STRATUS

ASSISTING HOMECARE FOR PERSON WITH OBESITY

Han Yang

Assisting Homecare for Person with Obesity

by

Han Yang

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Supervisors: Catherine Chong and Sandro Zaccolo

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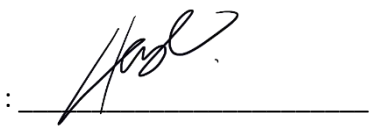
Student Signature : 

Student Name : Han Yang

Abstract

Healthcare providers play an essential role in Canadian society. The duties of a Personal Support Worker (PSW) are to help take care of those who are ill, elderly, or need extra support for daily tasks (OPSW, n.d.). Therefore, it is vital to keep healthcare providers safe and reduce their chance of getting injured in their workplace. According to the 2014 Canadian Community Health Survey, over 5 million adults are obese; according to the 2015 Canadian Health Measure Survey, 30% of Canadians are obese and may require medical support to manage their Obesity (Obesity Canada, 2021). More importantly, people who experience immobilization from obesity with ageing require extra daily support from healthcare providers, such as rolling over, standing, and transferring between beds and chairs. This work environment increases the possibility of PSW developing physical injuries. This thesis proposes an in-depth study of healthcare providers' challenges when caring for obese individuals at home, empathizing with people with obesity to discover the solution of enhancing their independence. Qualitative and quantitative research will collect data on these challenges and opportunities with interviews, surveys, and user observation. This information will advise a one-to-one human-centred design solution that better assists healthcare providers in caring for people with obesity at home.

***Keywords**:* Personal Support Worker (PSW), Obesity, Injure, homecare

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Chapter One: Introduction

Chapter one aims to discover the opportunities, general problems, and social context that could become the rational and significant support for the thesis research and solution through this thesis project.

Figure 1 – Obesity Canada, In the Hallway, Retrieved from: https://www.flickr.com/photos/obesitycanada/43357602194/

1.1 Problem definition

Canada's population is during a fundamental shift. In 2012, almost one in seven Canadians was a senior; by 2030, that number will jump to nearly one in four (Government of Canada, 2021). Homecare allows seniors to live at home with dignity and spend valuable time with their families. Personal support workers play an essential role in Canada's homecare community; they provide responsive, resilient, and adaptive personal care to those needed (OPSW, n.d.). But, in the homecare setting, individual support workers cannot avoid taking care of clients with Obesity, which increases the risk of work injury. Over the past decade, progress has been made by several groups of healthcare professionals and designers to create rooms in hospitals that are safe and accessible for patients with bariatric (Obesity Canada, 2021). Still, the current homecare setting for Obesity limits their independence and accessibility.

Therefore, this thesis report will examine how to create a holistic design to enhance the experience and independence of the person who lives with obesity and needs homecare daily; and it can provide efficiency and safety for personal support workers.

1.2 Rational Significance

The critical question to be answered	Essential information to be determined	Research tools
How to mitigate the challenges for personal support workers from their work environment?	The cause of challenges The current work environment	Literature review 1:1 Interview
How may we mitigate the dependency for the person with Obesity?	Needs for care Range of ability Lifestyle	Literature review User observation

		Video analysis
How may we mitigate the physical discomfort for personal support workers?	Major tasks per Day Workflow Product in use	User observation 1:1 Interview Ergonomic Study
How to determine the proper user group?	Target demographic User behavior	Literature review User observation
What are the needs for the design solution?	Existing solutions	Information research 1:1 interview
How can the comfort of the environment impact the value for individuals?	Semantic Aesthetics	1:1 Interview Ergonomic study

1.3 Background / History / Social Context

Obesity is a progressive, relapsing, chronic disease that affects a large portion of the population globally (Obesity Canada, 2021). Obesity is a complex chronic disease caused by many factors such as genetics, physiological, psychosocial, and environmental factors. According to the 2015 Canadian Health Measure Survey, 30% of Canadians are obese and may require medical support to manage their Obesity (Obesity Canada, 2021). That means almost one of the third Canadian lives with obesity. With the increasing population of obesity, the need for bariatric furniture or equipment has increased. But, people who live with obesity also require bariatric furniture at home and aim for personal home care.

Homecare has shifted from housekeeping to personal care in the past decades. For the past couple of years, emotional support has provided more home care for individuals, including from retired home to person's house. The Canada Government also aims to accomplish the goal

that most seniors can spend their retirement time at their homes with dignity and with families. Therefore, having a better connection between a personal support worker and the client with obesity would benefit both users.

The local community homecare facility provides the bariatric equipment that individuals use. The facility most often purchases equipment from what is in use in the retirement home or hospital. All the PSW would have the same knowledge set while they go through the certification course.

Chapter Two: Research

The objectives of chapter two is to utilize the research from the users to define the profile, generate the practice, and observe their behavior. Together with the study, it comprises the current product to acknowledge the features and function of the market.

Figure 2 - Obesity Canada, Suite Gather, Retrieved From: https://www.flickr.com/photos/obesitycanada/44075842111/

2.1 User Research

The goal of understanding the user through the research is to have a human-centered design solution. This section included the stakeholders for the design solution and discovered the use of the product within their behaviors. The research methods used in this section are user observation, 1:1 interview, and literature review.

2.1.1 User Profile – Persona

The target user groups are generated as the primary, secondary, and tertiary users. The following section is in detail explaining the stakeholders, demographics, and user behavior.

Stakeholders

Primary User	**A person with Obesity and Personal Support Work**
	The primary user has indicated the direct use of the product daily basis. The person with Obesity who needs daily assistance often is us
Secondary User	**Visitors or Family Members**
	The secondary users indicate the person who would interact with the product in the residential environment. Visitors such as nurse needs to provide medical needs for a person with Obesity occasionally.
Tertiary Users	**Repair Personnel or Physician**
	The tertiary user indicated the user group interacting with the product outside the residential environment. Technical needs to provide repair and guidance for the development. The physician would interact with the device within the hospital setting.

2.1.1.1 Demographics

Person with Obesity

According to the Government of Canada, the person with Obesity is measured with their Body Mass Index (BMI), which measures their weight in relation to their height squared (Government of Canada, 2020). To be defined as Obesity, the adults are defined as having a BMI greater than 30.0 kg/m^2.

- **Age and Gender:**

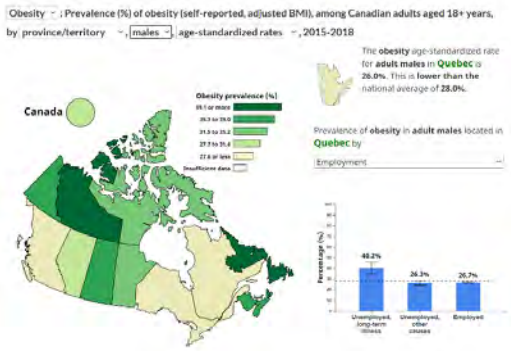


Figure 3 - Obesity Demographic Male, Retrieved from: https://health-infobase.canada.ca/canadian-risk-factor-atlas/

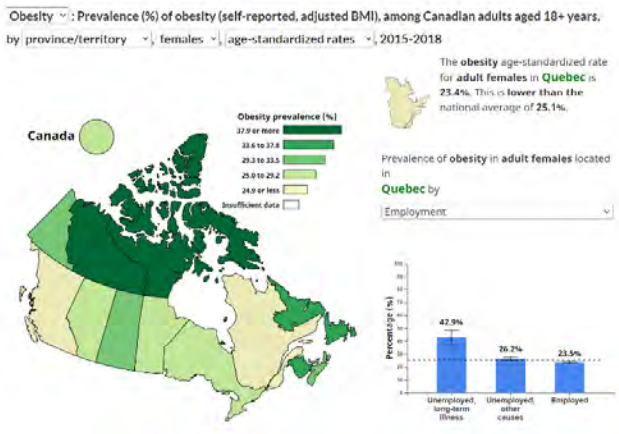


Figure 4 - Obesity Demographics Female, Retrieved from: https://health-infobase.canada.ca/canadian-risk-factor-atlas/

The two figures above represent the data of adults aged over 18 years prevalence of Obesity, from 2015 to 2018. According to the data, 25.1% of females are obese, and 28.0% of males are obese.

- **Education:**

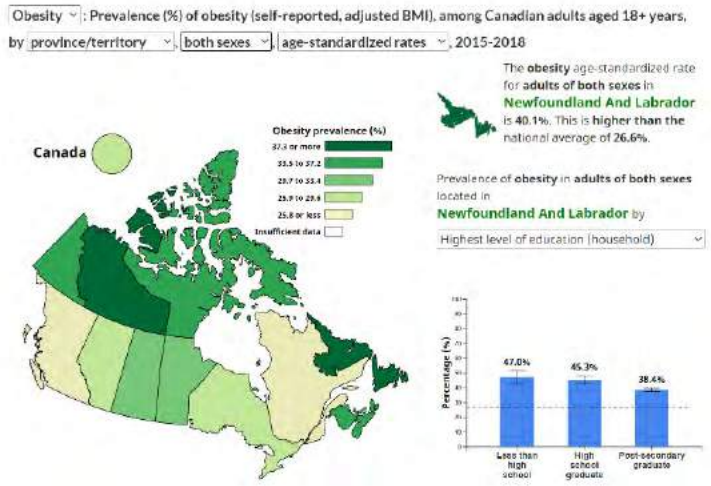


Figure 5 - Obesity Demographic Education, Retrieved from: https://health-infobase.canada.ca/canadian-risk-factor-atlas/

Figure 5 shows that most of the obese population has less than high school education, and 38.4% had post-secondary graduation.

- **Ethnicity:**

Obesity is a progressive chronic disease, and therefore there is no evidence to show the percentage of Obesity would vary by ethnicity. Yet, independent of age, household income, education and physical activity, Aboriginal people had elevated odds of overweight and Obesity compared with whites. South Asians and East- Southeast Asians. (Tremblay, Pérez, Bryan,& Katzmarzyk, 2005).

Personal Support Worker (PSW)

- **Age and Gender:**

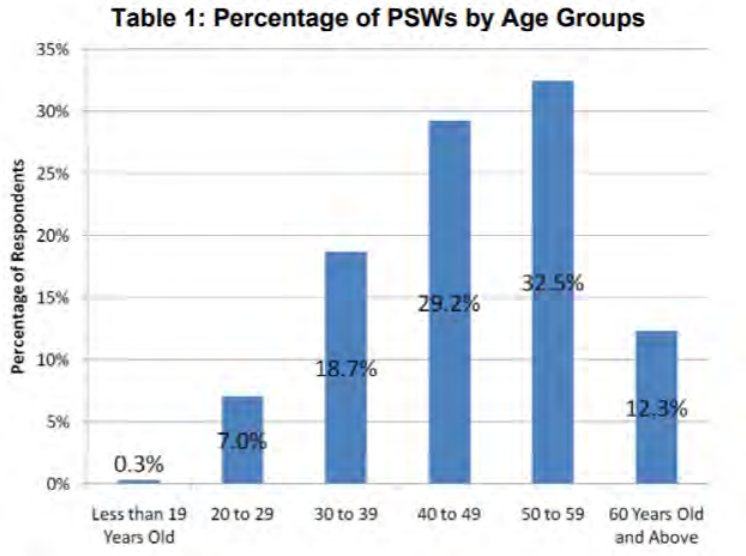


Figure 6 - Percentage of PSWs by Age, Retrieved from: https://www.ryerson.ca/content/dam/crncc/knowledge/infocus/factsheets/InFocus-Ontario%20PSWs%20in%20Home%20and%20Community%20Care.pdf

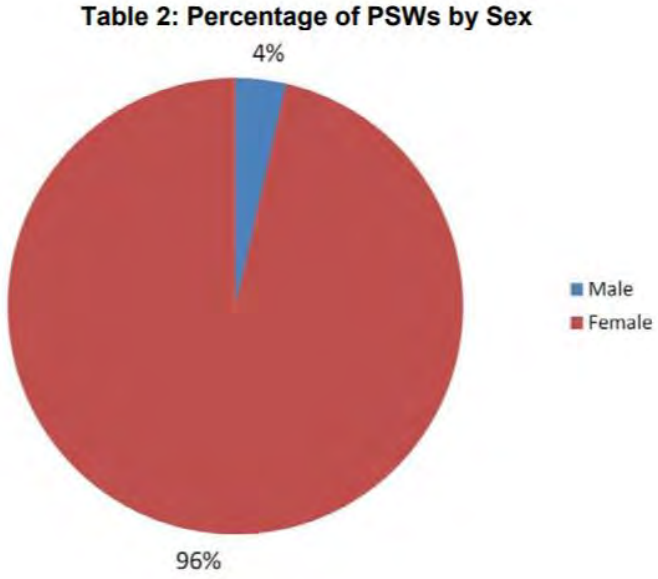


Figure 7 - Percentage of PSWs by Gender, Retrieved from: https://www.ryerson.ca/content/dam/crncc/knowledge/infocus/factsheets/InFocus-Ontario%20PSWs%20in%20Home%20and%20Community%20Care.pdf

Figures 6 and 7 show that most personal support workers are between the age of 50 to 59 years old, and 96% of them are female.

- **Education:**

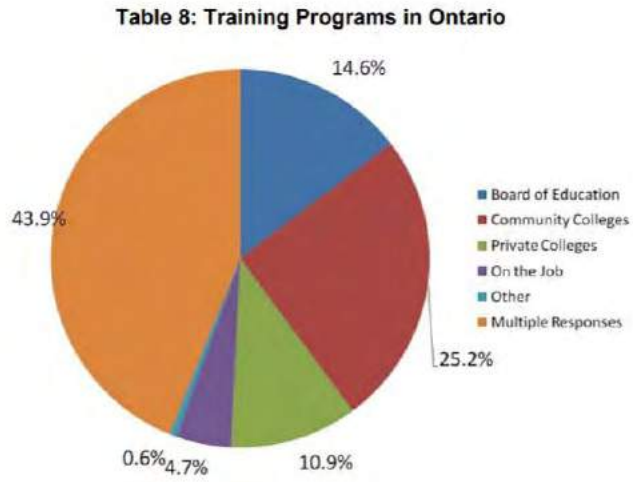


Figure 8 – Training Program in Ontario, retrieved from: https://www.ryerson.ca/content/dam/crncc/knowledge/infocus/factsheets/InFocus-Ontario%20PSWs%20in%20Home%20and%20Community%20Care.pdf

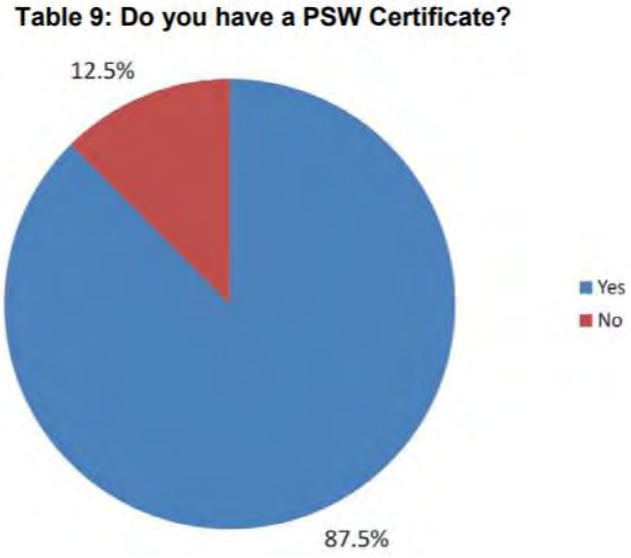


Figure 9 – PSW Certification Percentage, Retrieved from: https://www.ryerson.ca/content/dam/crncc/knowledge/infocus/factsheets/InFocus-Ontario%20PSWs%20in%20Home%20and%20Community%20Care.pdf

Most of the personal support workers have completed the certificate to achieve the ability of homecare, which means PSW are unregulated healthcare workers. Most of the PSW would graduate from community college for their education.

- **Work Setting:**

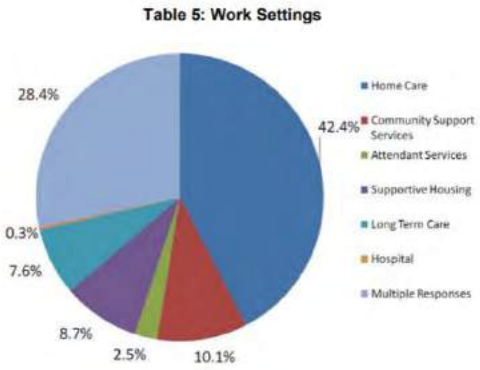


Figure 10 – PSW Work Setting, Retrieved from: https://www.ryerson.ca/content/dam/crncc/knowledge/infocus/factsheets/InFocus-Ontario%20PSWs%20in%20Home%20and%20Community%20Care.pdf

Most personal support workers are working in a home care setting, and 28.4% of them are working for multiple settings at the same time.

- **Ethnicity:**

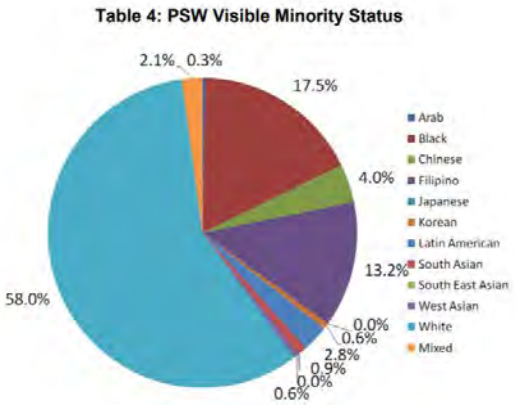


Figure 11 – PSW Ethical, Retrieved from: https://www.ryerson.ca/content/dam/crncc/knowledge/infocus/factsheets/InFocus-Ontario%20PSWs%20in%20Home%20and%20Community%20Care.pdf

The majority of personal support workers are white, and 17.5% of the personal support worker are black.

- **Experience:**

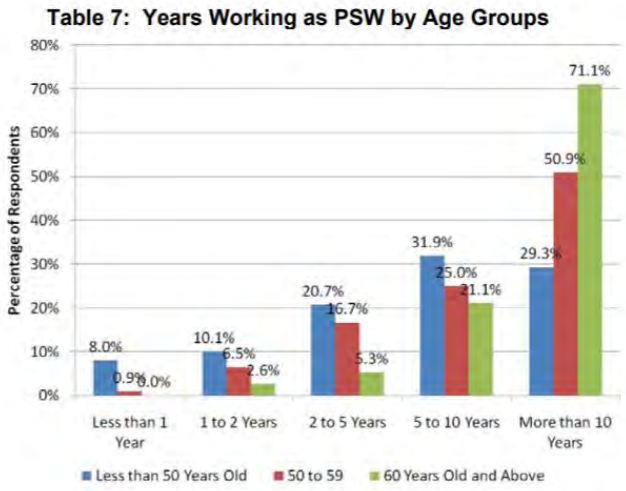


Figure 12 – Experience of PSW, Retrieved from: https://www.ryerson.ca/content/dam/crncc/knowledge/infocus/factsheets/InFocus-Ontario%20PSWs%20in%20Home%20and%20Community%20Care.pdf

Most of the personal support workers have ten years of experience in this field, and most of them are 60 years old or above.

2.1.1.2 User Persona

This thesis project is engaged with two primary user groups, a person with Obesity and a personal support worker.

Person with Obesity

Name	Mike McLean (Male)	
Age	70 years old	
Job	Retired Social Worker	
Education	Community College	

Location	GTA
Social	Family visits weekly or bi-weekly
Background	Divorced lives by himself Own a house Needs assistance and help from personal support worker daily Has PSWs visited three times per Day Weight 500 lbs.

Figure 13 - User Persona Obesity

Personal Support Worker (PSW)

Name	Alina Bai (Female)
Age	49 years old
Job	Personal Support Worker
Salary	$ 22 per hour
Education	College graduate, with PSW Certification
Location	GTA
Job Description	Working for the setting of home care and community support Work for eight or more hours per Day Needs to take care of 10 clients daily (average)
Background	Asian Immigrant Worked as PSW for over five years Experiencing muscle pain (lower back and wrist)

Figure 14 - User Persona PSW

2.1.1.3 User Behavior

- **Person with Obesity**

Mike has been retired for almost ten years. Mike lives alone. He has two children, one son and one daughter. Mike has a good relationship with his children. They would visit him once per week. Due to Obesity, he is also experiencing other chronic health conditions that need regular medication. Mike has PSW see him three times per Day. The tasks involved are to help him get up in the morning, help him with the toilet, and help him with cooking. Mike has trouble walking independently, so he needs to use a wheelchair to move around the house while the PSW is not around.

- **Personal Support worker (PSW)**

Alina has been working in this field for five years. She started working in the retirement house then transferred to the homecare setting. The majority of her shift is the night shift, which means her Day gets busier afternoon. Mike is his regular client. Each time she would have a similar task need to complete for Mike, she would be having another PSW with her for each session. Alina often meets with Mike around 7 PM for the night routine. She needs to help Mike with the toilet and do a sponge bath after that. The time duration would be 15 mins to 45 mins depending on the task she needs to complete for Mike.

2.1.2 Current User Practice

- **Frequency**

For primary users, the two groups would interact with the device daily. The person with Obesity would use the device as a sitting device, sleep device, the tool that helps them transfer between place A to place B. For PSW, the device is the tool that allows them to reduce the physical effort of input and to make sure the secure safe for the client.

- **Duration**

People with Obesity would spend most of their time on the device. They would interact with the device whether the PSW is with them or not.

The duration for PSW interacting with the device depends on the task or the time they need to spend with the client. When the task requires extended care, they will pay up to 45 mins. The shortest time with the obese client would be 15 mins. Especially for PSW, they would meet the client with Obesity once or twice per Day.

- **Social or Solitary**

The household provides all the tools. The person with Obesity would occasionally use the device outside of their house. PSW has no social or solidarity with the device or outside of the work with their client.

- **Motivation**

The motivation for using the device is to help all users with all the tasks they need to complete. When the device is easier to operate would increase the basis of the use.

- **Lifestyle**

The lifestyle of the person with Obesity depends on their mobility. When the device is more likely to increase their mobility, they are more likely to go out with their families or friends. PSW's lifestyle often has five or six days for work, and night or day shift depends on their schedule.

2.1.3 User Observation - Activity Mapping

The activity mapping is based on user observation and 1:1 interview results. Due to the COVID-19, the user observation is from existing videos prior to COVID-19 and reviewed with the

advisor. Image has been used in both mapping from *Day's video in The Life of Home Care* (ScottishCare, 2018).

- **PSW caring for the person with obesity**

Figure 15 - PSW caring for the person with Obesity, image retrieved from the video: https://www.youtube.com/watch?v=ITv53IhSwKk&list=PL398UKNH6OzisI42Oqi6p3q0CYHbXSjLs&index=6

The figure above represents the major task PSW needs to complete for a client with Obesity. Out of four major tasks, there are three of them that has the possible can would involving with assisting homecare device:

- **Transfer**: It usually takes about 15 mins. PSW needs to transfer the client from bed to commode, from commode to bariatric furniture, lastly from bariatric table to bed. Each transfer would happen at a separate time and need two PSW simultaneously.
- **Shower:** This section usually takes from 30 mins to 45 mins. The more independent client is not allowed to walk for a long time. PSW will use a sponge bath. The client has more dependency whey would guild them into the bathroom and help them take a shower.
- **Change:** This step is usually done within the shower or sponge bath. After the shower, they need to ensure the skin is dehydrated before they help them get dressed.

Figure 16 - User Experience, PSW caring for a client with obesity

The red line represents the experience for PSW. The blueline means the current experience for the client. The green line is the goal for both experiences.

- **PSW's day**

Figure 17 - PSW's Day, Image retrieved from the video :https://www.youtube.com/watch?v=ITv53IhSwKk&list=PL398UKNH6OzisI42Oqi6p3q0CYHbXSjLs&index=6

PSW often has a busy day. This activity mapping is based on one of the advisors. The advisor has a night shift. She often gets busy around 4:30 PM, cares for 13 clients, and feels most exhausted during the last couple of clients and after work.

Figure 18 - PSW's Day, User Experience

The red line is the current mood or experience for the PSW. The green line is the goal of the experience. PSW has a more negative feeling towards the end of the shift.

2.1.4 User Observation - Human Factors of Existing Products

The products used in the human factor study are related to the significant homecare tasks: transfer, sponge bath, and change. The PSW side included the back brace for study the injure prevention product study (Obesity Canada, 2021).

- **Bariatric Bed**: has three sections, allowing to adjust for different body positions. Designed for people with Obesity, the human factor is referred to as the width and the capacity functionally. The thermology of 'bariatric' refers to the furniture that has over 250 lbs.

Figure 19 - Bariatric Bed, retrieved from: https://www.transfermaster.com/bariatric-beds

- **Mechanic Lift**: This lift tool helps PSW lift the client for transfer between spots. The human action is the height of the lift, the adjustable range, and the overall size that would affect the path for PSW.

Figure 20 - Mechanic Lift, retrieved from: https://www.amazon.com/EZ-Way-Bariatric-Patient-Capacity/dp/B086GXS6ZC

- **Bariatric Wheelchair**: The wheelchair is differed from the regular due to the capacity and the width of the chair. It was designed for people with Obesity, considering the body size and followed with an ergonomic study.

