Response:

Stuck on you and other problems with Superglue.

Dear Dr. Bhargava, Dr. Hassall, and Editors:

We appreciate the opportunity to comment on the letter by Drs. Bhargava and Hassall. As emergency medicine physicians, we recognize that hospital services are often overwhelmed and we welcome the prospect of home care to decompress these resources. However, as physicians we should strive to provide the best possible treatment options for our patients, both the one's we are directly treating and those we are indirectly treating by way of medical guidelines, and we should rely on the best possible evidence to make these treatment decisions. Due to the paucity of supporting evidence in lay providers, potential risks and possible legal implications, we disagree with the authors that it is in the best interest of patients "that superglue find its way in every home/workplace first aid box."

We agree that cyanoacrylates have shown immense utility in the hospital setting and in the pre-hospital setting they have been used for a variety of other uses from blister treatment to treatment of finger cracks and fissures in outdoor activities (Ayton, 1993; Levy, Hile, Hile, & Miller, 2006). When used by trained medical providers in the hospital setting, cyanoacrylate skin glues have been shown to have comparable outcomes to traditional suture closure in select wounds (Singer, Quinn, Clark, & Hollander, 2002). Studies in hospital personnel also demonstrate that wound repair using cyanoacrylates is relatively easy to learn (Hollander & Singer, 1998; Lin, Coates, & Lewis, 2004). However, we advise caution when using data attained in trained medical providers to derive recommendations for untrained medical providers no matter what the intervention. It is often unclear how studies done a hospital environment translate to lay providers.

As cited by the authors', it is possible that cyanoacrylate glue can be safely and effectively applied by prehospital providers in certain situations, but the supporting literature is limited to case reports and anecdotes; in the pre-hospital environment few studies exist to guide the translation to all lay providers (Davis & Derlet, 2013). When evaluating the ability to translate the in-hospital data to lay providers multiple factors come into play. While it is essential to attain and maintain the skill, equally as important is the ability to know when to apply that therapy. Wound closure not only depends on the technical skill, but considerable judgement comes into play when determining optimal outcome, including wound length, depth, width, irregularity, degree of contamination, cosmetic features, and functional outcome. A study by Malyon (1999) appears to be the best available evidence for lay provider cyanoacrylate wound closure. This study assessed

military personnel ability to perform wound closure with medical grade cyanoacrylate glue in wound simulators. Following a short training session soldiers were able to adequately close these simulated wounds. Of significance, though, are the recognized limitations by the study authors: in this study instructions included not only the importance of cleaning the wound and not closing dirty wounds, but soldiers were also cautioned not to perform closure when higher medical care was available and that they should be checked by a medical officer at the next available opportunity to determine if complications were present and to update the tetanus vaccine as needed. While Drs. Bhargava and Hassall acknowledge the potential harms of inappropriate wound closure and state that providers should be "mindful of not filling deeper structures such as nerve, muscle or bone," we know of no literature to suggest that lay provider's possess the ability to recognize high risk wounds that would be inappropriate for closure.

Although it would be optimal to have large randomized controlled trials in lay providers to make first aid treatment recommendations, we recognize that due to the paucity of data, guidelines writers must rely on indirect evidence (such as the research cited above) to make treatment recommendations. Unfortunately, the indirect nature of the data downgrades the quality of the evidence making the value of the intervention less certain. In the instance of low quality data, the possible risks become more important. While some of these risks are discussed by the authors, they include wound contamination if appropriate wound cleaning does not occur, exothermic reaction potentially leading to burns, irritant effects, poor cosmetic outcome for large or poorly closed wounds, damage to underlying structures for deep wounds on inappropriate application, and inadvertent self-adhesion to unintended objects (Carstairs et al., 2017; Eyth, Echlin, & Jones, 2016; Kelemen, Karagergou, Jones, & Morritt, 2016). A recent 10-year review of cyanoacrylate exposures reported to a single US regional poison control center found 893 reports of accidental and intentional exposures, of which over 26% required management in a healthcare facility. While most of the effects were minor, just under 9% suffered moderate effects from exposure (Carstairs et al., 2017). Commercial cyanoacrylates are not designed for medical use. One of the major problems with commercial cyanoacrylate is that it can polymerize too quickly, making it too sticky, resulting in the potential for premature adhesion before the wound is cosmetically approximated and potential for self-adhesion (Davis & Derlet, 2013). In the authors' experience, lay provider attempts to remove tissue adhesive following inadvertent self-adhesion often leads to significant skin tears or partial thickness tissue avulsion. Commercial cyanoacrylate is also less flexible, making it brittle with the potential for early cracking and flaking before the wound has healed (Davis & Derlet, 2013).

In most instances, when a trained medical provider is available we feel the possible risk of inappropriate wound closure would outweigh the low-quality evidence supporting the use of this intervention by the lay provider. Regarding wound closure, to our knowledge all available studies use medical grade cyanoacrylate glue which has been optimized for human tissue applications. In many countries, using medical grade cyanoacrylate is not an option for lay providers as it must be applied by a licensed medical professional. In

addition, the legal implications of recommending a non-medical device to lay providers must be considered before recommending over the counter "superglue" for use on humans. However, in some countries there are readily available sterile and medical-grade liquid-bandage polymer alternatives, such as 3M Nexcare© (Hexamethyldisiloxane, Isooctane, Acrylate Terpolymer and Polyphenylmethylsiloxane). These liquid adhesive alternatives, while not studied in the first aid setting, are available in sterile applications and have been found to have less cytotoxicity, less risk of exothermic reactions, and are more flexible than commercial cyanoacrylate (Zhang et al., 2010).

While we appreciate the utility of cyanoacrylates in certain medical situations we would again caution against the ubiquitous use by the lay provider based on current data. In this and in many other first aid topics there is a paucity of data to guide recommendations. We would encourage further research on the use of cyanoacrylates and liquid-bandage polymers in the pre-hospital setting, including with lay providers.

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