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Reducing Patient Anxiety During Vaccinations

through Multimedia Solutions: Exploration

In addition to working as an educational children's game artist, I also work as a secretary for my mother's pediatrics office, Sears Pediatrics. Since it is a single doctor practice (with me as the only other employee), we have to make most of our own systems and services. I'd like to focus on improving the patient experience for my semester project.

The most anxiety-inducing visits at Sears Pediatrics are vaccine appointments. For babies and young children under 3, it is usually easy to distract them and vaccine administration goes smoothly. For children in the 4-6 age range however, vaccines are often met with screaming and great resistance, since they're more aware of what's happening. According to study done by A. Taddio, in a sample of 1024 children and 883 parents, two-thirds of children and one-quarter of adults reported a fear of needles (2012). This needle fear caused immunization non-compliance and healthcare avoidance in about one twelfth of both adults and children (Taddio 2012). Despite the great importance of vaccinations and crowd immunity against potentially deadly diseases, vaccination is too-often avoided because of fear and anxiety. I have a needle phobia myself, so this topic has some emotional importance for me. I want to develop some way to reduce the anxiety surrounding these visits so that they can go as smoothly as possible, and reduce the chances of children developing needle phobias like my own.

According to Dr. Sears and my observations, many parents currently use their phones to try to distract their children during vaccinations. There is already technology being used as an informal solution, so I'd like to introduce more specialized aids that better serve the nuances of the vaccination process. Several effective technological solutions are on the market currently, but they seem to be used primarily in large hospitals, and utilize virtual reality consoles that would be too difficult, expensive, and time-consuming for a less tech-savvy pediatrician to set up (Li 2011).

For these problems, I ask the following questions:

How might we reduce patient anxiety during vaccination appointments, to lessen the possibility of children developing lasting needle phobias? Furthermore, how might we develop a specialized solution that would be accessible to smaller pediatric offices, and not just hospitals with more employees and larger budgets?

Data Collection

To gather inspiration for a solution, I interviewed one of Dr. Sears' 6-year old patients, and Dr. Sears herself. I also observed one of the appointments to get a better idea of the vaccination process for 4-6 year old children.

Interview with N, a 6-year old patient of Dr. Sears:

The interview with N, a 6-year old patient, lasted about 12 minutes. She seemed a little nervous and didn't give very detailed answers (likely because of the scary subject matter), despite being a family friend of ours. Nonetheless, I got some helpful input from both her and her 8-year old sister, S. I started by asking about her favorite shows and games and what she likes about them, so that some of their aspects could be incorporated into my designs. These questions eased her into the more difficult questions like what she does to make herself feel less scared, and what she doesn't like about vaccines.

From N's answers, I found out that she doesn't get to play games on her parent's phone, but her favorite game in general is I-Spy. She likes watching cartoons on TV, especially $E=MC^2$, and Pony Sitters Club. She hugs her stuffed animals when she gets scared, though this isn't available to her during vaccination.

N thinks that not being able to see the shot (as in a virtual reality headset) would make the experience scarier, and she dislikes strep tests more than vaccinations. N doesn't know why vaccines were helpful. Her sister thinks that leg-administered vaccines, as my mom does for young children, are worse than arm-administered vaccines. She also wasn't scared at all for one of her appointments, because she didn't know what was

happening. She also likes the prize given at the end of appointments.

Observation of T's vaccine appointment:

I then did an observation of a vaccine appointment. The patient, T, is a 2 ½-year old child on the autistic spectrum—despite this being a little outside my target age range of 4-6, the process was apparently the same and offered helpful insight on how vaccines are administered for young children at Sears Pediatrics. Both parents were present. The appointment lasted about 15 minutes total.

During my observation, I learned that it is common for children's shots to be administered on the leg—apparently this is easier for intramuscular administration, since the leg muscle is very large compared to the arm muscle. It is also further away from the brain. Children lie down for the process and often have to be restrained with the help of parents for easy administration. I didn't foresee that children wouldn't be able to move their limbs much at all during the process.

The parents were well-prepared with distractions for T: Paw patrol played on her mom's iPhone for the entire visit, her mom sang happy songs to T, and both parents talked about unrelated future plans. For most of the visit, T sat in her parents' laps and was comforted. Both Dr. Sears and the parents cheered on T during and after the process, and she received a prize after. Despite all of this, T seemed very upset for most of the visit. She seemed least upset when she was distracted by the iPhone, and protested the most when she had to lie down on the examination table. I noted that Paw Patrol was not visible during the actual vaccination administration, and that the parents had their hands full holding the child's hands.

