

# AVCC: Technical Memo

## Breathe New Life Into Healing

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**AVCC: Air Ventilation Compartment Cast**  
**-Breathe New Life Into Healing-**  
Aditi, Bryan, Gokce, Joy, Layne



### Product Opportunity Statement

How might we improve the design and functionality of arm casts for teenagers that have a busy worklife to make their daily routine easier and the cast less distracting?

### Product Requirements

**Secure & Comfortable** → Fastening Mechanism

**Breathable** → Manually Opening Holes for Ventilation and Itching

**Customized for User** → 3D Print

### Understand (User Research - Competitor Analysis - VOA)

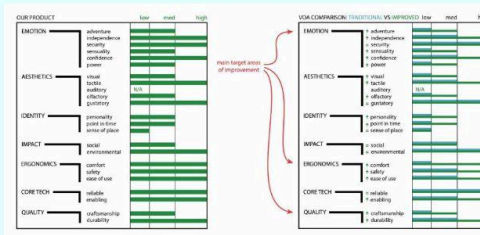
#### User Research:

Conducted interviews with 1) teenagers who broke their bones/experienced wearing a cast 2) professional medical personnels to learn about the feasibility of altering casts + important pain points they observed from patients

#### Competitor Analysis + VOAs:

1- not breathable/waterproof enough

2- VOA priority: improve sense of independence, ergonomics, and overall durability/quality

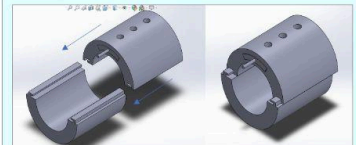


### Prototype

Our final concept combines 2 of our concept selections. The Air Vent Compartment Cast (AVCC) is a **compartmentalized cast equipped with holes that can be opened and closed by the user.**



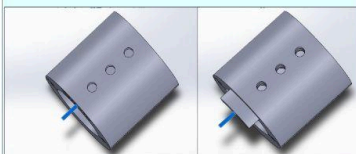
Sketch Design of Front View of AVCC



CAD representation of fastening mechanism of the cast



Sketch Design of Side View of AVCC

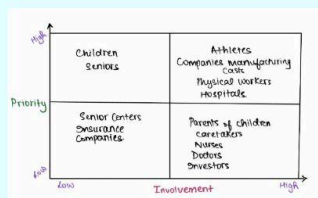


CAD representation of cast with holes closed (left) and cast with holes opened (right)

### Identify (Generating and narrowing down POGs)

#### Generating POGs:

2X2 matrix categorizing high/low priority and involvement



#### Narrowing down POGs:

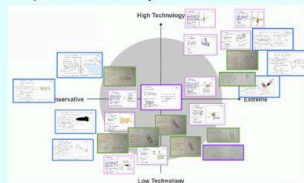
Creating 3 unique personas from interview observations to narrow down pain points + demographic to target

Person	Information	Injury	Pain Points and Findings
1	Dancing Daria Age: 16 High School Junior Activities: dances daily for 2-3 hours on weekdays	Area: broken forearm Cause: fell off her bike from downhill Cast type: plaster Casting length: 7 weeks	Unremovable material - never tripped inside arm from her dance classmate - very itchy but hard to scratch - smudged foot after taken off - experienced numbness by plaster cannot get wet - also might result in infection/irritation - had to wear a plastic bag covering each time
2	Scared Sally Age: 17 High School Junior Activities: swim team practices for 2 hours every weekend	Area: broken forearm + wrist Cause: minor collision on machine while swimming Casting type: fiberglass Casting length: 7-8 weeks	VERY itchy of sharp objects - scratched and itchy of the cast removal process - scratchy sides - very annoyed at the uncomfortable material - very red and dry skin around the edges of the cast - had to use a sand block to rub skin through the tape on top - asked a parent to cast to scratch
3	Techy Tim Age: 18 College Sophomore Activities: only goes on walks every weekend, none of a CS indoors person	Area: broken forearm Cause: minor car crash Casting Type: Cast 21 Casting Length: 7 weeks	Although the cast was a bit more breathable, it was itchy - Tim asked to be given the cast every two days - most doctors would prefer to give either one - very hard to find this type of cast commercially - not a lot of doctors are knowledgeable on this subject - not a lot of doctors are knowledgeable on this subject - not a lot of doctors are knowledgeable on this subject

