to high-risk biohazards is still very protective. One study demonstrated that double gloving was 98.83% effective and preventing leaks.

4) Breaks in the skin

Never work with biohazards with skin breaks or unhealed. In addition, you may not realize that you have small, microscopic breaks in your skin frequently around your cuticles and nail beds. Double gloving can also help protect you in these situations.

Please consult with Yale Health's Employee Health Department (203-432-7978) to evaluate any breaks in your skin before working with biohazards. They may be able to inspect the wound or cut to make sure it is has healed appropriately. As a precaution, they may also recommend the use of waterproof bandages and double gloving in situations where it is difficult to tell. But the take home message is to never work with biohazards when you have breaks in your skin!