Figure 21 - Bariatric Wheelchair, retrieved from: https://www.alimed.com/sentra-ec-heavy-duty-wheelchair.html

2.1.5 User Observation - Safety and Health of Existing Products

Design device for people with obesity or person with mobility is very important to be aware their safety issues, that may involve with the structure of the device or the materials of the device. Therefore, the material of Stratus needs to follow the safety regulation of:

- A medical device shall be designed and manufactured to be safe, and to this end the manufacturer shall take reasonable measures to
    - identify the risks inherent in the device.
    - if the risks can be eliminated, eliminate them.
    - if the risks cannot be eliminated,
    - reduce the risks to the extent possible,

- provide for protection appropriate to those risks, including the provision of alarms, and
- provide, with the device, information relative to the risks that remain; and
- minimize the hazard from potential failures during the projected useful life of the device.
- A medical device other than a decorative contact lens shall not, when used for the medical conditions, purposes or uses for which it is manufactured, sold or represented, adversely affect the health or safety of a patient, user or other person, except to the extent that a possible adverse effect of the device constitutes an acceptable risk when weighed against the benefits to the patient and the risk is compatible with a high level of protection of health and safety.

- A decorative contact lens shall not adversely affect the health or safety of a user, except to the extent that a possible adverse effect of the device constitutes a risk that is compatible with a high level of protection of health and safety
  - During the projected useful life of a medical device, its characteristics and performance shall not deteriorate under normal use to such a degree that the health or safety of a patient, user or other person is adversely affected.
  - The characteristics and performance of a medical device shall not be adversely affected by transport or conditions of storage, considering the manufacturer's instructions and information for transport and storage.

- Reasonable measures shall be taken to ensure that every material used in the manufacture of a medical device shall be compatible with every other material with which it interacts and with material that may met it in normal use and shall not pose any undue risk to a patient, user or other person.
- The design, manufacture and packaging of a medical device shall minimize any risk to a patient, user, or other person from reasonably foreseeable hazards, including
- flammability or explosion.
- presence of a contaminant or chemical or microbial residue.
- radiation.
- electrical, mechanical, or thermal hazards; and
- fluid leaking from or entering the device
- A medical device that is to be sold in a sterile condition shall be manufactured and sterilized under appropriately controlled conditions, and the sterilization method used shall be validated.
- A medical device that is part of a system shall be compatible with every other component or part of the system with which it interacts and shall not adversely affect the performance of that system.
- A medical device that performs a measuring function shall be designed to perform that function within tolerance limits that are appropriate for the medical conditions, purposes and uses for which the device is manufactured, sold, or represented.

- If a medical device consists of or contains software, the software shall be designed to perform as intended by the manufacturer, and the performance of the software shall be validated. The regulations above grounded the standards for Stratus, the solution of this device would base on the research and user's needs. All the detentions and design futures are considered by the existing product that out of market or through interviews.

2.2 Product Research

2.2.1 Benchmarking - Benefits and Features of Existing Products

This section compares the products that would interact with the primary user. The complete list research has studied the wide range of products to help both primary users and homecare. The entire product list is attached in Appendix C – Field Research (Product).

Shoulder Brace	Draw Sheet / Positioning Pad	No-Lift Booster	Bed Shifter	Powered Turing System	Patient Lift	Back Brace	Wrist Support
							
Benefits							
• Adjustability • Durability • Comfort • Lightweight • Easy to clean • Portable • Security	• Eco-friendly • Comfort • Durability • Effort reduce • Easy to clean • Multifunctional • Easy to grip	• Reduce the effort for boosting patients • Reduce caregiver back strain • Better gripping • Durability • Easy to clean	• Durability • Reduce the effort for lateral transfer • Customizability • Versatility • Easy to grip	• Safety • Secure • Reduce effort for caregiver • Comfort • Convenient	• Easy to use • Versatility • High Capacity • Comfort • Safety • Durability • Efficiency	• Adjustability • Stimulate blood circulation • Comfort • Portable • Easy to use and clean • Affordability	• Adjustability • Durability • Easy to clean • Portable • Safety
User in This Topic							
• Primary user: PSWs	• Primary user: PSWs / Nurse • Secondday User: Obese individuals	• Primary user: PSWs / Nurse • Secondday User: Obese individuals	• Primary user: PSWs / Nurse • Secondday User: Obese individuals	• Primary user: PSWs / Nurse • Secondday User: Obese individuals	• Primary user: PSWs / Nurse • Secondday User: Obese individuals	• Primary user: PSWs / Nurse	• Primary user: PSWs

Features							
• Made from neoprene blend • Has Extender strap • Fastener system • Arm 8" - 16" • Chest 27" - 39"	• Weight capacity 250 lbs • Has 8 reinforced handles • Waterproof materials • Double-side polyester • 24 x 16.69 x 9.7cm	• Weight capacity: 600 lbs • Smooth inner surface • Has two handles • Sewn in handel 46" x 46"	• Weight capacity: 600 lbs • Flexible plastics • Has 14 handles • Handles in an ergonomically correct position • 72" x 28" x 3/26"	• Powered equipment • Only one healthcare provider required • Weight capacity: 820 lbs • Sheet made from cotton • 36" x 88"	• Build-in LED screen • Made from steel • 2 batteries • Electric lift • Weight capacity 1000 lbs • 66" x 53" x 30"	• Made from 60% neoprene, 20% nylon, 10% elastic cotton, 10% velcro • Washtable materials • FDE Reg • 34" x 40"	• Made from elastic, polyester, cotton, and velcro • 22.1 x 11.94 x 2.54 cm
Opportunities							
• How to improve the versatility for healthcare providers' use	• How to keep the multifunctional feature while maintaining the safety while caring for obese individuals	• How to reduce the shoulder and wrist pain point while using the product	• How to keep the simplicity while maximize the comfort	• How to incorporate within residential space (easy installation and use)	• How to make the powered equipment more user friendly within residential environment	• How to improve the functionality while fit for all season and more comfortable	• How to improve the aesthetics and function that more fit into caregiver's lifestyle

Figure 22 - Table of Benchmarking

2.2.2 Benchmarking - Functionality of Existing Products

The existing products been researched on are the current products that PSWs would use for caring for person with obesity within home settings, these products are used on the person with obesity and PSW.

	**Function/Feature:** Obese individuals able to adjust the position by themselves Reduce the effort for. healthcare providers Build-in bedrails **Challenges:** Expensive for residential obese individuals The wide bed requires more effort for the healthcare provider
 **Patient Lift - $2,098**	**Functions/Features:** Six-point extra-wide cradle Adjustable and lock legs in position 600 lb weight capacity **Challenges:** Expensive for an individual residential user ($2,000+) installation challenge for residential user safety concern for residential user **Specifications:** Height: 74.5"-32", thickness 3/8", weight capacity: 600 lbs The lift is made out of metal

	Body sling made out of polyester mesh or solid materials
 **Wheelchair - $416**	**Function/Feature:** Up to 450 lb Dual crossbar choice of arm and leg styles adjust Hemi height **Challenges:** Expensive to customize the product **Specifications:** Seat width: 20", weight capacity: 450 lbs Made from chrome-coated carbon steel frame
 *Figure 23 - Recline Chair, Retrieved from: https://www.alimed.com/bariatric-care-cliner-12296.html* **Chair - $1,990**	**Function/Feature:** Obese individuals able to adjust the position by themselves Reduce the effort for healthcare providers Built-in headrest Three reclining positions **Challenges:** Expensive for residential obese individuals The wide bed requires more effort for the healthcare provider **Specifications:** Overall: 35" x 49", seat: 25" x 21" Frame made from steel Cushion made from density foam and faux leather

2.2.3 Benchmarking - Aesthetics and semantic Profile of Existing Products

This design concept combined the essential tasks that a personal support worker needs to complete for caring for a person with obesity at home. The primary functions in clued a sponge bath, helping with the toilet by changing the diaper and user commode, and helping transfer the patient between bariatric furniture. The aesthetics and semantic profile are studied for the major

equipment that the person with obesity would interact with, and the product may involve with help from their PSWs.

Figure 24 - Mechanical Lifts, retrieved from:

1- 1,2,3,4); a different kind of lift is installed on the ceiling (figure 1-5), used for transferring patients between A to B. The noticeable style that connects to the cultural context is that all. The machinal lifts deliver a mechanical and strong structure into the design. And the overhanging arm represents the arm of humans to give a safe and welcoming semantic for all users. The color used in the plan is primarily white, grey, and blue—which offers the cleaning and clam vibe to the user. In the home care setting, the portable lift is used more often than the ceiling lift because of the feasibility of the product. All the lifts had the visual design language of adjustable that delivered the message of useability. The major takeaway from the lift is to keep the overhanging arm that always makes sure the patient is in the centre of the equipment and the feasibility of operating the equipment.

Figure 25 - Bariatric bed, retrieved from:

Figure two shows the current bariatric furniture used in the homecare setting. Images one and two in figure two are the reclining chair used for obesity. The chair has a wheel to let the user move within the home freely, and it must be adjustable and recline to different positions. The semantic in these two products offer the look of a standard recline chair that normalizes a person's body condition with obesity. The thick cushion shows the product's comfort, with the leather being easy to clean and take care of. Images three and four in figure two are the typical bariatric bed used in the home for obesity. In addition to the regular bed, the bariatric bed offers the position change that allows the user to stay in bed while doing other daily tasks. The furniture from figure two has a rail or armrest to keep their safety and support their movement. The social content in the bariatric table is to remind the original function of the furniture but consider the ability for those who need extra care and different needs. The takeaway from this section is to keep the comfort and welcome semantic towards the design to achieve the semantic for the design the bariatric table is to remind the original function of the furniture but consider the ability for those who need extra care and different needs. The takeaway from this section is to keep the comfort and welcome semantic towards the design to achieve the semantic for the design.

2.3 Summary of Chapter 2

Based on the research from chapter one, this chapter is more focused on the user and the current products that in use. From the research on the target groups, the users has been narrowed into both person with obesity and their PSWs. The most common caring that PSW needs to be finish are transfer, help with shower, and help with toilet. The products that used in the home care settings are more likely the wheelchair, bed, and the transferring tools. Therefore, the later chapter is to analysis the needs and pains from the current situations

Chapter Three: Analysis

After the research on users and products, this section aims for a deep analysis of user's needs and the opportunities for the design solution. Moreover, this section includes the study schematic and ergonomics for the initial design solution.

Figure 26 - Analysis, by UX Indonesia, retrieved from: https://unsplash.com/photos/8mikJ83LmSQ?utm_source=unsplash&utm_medium=referral&utm_content=creditShareLink

3.1 Analysis Needs

This section aims to analyze the needs based on the previous research. The need analysis is combined from both existing products and the user interviews.

3.1.1 Opportunities

- Simple tools are standard, but lack of consideration for obese individuals use (it requires a lot of muscle use for healthcare providers)
- Powered tools are not universal and affordable for individuals at home

Injure protection types of equipment are not designed for the caregiver (it study the lifestyle of caregiver)

3.1.2 Latent Needs

- **Statement**: Healthcare providers experience physical discomfort and mental stress while caring for obese individuals
- **Opportunities:** Positively promote the current equipment to reduce the physical effort for healthcare providers while caring for individuals

3.1.3 Categorization of Needs

Person With Obesity

Immediate Needs	Latent Needs	Want / Wishes
Needs additional assistance to complete their daily tasks (get up/toilet/ sleep) Needs to do tasks by themselves when the healthcare providers are not around	Need to feel respected and valued by society I need to feel more independent Need to keep active mentally and physically	Wish able to have better lifestyles Wish would have more control for the equipment I wish they have an enhanced experience for their leisure time

PSW

Immediate Needs	Latent Needs	Want / Wishes
Needs to guide or/and help the clients to complete the daily tasks Needs to be aware of body mechanics to reduce the injures from the repetition of work Needs to visit at least ten clients per Day Needs to increase the physical stimulation daily	Needs to improve the mental stimulation Needs to better communicate with their peers	Wish to have more functional equipment to help them care for obese individuals Wish to have a stress-free work environment Wish would have better rehabilitation for their physical discomfort

3.2 Usability

3.2.1 Journey Map

- **PSW caring for the person with obesity**

	Preparation	Check-in	Cook	Transfer	Shower	Change	Goal	Completion
Storyboard								
User Goals	Get ready for work	Check the tasks for the client	Cook the meal for client	Transfer the client	Clean the client	Reduce the bacteria grow	To help client with daily tasks	Finish within the time
User Actions	• Get up at early for the day • Dress up for work • Bring mask and gloves • Back brace	• Verbally communicate with client to make sure the tasks are correct	• Check with client about what to cook • Microwave the food or cook food	• Transfer from bed to commode • Transfer from commode to chair • Transfer from chair to bed	• Roll over the clients • Bed bath • Straight up the client • Change	• Change the diaper • Change the cloth	• Two caregiver push the clients to the living room • Ensure to clear the path while transferring	• To record the time the tasks on the booklet
User Thoughts	"Today would be busy for me"	"Hope there is no any changes"	"I wish he would like the food"	"I hope heis comfort and safe"	"I need to make sure all cleaned"	"I need to make sure his body is dried well"	"I gonna leaving soon"	"I hope I didn't take too long"
User Feelings	Exciting	Neutral	Concerning	Concerning	Concerning	Concerning	Concerning	Exhausted
Ideas / Takeaway	Enhance the experience with busy day	Improve the effect for communicating		Enhance the user experience reduce the physical hurting	Enhance the user experience reduce the physical hurting	Increase the user experience after PSW left	Reduce the time and effort for caregivers	Reduce the mental stress

Figure 27 - Journey map of PSW caring for people with Obesity

- **PSW's day**

	Planning	Commute to Work	Meet with clients	Break	Meet with clients	Commute in between	Meet with clients	Completion
Storyboard								
User Goals	Get ready for work	Commute to the client's house	Complete client's needs	Rest and eat	Complete the client's needs	To meet with clients	Complete client's needs	Complete the day of work
Yeah~								
Ok, ok								
Well....								
Hum....								
Ugh!								
Problems / challenge	Hard to get up and also be thinking ahead the protection from injure	Weather condition would affect the travel time	Hard to commuting with client	Not have enough time to eat or rest	Tight schedule could be running late	Bad weather condition increase the extra tiredness	Feel tired after multiple clients	Feel exhausted from work and experiencing the muscle pain
Opportunities	How to reduce the work effort for a day	How to enhance the experience while in the car	How to easier communicate with client	How to better manage their break and physical stress	How to improve the efficiency for each task	How to enhance the experience while in the car	How to reduce the tiredness after multiple clients	How to enhance the user's experience

Figure 28 - Journey map of PSW's Day

3.2.2 User Experience

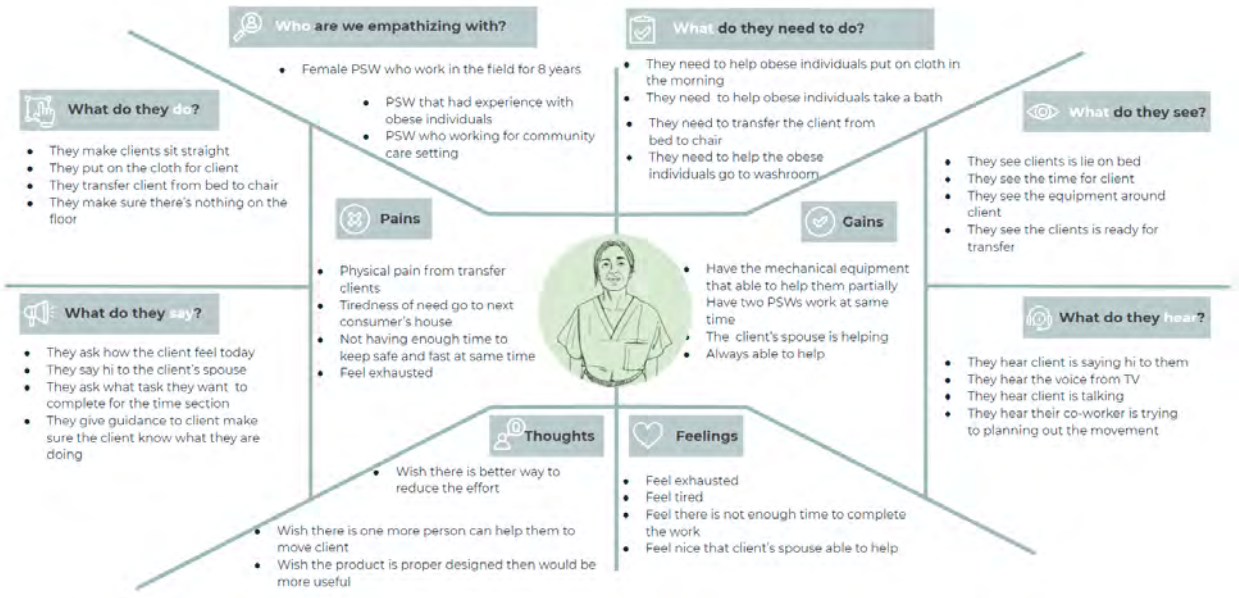


Figure 29 - Empathy Map

3.3 Human Factors

The purpose of the one-to-one ergonomics study for the thesis report is to understand the proper proportion and human interaction of the design solution and approve the design solution's feasibility. The entire one-to-one ergonomic study is applied to the solution of 'how

may we better assist healthcare providers in caring for obese individuals at home?', including the significant touchpoint for both sides of users: personal support works and obesity clients. In this report, the context would be including the methodology that used for the study, which the one-to-one mock-model to be easily adjustable and justifiable across the study section; the result of finding to showcase the accurate ergonomic by visualization; lastly, the conclusion of the study and further development for the design solution.

3.3.1 Product Schematic

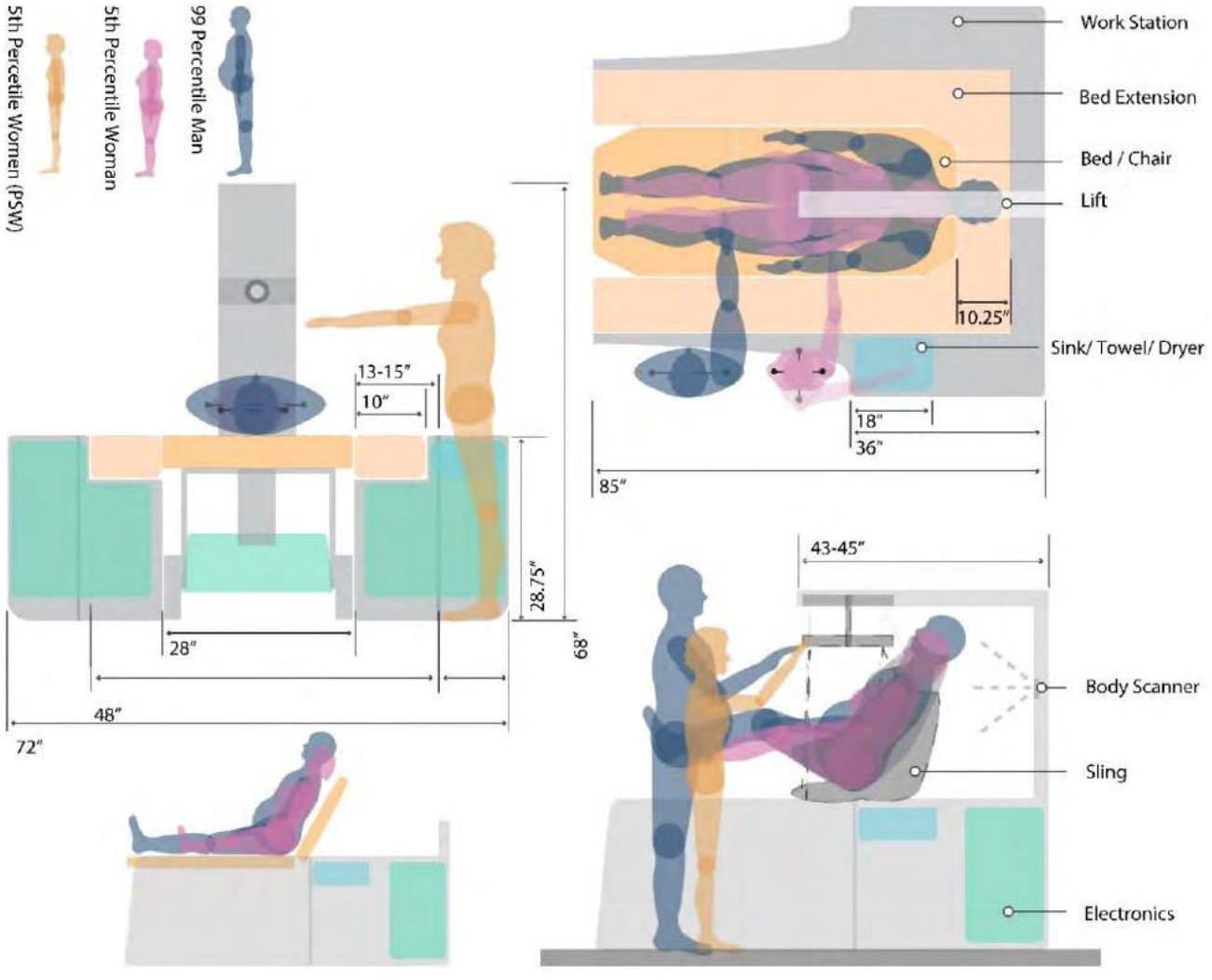


Figure 30 - Schematic Diagram One

Major components including:

- Stationary station
- Bed cushion
- Wheelchair
- Mechanical lift
- Body Scanner
- Workstation (sink / towel /dryer)
- Electrics (station)

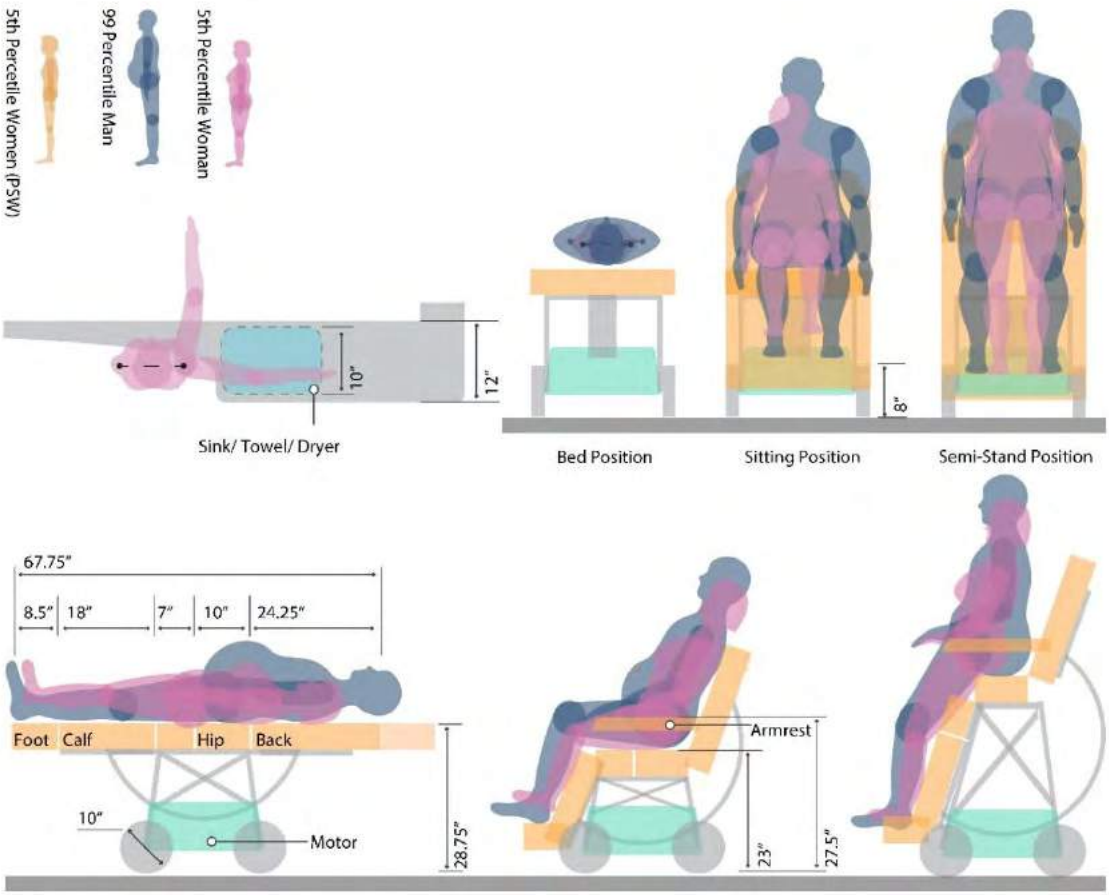


Figure 31 - Schematic Two

Major components including:

- Motor (wheelchair)
- Back support
- Hip support
- Calf support
- Foot support
- Wheels
- Armrest
- Camera / sensor

3.3.2 Ergonomic

3.3.2.1 Methodology

The methodology used for this ergonomic study is a one-to-one mock-up model and used the available percentiles from 95th percentile men to 50th percentile women. The images are included information on the proportion of the design solution and the significant touchpoints.