### Concept Generation

After each member generated ~20 concepts, we used a 2x2 matrix to group our ideas by High-Low Technology, and **Conservative vs. Extreme**

Design Technique: **77 Principles**



### Next Steps

**Prototype Testing Plan:** Conduct physical testing with teenagers who experienced arm casts before. Test comfort, security, breathability, etc. while:

1 - Holes Open 2 - Holes Closed 3 - Fan Blowing into holes

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# Abstract

Our process started with having to improve the casting of bones. The road to our final POG included various factors such as taking into account the different stakeholders, what was the availability of our target audience, how would we create the largest impact, useful research methods for implementation, existent interview resources, and a specific POG that would narrow down the rather broad POG of improving the casting process of bones. After looking at various occurrences of bone damage amongst people through 1-on-1 interviews, we were able to conclude upon improving and making the casting process of arm bones more comfortable and less irritating, targeting college students specifically. Taking into consideration our own lives as young adults, we decided to focus on making the completion of daily tasks easier while having a cast. Finally, after comparing the market competition to our own goals and completing VOA's, we were able to polish our final POG.

## Phase 1 Overview

Our Initial Problem Statement involved analyzing broken bones and fractures. Broken bones are one of the most common injuries for children, young adults, and seniors. Around 40-50% of children will experience a fracture or broken bone in their life (Hakeos, 2020). The healing process of bones takes weeks, or sometimes months to successfully heal, which can cause extreme discomfort to patients when wearing a cast for prolonged periods of time. Some limitations and discomforts may include itchiness, movement limitations, smelliness, and the inability to perform daily tasks independently. Another major problem is if the cast is not put on correctly, it can cause the wrong joining of bones, furthering complications. Thus, our initial POG was: how might we improve the casting process of broken bones for children? Before we delved into our user research and online resources, our POG Statement was still quite unrevised. It targeted a very broad audience, without specifying the age of the children we were meaning to help. Also, a specific targeted body area of casting was not identified first and what we were hoping to improve was also very vague. However, after all the research and design methods we have implemented, we were able to fully develop a well-versed POG statement in the very end.

## Key Stakeholders

In order to identify our stakeholders, our team created a 2x2 matrix with priority and involvement as our axes. While we are still working to narrow down our customer base, at high priority and low involvement, the main target market that could use improvement in the casting process is the elderly population and children. These are the people that would actually be purchasing and using our product and would physically benefit from any improvements made. From an economic point of view, the stakeholders that would be benefiting monetarily are at high priority and high involvement. This includes the manufacturing companies, hospitals, athletes and any workers involved in the physical production of the casts. Next, the lowest priority and lowest involvement stakeholders are places where these casts are being used like in senior centers and the insurance companies that deal with medical claims surrounding the process of casting. Lastly, we identified stakeholders that would be of low priority, but are still impacted by our process. This includes families of patients such as parents of children and caretakers of

seniors. In addition, the doctors and nurses that utilize casts also have some involvement and investors also play a role in our map. In terms of the stakeholders there is an importance towards athletes which encompasses teenagers with sports and other physical activities such as dance and martial arts. The commonalities between the different kinds of athletes which will allow us to reach closer to our final POG and help our target audience.

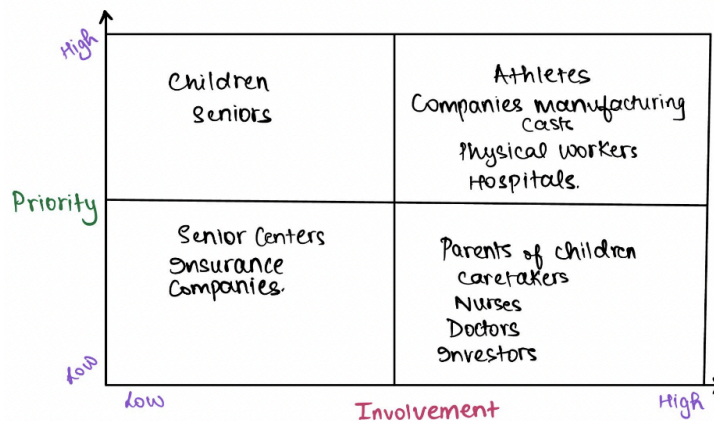


Figure 1: Key Stakeholder Map

## User Research

Throughout Phase 2 of user research, we split our priorities of collecting information and sorting data into 3 sections:

