CORRESPONDENCE

A low-cost low-tech solution to lessen the fear of needles in children

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In this paper, we present a novel solution for trypanophobia—fear of needles—predominately in children. Although developed in a low- and middle-income country, this low-cost solution can be applied in any clinical setting. A meta-analysis by McLaren et al. concluded that the prevalence of needle fear ranged from 20 to 50% in adolescents and 20–30% in young adults.¹ Prior interventions have included distracting the child by playing with him/her and numbing his/her skin by using ice packs or vibrating devices. However, most of the solutions are either expensive to implement or are time-consuming, hence not always available. The challenge to find a solution was taken up during a pediatrics-themed Hackathon conducted at the Aga Khan University.² The innovation we have developed is the concept of pain-free invisible needles (PFINs).

The suggested solution was based on two fundamental principles: (1) hiding the needle—invisible, and (2) preventing pain—pain free. We developed a number of prototypes, the first being a dual-chamber watch (Fig. 1) with a hollow interior, with the watch face lifting toward the child to obstruct the view of the needle—the visual trigger of potential pain. At the same time, an anesthetic patch, e.g., eutectic mixture of local anesthetics or liposomal Lidocaine at the bottom of the device numbs the surface, contributing toward the pain-free aspect.³ In-house

testing on dummy arms proved that this design was not practical and phlebotomist friendly, so we developed a second prototype.

The second prototype was of a shield (Fig. 2a). This shield was used to obstruct the patient's view of the needle (Fig. 2b) and provided a sufficient range of motion for the phlebotomists (Fig. 2c) to manipulate the wrist and was more comfortable to wear, courtesy the sleeve. The area distal to the shield was numbed using local anesthesia and cartoons were drawn on the surface facing the patient—which are to be replaced by e-stickers in the future. This design was approved by the phlebotomists. The PFIN is now undergoing further trials and a patent is being obtained. The primary advantage of this innovation is the ease of use in all clinical settings—irrespective of financial status—because of its low cost (estimated at \$0.30) and a simple operating mechanism.

We believe that this simple innovation will decrease cost and improve the experience of children. Our main lesson is that, among several prototyping challenges, perhaps the biggest challenge was to forego the initial version and to shift to a newer

Fig. 1 First iteration of the suggested solution. **a, b** 3D graphical representation of first proposed PFIN model. **c, d** Printed 3D model of first proposed PFIN model.

Fig. 2 Second iteration of the suggested solution. **a** Second proposed model of PFIN with shield and accompanying sleeve. **b** Effectiveness of second proposed PFIN model in obstructing view of needle. **c** Effectiveness of second proposed PFIN model in providing accessibility to phlebotomist.

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technique. Maybe that is what defines innovation—acknowledging failures and moving on.

AUTHOR CONTRIBUTIONS

M.I.S. conceptualized the device, wrote the initial manuscript, and revised before submission. A.S.A., M.A.B., and N.N. developed the prototype of the device. A.I.M. supervised the project and revised the manuscript before submission.

ADDITIONAL INFORMATION

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