3.3.2.2 Results

Figure 32 – 95th Percentile - Lying in Bed Position (Station)

Figure 33- 95t Percentile - Reclining Sit Up Position (Station)

Figure 34 - 95th percentile - up-right sit up position (station)

Figure 35 - 80th percentile - lying in bed position (station)

Figure 36 - 80th percentile - reclining sit-up position (station)

Figure 37 - 80th percentile - up-right sit up position (station)

Figure 38 - 80th percentile 400 lbs. lying in bed position (station)

Figure 39 - 80th percentile - 400lbs - sit in the wheelchair

Figure 40 - 80th percentile - 400lbs sit in a wheelchair (side view)

Figure 41 - 45th percentile women up-right sit up (station)

Figure 42 - 45th percentile reclining sit up (station)

Figure 43 - 95th percentile PSW caring (bed in the station)

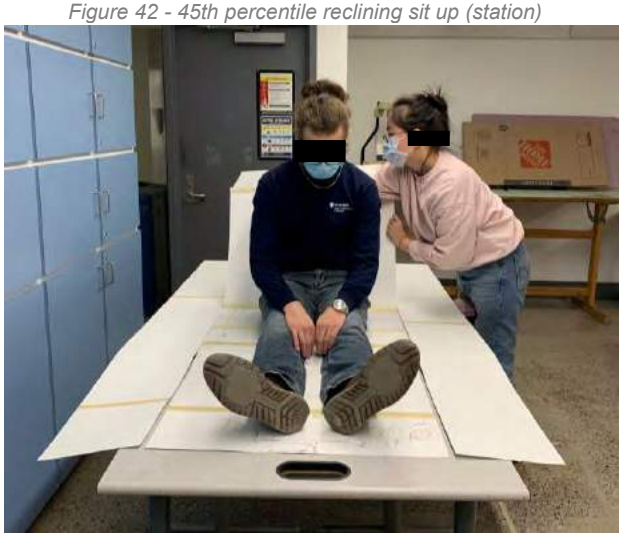


Figure 44 - 95th percentile PSW caring (sit-up in station)

Figure 45 - 45th percentile PSW caring (bed in the station)

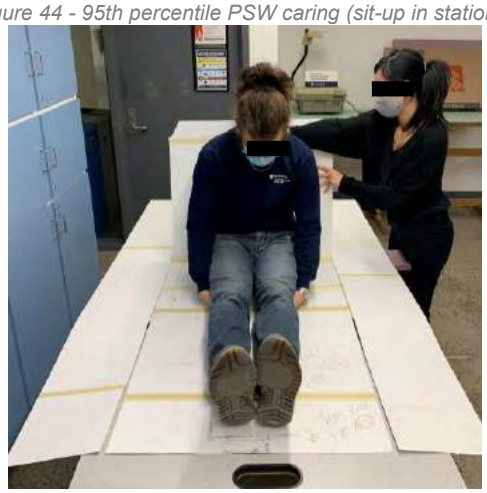


Figure 46 - 45th percentile PSW caring (sit-up station)

Figure 47 - 90th percentile with Lift

Figure 48 - 90th percentile with lift (front)

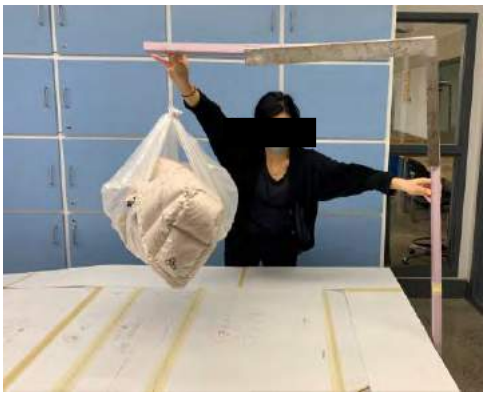


Figure 49 - 45th percentile with lift

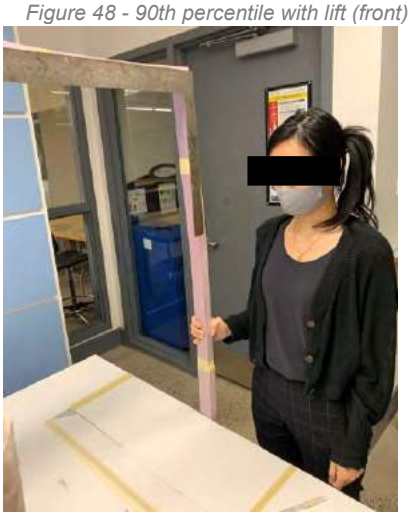


Figure 50 - 45th percentile with lift

Figure 51 - 45th percentile besides lift

3.3.2.3 Analysis

This design solution, along with the human interaction and proportion study, enforces the useability and feasibility for the final design solution, which applies to a combination workstation that offers efficiency and independence for obese individuals who need assistance from healthcare providers. The ergonomic study demonstrates the tasks that personal support work needs to complete for caring for obese individuals at home, including using a lift tool for transfer, a sponge bath, and the toilet. It also demonstrates the functionality of the wheelchair, being able to transfer the chair to the sleep lounge and help the user in the standing position.

The percentiles that have been used on the physical, ergonomic bucks are from 95th percentile man to 50th percentile women, which is mitigating the body size for obese individuals in this study. The solution also tested with 95th percentile women and 50th percentile women to understand the usability for personal support women. The ergonomic diagram from figure 32 and 51 filled out the blank with 99th percentile man and 5th percentile woman.

The ergonomic bucks have two main sections: the stationary workstation for personal support workers and the transportable wheelchair that offers three different positions.

According to the primary research, the significant tasks involving physical efforts for personal support works for obese clients are to help them get up, use the toilet, and do a sponge bath. Therefore, this design solution improves the efficiency of personal support work while reducing the possibility of injures. The ergonomic bucks need to prove the range of motion for a sponge bath, cloth change, and use of a lift tool. The overall height of the workstation is 28.75", which is below the user's waist, and the user can access the workstation surface without bending their body.

The workstation's height is higher than the available bed, allowing users to have a higher workstation to reduce the tension on the user's lower back. The distance from the edge of the station to the center of the bed is from 27" to 29"; it offers good space for a user when they reach their clients, also gives good support for their lower back when they use the chest support function. The sink size is from the ergonomic of 99th percentile female's hands, 10" wide and 12" long. It can access from any angle and has enough room for water and a towel. The towel warmer and dryer is located near the sink and on the outer side of the station. It allows 5th percentile

woman easy to reach and offer usability within the station. The lift tool is 68" in height. The distance from the bed to the highest point of the lift tool provides enough room for 99th percentile men to sit up and raise the height from the bed. The Lift tool can move up and down for all users to reach and use.

The wheelchair has three positions that enhance users' useability while the personal support works are not around. To achieve the function, the wheelchair has five sections: footrest, calf support, thigh, hip, and back. Due to the ergonomic study and safety, the chair would raise the heigh when it turns from chair to bed. The height of bed position of the wheelchair is 28.75' that reduce the difference for the station, the seat height of the wheelchair is 23" that allows the user easy to enter the chair and safer to control. The footrest is 8" from the floor that provides user feel safe. For other touchpoints, the footrest length is 8.5", which gives extra distance when it's in the bed position. The armrest from the floor is 27.5", which allows the user to rest on the armrest with comfort over time. The front of the armrest is on the same plane as the seat front, and it follows the ergonomic study and the human behaviour of rest hands. The front of the armrest is chamfered. The angel makes it easier to reach the control button and reduces the tiredness over time.

For people who are obese and need daily assistance, comfort needs to accomplish for the functionality. Separating the seat into two sections that support the user's thigh and hip allows the wheelchair to have multiple positions while maintaining comfort. The hip section on the wheelchair is 10", it able to enable the user to touch the footrest while standing but also has

enough touch surface with their sit bone. The thigh section is 7" that allows all users able to feel comfortable when the seat the flat.

The width of the wheelchair is 28"; by that width, it gives enough room for people in the BMI range of 30 -35. According to the Ontario Building Code, the minimum width of a living room door is 33" (2021). Having a 28" wheelchair allows the user able access all the areas in the home environment. And the overall size for the station is 72" by 85" by 68" (width by length by height). It gives enough sleep and leisure space for obese individuals and usability for a personal support worker.

The purpose of designing a wheelchair that can transfer from a bed position to a chair or even a standing position is to increase the efficiency of personal support workers and allow obese individuals to have more control within the residential environment. The combination of tools in the workstation is helping personal support work to reduce the mental stress and have physical support for their work. The ergonomic study can fully understand all users' space and range of motion.

3.4 Innovation Opportunity

3.4.1 Needs Analysis Diagram

Figure 52 - Roots of Cause

3.4.2 Desirability, Feasibility, and Viability

3.4.2.1 Insight Statement:

- There is an increase in residential disability/elderly care demand in Canada due to:
    - Increased elderly population recent year
    - Importance of professional care to those who need
    - Strong human desires for responsive, resilient, and adaptive personal care relationship
- There is an increase in physical injuries for healthcare providers due to:
    - Increased personal care demand
    - Increased disability/elderly obese individuals
    - Increased mental stress

3.5 Summary of Chapter 3- Defining Design Brief

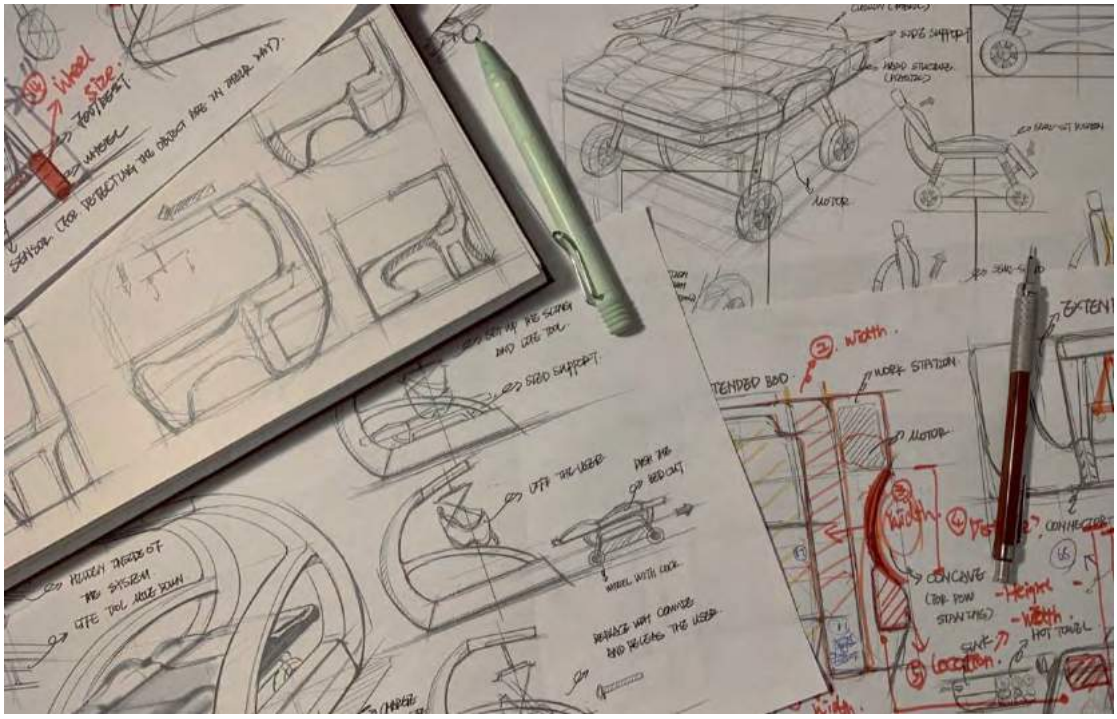
This thesis project aims to design a device to enhance the independence of obese individuals who need assistance from healthcare providers and decrease the possibility of physical injuries for healthcare providers while caring for obese individuals in the home service setting. The device solution should include the functions of transfer and personal care. The objects of this thesis project are the following:

- The product should be considered from both ends of the primary user and maximize the experience for all users.
- This thesis solution should be versatile in its function for all users.
- Adopting new technology to the design solution is beneficial for improving personal care efficiency.
- The design solution should improve the ergonomics that allow all users to be comfortable.
- The design solution should emphasize the sensory for all users to impact the mental stimulation.
- The design solution should be easy and intuitive to operate and have a clear design signal across all cultures.
- The repetitive tasks for a healthcare provider are the primary cause of physical injury. Creating a comfortable work device is essential for physical stimulation for all users.
- The aesthetic of the design solution should deliver comfort, welcome, and safe for all users. The aesthetic is essential to show the value of individuals.

- The design solution should ensure minimal environmental impact and sustainable solutions for the product afterlife.
- The solution should create reliable and safe equipment for all users in an emergency.

Chapter Four: Design Development

By studying the ergonomics of the design, this section in-depth presents the concept development, inspiration, and schematic based on the research.



4.1 Initial Idea Generation

4.1.1 Aesthetics Approach & Semantic Profile

As part of their consumer, the person with obesity requires them to take longer time and effort while caring for them. According to the research, the population with obesity is one-third of the overall Canadian adults (). The design solution's style and form would be the first impression on the users. The semantic product analyses would help to achieve the objects that have been stated for the thesis project. This report would have a significant section to discuss the semantics for the design solution in the current products and the inspirational form.

The design solution would include the functions that help the personal support worker complete significant tasks for obesity. The inspiration for the overall concept is from the game station rising its popularity in recent years (Figure 3). To avoid the high-tech design language, the primary inspiration is the organic form that can offer comfort and a welcoming message to obesity. The concept is the station that the person would be spending their time on and can be reattracted from the station to which they would have more dependency.

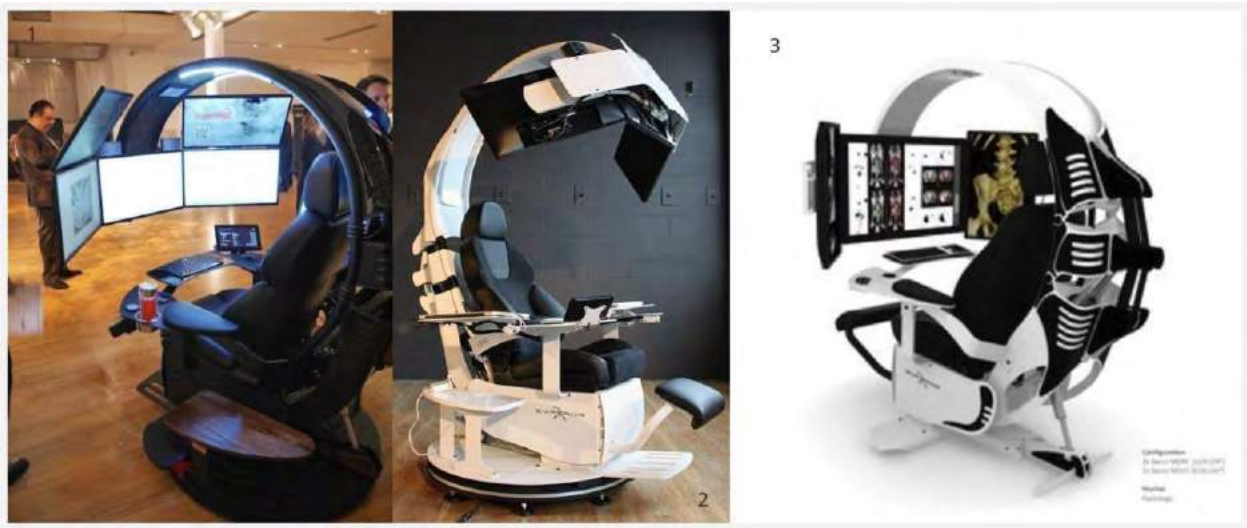


Figure 53 - Images of game stations, retrieved from: https://miro.com/app/board/o9J_lxcwxx0=/

From the reading *Product Semantics: Exploring the symbolic qualities of form*, besides the physical and physiology, the psychological, social, and cultural context is more important to the product semantics. The psychological of the inspiration form is to let the. Users feel safe and reduce their mental stress over time. The social content is to adapt the technology that allows the user to have more options to the device and increase the efficiency for personal support workers. The cultural context improves the user experience and focuses the human-centred design. Image below is the form direction that would apply along with the design solution, and it fits into the symbolic environment for the design solution.

Figure 54 - Group of inspirations, retrieved from: https://miro.com/app/board/o9J_lxcwxx0=/

4.1.2 Mind Mapping

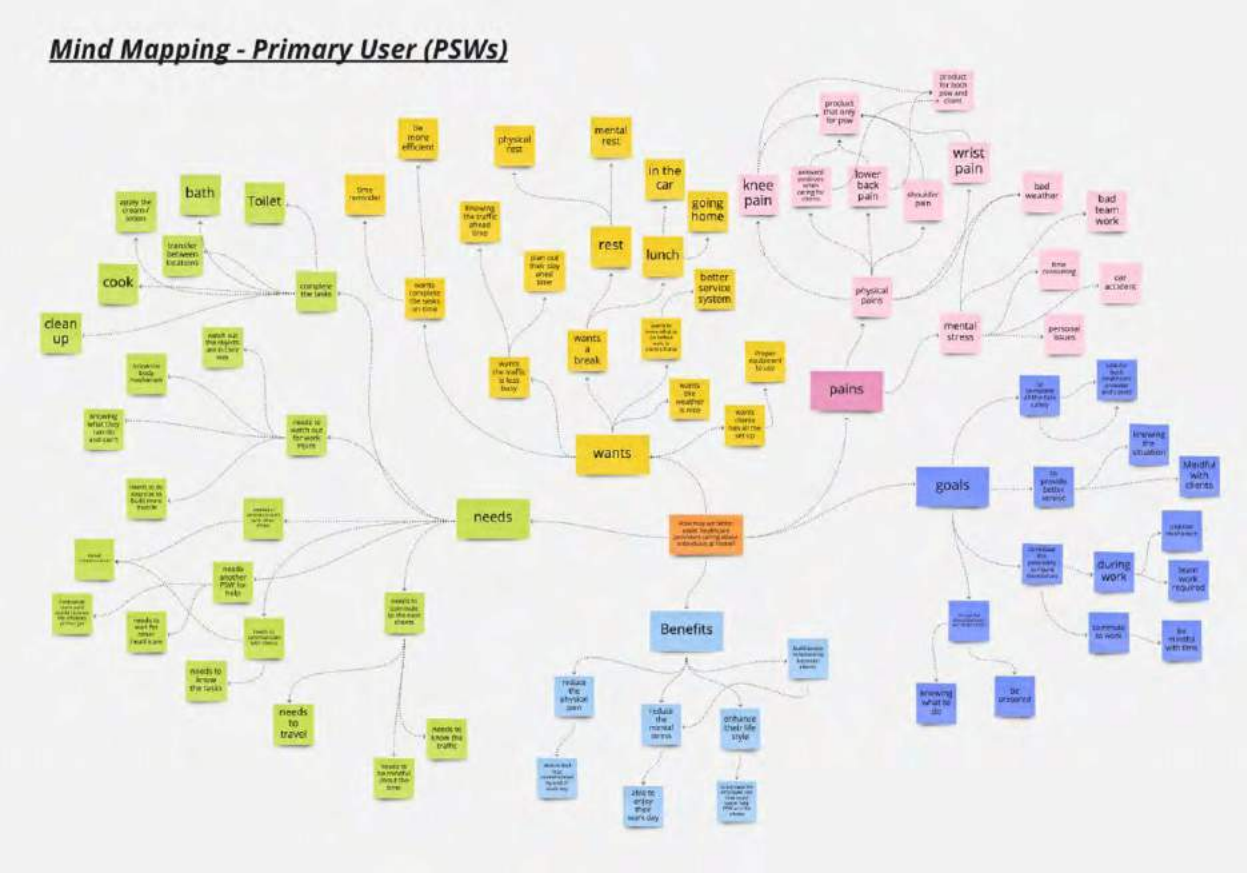


Figure 56 - Mind Map

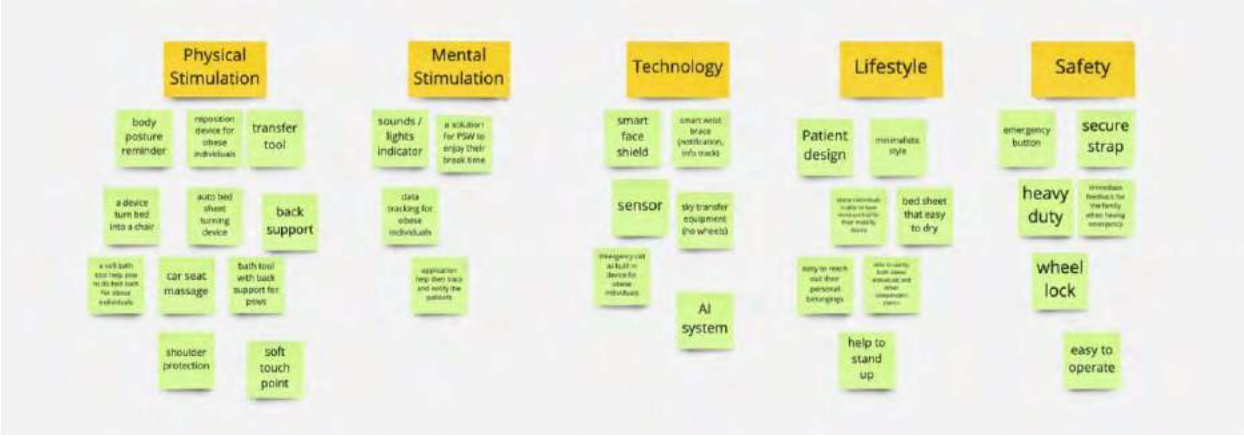


Figure 55 - Ideation Category

4.1.3 Ideation Sketches

After the research, the ideation phase is trying to generate how to reduce the injury of personal support workers. Therefore, each concept focuses on a better solution for reducing the physical and mental stress from the caring routing, the commute, and communicating with their clients. To connect the design solution with both users, some of the ideation also focuses on better assisting the person with obesity when their caregiver is away.

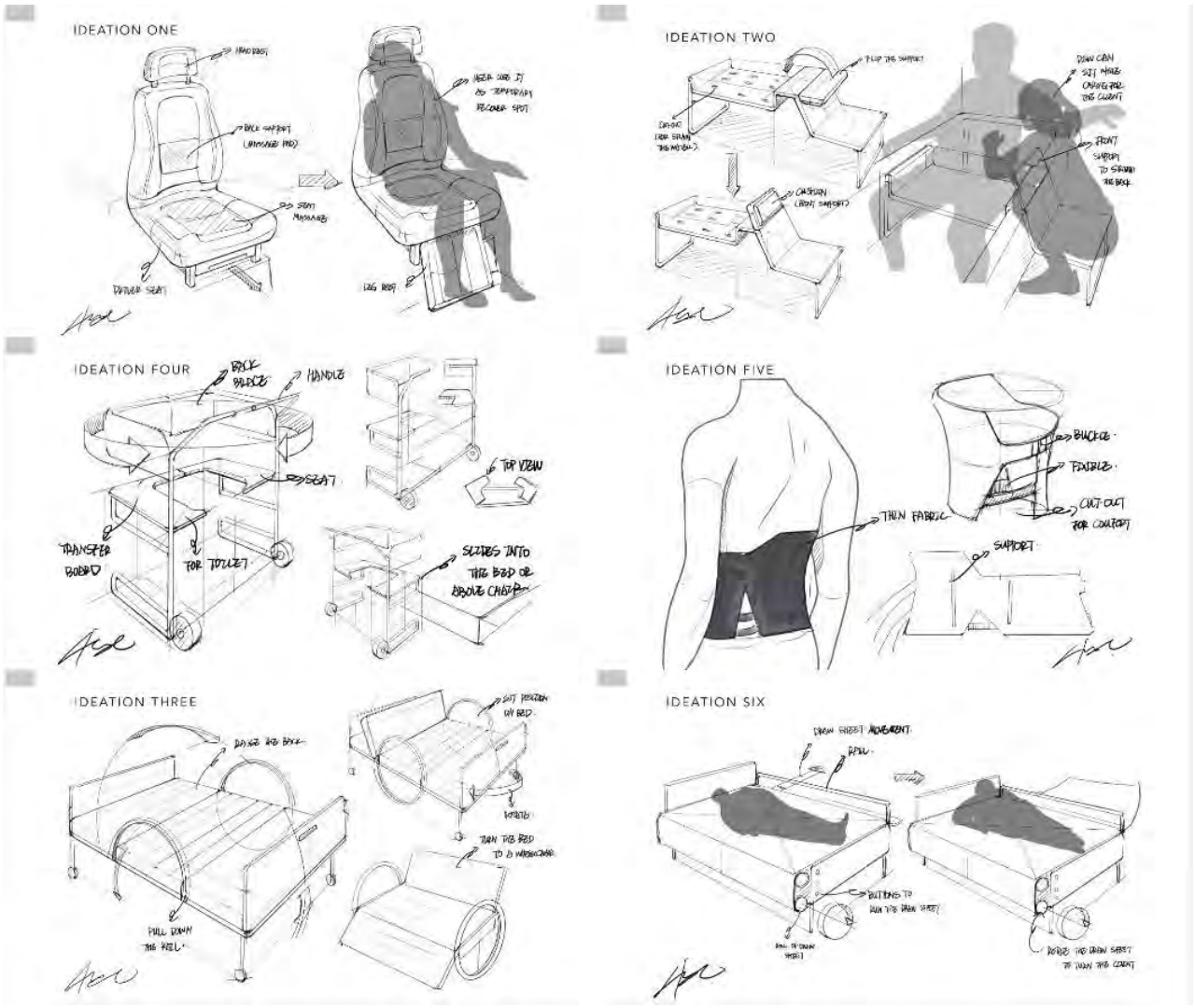


Figure 57 - Ideations

4.2 Concept Exploration

4.2.1 Concept One

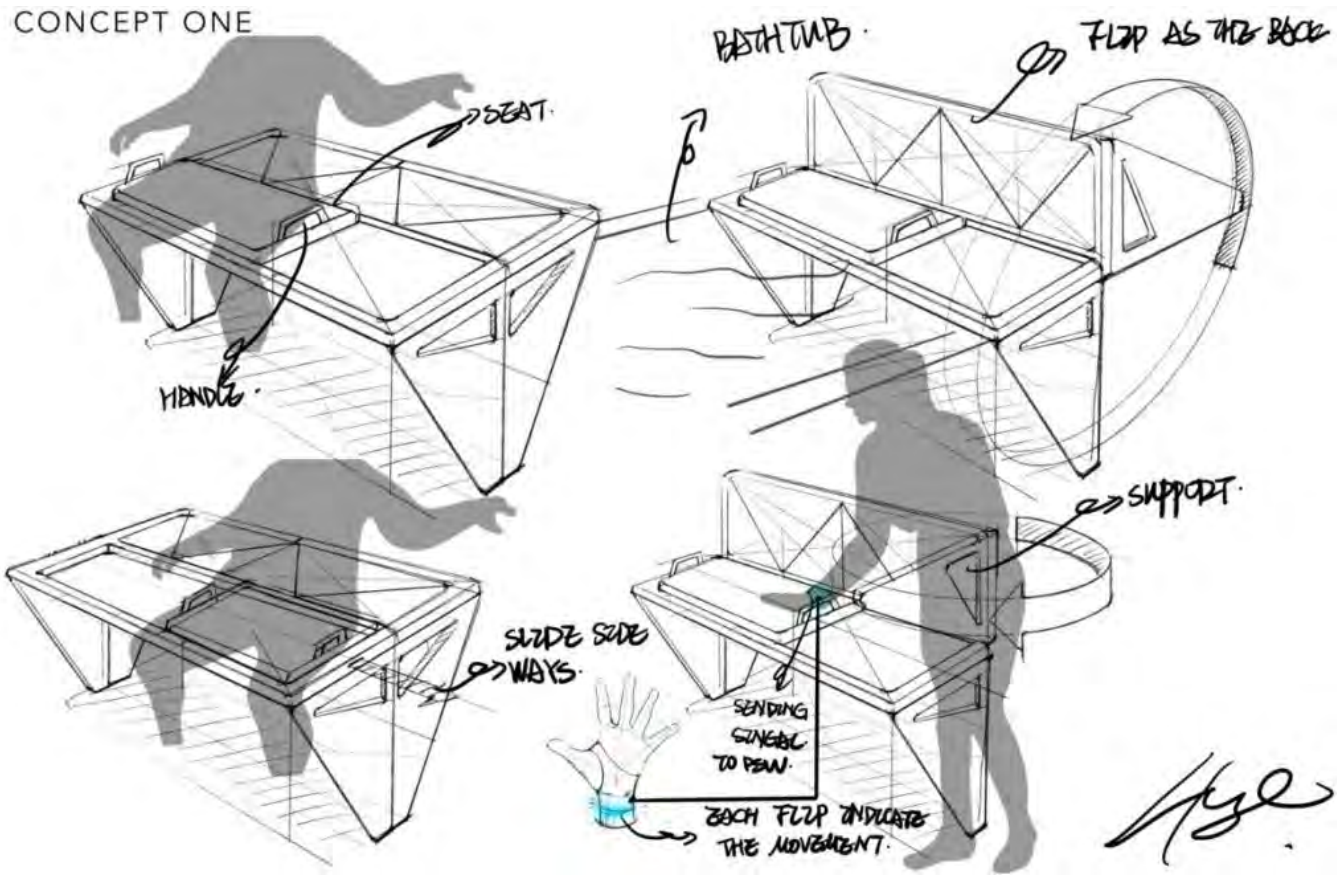


Figure 58 - Concept One, Assisting Shower Tool

This concept is chosen because it communicates for both users. It focuses on better assisting PSW to take a shower for the person with obesity. The importance here is to reduce the physical stress from the awkward position and chaotic environment.