- 1) Interview conduction with Medical Personnel and Previous Cast Users
- 2) Survey Statistics
- 3) Online Research Insights (included as additional backup information for our interviews with students)

Priority was placed upon our interviews with medical personnels given the technical nature of our POG. We knew we required the relevant medical expertise to gain a better understanding of the topic our POG is trying to tackle upon. After all, their area of study goes into the technical details of ensuring the health and wellness of our target group, thereby being in the best position of advising upon what can and cannot be done to improve the casting process. The interview questions varied per interviewee, although they were all designed along three main lines of inquiry. Firstly, we wanted to gain a better understanding of the technical knowledge that goes behind the overall casting process. This includes but is not limited to the materials used in the casting process and the difference in techniques for different body parts. Secondly, given their personal interactions with patients who utilize casts and the focus they place upon maximizing their health and wellness, we wanted to seek their perspective on how the casting process affected the livelihoods of their patients. Lastly, we wanted to seek their opinions and suggestions on how they would like the casting process to be improved. The standardized list of interview questions, alongside the transcripts for all interviews conducted, are included in *Appendix (1)*.

There are three main findings that can be consolidated from our interviews. Firstly, there is a general consensus that the immobility function of the casts cannot be compromised upon. Keeping the intended body part to be healed firmly in place and immobile is critical in allowing the fractured bone to naturally heal through ossification. Casts are usually designed with a captivity-like structure to ensure the body part is held in place. With whatever design improvements we hope to make to the casting process, it cannot interfere with this function at any cost. Secondly, all agreed upon the primary medical concerns that arise from the usage of casts. The first medical concern involves the occurrence of rashes and itchiness as a result of trapped sweat and heat. Casted areas need to be kept dry and away from water, thus they cannot be washed. To address the rashes and itchiness, medical personnel would be required to remove and reapply the cast which disrupts the healing process of the body part in the long term. A second medical concern is termed “compartment syndrome”, where when the cast is put on too tight it could restrict blood flow to the body part. It also necessitates the removal and reapplication of casts, or in the worst-case scenario it requires surgical intervention. For our last main finding, we found that there were mixed assessments on how the casting process impacted the lives of the interviewees’ patients. Some assessed that there was no disruption to their livelihoods, with some of their patients resuming physically strenuous tasks as per normal, while others commented on how the casting process disrupted social interactions, especially for teenage patients. To gain further clarity on the impact casts had on a user’s livelihood, especially for our intended group, we realized that further user research methods were required. We decided to do so by conducting interviews and surveys of previous cast users.

For interview conductions with previous cast users, every member of the team had interviewed at least 2-3 students they knew who had experienced wearing a cast. We mainly targeted students from ages 17-23 because this demographic was the one we had the most access to as college students at UC Berkeley. Specifically, we targeted people who had broken their arms because upon online research, arm fractures account for 50% of adult fractures, and they’re the second-most common fracture site in children (Thebarghe).

Throughout the interview process, we created a standardized set of interview questions so we could efficiently compare the collected answers and group the data easily. You can access the Standardized Interview Questions in *Appendix (2)*.

As for how we decided to group the data, we created personas to categorize the frequent trends we observed in people’s answers. We created three personas, all concerning various pain points and findings people had concluded from their experiences in wearing casts. Such pain points included the unbreathable material resulting in a foul smell from trapping sweat, being extremely scared of removing the cast due to the fear of sharp objects, having sensitive skin that was inflamed and irritated by the casting material, or trying out a new modern cast but finding other technical and supply issues, etc. Further details can be found in *Appendix (3)* showcasing the Persona graph.

Lastly, we created a short survey to collect mass data in order to strengthen which pain points are the biggest priority for people. Through our cast survey, we answered a set of simple questions, including what type of cast they had, how they were injured, and what issues they had with the cast by filling a scale from 1-5 on how bad each issue was, as well as how they tried to handle each of the difficulties. We are

currently in the process of collecting our responses, but our preliminary findings show that most respondents claim that itchiness and breathability are their primary concerns.