Interview with Dr. Sears:

I also interviewed Dr. Sears on how she administers vaccines, what unique struggles there are for particular age groups, and what parameters would need to be considered when designing a solution. I wanted multiple perspectives beyond 4-6-year old children, since N seemed to have difficulty articulating what made her the most scared about vaccinations. Dr. Sears would also be a primary stakeholder for the solution I create, so I needed to find out what she currently struggles with most. The

interview lasted about 24 minutes.

Dr. Sears wants to do what is best and healthiest for children, and pays close attention to details that will make the process less painful. For example, she replaces the needle after getting the vaccine out of the vial, so that the needle is as sharp as possible when administered. She also uses the thinnest needle available for minimal pain, even though it is shorter and more difficult to administer. She lightly pinches the area while administering the vaccine to distract the pain receptors, and advocates for only doing one vaccine per visit to reduce the child's stress and to allow for the liver to clear out metals used in the vaccine.

Dr. Sears emphasized that the some children might not be afraid of vaccines because of preparation from parents, sufficient distraction, the expectation of a nice prize after, and active parental participation during the process. She thinks that parental participation and distracting as many senses as possible is most effective for reducing patient anxiety. Apparently the most difficult part of the process is convincing the child to lie down—they hate being restrained and hate feeling vulnerable.

During my research process, I thought that perhaps teaching kids about the benefits of vaccines might help reduce some of their fears. My previous interview with N showed me that young children aren't really aware of what the vaccines are for. According to Dr. Sears, children over 7 have some knowledge of germ theory and know about vaccines, but younger children don't really understand these concepts well. She used to make the analogy of the body making little army men, but wasn't sure if this helped or not. I didn't have any perspective of when children learn about things like germs and sickness (I definitely learned germ theory a lot earlier than other kids, being the child of a doctor), so I'll definitely have to consider a very boiled-down version if I want to educate kids on the purpose of vaccines in any part of my solution.

According to Dr. Sears, "easy" vaccinations take about 5 minutes total (2 minutes for the actual administration), and "difficult" vaccinations take up to 30 minutes– after that they give up and try another time. Considering vaccine appointments are allotted 15 minutes in the schedule, this can push back other appointments for the rest of the day. She said that the most time she would be willing to spend setting up a distraction

method *during* the appointment would be about 3 minutes. She foresaw that virtual reality as a format would too technologically advanced for her to set up quickly, but Google Cardboard (a cardboard headset that you just pop your phone in) would be easy enough. She said that virtual reality would be exciting for older children who have more familiarity with technology, but young children hate having things on their head and might be too disoriented by it. All of this information will be useful for informing the complexity and format of my solution.

Characteristics and Tasks of Users and Stakeholders

(please note that some characteristics of specific participants have already been mentioned in the interview section)

Youth users:

The youth users for the design will be primarily ages 4-6, though I don't think it would be too difficult to make it adaptable to older and younger children. According to Dr. Sears and my observations, the worst part of getting the vaccine for them is lying down on the examination table, feeling restrained, and feeling vulnerable. The pain is also a factor, but according to Windich-Biermeier, pain is magnified greatly by fear, and Dr. Sears is already doing everything she can to reduce this pain (2007). Prizes are somewhat effective at reducing children's negative associations with vaccinations.

When children are 4-6 years old, they have not gone through much schooling yet, usually do not know why vaccines are helpful, and do not understand the foundational concepts such as germ theory. They are also not heavy users of technology, and many aspects and controls for smart devices are not intuitive to them yet (Aziz 2013). However, they do like watching cartoons a lot.

The youth user must remain calm and still enough during the process for the vaccination to be administered swiftly and safely while they lie down. They can't move very much, or at all, during the process. Whatever distraction method is used, they should remain as engaged as possible so that they do not get overly anxious and delay administration.

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Pediatricians:

For this project, I am primarily focusing on small-practice pediatricians such as Dr. Sears. These pediatricians do not have the same large technology budget as hospitals, and may not have nurses or other assistance to help them with vaccine administration. They also may not have the time or skill to fiddle around with unfamiliar technology.

According to Dr. Sears, many pediatricians do multiple vaccinations per appointment, and may do arm administration instead of leg administration for young children. I'd like to focus on leg administration, since it is more applicable to Sears Pediatrics. Apparently older children have vaccines administered through their arm muscle, so I may design another solution that is applicable to older children and arm administration.

These pediatricians are likely on tight schedules, and do not allow much time for vaccines in between other appointments.

The pediatrician's task is to administer the vaccine as efficiently as possible without making mistakes. For the design, it will likely be the pediatrician's job to set up the distraction method, and possibly to provide a simple introduction to the parent or child on how to interact with it.