4.2.2 Concept Two

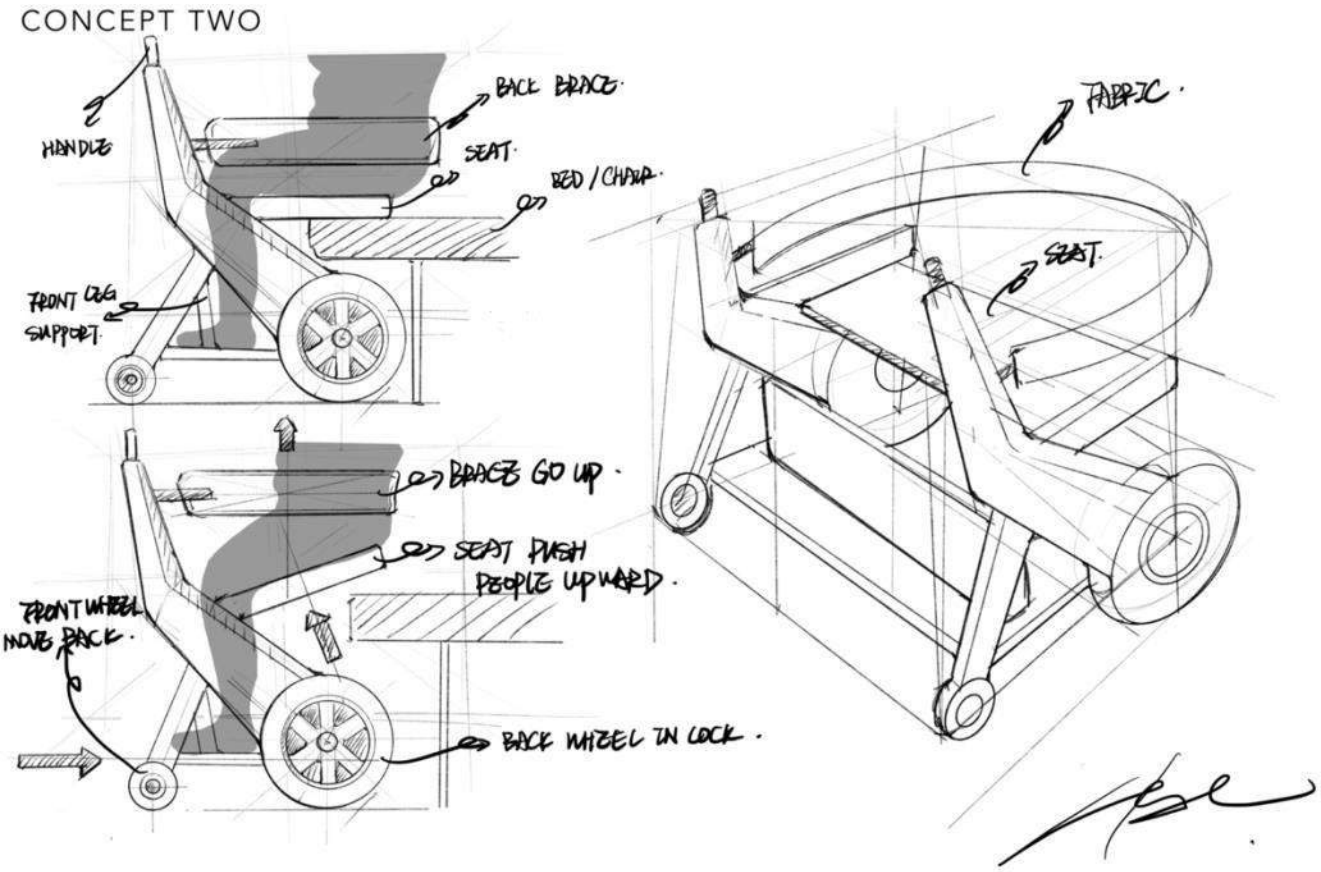


Figure 59 - Concept Two, Assisting Standing Tool

Concept two is designed to handle clients' transfers when no mechanical lift is available. This concept can promote the rehabilitation of a person with obesity. It has gradually helped the person stand up for a short period and allowed the PSW to reach and clean the torso area of their client.

4.2.3 Concept Three

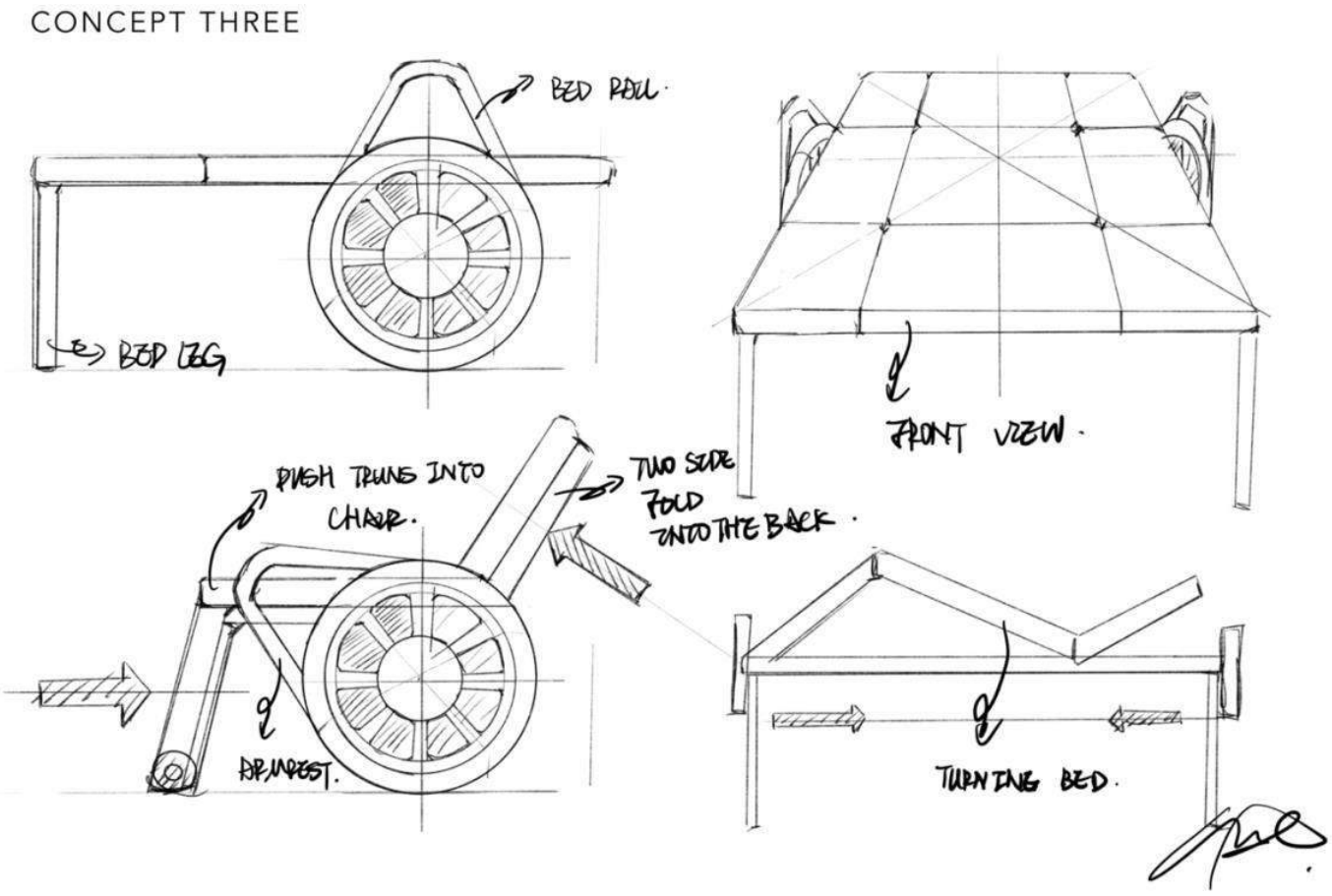


Figure 60 - Concept Three, Wheelchair Assisting Device

To help promote the movement and rehabilitation of persons with obesity, it allows the wheelchair turns into a bed and controls the chair navigating to different locations within their space. This concept aims to increase the independence of people with obesity when their PSW is not around.

4.3 Concept Strategy

4.3.1 Concept Direction & Product Schematic One

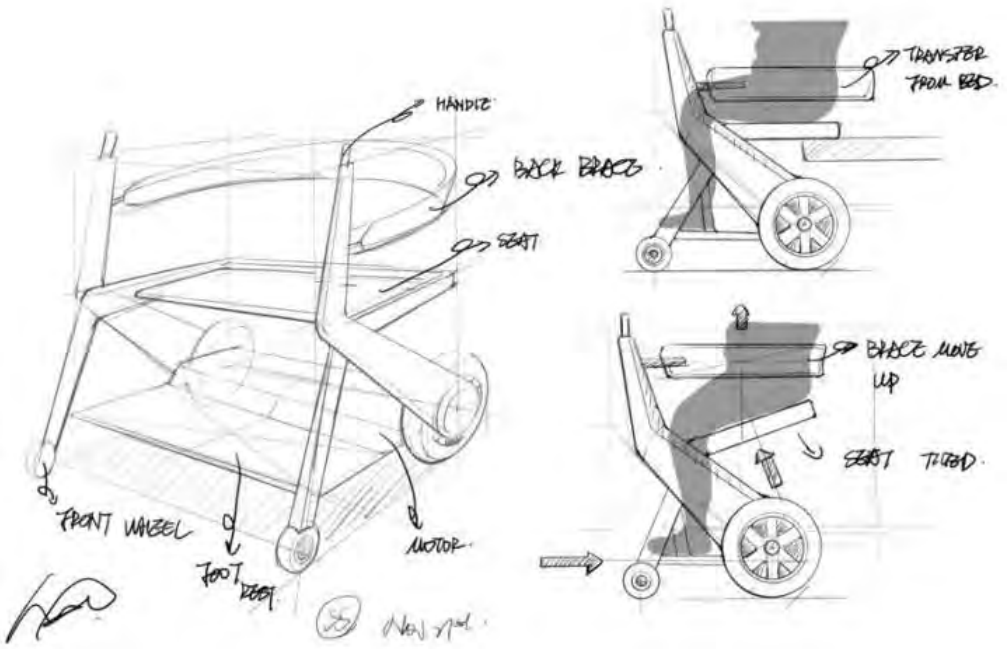


Figure 61 - Concept 1

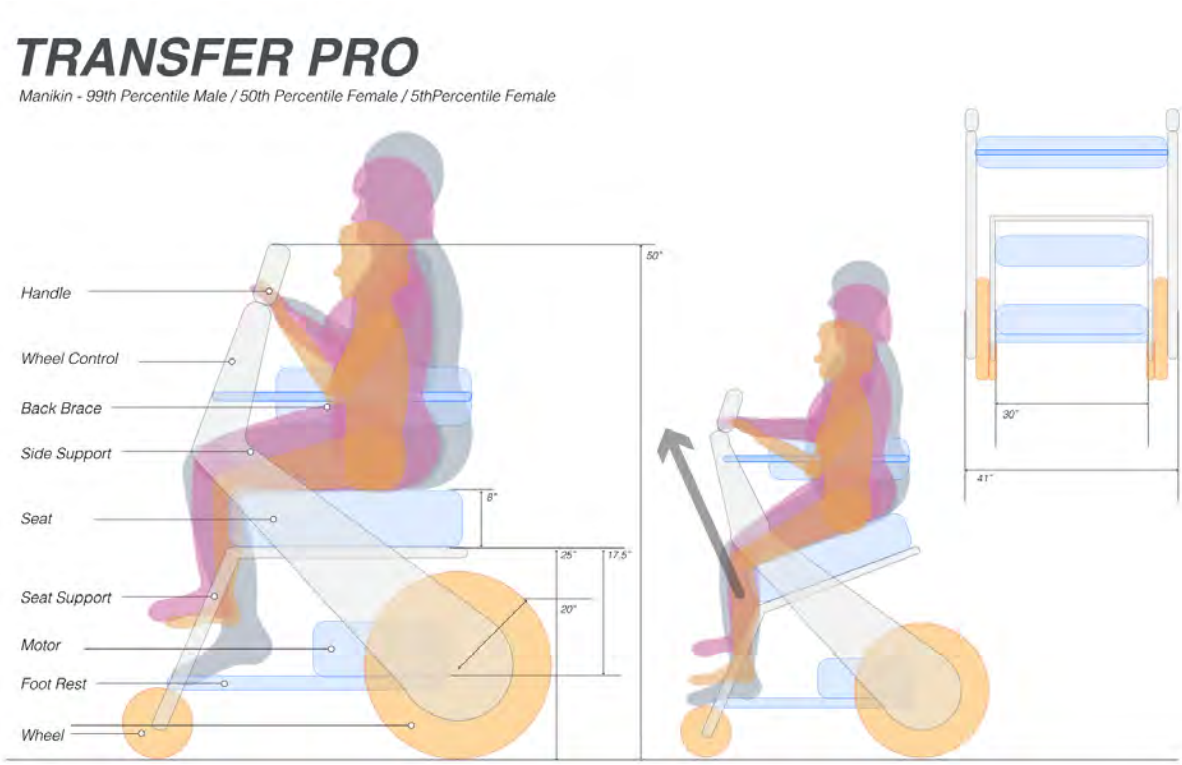


Figure 62 - Concept 1 Diagram configuration

4.3.2 Concept Direction & Product Schematic Two

The final direction of the design is to be focusing on the two set of the user, to better assist the PSW when they are caring