## Competitors and VOA

In order to identify our main competitors, our team conducted extensive online research, surveys, and 1-on-1 interviews. Based on the patterns that we noticed in this information, we decided to break down our competition into three categories; traditional methods, modern methods, and secondary products. The most commonly used method of casting that people think of when they think of a cast and that more than 75% of our survey respondents reported use of, was a traditional plaster cast. We also discovered fiberglass casts are also fairly common. However, we created a VOA chart for the plaster method and used it as our baseline for comparison as this is still the most commonly used casting method today and has the most room for improvement in its VOA.

Since the development of modern casting methods is still new and not many people have had personal experience with them, we researched up-and-coming companies that are dominating this sector. Cast 21 and ActivArmor were both identified as direct competitors that are striving to target some of the same deficiencies in traditional casting methods. We decided to also create a VOA chart for Cast 21 as this was our closest competitor. See VOA charts below:

Lastly, we also considered, but did not create VOA charts for indirect competitors such as

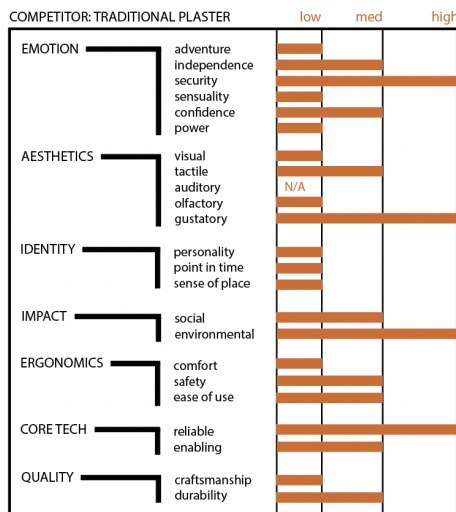


Figure 2: Plaster Cast VOA Chart

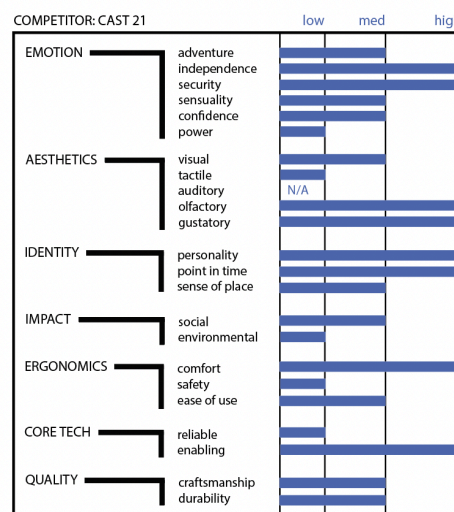


Figure 3: Cast 21 VOA Chart

secondary products that patients use to solve some of the issues brought on by shortcomings in conventional casts. We focused on waterproof cast coverings, and itching/soothing creams and powders based on data from our survey.

The next step in this process was to create a target VOA for our own product and compare that against our baseline of traditional plaster casts. By analyzing the two next to each other, we observed three areas that offered the most room for improvement and aligned with our POG. Those target areas were emotion, ergonomics, and quality. These categories showed the biggest overall improvement when compared to the traditional cast which was the main goal of our project. Since we wanted to focus on decreasing the difficulty of daily tasks, specifically the independence, confidence, and power subcategories were important to take into consideration and all of those attributes were increased. In



addition, we also were trying to make the cast more comfortable to reduce irritation and other downsides that come with wearing a cast. In the ergonomics section, there was clear growth in comfort, safety, and ease of use which all help to achieve our POG. We also chose to target the quality aspect of our VOA because we did not want to diminish the general effectiveness and fundamental craftsmanship of the cast as this is a medical product that needs to maintain its healing capabilities. Focusing on the physical nature of the cast would also help to improve some of the casts' problems such as creating a more seamless and less scary removal and application process.