Parents:

Parents often use their phones and singing to distract their children during vaccination appointments. According to Dr. Sears, they usually forget to hold their child's hand during the process, or do not participate enough to provide comfort to the child.

Parents of 4-6 year old children typically know about their child's likes and dislikes, including favorite TV shows, toys, and games. These parents are likely to know what songs and distraction methods their child prefers.

Their task is to provide secondary comfort and distraction to the child during the process, possibly through touch, song, or encouragement. Even though I plan for my design to be engaging at least with visuals and sound for the child, I will likely include audio directions for the parent to participate as well.

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Social and Technological Scope

For the social scope of my design, I will be primarily catering to Sears Pediatrics' needs first and foremost, though the design should be easily adaptable to other small practices. This product will also intersect with patient needs and families.

In my research, I found several technological formats to reducing pain and distress during general medical treatments: pre-operative simulations, virtual reality games, and non-digital forms of distraction (Liguori 2016, Windich-Biermeier 2007, Li 2012). Of the formats, VR seemed to have the most groundbreaking success in studies within hospitals, though access to this technology is likely limited (Li 2012). Options for effective, specifically designed games (ones that will not require head / body / arm movement) are also few in number.

Since full VR consoles are not very accessible or intuitive for small pediatricians, I think Google Cardboard will be a good virtual reality format for slightly older children, because it is very inexpensive, requires little setup, and integrates the UI familiarity of a smartphone. I think this would only be for older patients however, since younger children don't like wearing things on their head and might find it scarier.

In general, I think a smart device like a phone or tablet would be the best base format, since it can provide an intuitive interface for pediatricians and parents to work with, can display video, and has been shown to be more engaging than non-digital forms of distraction (Windich-Biermeier 2007). I can also use my expertise in animation and children's game design to create an engaging experience.

Evaluation Criteria

My design will ideally adhere to these goals:

1. Accessible to smaller pediatricians, not just hospitals that have a larger technology budget.
2. Be visually interesting and appealing for all ages, but especially children ages 4-6.

3. Set up as quickly and smoothly as possible to fit within the vaccine appointment timeframe (and to cause as little anticipation distress for the child as possible).
4. Low activity on the patient end, so that it will require little to no body movement that would hinder the vaccination process.
5. May involve parent participation / direction to provide additional comfort to the child.
6. Must be visible to the child while the vaccine is being administered.
7. Must not get in the way of the pediatrician to ensure safe administration.
8. Won't be confusing to parents or children, and will require little to no explanation that would take up time during the appointment.
9. Will incentivize young children to remain lying on their backs.
10. Fun and effectively distracting for the child to reduce fear and pain perception.

At the moment, I could find solutions on the market that adhere to some, but not all of these goals.

The solution must be fairly low-tech, intuitive, or familiar if there is anything to do participation-wise on the parent or patient end. They have a very limited time within the appointment room to be considered a "smooth" vaccine appointment. With this speed, there is no time for tutorials or extensive explanation, unless there is preparation before the appointment (which might take some level of convincing or reminding to do; not preferable).

Because there is very little time for explanation or tutorials, it would be best to stick close to familiar activities well known by young children—I Spy as mentioned by N, or familiar songs. This experience can be made more distracting and engaging by integrating friendly, new cartoon characters that I will design.

Due to the limited movement available for younger patients, any sort of smartphone game requiring touch gestures on the patient end is probably not feasible. Parents can possibly participate and do any arm movement needed for touch gestures. In its most basic form, a video-based activity would require no touch input other than to activate it. Audio controls might also be an option, which would also provide incentive for the child to remain calm enough to say certain words.

According to Dr. Sears, parents often forget to engage with their children to provide

comfort—while the system will not specifically mention the need for comfort, I think the system should engage parents in the activity as well, or provide specific audio instructions for them so that they remain nearby. This option could probably be turned off for older children who might not want their parents' participation.

I found that during my observation, phone distractions are not visible during the actual vaccine. For this, a wall mount may need to be considered for the design. This will keep all participants' hands free, and ensure that the distraction is visible. This will also provide incentive for the patient to lie on their back. I'll have to consider the best balance between visible for the patient and visible for the parent—will the parent need to see or use the screen, or can they just have audio controls?

If a Google Cardboard VR format is used, gyroscope head movements might be a usable control. Older children who receive arm administration would also have one arm's worth of control available to them, and likely would not need to be restrained.

Overall, I feel prepared and excited to delve into the second stage of the project! Thank you for reading.

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