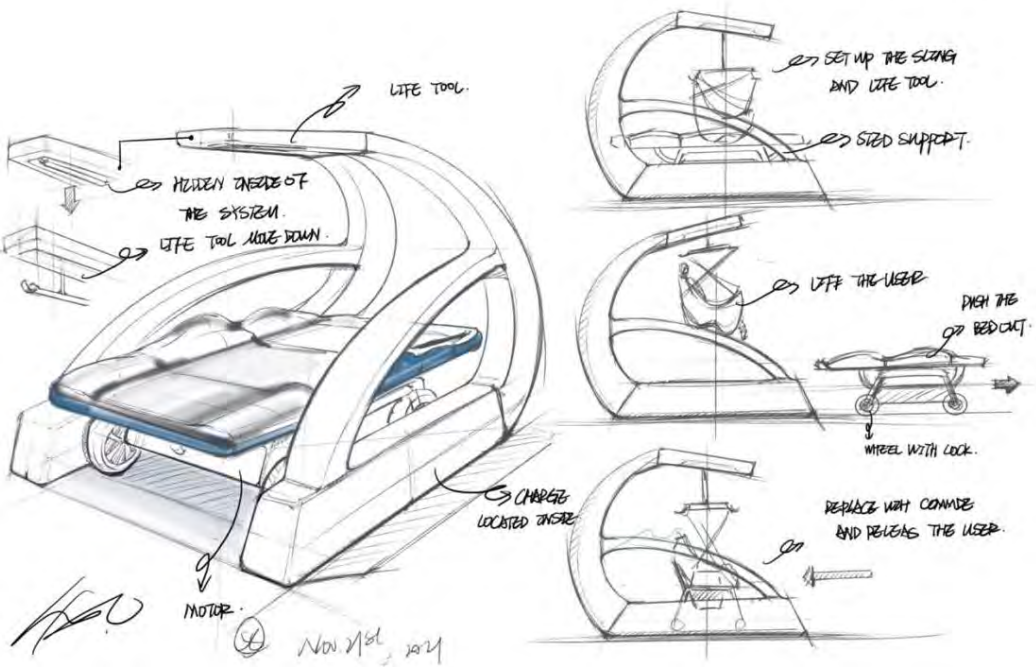


Figure 63 - Concept 2

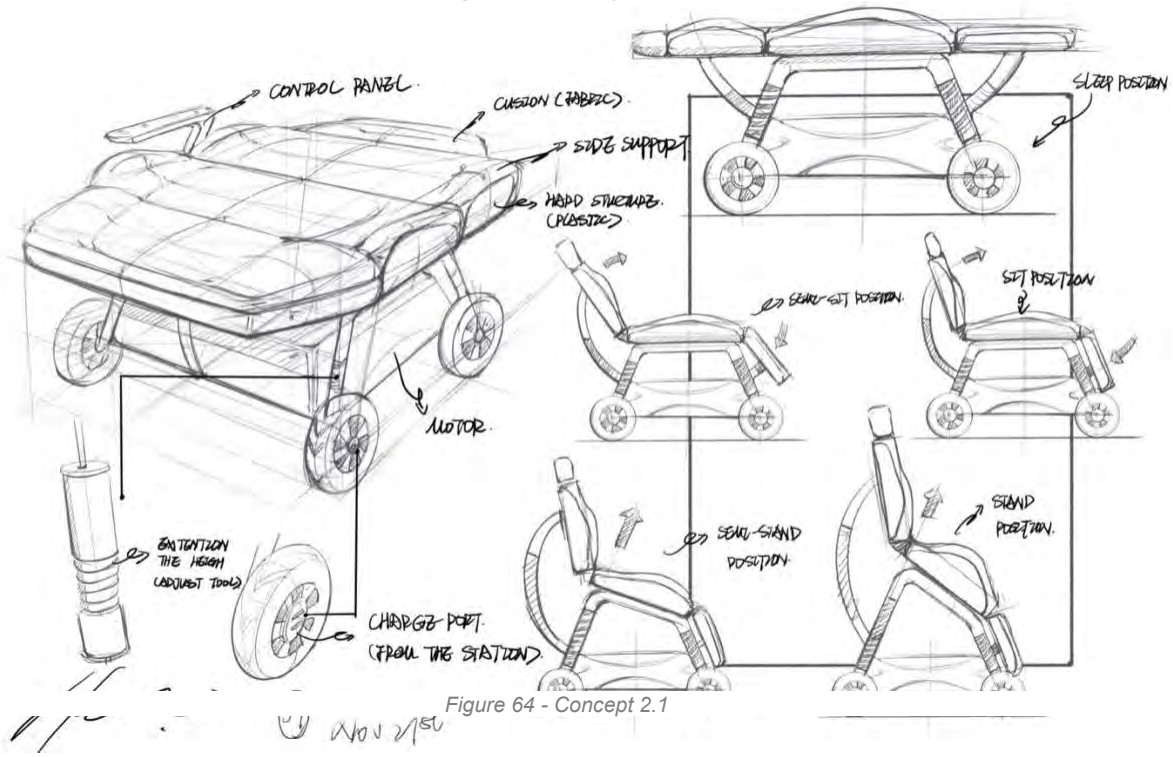


Figure 64 - Concept 2.1

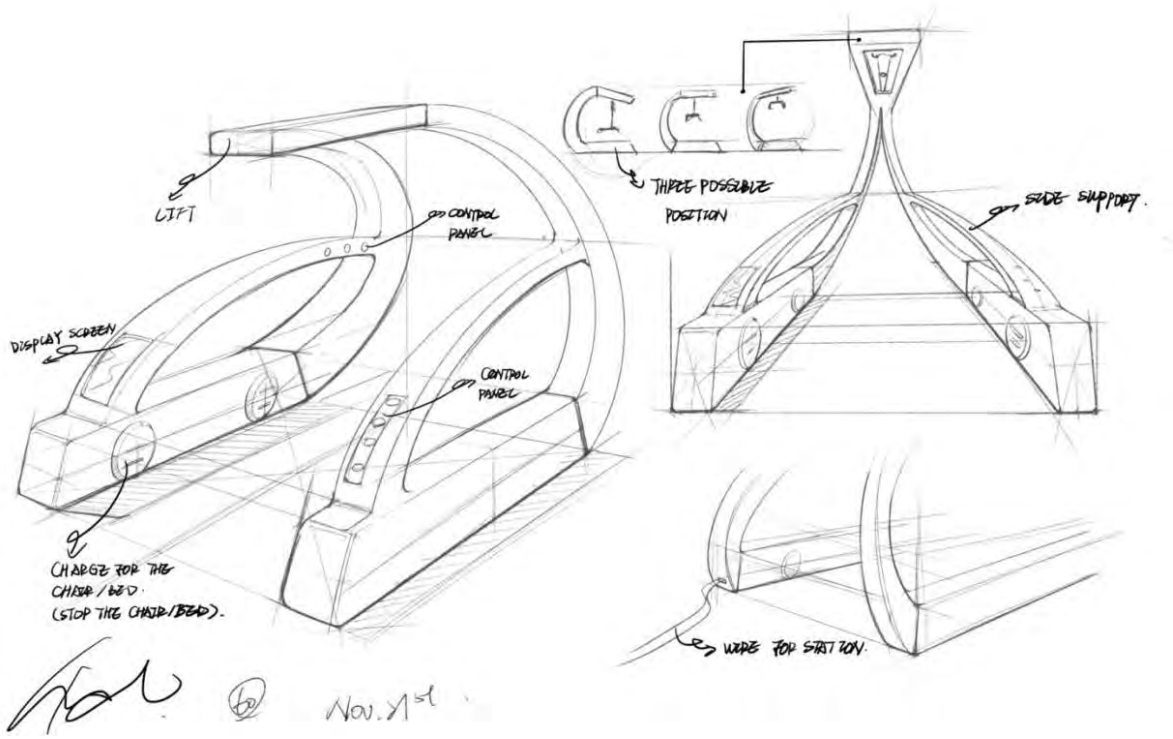


Figure 66 - Concept 2

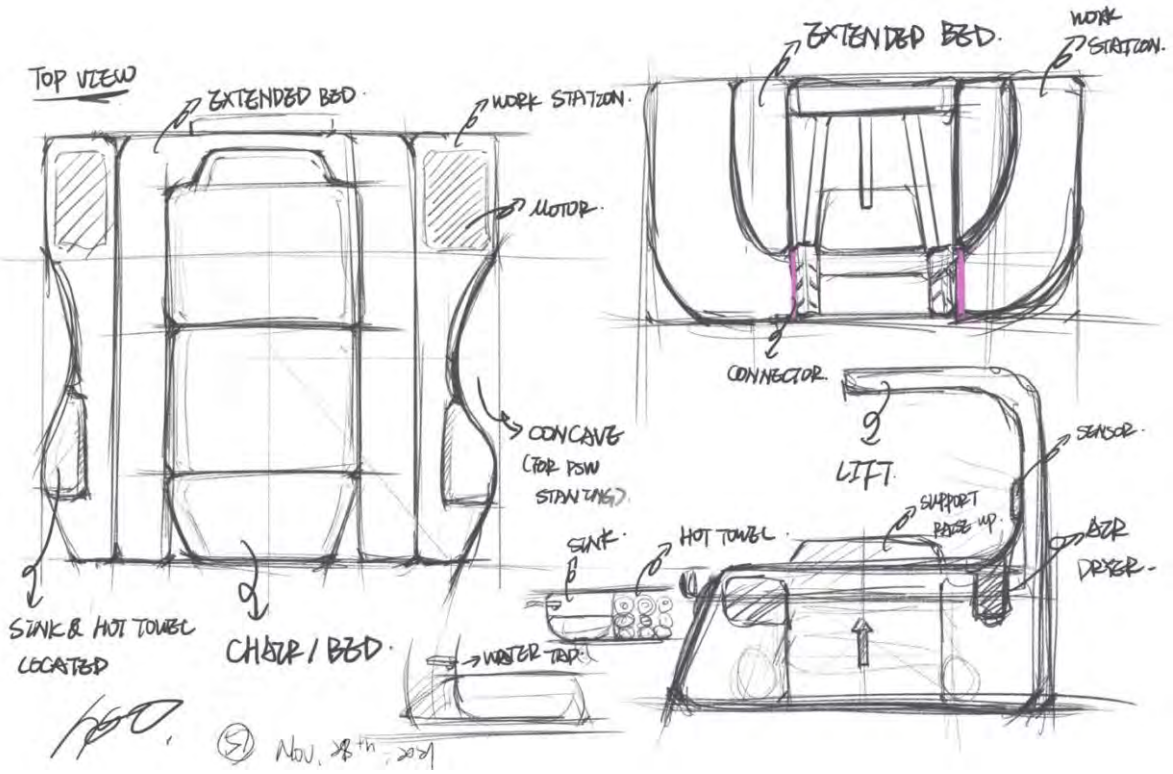


Figure 65 - Concept 2.3

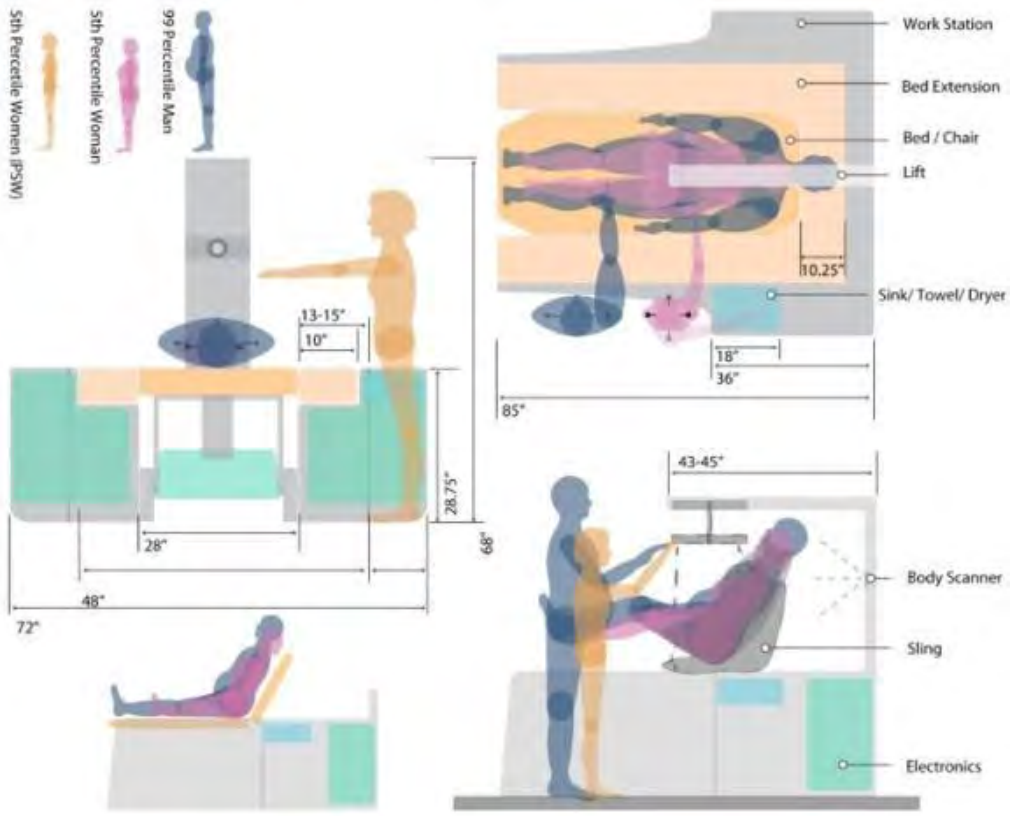


Figure 68 - Concept 2 Digram

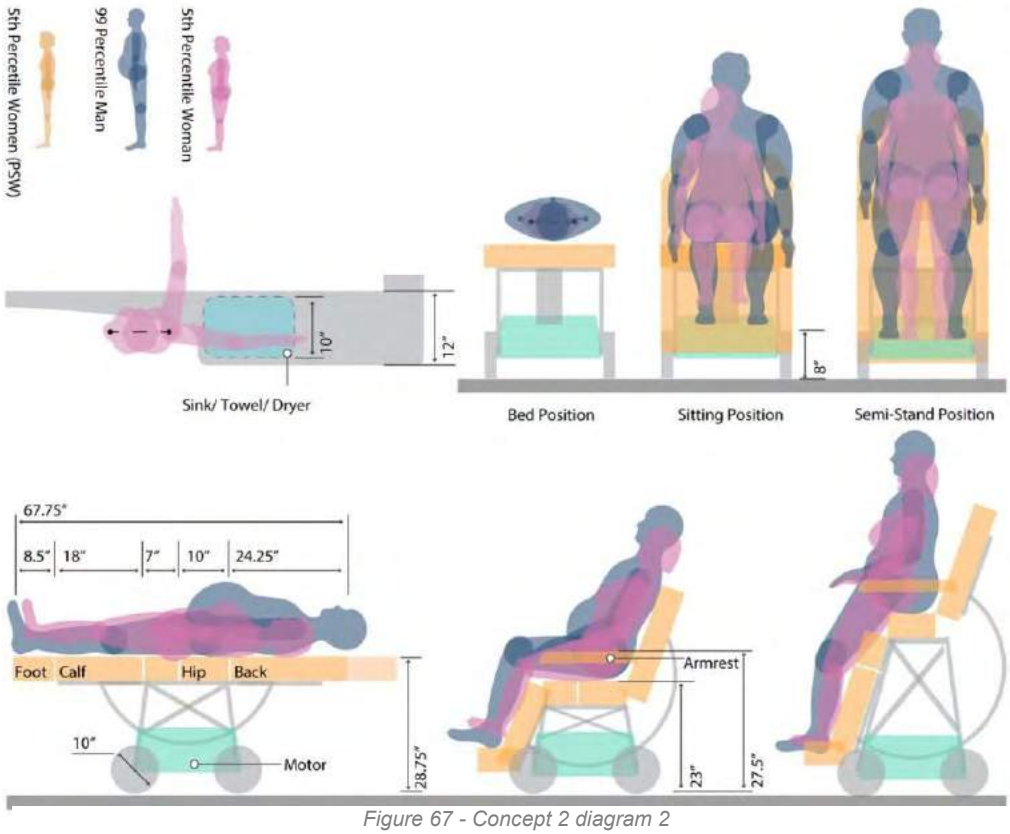


Figure 67 - Concept 2 diagram 2

4.4 Concept Refinement & Validation

4.4.1 Design Refinement

The design refinement for the design is to improve on the overall shape for the product and finalize the human interaction with the design. Additionally, to have achieve better design solution and manufacturing purpose of the design, the design refinement also includes the potential solution for the mechanism on the design.

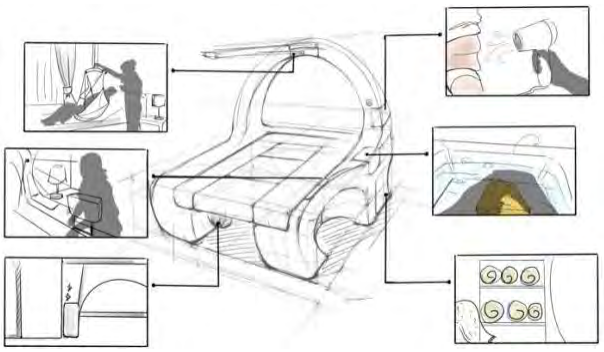


Figure 69 - User Journey 1

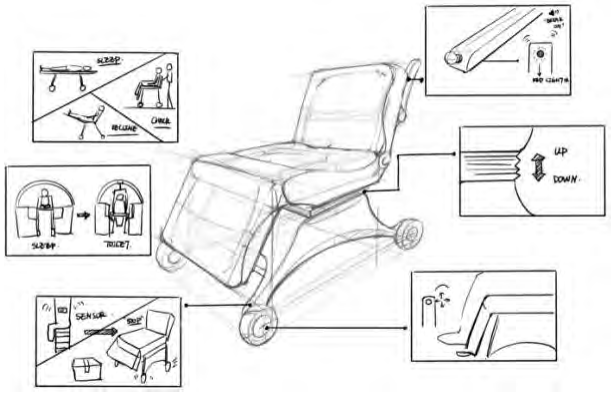


Figure 70 - User Journey 2

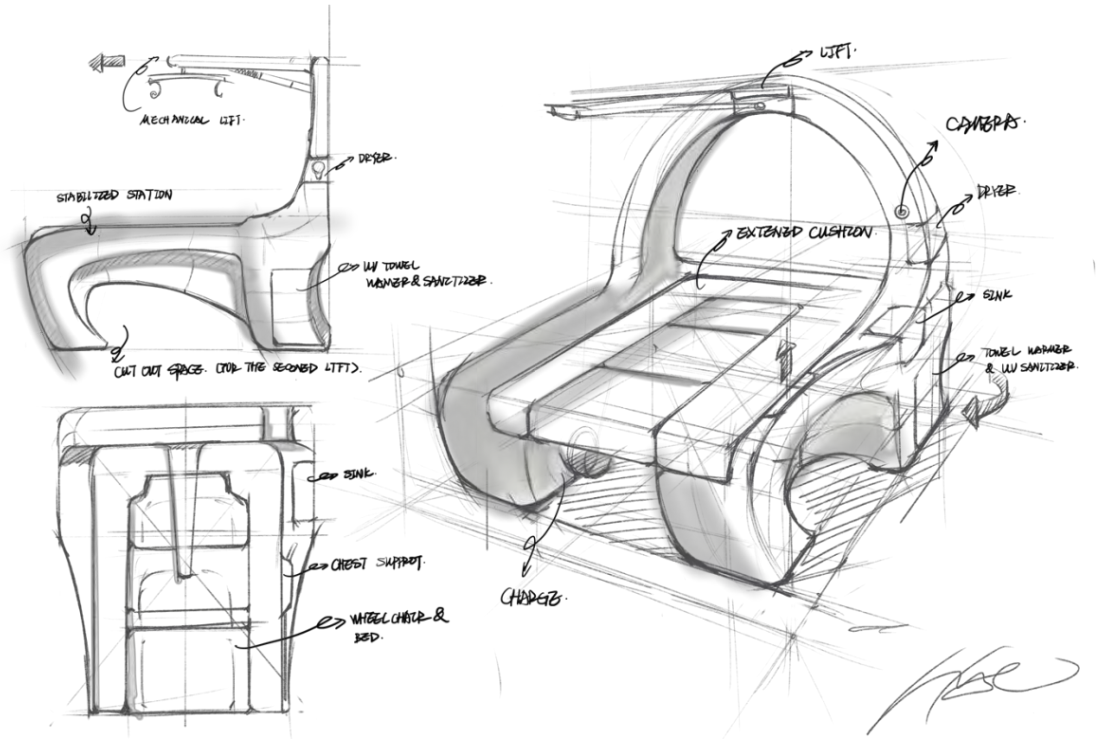


Figure 71 - Stratus Bed

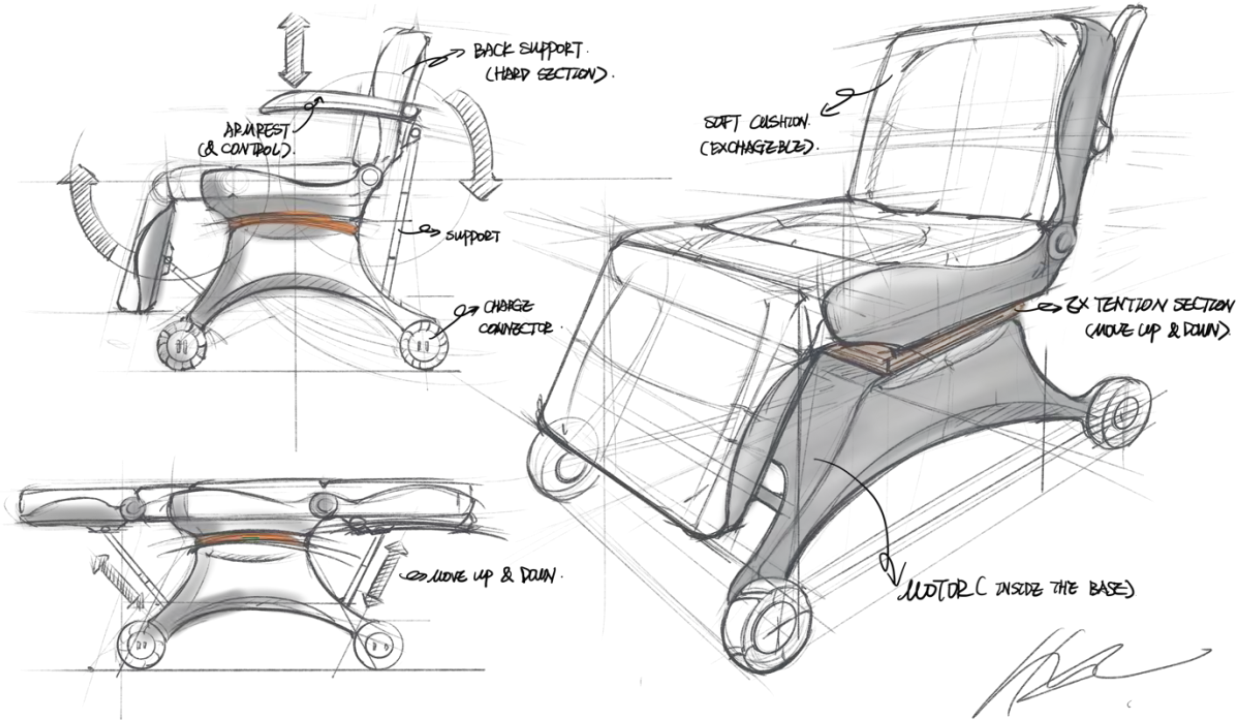


Figure 72 - Concept

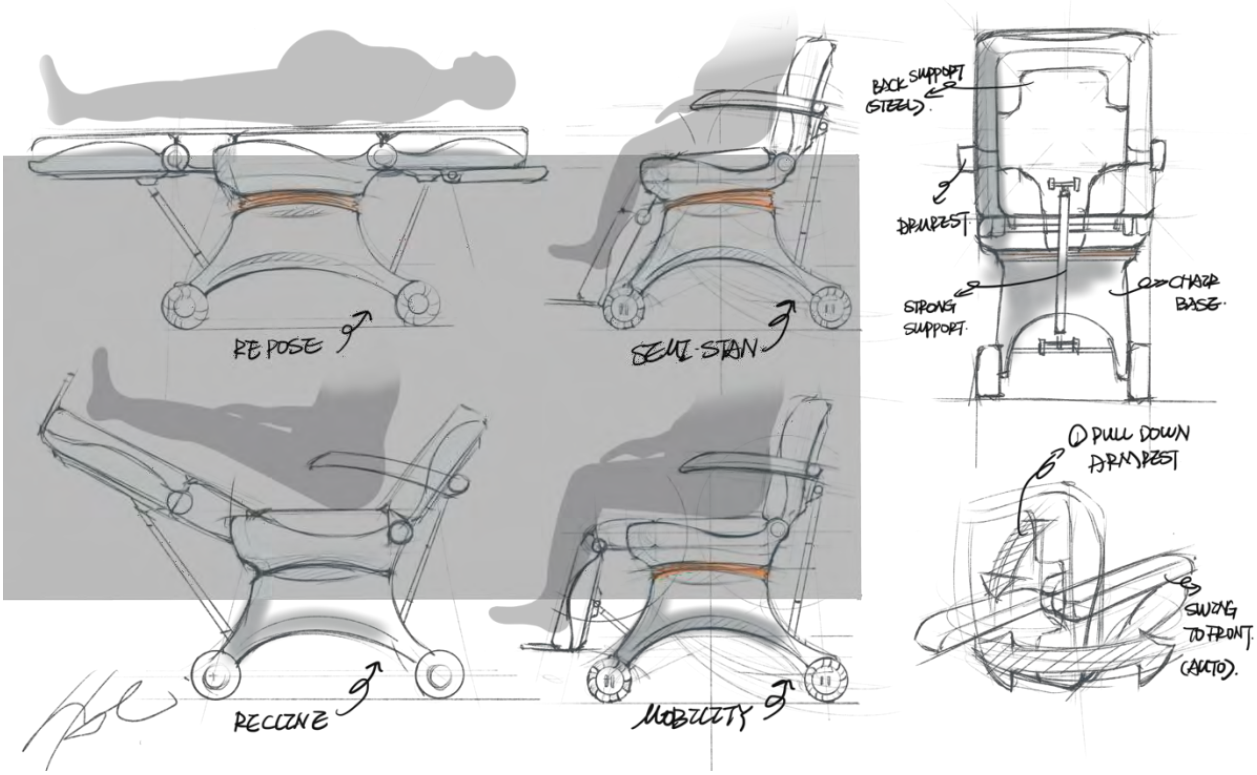


Figure 73 - Concept

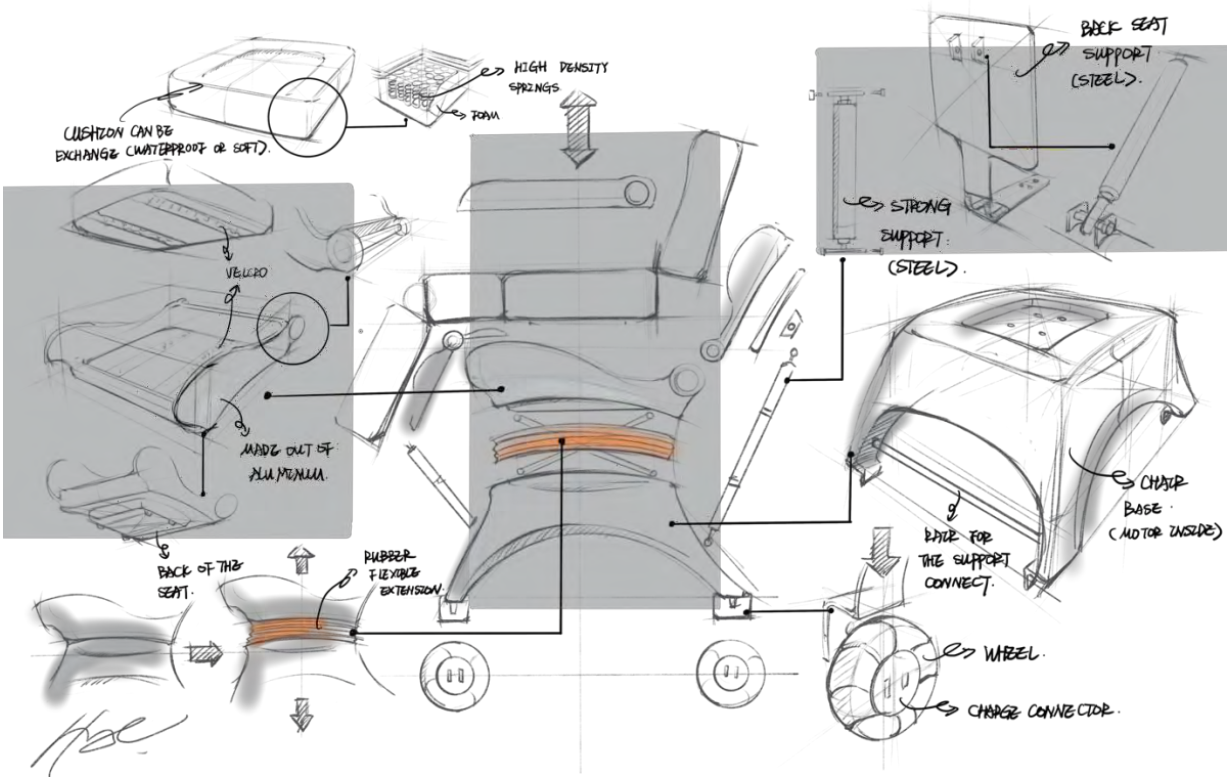


Figure 74 - Concept Chair details

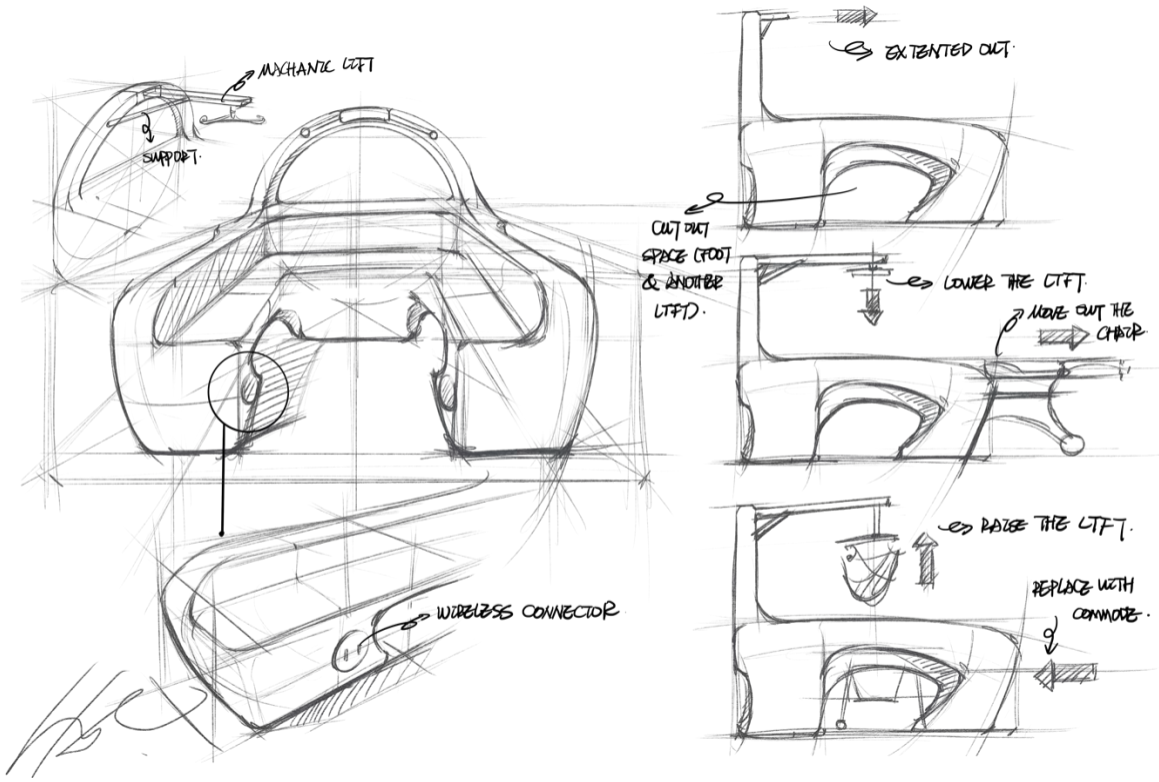
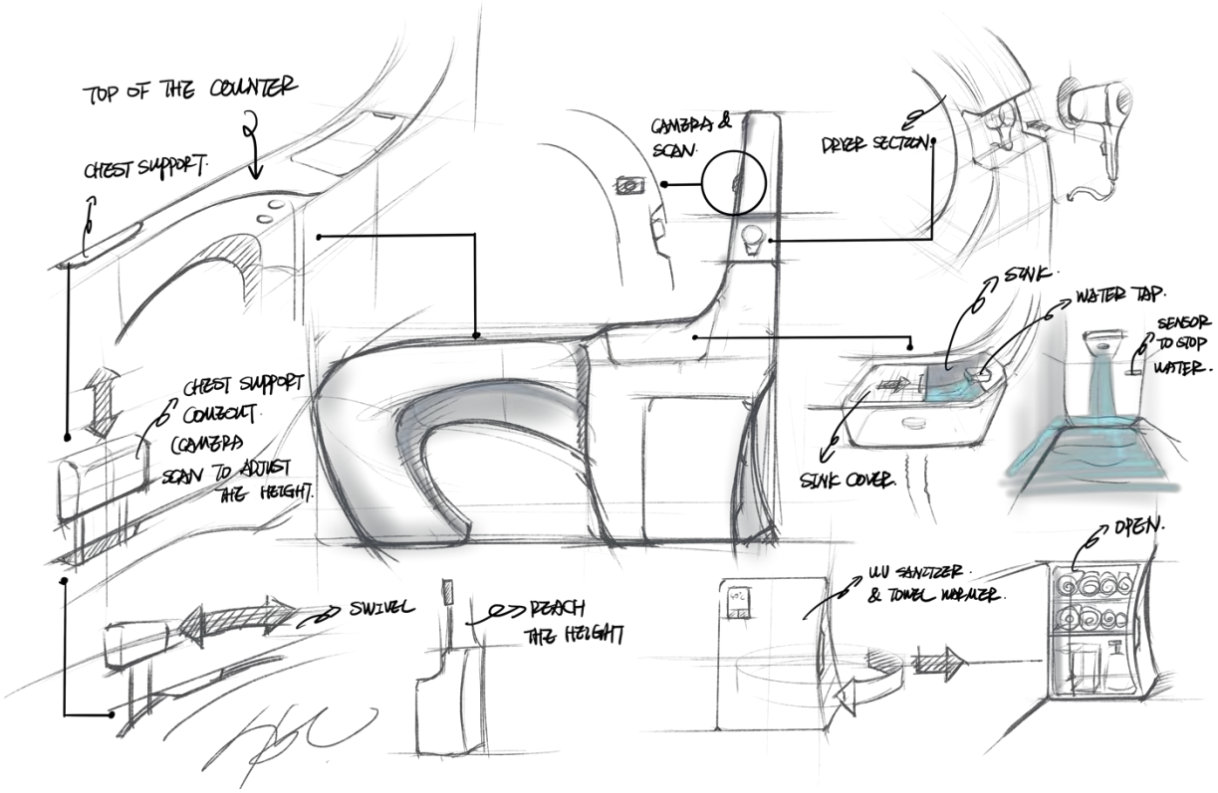