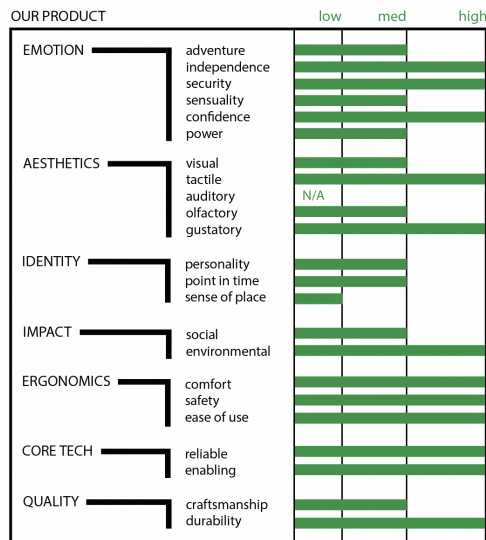


Figure 4: Our Product VOA Chart

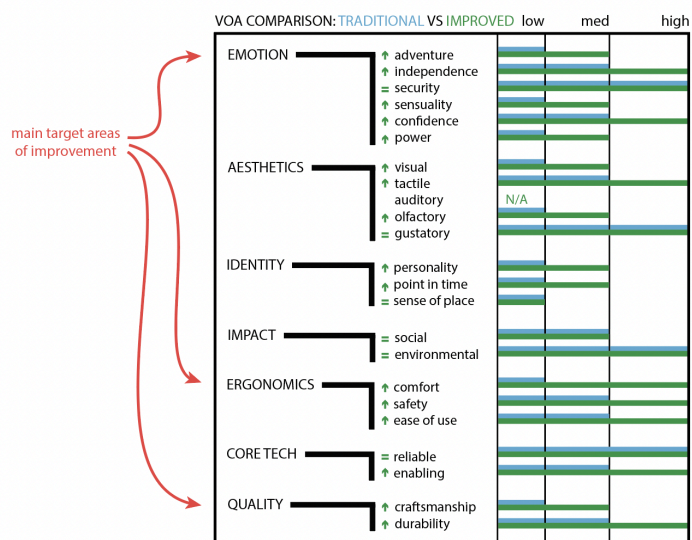


Figure 5: Proposed Product vs. Plaster Cast VOA Comparison

## Product requirements

After conducting all our interviews and analyzing our competitors, we had the chance to figure out the most critical features we must include in our product. From our medical interviews, we learned that the immobility of a cast could not be compromised for a successful bone recovery, regardless of how uncomfortable it might be for the patient.

Secondly, from our user interviews, we determined that the most annoying property of average casts was the smell it produced, which was a direct result of the cast not being fully waterproof. Furthermore, some patients admitted to having stuck a pen or another material inside the cast to prevent itchiness, which is highly risky for the cast healing process. Hence, we identified that we should definitely address itchiness in our product design and also make it waterproof.

Lastly, our VOA charts helped us compare conventional and modern casts in the market, and specify each of their advantages and disadvantages. Continuing from our findings from our medical and patient interviews, we concluded that modern casts did a much better job in providing a comfortable experience for patients, in terms of resolving itchiness and producing waterproof casts. However, since modern casts incorporated large holes in their cast design to address itching and skin breathing, traditional casts were more successful in securing the broken bone than our newer competitors. Also, we deduced

that the amount of information available for customers about these latest-technology casts were not enough to make them feel comfortable and safe before putting these cast on. Hence, we agreed that an important requirement for our product was transparency and making sure answers to all potential questions and concerns were available online.

In summary, we finalized our product requirements as:

1. Secureness of the cast
2. Waterproof
3. Itchiness
4. Transparency of Information

## Revised POG

How might we improve the design and functionality of arm casts such that we make it more comfortable for teenagers that live alone to make their daily routine easier, while not compromising from the cast's medical purposes?

## References & Appendix

### References:

Hakeos, W. (2020, September 18). *What you need to know about childhood fractures* | Henry Ford Health ... What You Need To Know About Childhood Fractures. Retrieved March 19, 2023, from <https://www.henryford.com/blog/2020/09/what-you-need-to-know-about-childhood-fractures>

Thebarga, S. (n.d.). *Health Library*. Here Are The Five Bones You're Most Likely To Break. Retrieved March 18, 2023, from <https://www.gohealthuc.com/library/here-are-five-bones-youre-most-likely-break>.

### Appendix:

#### Appendix (1):

#### Interview Questions with medical professionals

The prepared line of questions followed the list below, with occasional deviations depending on the interviewee's responses:

<b>Interview Questions:</b>
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1.	What is the primary medical function of casts?
2.	What considerations go into the type of casts used for different body parts?
3.	What considerations go into the type of casts used for patients of different age ranges?
4.	If you had to make changes to the casting process, what would you do and why?

