Deliverable B - Needs, Problem Statement, Metrics, Benchmarking and Target Specifications

Submitted by

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# **Introduction**

During our lab on September 20th, 2022, we had the pleasure of meeting with our client on zoom. Our client explained their problem very thoroughly, allowing us to fully understand the problem and empathize with them. This deliverable will include a list of client statements interpreted into a list of prioritized customer needs, and a problem statement as well as a list of functional and non-functional metrics. We will also include our benchmarking process and target specifications.

# **Client Interview Reflection**

Our client was very clear about what they were looking for. They explained the injuries the chair was causing, and the different types of obstacles that cause them. They showed us the device they are currently using to resolve this problem and gave a thorough explanation of why it isn’t working. This gave us a product to begin the benchmarking stage. The client explained how the current device causes them to sit, and how it affects the seatbelt. This allowed us to understand the shortcomings of the current design. They were also very open about their personal medical history, which helped us understand why this project was so important to them and allowed us to empathize better.

# **Client Statements:**

* The client has Ehlers-Danlos Syndromes (EDS), which causes an increased amount of hyperextension and dislocation of joints due to connective tissue damage. The client is also diagnosed with epilepsy and has anaphylactic reactions.
* The client’s wheelchair is reclined to ensure she does not fall when having a seizure.
* After starting to use the wheelchair, the client’s back dislocated when extra force was encountered (via a bump, pothole, or similar small obstacle).
* The client has tried using a foam cushion like ones used in computer chairs, however they have found that it adds too much width to the padding, leading to increased pressure from the seatbelt.
* The client thinks having something half the height of the cushion would be a good starting place.
* The last time the client injured their back was 2 weeks prior to the meeting (around the week of September 5th.
* The client’s idea of a solution is anything from an idea to a physical product.

# **Client Needs (% Importance)**

1. (55%) The Product should alleviate or mitigate the force on the client’s upper back when the wheelchair is reclined.
2. (10%) The Product must be comfortable to use for several hours a day.
3. (10%) The Product should maintain the width of padding on the lower back of the chair.
4. (10%) The product must be able to strap to the chair.
5. (5%) The Product should fit on the chair
6. (5%) The Product should be easy to manufacture (no equipment necessary) or cheap to ship (light, compact), as the client is not local.
7. (5%) The Product should match the aesthetic of the rest of the chair.
8. (5%) The Product should remain within cost constraints (< $100 CAD)

# **Problem Statement**

The client is experiencing discomfort when reclining in their wheelchair due to their EDS diagnosis and insufficient padding. Our product will mitigate force on the client’s back while maintaining the dimensions of the chair’s lower backrest.

# **Metrics**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Metric # | Need # | Functional Metric | IMP (1-5) | Units |
| 1 | 3 | The product cannot change the width on the bottom of the back of the chair.  | 3 | Cm |
| 2 | 1 | The Product should transfer force from backrest to upper back | 5 | N |
| 3 | 2 | The product must be comfortable for long use  | 3 | Hrs |
| 4 | 5 | Product same size as chair | 3 | in  |
| 5 | 6 | The Product should be easy to manufacture | 4 | N/A |
| 6 | 4 | The product must attach to the chair without modifying chair | 4 | N/A |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Metric # | Need # | Non-Functional Metric | IMP (1-5) | Units |
| 1 | 7 | The aesthetic of the cushion matches the chair  | 2 | N/A |
| 2 | 8 | The cost of the product is under 100$  | 2.5 | $ |