Figure 75 - Concept Station Details


TOP OF THE COUNTER
CHEST SUPPORT
CAMERAS & SCAN
DRYER SECTION
SINK
WATER TAP
SENSOR TO STOP WATER
CHEST SUPPORT CONNECT CAMERAS SCAN TO ADJUST THE HEIGHT
SINK COVER
OPEN
UV SANITIZER & TOWEL WARMER
SWIVEL
REACH THE HEIGHT

4.4.2 Design Development

4.4.3 Refined Product Schematic & Key Ergonomic

The refined product schematic is designed according to the ergonomic study and human interaction for the product. The

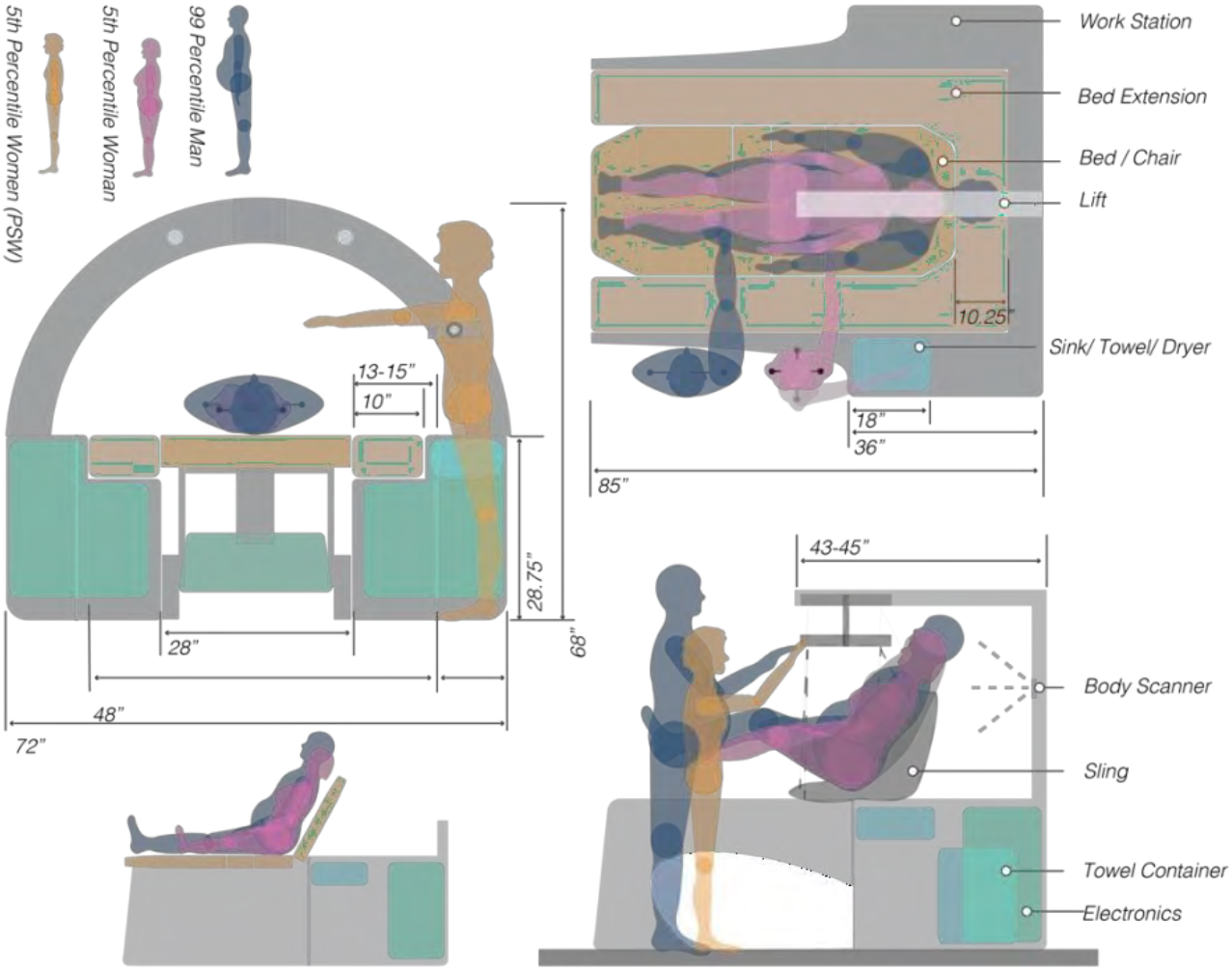


Figure 76 - Updated Configuration 1

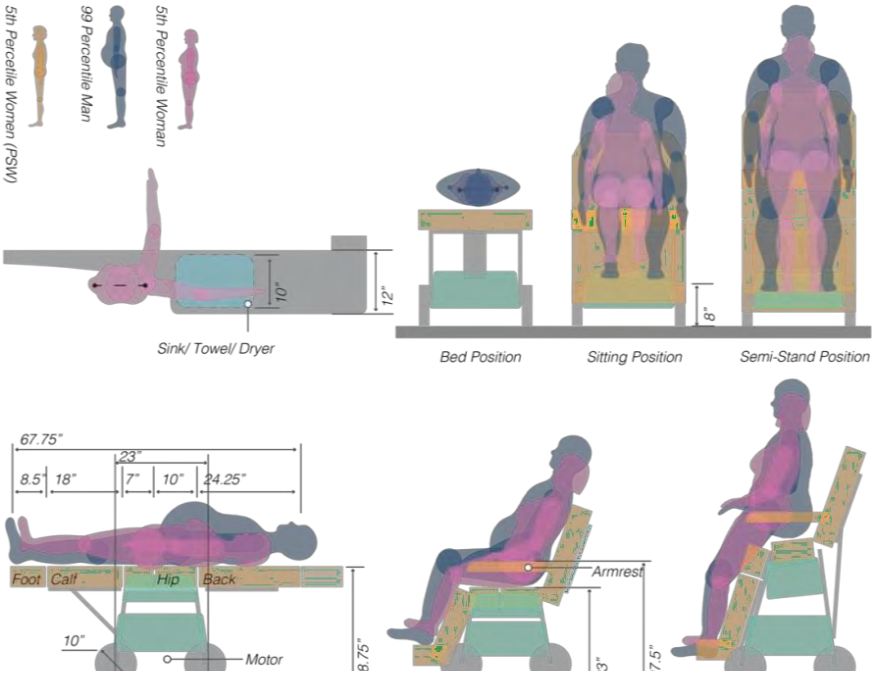


Figure 77 - Updated Configuration 2

4.4 Concept Realization

4.4.1Design finalization

This section includes the final design; the design focuses on the solution's aesthetics and function. The final concept is to enhance the independence of people with obesity when their caregiver is not around, yet to combine all the essential care for their PSW. The goal is to reduce the physical and mental stress of PSW when they are in rush time.

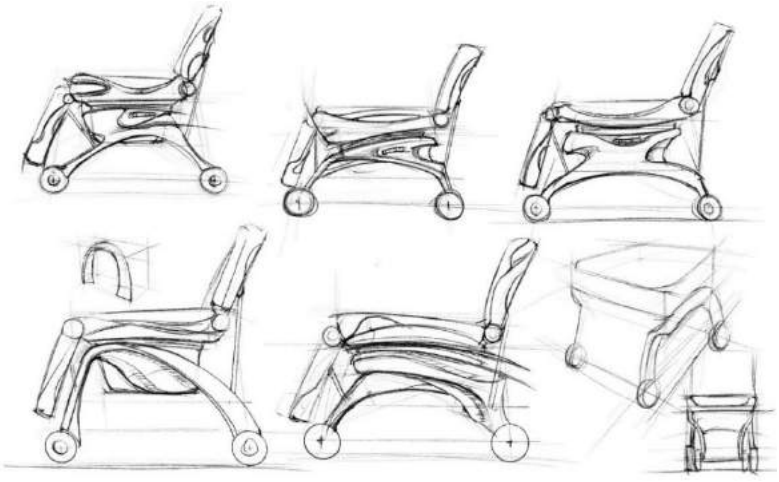


Figure 78 - Chair Form Exploration

To enhance for those individuals who with experiencing obesity, the aesthetic of the device is essential.

The image above is the ideation for finalizing the look for the wheelchair.

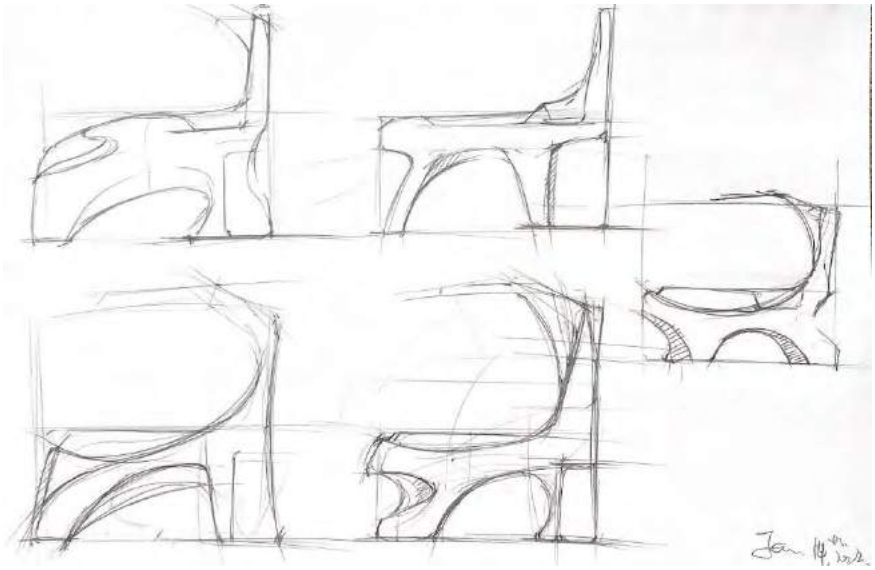


Figure 79 - Station Form Exploration

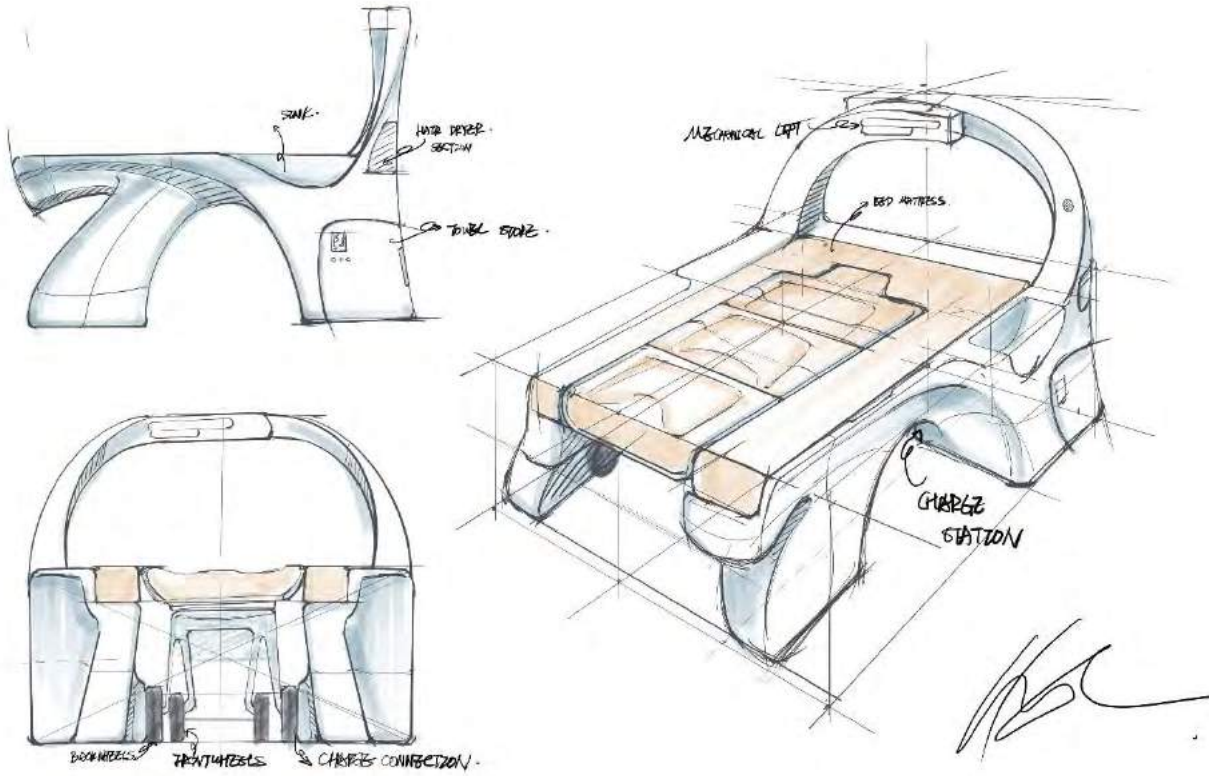


Figure 80 - Stratus Final Design Overall

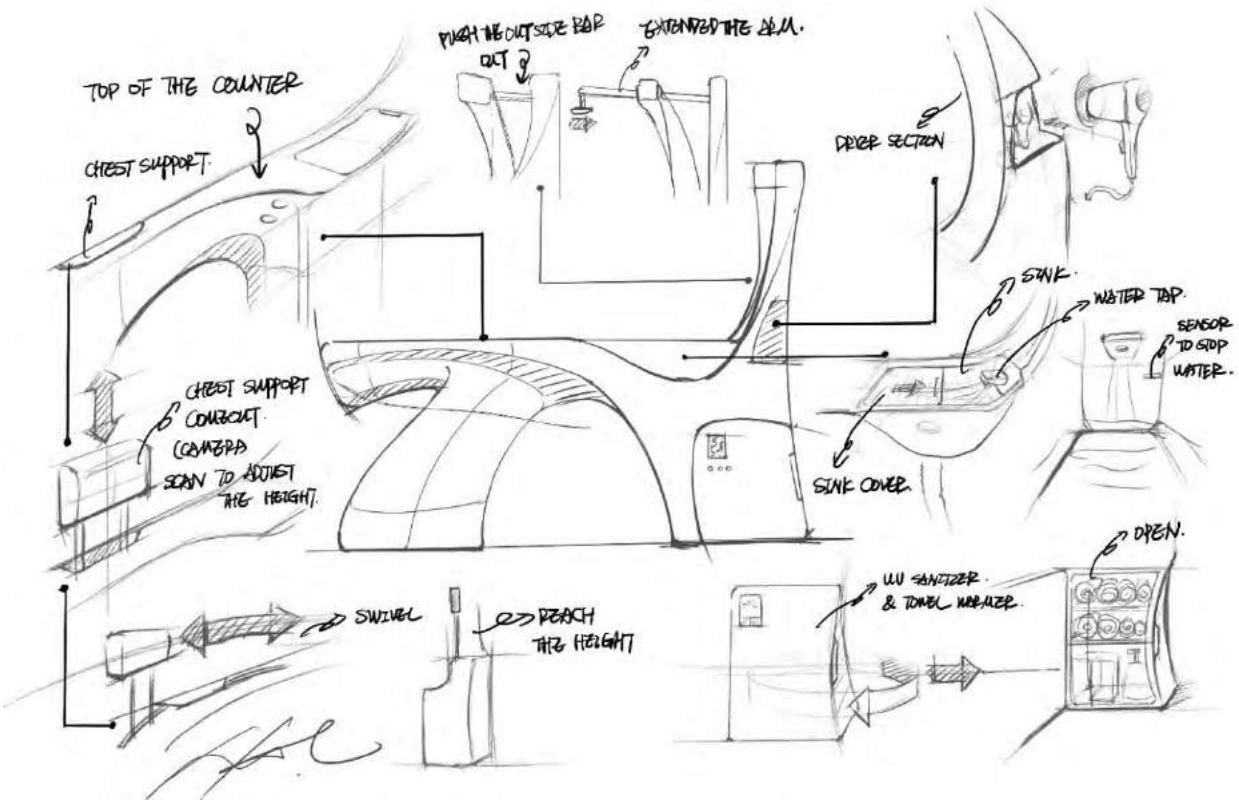


Figure 81 - Stratus Station Design

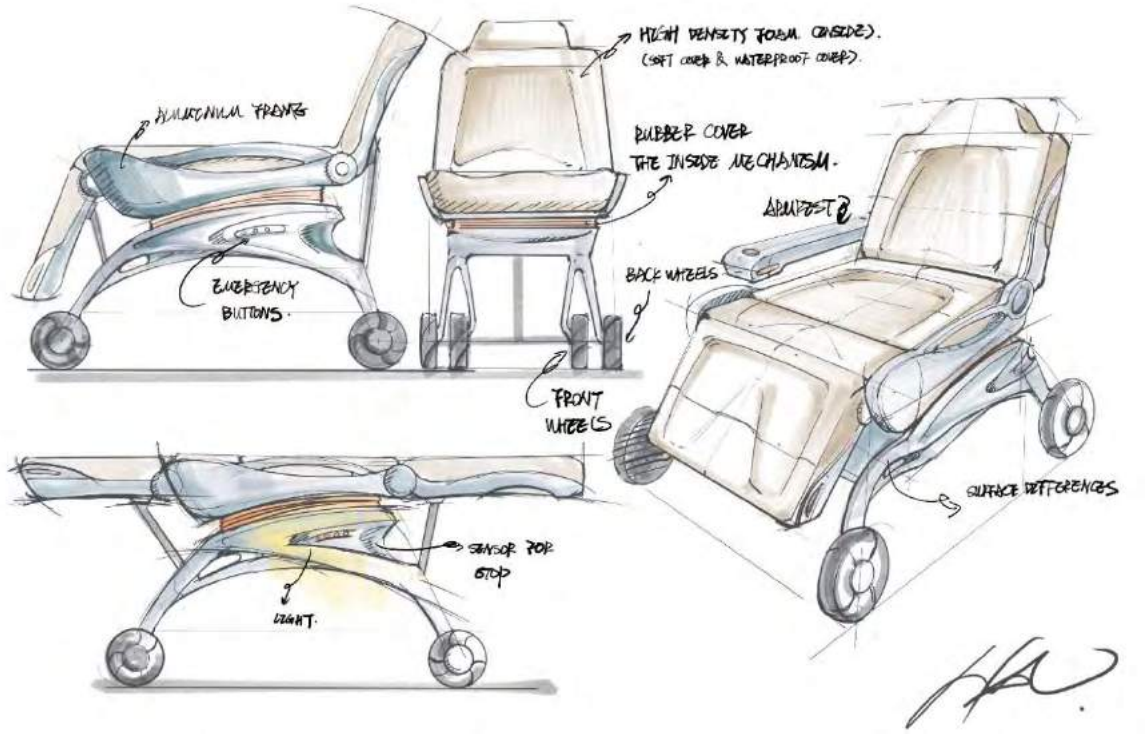


Figure 82 -Stratus Chair Design

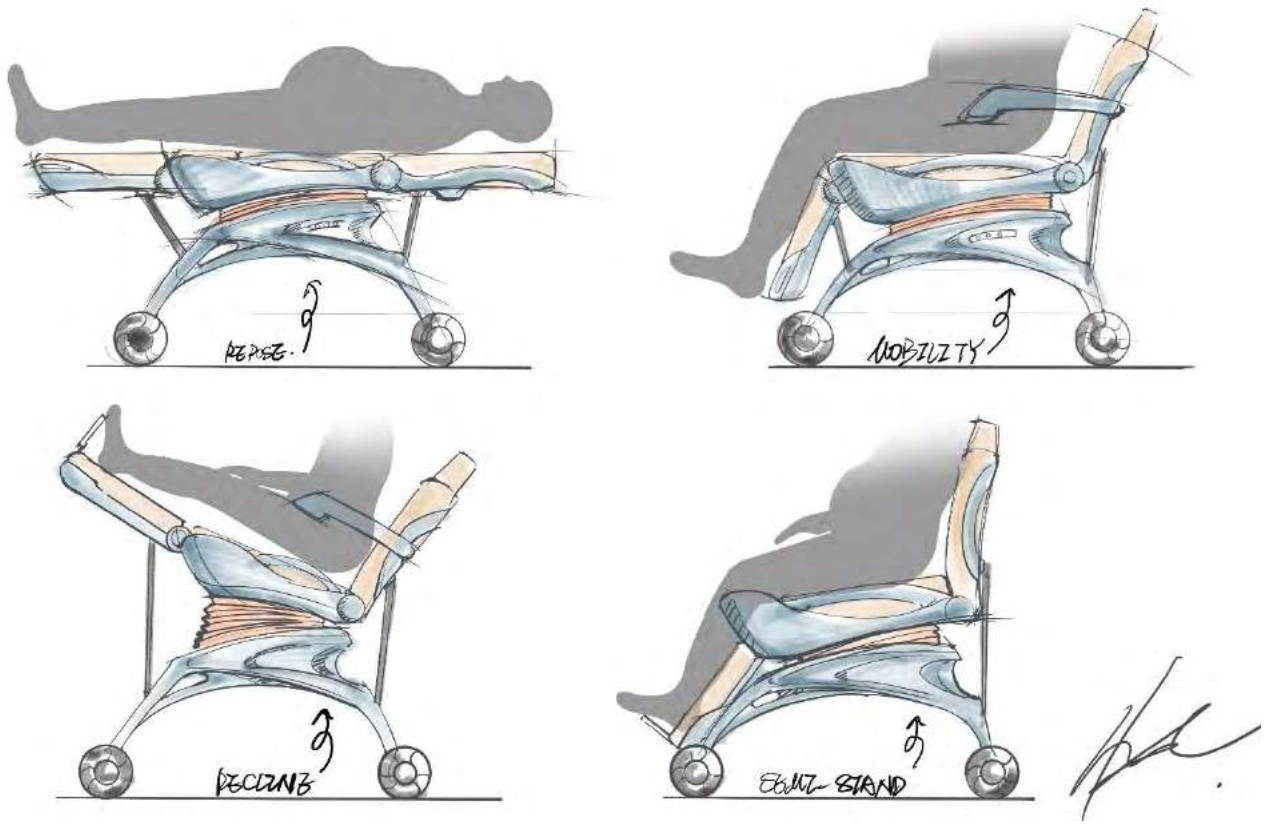


Figure 83 - Stratus Chair Positions

4.5.2 Physical Study Models

This section indicated the scaled physical model better to understate the size, ergonomic, and design features. The physical model is a 1:6 model made mostly from foam core and illustration board; the model's overall size is 14.17 inches by 11 inches. The image below is templated used in the sketch model.