## Interview Transcripts with Medical Professionals

- **Interview 1:** Lim Kia Teng, Graduated Medical Student from National University of Singapore currently in 1<sup>st</sup> year of hospital rotation, 7 Feb 2022

<u>Speaker</u>	<u>Transcript</u>
Bryan:	Hey Kia Teng, been a long time! Thanks for doing this!
Kia Teng (KT):	No worries! Very happy to do this!
Bryan:	I was wondering if we could start with a quick introduction to what casting is all about?
KT:	<p>Sure! Casting usually is a process pointing to multiple materials like crepe, orthobon which is a soft wool like thing, and the cast itself is either plaster of paris (PoP), or fiberglass which is a bit harder. Generally different fractures need different extents of casting and splinting, this is a general guide.</p> <p>(Shares notes through zoom message)</p> <p>Creds to my friend's notes hahaha maybe don't forward or share this because it's not my notes. but just to give you a general idea of how casting is different for different body parts.</p> <p>Casting's primary purpose is to immobilize the body part to allow the fracture to heal properly.</p>
Bryan:	How does the healing process work?

KT:	Long story short it's different for bones to heal via casting versus surgery which grants more stability, because the way you want them to heal is different. Healing via casting allows for relative stability and secondary bone healing, the bone heals via endochondral ossification, clinically this manifests as callus formation on XR. For surgery because you put plates and screws so there is absolute stability, the bones heal via compression through a cutting cone mechanism with no callus formation on XR. Can read more about the mechanisms but cutting cones is basically osteoclasts in front of the cone, osteoblasts behind. osteoclasts destroy bone, osteoblasts make new ones. The blood vessel is at the center of the core. and the whole model is likened to a cutting cone across fracture site
Bryan:	If you had to innovate and improve on some of the problems the current process of casting has, what would you do?
KT:	Some issues with a full cast I would address are: discomfort because cannot bathe that area, itchy/rashes because heat trapped plus sweat. In worse cases compartment syndrome occurs when the cast is too tight then physicians have to cut open the cast
Bryan:	What are some of the challenges that teenage cast users face? Do they face unique challenges that other target groups?
KT:	Nah... when I had a cast I performed in a dance troupe!
Bryan:	Oh what the cast seemed to not affect you at all then!
KT:	After 2-3 days you'll get used to it. Immobility is required for healing. But if really cannot take it off, fiberglass casts that can be opened and closed like a clamp for bathing, airing etc. Easy idea is making a case with fiberglass, separate into half with cast saw and attach hinges.
Bryan:	What did you need to do to maintain the casts?
KT:	I had to keep it dry and away from water. It's difficult for long arm cast/ leg casts hahaha and sometimes when you are doing work it can become quite dirty and sweaty. Hard to clean unless the cast can be removed.

Bryan:	I see, thank you so much for your insights, that's all the questions I have!
KT:	No worries and all the best for your project!

- **Interview 2:** Tan Shyn Yi, Graduated Medical Student from Nanyang Technological University currently in 1<sup>st</sup> year of hospital rotation, 8 Feb 2022

Speaker	Transcript
Bryan:	Hey Shyn Yi can't believe it has been 12 years thanks so much for responding to my Instagram story!
Shyn Yi (SY):	Haha yeah hope you're doing good!
Bryan:	I was wondering if we could start with a quick explanation on what the function of a cast is and why it needs to have limited mobility?
SY:	I'm not super sure but I think is for proper positioning of the bones and avoid moving it.
Bryan:	Is there a different casting process for different bones in the body? Or are they mostly the same?
SY:	It's a different cast for different bones like the way they cast it but they use the same base materials to form the cast, the main concept is the same for different body parts, I can't demo to you in person but I could show you a video and explain the process on how it works.
Bryan:	That would be awesome!