**User Benchmarking**

|  |  |  |  |
| --- | --- | --- | --- |
| **Design Specifications** | Computer Chair Cushion  | Qutool Memory Foam Cushion (2) | SmartMove Cushion (1) |
| Large amounts of upper back support | It has back support but too much lower back. | Provides excellent back support and relieve common symptoms that result from body weight pressing on the lower back area | Not good lower or upper back support. |
| Comfort | Comfortable enough but it doesn’t really improve the quality of life too much. | Memory foam so it automatically takes the shape of the back and there is a non-slip bottom to keep the seat cushion in place. | High-density foam cushion encapsulates a viscous gel bladder, conforms to your body's natural contours |
| Thickness of product | Product is too thick. | The product is not too thick and depending on the pressure put in it can get less thick  | Thick and might be uncomfortable for her legs after longs hours of sitting  |
| Able to be replicated  | Can be purchased online. | Can be purchased on amazon and be delivered in 2 days  | Can be purchased online  |
| Size of product | Size of whole back of chair. | 13x13x4.3 for the upper part and 18x14x3 for the lower part. | Undefined but hopefully has one size that fits our needs. |
| Cost of product | Around $80 | Around $120 | Around $50 |
| Aesthetic  | Doesn’t match chair | Could match with the wheelchair  | Could match with the wheelchair  |
| Easy to attach to chair  | Velcro straps to hold on the back of the chair. | 4 adjustable elastic straps (2 for the upper part and 2 for the lower part of the chair). | Does not have straps so it must fit perfectly with the dimensions of the wheelchair. |

# **Target Specifications**

|  |  |  |  |
| --- | --- | --- | --- |
|  | **At Least** | **At Most** | **Ideally** |
| **Functionality** | Cushion improves client's pain while going over bumps 50% of the time. | Cushion improves client’s pain while going over bumps 100% of the time | Cushion improves client’s pain while going over bumps 90-95% of the time. |
| **Aesthetics** | Cushion is noticeable on wheelchair while client is using it.  | Cushion is not noticeable on wheelchair. | Cushion is only noticeable when the client is not in the wheelchair. |
| **Ease of Use** | Client is unable to install cushion on the wheelchair by themselves. | Client can install cushion on the wheelchair by themselves. | Client can install cushion on the wheelchair by themselves. |
| **Efficiency** | The cushion can be fully installed in five minutes. | The cushion can be fully installed in one minute. | The cushion can be fully installed in one to two minutes. |
| **Durability** | The cushion lasts six months without needing to be replaced. | The cushion lasts upwards of two years without needing to be replaced. | The cushion can last up to two years without being replaced. |

**Conclusion**

Upon speaking to the client, we were able to gain a better understanding of what was expected from us in terms of the wheelchair cushion design. This conversation also provided the team with the ability to empathize with the client by understanding the challenges the current cushion causes them in their day-to-day life. Due to their illnesses, the client has made it clear that safety is their priority when it comes to the cushion. Additionally, the client needs the cushion to be comfortable for extended periods of use. The team was shown the current cushion, which was used to start the benchmarking process. From this, the team was able to identify the functional and non-functional metrics. During the benchmarking, the team discovered that the main challenge was going to be keeping the price under the $100 budget, so different methods have to be considered to keep the price below a certain point. Based on all the above information, the target specifications could be decided. The team identified the ideal situations for the functionality, aesthetics, ease of use, efficiency, and durability of the product and will reference them throughout the project.

**Wrike Snapshot:** <https://www.wrike.com/frontend/ganttchart/index.html?snapshotId=QsHwSMsqXFqMhDehSnBdzVMUgnlvtdUV%7CIE2DSNZVHA2DELSTGIYA>

**References**

(1) [SmartMove Medical High Density Foam Gel Seat Cushion- 3 Inch Wheelchair Cushion- Car/Office/Chair Cushions : Amazon.ca: Health & Personal Care](https://www.amazon.ca/SmartMove-Medical-Cushion-Wheelchair-Cushions/dp/B08PW7S29N/ref%3Dsr_1_37?crid=PI1LV329B82V&keywords=wheel+chair+cushion+covers&qid=1664048993&sprefix=wheel+chaircushion+covers%2Caps%2C97&sr=8-37)

(2) [Qutool Orthopedic Memory Foam Seat Cushion and Lumbar Support Back Pillow for Lower Back Tailbone and Sciatica Relief Office Chair and Car Seat Cushion Set with Premium Adjustable Strap (Black) : Amazon.ca: Home](https://www.amazon.ca/Qutool-Orthopedic-Tailbone-Sciatica-Adjustable/dp/B074CV2HQC/ref%3Dasc_df_B074CV2HQC?tag=bingshopdesk-20&linkCode=df0&hvadid=80058281925694&hvnetw=o&hvqmt=e&hvbmt=be&hvdev=c&hvlocint=&hvlocphy=&hvtargid=pla-4583657827007387&th=1)