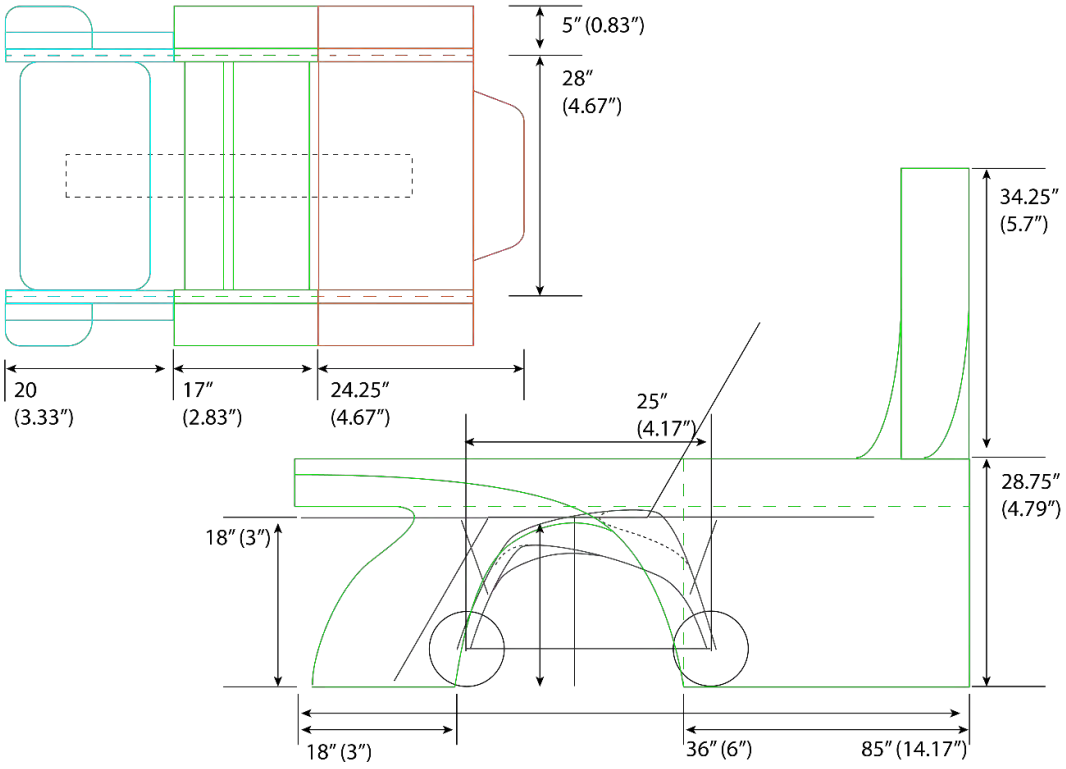


Figure 84 - Dimensions for Sketch model

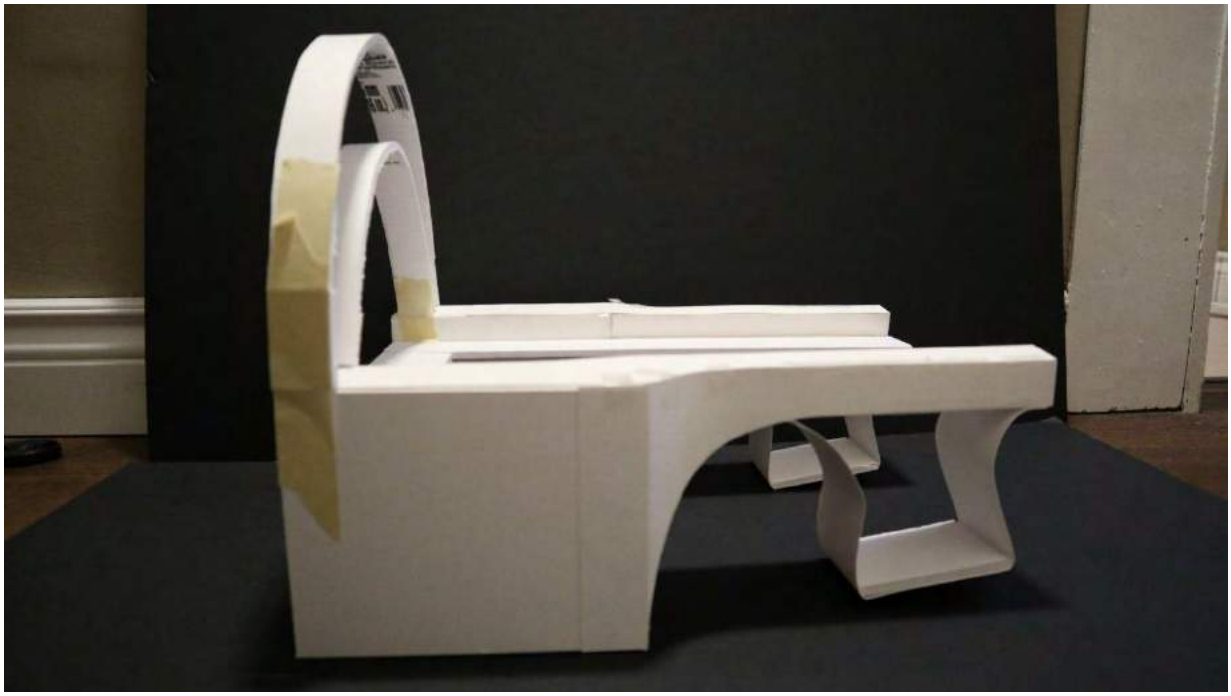


Figure 85 - Side View

Figure 86 - Top View

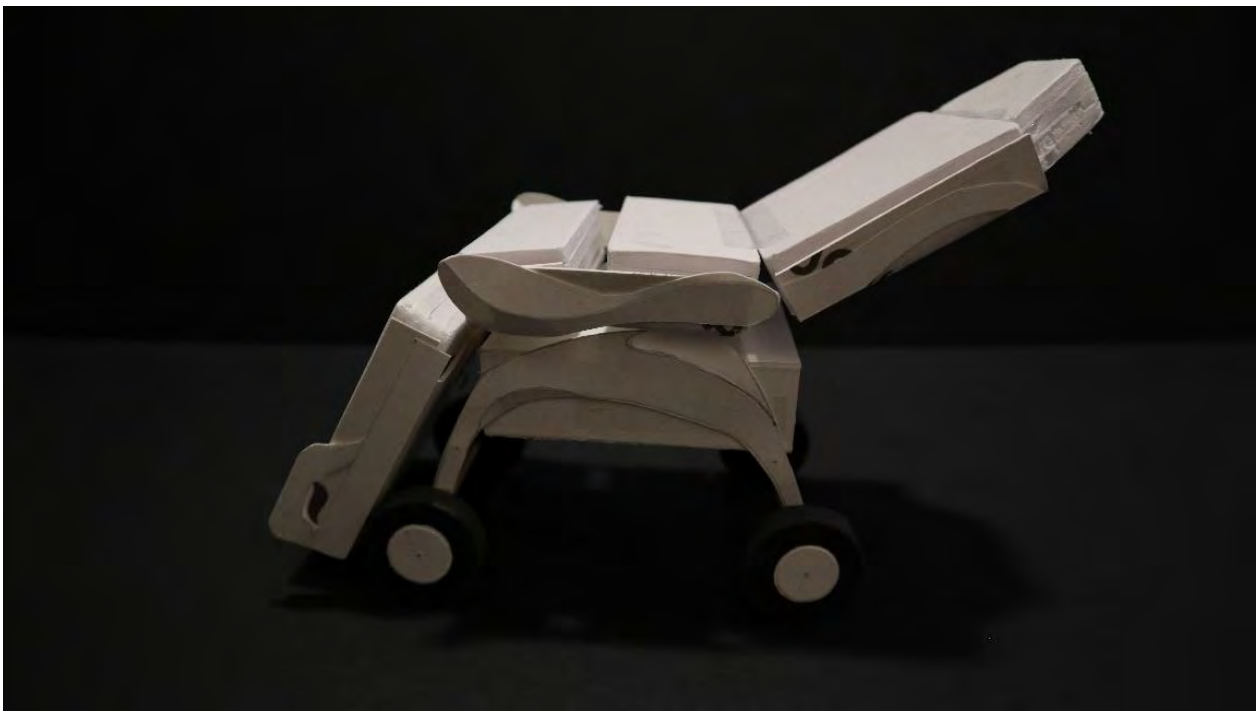


Figure 87 - Chair Side

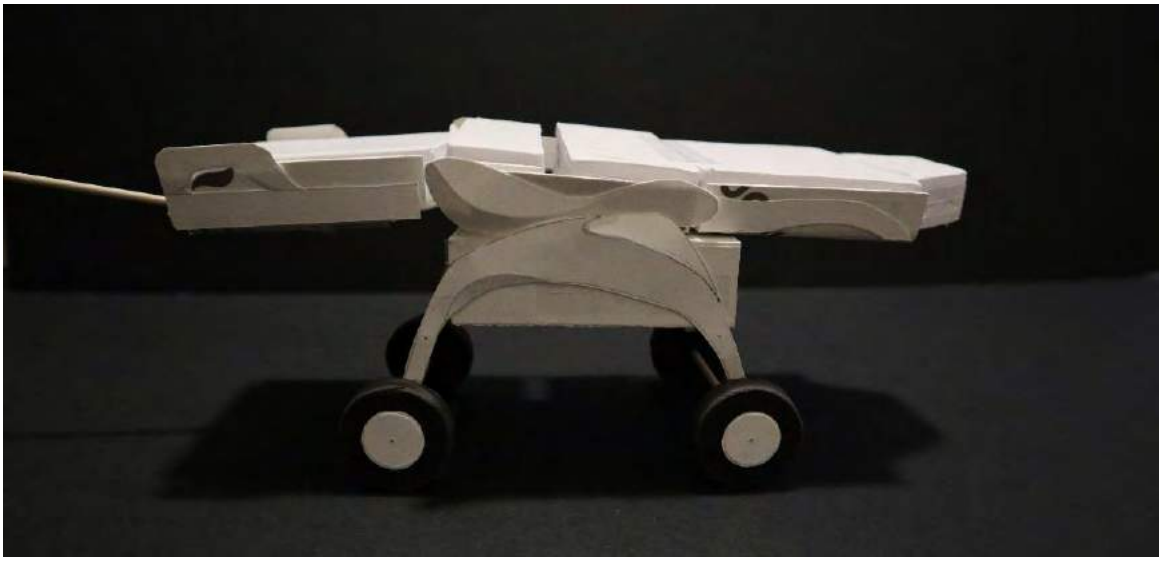


Figure 88 - Chair in Repose Position

Figure 89 - Chair in Recline Position

The size and dimension have been finalized through the physical sketch model for the final scale-down model. For future development, the sketch model helped refine the size of the chair to achieve the best solution for the ergonomics. To better indicate the design feature, the

sketch model has helped with the layout of the feature of the design and mimicked the human interaction overall.

4.6 Design resolution

Before the final digital model, this step is to understate better design and overall aesthetic based on the accurate size block. The image below shows the finalization of the design, and the thinking progress of the digital model making.

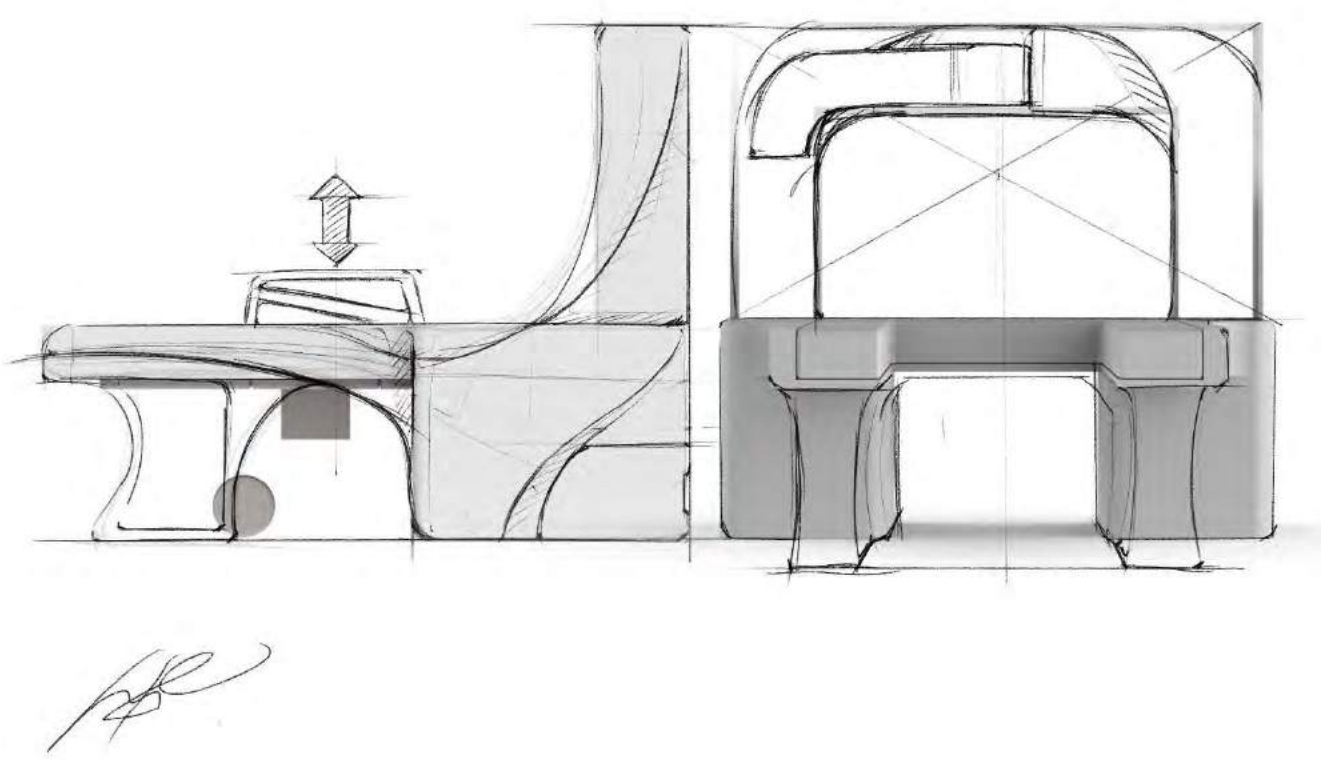


Figure 90 - Finalized Form for CAD 1

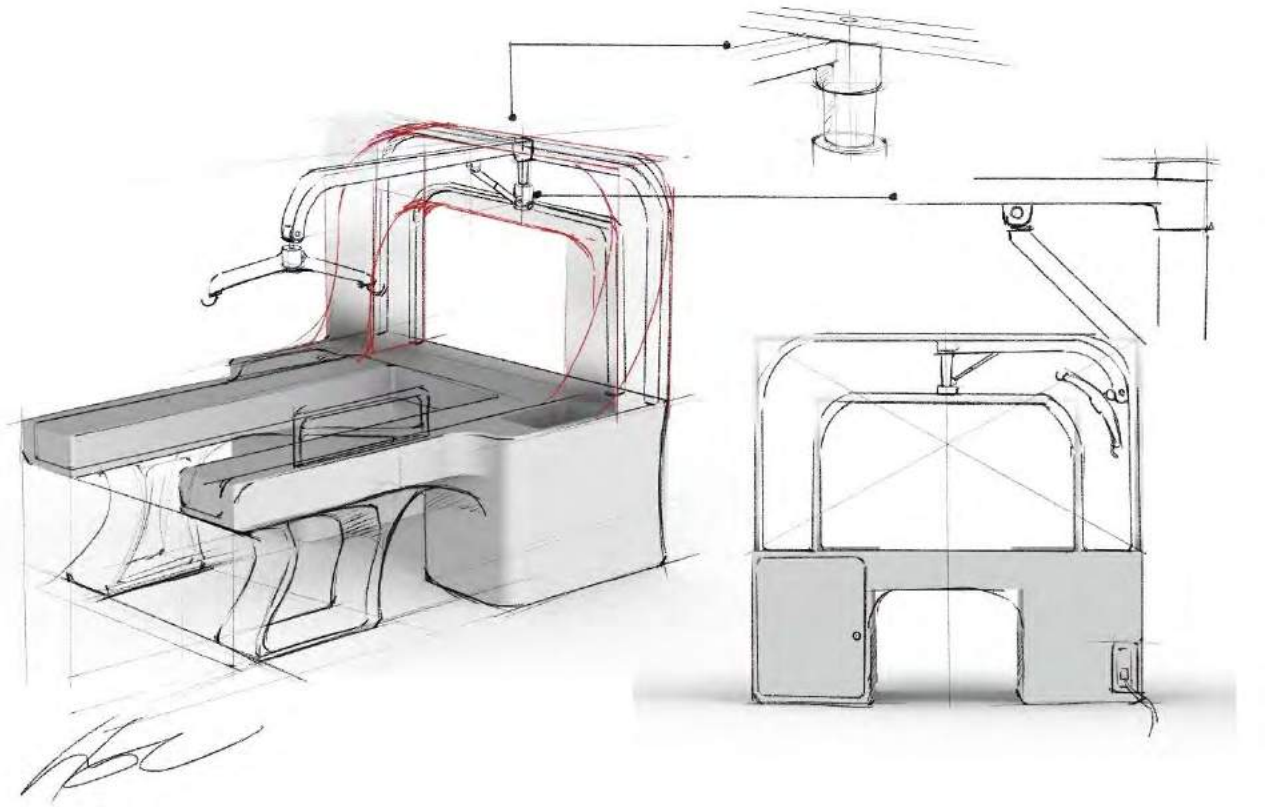


Figure 91 - Finalized Form for CAD 2

4.7 CAD Development

In this section, the steps of the digital model building have been shown. The CAD includes two significant areas, the wheelchair and the bed station. Each central team has multiple parts to present the manufacturing possibilities. The overall CAD model consists of the soft goods, metal, and rubber sections. The detail of the model will be indicated in the following images.

Figure 92 – Chair CAD

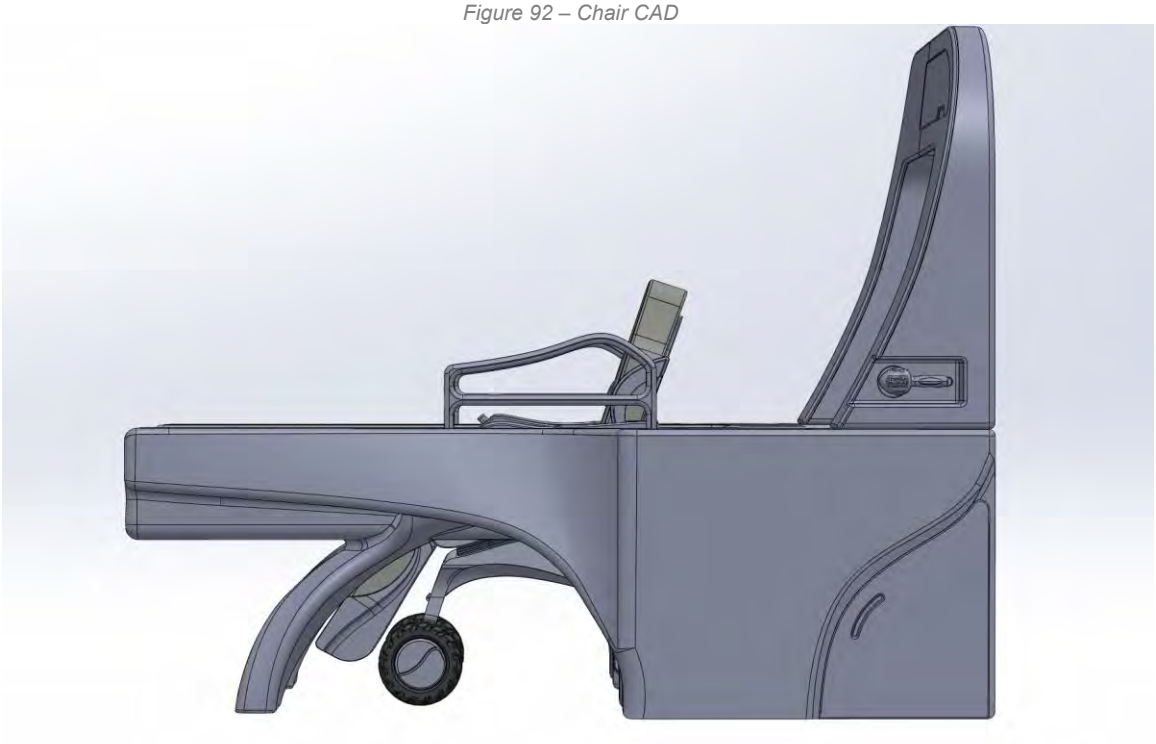


Figure 93 - Overall CAD

4.8 Physical Model Fabrication

To achieve the accuracy and stable physical model, a 3D printing moth has been selected. The printing has been separated into two sections: the self-printing by using FDM (Fused Depositing Modeling) printer and the outsource SLA (Stereolithography) printing method. FDM printing is used for most on the chair; to better monitor the printing and fix the possible mistake is the main reason for using the personal FED printer. The SLA printing is for the bed station. Due to the size and complex curve designed in the model, printing the bed base in one go is the solution. Therefore, outsourcing SLA printing services can save time and avoid the unsavable issues by FDM printers. Another exceptional material finish was down by outsourcing due to the real achievement for the physical model. The finish on the model is colour spray painted with coating, with colour coating it shows the potential material and aesthetic achievement. Between the printing and colouring the parts would sand to present with nice surface.

Chapter 5 Final Design

In this chapter, the main focuses are to indicate the four pillars of the final design, and how the design is ties back to the solution. The physical model would show in this section with its features.

5.1 Summary

With the current growing elderly population, Canada's demand for elderly care has also increased. People desire responsive, resilient, and adaptive personal care when faced with this situation. The increased need for personal support workers (PSWs) creates more stress and pressure than before. Unfortunately, a PSW working part-time within a homecare setting does not receive the same benefits and insurance coverage as colleagues working within a nursing home or hospital setting. However, in recent years retiring at home has been suggested, and therefore the demand for home care will continue to go up. For that reason, awareness and empathy are essential to the quality of care.

Furthermore, obesity is rising, and future medical support may be needed as they grow older and become immobilized. This comes with a decrease in mental health and independence. A person with obesity requires more time and care overall; it is essential to enhance their personal care experience while reducing the psychological and physical stress experienced by the PSWs. Therefore, the design of Stratus is a homecare assisting device that combines a mobility wheelchair for people with obesity and a workstation for their support workers (PSWs).

5.2 Design Criteria Met

This section explains the main features and design intent according to the research and the purpose of the design solution: Stratus.

5.2.1 Full Bodies Interaction Design

As a homecare assisting device, Stratus services two different users, making human interaction significant. The Stratus wheelchair is height adjustable and can be tilted accordingly. It can be used in three different positions allowing the user to repose horizontally, recline, and

detach for increased mobility within their space. The self-swing armrest is there for use when needed and poses can be altered throughout the day to ensure full-body comfort. All features on the Stratus' bed-station follow the essential needs of personal support workers (PSW) caring for peoples with obesity. The over hanging mechanical lift aids in a smooth transition to the appropriate seating position for an easier care experience. This allows better facilitating of a commode toilet and puts the sink, hairdryer, and towels within arms reach minimizing movement within their care routine.

Additionally, the ergonomic features for the users of Stratus have been narrowed down through observation and research. The Stratus chair was modelled with the 95th percentile male and the standard width of a bariatric wheelchair. The Stratus bed-station is equipped with the essential equipment needed for routine care of the obese client. The height of the mechanical lift allows the PSW to comfortably reach and safely lift the client, making it easier to move the chair out easily. The space underneath the Straus bed-station accommodates a variety of movements for the PSW. The bed rail is positioned within the arm's reach for the person with obesity. The location of all the tools are also designed to be ergonomic and practically laid out. This offers optimal and efficient space for the PSW during their care routine.

5.2.2 Materials, Processes, and Technology

The importance of achieving sustainable products is to reduce the footprint from manufacturing and use sustainable materials that accomplish the close circle of production. The objectives in this section are to utilize the current materials used for the product yet discover the new materials that enhance the user experience and impact the climate. Each material and the

manufacturing process would indicate each component in this section to reduce waste and minimize the manufacturing process.

Materials

The design solution includes two major sections, the mobility chair, and the workstation for Personal Support Worker (PSW). The design solution reminds two disciplines of the material type: hard materials and soft materials. The rugged materials used on the current products are steel (figure 1), which provides a robust structure for the wheelchairs; it also is the most sustainable metal. In addition to the steel structure for the chair, most of the current wheelchairs use various plastic to cover the joins. It protected the wear and tear of the products yet contained the overall design aesthetic. The touchpoints on the current design also used soft foam for the secondary user, and it offers a more comfortable grip.

Figure 94 - Wheelchair, Retrieved from: : https://www.futuremobility.ca/orion-ii-wheelchair/#specifications

The soft materials are used in the foam cushions and the cushion cover. Most of the products provide breathable cushion covers that enhance the user experience. The foam on the

seatback calves is designed for different shapes that help pressure distribution users. The most common foam used for the cushion is High Resiliency (HR) and Visco Elastic foams (figure 2); these are used for the different layers that achieve stability, skin protection, or positioning (Permobi CA. 2022). Currently, the foam used on most wheelchairs is not able to biodegradable. In Canada, donating the wheelchair would be the most solution for the old wheelchairs. Each component would be separated into small sections after donation and indicated as reusable or trash.

Figure 95 - Wheelchair Cushion. Retrieved from: https://www.primacare.co.za/product/wheelchair-cushion-x-seat-clinic/

Durability is essential in the mobility equipment; thus, the materials chosen for the cushion cover need to be washable or/and easy to clean. The most widely used cushion cover is made from vinyl or nylon. Vinyl and nylon are the top choices for medical use because the smooth surface allows users to transfer between places quickly and reposition themselves. Nylon is most used on home care equipment, and it offers good breathability and is easy to wash or clean. Since

vinyl is non-breathable, it is used to simulate leather and is employed more commonly in hospital settings.

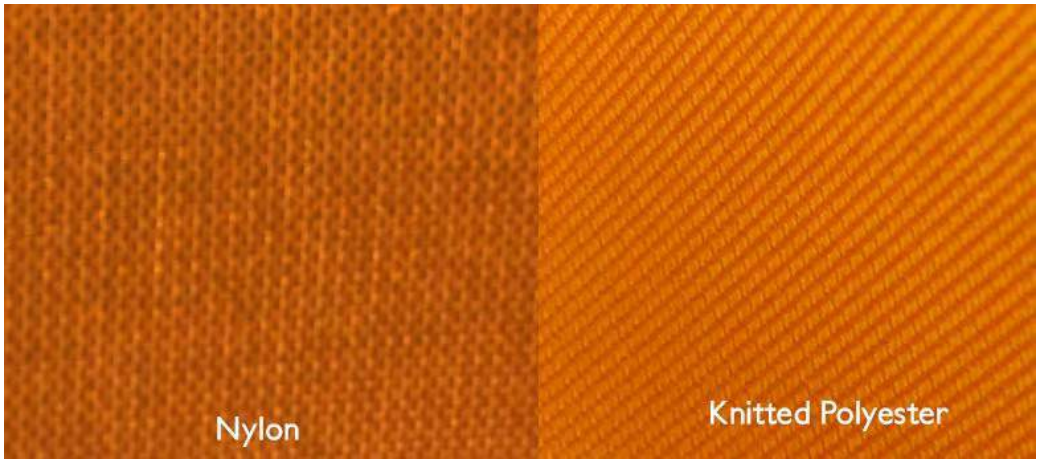


Figure 96 - Nylon VS Vinyl. Retrieved from: https://www.fabricgateway.com/topic/vinyl+vs+polyester

Manufacturing

The manufacturing for all the metal parts would be done by injection molding; it creates suitable wall thickness and maintains multiple injections and different materials simultaneously, which can reduce the cost of the product. The metal would be done by extrusion for the first step and CNC bending to increase the efficiency and reduce the labor cost for manufacturing. The latex cushion would use the model to shaper the cushion and be baked to the bouncy comfort cushion.

