Thirdly, it is unfortunate that other readily available liquids were not compared to vinegar using this model. The authors mention the use of hot water in the treatment of stings by *Physalia* species, and it would be interesting to see what effect this would have in the model used. Without a comparison group, it is unclear as to whether

Reply:

We thank Drs Gibbs, Corkeron and Blake for their interest in our study.[1] We are delighted to respond to their comments. Firstly, the anecdote that vinegar increases pain and an unpublished case series (into analgesic requirements in

Irukandji envenomation) performed at Cairns Hospital concerned us that vinegar may not be the panacea it is thought to be and prompted the study. Interestingly this increased opiate requirement was for systemic pain and not for any pain at the sting site. Our initial suspicion was that the increased opiate requirement was driven by the lack of application of vinegar; however, our findings suggested otherwise; the use of vinegar on an envenomation increased opiate requirements and increased the length of stay at a medical facility.

Secondly, the relevance of our stimulated nematocysts model to clinical envenoming has been discussed previously with our in vivo pressure immobilisation bandages (PIB) experiment in 2000.[2,3] We would expect that by now there would be evidence to support this concern but, to date, we are unaware of any evidence to this effect. Whether this technique is an adequate simulation does not refute the evidence that discharged nematocysts still have residual venom, and that, when vinegar is applied, an average of 60% more venom is released.[1–3] It has been demonstrated previously that nematocysts have residual venom and that the volume of venom retained within may be equivalent to that which has already been discharged.[2,3] It has also been demonstrated that this venom can be expressed by pressure and we now add to this knowledge that this residual venom can also be expressed by application of vinegar. Similar to our conclusions with PIB, this has the potential to worsen an envenomation.

Thirdly, that vinegar effectively disables undischarged nematocysts is not disputed; however, we are unaware of any data that would support the quoted figure that 80% of nematocysts in contact with skin are undischarged. Consequently, the claim that vinegar protects the victim from these discharging, causing further envenomation, is speculative. It is, however, plausible that some nematocysts may not be in contact with skin, considering that *Chironex fleckeri* tentacles are ribbon-shaped and may adhere to the victim in a convoluted and contracted state. Without further manipulation these nematocysts are clinically irrelevant to further envenomation. We are unaware of any data that answers the question raised by the authors in relation to the population of discharged versus undischarged nematocysts in direct skin contact, where the relevance of vinegar does actually have a bearing.

Finally, vinegar is the one recognised first-aid treatment for tropical marine jellyfish stings. As such, this experiment was performed specifically to examine the effect of vinegar on residual venom held in discharged nematocysts. Further to this, the testing of other common liquids as suggested, which have already been shown to be ineffective in de-activating nematocysts is irrelevant to the experiment and the envenomed victim.[4]

We disagree with Gibbs, Corkeron and Blake. Without evidence as to its effectiveness or safety, vinegar was promoted and recommended to specifically reduce further envenomation. Instead we have now demonstrated that it has potential to worsen envenomation. This is not just an interesting finding, it is a genuine concern.

Like PIB, where the potential to cause harm has been demonstrated in the absence of effectiveness or safety, it would be prudent to acknowledge the risk in the use of vinegar and to judiciously express this risk in a measured recommendation for its continued use, rather than continuing to recommend its unfettered use. That modified recommendation should continue until the safety and efficacy of vinegar has been established fully by appropriate research. We recognise that vinegar has been introduced and accepted as a core first-aid treatment in marine stings at a time when the requirements for demonstrated safety or efficacy were not as stringent. We now provide a need to re-examine this.

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Key words
Jellyfish, envenomation, clinical toxicology, toxin, first aid, letters (to the Editor)