SY:	<p>Sweet let me pull it up.</p> <p>(As video is playing: <a href="https://www.youtube.com/watch?v=JCdviXFHKW4">https://www.youtube.com/watch?v=JCdviXFHKW4</a>)</p> <p>The first step of the casting process involves a stocking, serving as the base for the cast as it allows adhesive layers to be added on top of it. The second step of the casting process involves a padding rolled over the 1<sup>st</sup> layer, with the padding rolled over itself to ensure that the layer is even throughout. The third step of the casting process involves adding layers of plasters to ensure that the cast is not porous. The final step of the casting process involves adding the crepe bandage layer, the firmest and hardest layer, to ensure protection for the bandaged body part while ensuring its immobility.</p>
Bryan:	Wow this is super informative really appreciate it! Out of curiosity how about casting for the elderly vs kids would there be any differences/considerations there?
SY:	Hmmm for this one I'm not sure... I don't know if this is relevant to you - elderly and kids will have different kinds of fractures because of their risk factors... Also elderly and kids may be offered different kind of treatment (surgical vs expectant) so based on that whether there's a cast and what kind of cast might differ.
Bryan:	What's surgical vs expectant?
SY:	Basically surgical means they do surgery to fix the bone and expectant just means you don't do surgery and just wait for the body to heal but other than age there are other indications on whether to do surgery or not.
Bryan:	I'd presume for kids it's more expectant and for elderly it's surgical?
SY:	Haha not necessarily, some elderly can't do surgery cause of other medical conditions also. Also apologies I have a rotation beginning in about 5 minutes so I'll need to cut this interview short but I hope this was helpful for you! If you ever need additional information please do reach out!
Bryan:	Oh no worries thanks so much for the download!

SY:	Haha no probs! Just hoped that I was able to help!
Bryan:	For sure yeah thank you so much!

- **Interview 3:** Surya Varma , Graduated Medical Student from Nanyang Technological University currently in 1<sup>st</sup> year of hospital rotation, 10 Feb 2022

<u>Speaker</u>	<u>Transcript</u>
Bryan:	What's up old friend it's been a long time.
Surya Varma (SV):	Hell yeah bro just happy to help.
Bryan:	Maybe we can start with the basic function of casts?
SV:	If I were to succinctly describe their function it would be the immobilization of the bone fragments in their correct orientation so that they can fuse and heal correctly.
Bryan:	If you had to innovate and improve on some of the problems the current process of casting has, what would you do?
SV:	Hmm I will be honest, from a physiological standpoint I think casting is already the most effective technique available for bone fixation post-fracture! Perhaps one thing you can look into is reducing the risk of compartment syndrome in limbs that are put into casts? It is a surgical emergency that can be caused by restricted blood flow within the limbs, and oftentimes casts may cause this because they are a rigid structure and force the limb and its entire blood supply into a restricted space. That being said I am but a measly 1 <sup>st</sup> year lolz take whatever medical information i give you with a pinch of salt...
Bryan:	What talking u bro one day you'll be Dr Surya and I'll find u to fix me! What about casting for the elderly do they face anything unique different?

SV:	Hmmm let me think ah... I would say casting is quite good for the elderly as it is because they comprise the majority of fractures statistically speaking... I guess if one thing can be worked on, it can be making it easier to maintain? Because can be a hassle for them to upkeep and take care of.
Bryan:	What do cast users have to do in upkeeping and taking care of the casts while it is on? Heard that for the elderly they face difficulties in maintaining the casts.
SV:	A lot of steps, mainly to do with maintenance of hygiene of the casts like wrapping it up when showering, going out of your way to keep it clean, etc etc... but every now and then if the cast needs replacement like when the cast gets too loose or is too tight from the get-go, it needs to be taken out and reapplied.
Bryan:	I see... at the moment we are trying to narrow down the target group on which we hope to create redesigns of the casting process for, while we are looking into casting for seniors we are also looking into casting for teenagers. What are some of the challenges that they would face that other target groups like seniors or the elderly would not?
SV:	I think teenage cast users generally have a much better time with casts than most other people, but I guess one aspect you need to consider is the compromise on social mobility. They won't get to do the things they enjoy with the people they enjoy for the duration of the casts. Younger patients do more often undergo casting alone, while for older patients it usually goes in tandem with surgical intervention.
Bryan:	Just touched upon this topic in a previous interview! What would you say are the differences in surgical and casting methods?



SV:	Fundamentally there isn't much difference. Just that surgery is used sometimes to facilitate the process of bone healing in cases where casting may not be too good of an option, for instance in internal/external fixation of bones. The real big difference comes when you're talking about arthroplasties or joint replacements, because it has become a foregone conclusion that the bone is incapable of healing or is irreversibly damaged, so it needs to be replaced. Generally, you need to keep in mind that orthopaedic principles would dictate that if the person is able to in terms of age and ability, it is best to let the bone heal on its own and to do what you can to facilitate that process
Bryan:	Most cast users face challenges when it comes to things like itchiness, rashness and compartment syndrome, but what is your take on the issue of lack of mobility amongst cast users (lack of ability to do daily tasks) and is there any way to address it without compromising the medical function of casts?
SV:	It is extremely difficult, I would say impossible even, to address the lack of mobility of casts without compromising their medical function, because bone turnover and repair as a physiological process is an extremely delicate process. if let's say the cast is misaligned, even for a bit, the bone could be fused in an awkward or incorrect angle or position for a lifetime. That said, I believe the issues that you mentioned are still pertinent issues that need to be addressed, and can be addressed with innovation.
Bryan:	Well bro that's all the questions I got, thank you so much for your help on this man I really owe you one.
SV:	Of course bro anytime!

## Appendix (2):

### Standardized Interview Questions with Former and Present Cast Users

1. Hello. Thank you so much for doing this interview with me. Can you tell me a little about yourself? What's your name, your age?
2. Can you describe your bone injury to me? How did it happen? Which part of your body was injured? What age were you when you had the injury?
3. Where was the cast put on? For how long did you have the cast on?

4. What do you remember being the biggest problem of having the cast on?
5. Could you write while your cast was on? If yes, what were the discomforts of writing with a cast?
6. Could you type or use your computer when the cast was on? What was uncomfortable about it?
7. What daily life tasks do you remember having a hard time with when you had your cast on, especially as a student?
8. Did you have any problems with your cast being too tight, or too loose? Did your cast scar the skin around its ends?
9. Did your cast cause any skin irritations?
10. Was it hard to put clothes on while you had a cast?
11. Was it ever too hot inside the cast?
12. What about showering or washing your hands? Did you ever get your cast wet?
13. Was it ever itchy inside the cast? Did you ever try to scratch inside your cast?
14. Did you have any problems with adjusting after your cast was removed? Was there any loss of tissue or muscle? Did it smell bad?
15. Lastly, would you have any recommendations for us on ways to improve your experience with an arm cast as a student?
16. Thank you so much for the interview! Your insights gave us extremely valuable information about the user experience:)

## Appendix (3):

### Personas Graph

# Personas

Person:		Information:	Injury:	Pain Points and Findings:
1	Dancing Darla	<b>Age:</b> 18 High School <b>Junior</b> <b>Activeness:</b> dances daily for 2-3 hours on weekdays	<b>Area:</b> broken forearm <b>Cause:</b> fell off her bike from downhill <b>Cast type:</b> plaster <b>Casting length:</b> 7 weeks	- <b>Unbreathable material</b> → sweat trapped inside arm from hot dance classroom + very itchy but hard to scratch = <b>smelled foul</b> after taken off - Inconvenience with showering bc plaster <b>cannot get wet or else might result in infection/irritation</b> → had to wear a plastic bag covering each time
2	Scared Sally	<b>Age:</b> 17 High School <b>Junior</b> <b>Activeness:</b> swim team practice for 2 hours every weekend	<b>Area:</b> broken forearm + wrist <b>Cause:</b> minor collision on electric scooter <b>Casting type:</b> fiberglass <b>Casting length:</b> 7-8 weeks	- <b>VERY scared of sharp objects</b> → doubtful and fearful of the cast removal process - <b>Sensitive skin</b> → very annoyed at the uncomfortable material = very red and dry skin around the edges of the cast – had to use a <b>cool blow dryer to calm skin</b> through the space on top + <b>stick a pencil in cast</b> to scratch
3	Techy Tim	<b>Age:</b> 19 College <b>Sophomore</b> <b>Activeness:</b> only goes on walks every weekend; more of a CS indoors person	<b>Area:</b> broken forearm <b>Cause:</b> minor car crash <b>Casting Type:</b> Cast 21 <b>Casting Length:</b> 7 weeks	- Although the cast was a lot more breathable, it also made Tim <b>scared bc the gaps on the cast were too big</b> → could possibly injure yourself in some other way - <b>Very hard to find this type of cast commercially</b> → not a lot of doctors are knowledgeable on its usage + not offered in most hospitals = <b>inconvenient</b>