5.2.3 Design Implementation

Part #	Description	Material	Manufacturing	Qty
1	Back support	Aluminum	Die casting	1
2	Seat support	Aluminum	Die casting	1
3	Front seat support	Aluminum	Stamping	1

4	Calf support	Aluminum	Die casting	1
5	Base	Aluminum	Die casting	1
6	Armrest	Aluminum	Die casting	2
7	Tires	Rubber	Vulcanization	4
8	Tire inner plates	Aluminum	Stamping	4
9	Tire outer plates	Aluminum	Stamping	2
10	Tire outer plates for charge	Aluminum	Stamping	2
11	Back cushion	Natural latex	Forth, molds, and baked	1
12	Seat cushion	Natural latex	Forth, molds, and baked	1
13	Front seat cushion	Natural latex	Forth, molds, and baked	1
14	Calf cushion	Natural latex	Forth, molds, and baked	1
15	Footrest	Aluminum	Die casting	2

Part #	**Description**	**Material**	**Manufacturing**	**Qty**
1	Body panel curved	Aluminum	Metal Foaming	2
2	Back cover	Aluminum	Stamping	1
3	Centre Section	Aluminum	Hydro foaming	1
4	Lift cover back	Aluminum	Stamping	1
5	Lift cover front	Aluminum	Stamping	2
6	Lift support	Steel	Extrusion	2
7	Station support	Steel	Extrusion	20
8	Bed rail	Aluminum	Tube bending	2
9	Sink cover	Aluminum	Stamping	1

10	Water tap	Stainless steel	Die casting	1
11	UV carbine	Aluminum	Sheet metal bending	1
12	UV carbine door	Aluminum	Sheet metal bending	1
13	Hand-held dryer door	plastic	Injection molding	1
14	Lift	Steel	Casting	1

5.3 Final CAD Rendering

The following images indicate how Straus would be used in real life in the institution renders. The archive of the home-use medical device, the colour chosen for Straus, is more natural and unisex.

Figure 97 - Render 1

Figure 98 - Render 2

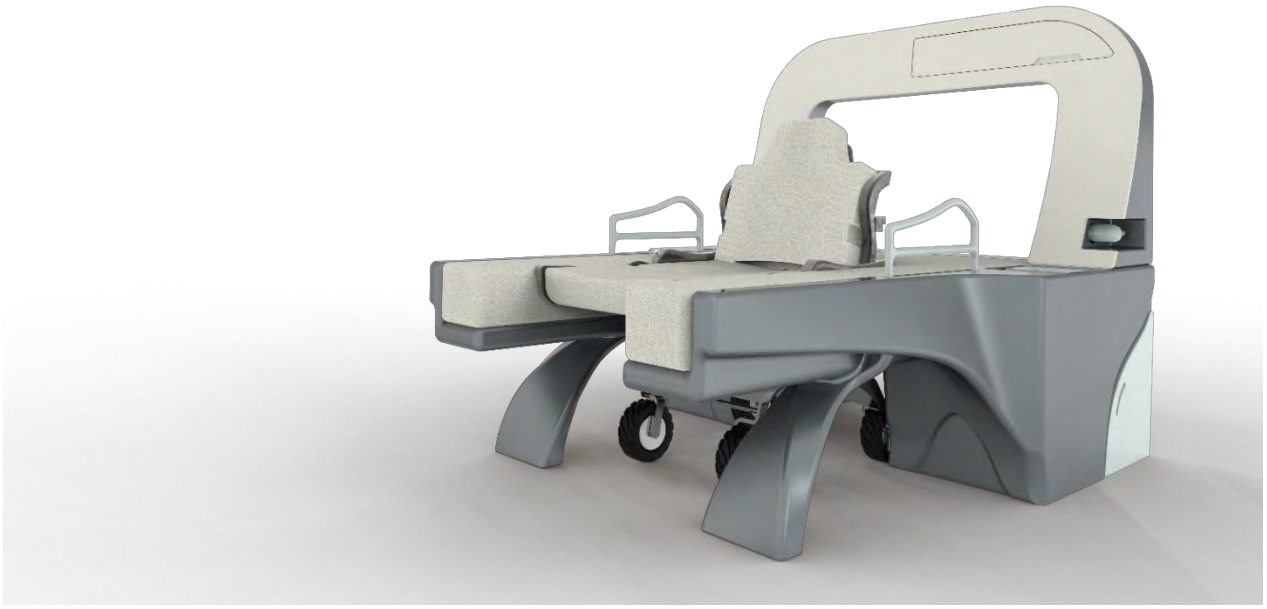


Figure 99 - Render 3

Figure 100 - Render 4

Figure 101 - Render 5

Figure 102 - Render 6

5.4 Physical Model

As mentioned in the previous section, this physical model is majority printed by FDM and SLA printers. The materials are PLA and plastics. The physical model has two major sections, the Stratus wheelchair, and the Stratus bed-section. The chair stays in the mobility model for the visual presentation content, and the mechanical lift on the station can swing out to mimic the lift in use and store away.

Figure 103 - Physical Model Overall

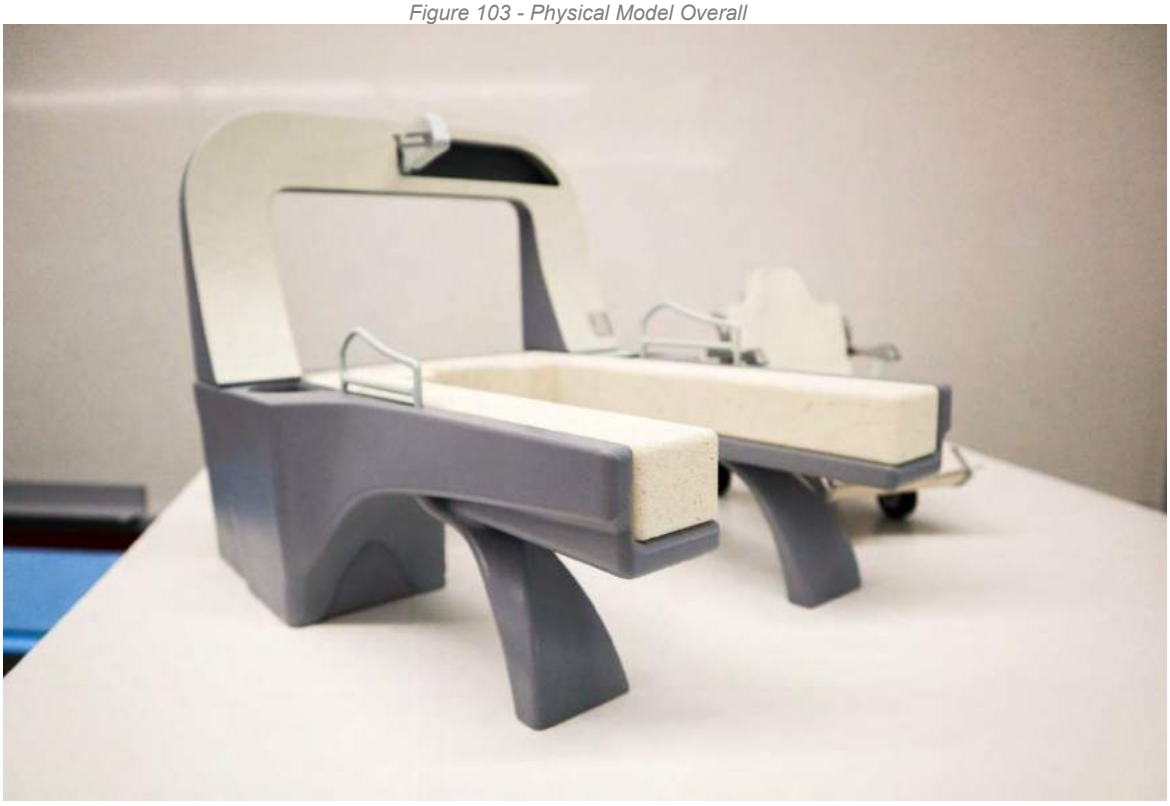


Figure 104 - Physical Model 2

Figure 105 - Physical Model Chair

Figure 106 - Physical Model 3

Figure 107 - Physical Model 4

Figure 108 - Model 5

Figure 109 - Model 6

Figure 110 - Model 7

Figure 111 - model 8

Figure 112 - Model 9

5.5 Technical Drawings

5.6 Sustainability

This section discusses the materials and manufacturing of the current benchmarking, which expressly indicates the design solution of assisting home care for the person with obesity to deliver sustainable customer value in the design solution. In an attempt to ensure health and safety within the design solution, this report dedicated the research to the user group. Additionally, this report expanded on the sustainability response to the environment and the user; stated the sustainable goal in the design solution.

The primary users in this thesis project are the personal support workers and people with obesity. These two specific user groups ensure safety and usabilities are the prioritized goals. The standard bariatric equipment guideline recommends the provision of beds, toilets, wheelchairs, and diagnostic in interventional equipment capable of accommodating the size and weight of a person with obesity (CADTH. January 19, 2012). Therefore, the design solution needs to consider using materials to improve the user experience.

According to the research, the average lifespan of a wheelchair is two to three years, with a maximum of five years for manual wheelchairs ("Ultimate guide to Buying a Wheelchair." 2022). For that reason, use sustainable materials and reduce manufacturing processes to benefit all users' the environment, safety, and users.

This section researches the sustainable benchmark initiative, material, and safety hazers to achieve sustainability. This research can provide an excellent baseline for the design solution and

enhance the current product's usability. This section also included the potential materials that can increase the design's sustainability.

Benchmark Sustainable Initiative

Within the research from the previous section, the current benchmark for the wheelchair aims to increase reusability. However, after the disassembly, most of the parts on the cushion cannot reuse and not impact the climate. Therefore, maximizing the use of sustainable materials is the goal of this design solution. In this design solution, all the rigid sections are made from steel, maximizing the product's strength and providing an excellent recycling rate. *Convestro* provides fantastically sustainable, engineered plastic that impacts the climate yet offers exceptional durability over time for the use of plastic (figure 4).

Figure 113 - Plastic, retrieved from:

The soft materials used in this design solution are foam and fabrics. Instead of using High Resiliency (HR) and Visco Elastic foams for all the cushions, the cushion and mattresses would use latex foam. The latex foam is made from natural rubber trees, and it provides various hardness for users. Natural latex foam offers eco-friendly and longevity since latex is made from organic resources (Figure 104). It is also biodegradable, which solves the non-recyclable problem

for the current cushion foam. The material combination above enhances the durability of the product and reduces the footprint of the materials.

Figure 114 - Nature Latex Mattress. Retrieved from: https://www.indiamart.com/proddetail/natural-latex-mattress-20021723830.html

Health

To accomplish the heath within this design solution is to control the water waste from the station. Reducing the water used for the user and minimizing the unclean water in the station can benefit the local community.

Using heat-resistance plastic is an excellent way to provide health hazers to avoid the heath hazer from the materials. Additionally, using plastic that works well with electronics; also is essential for the user. It helps reduce the risk of flame. Using organic material for the mattress and cushion minimizes the health concern for the user and the factory worker. And the

breathable cushion helps the user reduce bacteria growth over time. The recycling, reduce, and reuse principle is applied in the design to reduce health and environmental hazards.

Safety

The primary two objectives under safety are lined to use materials. First, using a solid and robust structure for the design is vital for the user's security. Therefore, choosing steel as the construction ensures safety for all users. To maximize the rigged connection, using plastic or protecting joints is essential for the user. Secondly, use strong plastic and wheel sealed parting line is to prevent water floor. Easy assembly is necessary for keeping the user or the technician safe; minimizing the assembling components helps increase efficiency and reduce the complexity of repairing.

Sustainable Statement for Final Design

Good products shouldn't only focus on problem-solving aesthetics and the responsibility of the environment and user. The sustainable statement in this design solution follows some of the lists from *The Global Goals*:

- Good health
    - Ensure health materials and provide health products for the consumer
- Clean water and sanitation
    - Control the water waste for the build-in sink
- Sustainable cities and communities
    - Maximize the sustainable and recycled materials in the design
- Responsible consumption
    - Reduce the footprint for manufacturing (long term)

- Climate action
    - Increase usage of the product and provide easy repair, reuse, and recycle plan

Overall, the initial goal for this design solution is to enhance the user experience for the person with obesity and reduce the stress for personal support workers. In addition, to create greater design solutions, sustainability is essential to be considering. This report analyzed the current material, manufacturing process, and the basic regulation to set a boundary for the solution. But also, to seek opportunities to improve the sustainability response overall. Therefore, using materials, reducing the footprints through manufacturing, and reducing the product's afterlife damage can enhance the sustainability of the design solution.

Chapter 6 : Conclusion

Stratus is a homecare assisting device that combines a mobility wheelchair for people with obesity and a workstation for their personal support workers (PSWs).

The design aims to elevate a person's independence with obesity when their caregiver is not around. Stratus allows the user to control their device freely within their space; they have the ability to reposition their wheelchair to become a part of their bed or detach to move around their living space. Additionally, Stratus has a modern look encouraging the user to use the wheelchair outside of their space, promoting rehabilitation.

This design solution reduces the mental and physical stress experienced by PSWs by making all tools needed for the personal care more accessible. With more than 10 clients per day, 15-45 mins per session, Stratus greatly reduces the stress experienced from all parties and improves the overall quality of care.

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Appendix A – Discovery

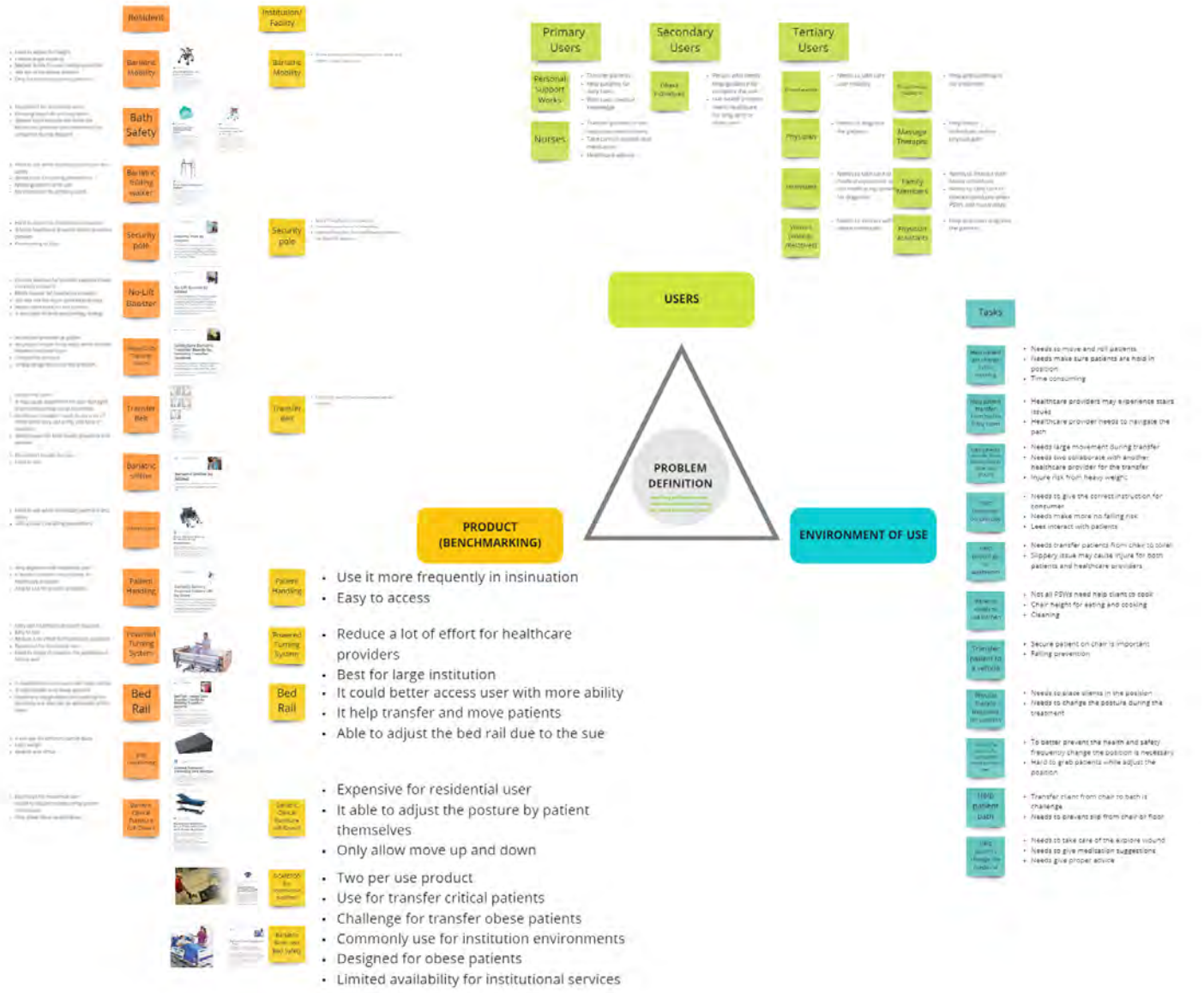

Figure 115 - Research

Appendix B – Contextual Research (User)

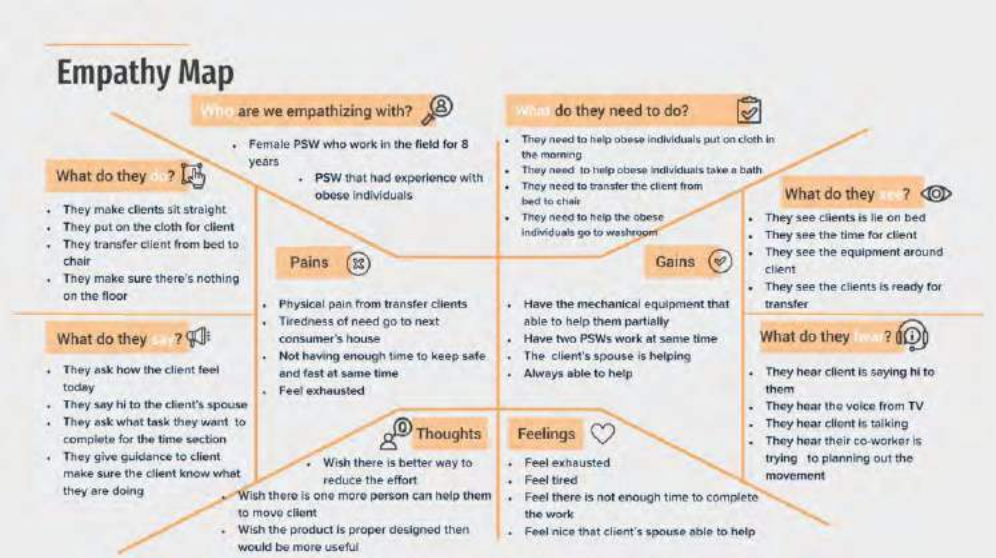

Figure 116 - Empathy Map

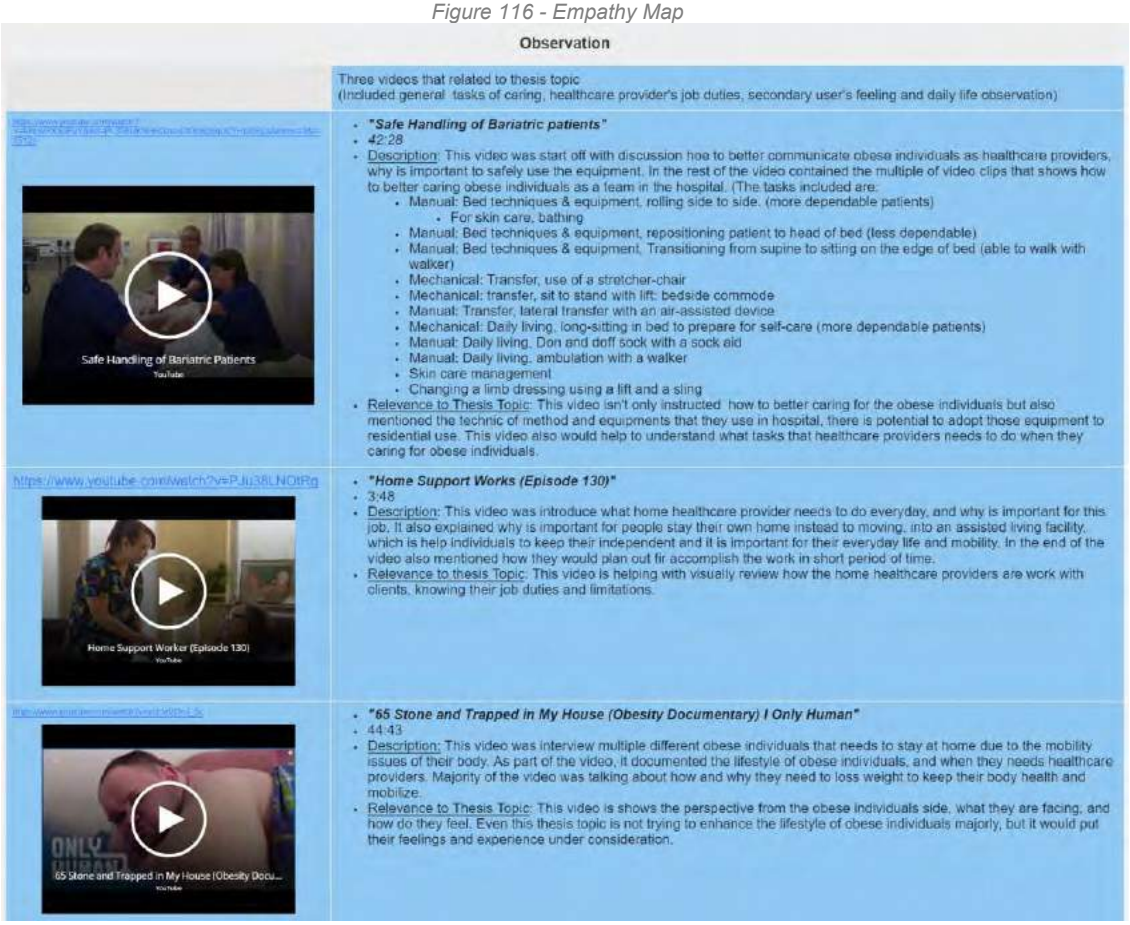

Figure 117 - User Observation 1

- **what is the objective for the thesis research?**
  - Needs to reduce the injure for healthcare providers caring for obese individuals at home
    - Needs to detecting the problem from the third person
    - Needs to know secondary user's reaction for each tasks
- **Decision(s) to be made?**
  - Discover information that user may forgot and didn't realize
  - Discover the relationship and interact between clients and healthcare providers
- **What information is required in the design research?**
  - How they transfer client (what equipment they use, how they use, what is the facial expression, how the clients is react to the method)
  - How they repositioning the client (what equipment they use, how they use, what is the potential problem need to solve)
  - How they help client do bath and use washroom (what is the difficulty, what method they use)
  - What is different or challenge for caring obese individuals vs. other clients
- **Who is the target user? Is it an individual or group?**
  - Primary users: personal support workers
  - Secondary users: Obese individuals
- **Target background?**
  - *Primary users: personal support workers*
    - Average age of 45 years old
    - Female
    - Had PSW certification
    - Work for long-term care facility or in clients's home as an employee of a home care agency
    - Have regular obesity clients
  - *Secondary users: Obese individuals*
    - Age 60 years old and above
    - Both female and male
    - Decreasing the mobility needs help from healthcare providers
    - Lives with spouse
    - Lives in sub-urban area
- **What is the preferred observation method?**
  - Videos
  - Photograph
  - In-person observation (general)
- **Observation infos:**
  - aiming for 2 - 5 in person observation
    - Contact V

Figure 118 - Research Plan 1

1:1 Interview: Help me gather the in-depth information

- **what is the objective for the thesis research?**
  - Needs to reduce the injure for healthcare providers caring for obese individuals at home
    - Needs to hearing out the experience from primary users
- **Decision(s) to be made? (Why to have the interview)**
  - Understanding their job
  - Understanding how they interact with client /patients
  - Discover what is the overlap between caring at hospitals and home
  - Discover the problem and needs
  - Discover the pain point
  - Discover the opportunities
- **What information is required in the design research?(what to focus on)**
  - Focus on the background of users (work experience, work environment, and persona)
  - Focus on their problems from their work environment (place, tools, time, people, experience, current physical condition - having or had physical injuries or pain)
  - Focus on their feedback of curtain products (positives, negatives, wishes)
  - Focus on their needs (immediate needs, latent needs, wishes)
  - Focus on their experience (how often to have a obese client /patient, experience of the tasks)
- **Who is the target user? Is it an individual or group?**
  - Primary users: personal support workers
  - Secondary users: Nurse
- **Target background? (any changes and additional information from research?)**
  - *Primary users: personal support worker*
    - Average age of 45 years old
    - Female
    - Had PSW certification
    - Work for long-term care facility or in clients's home as an employee of a home care agency
    - Have regular obesity clients
  - *Secondary users: Nurse*
    - Average age of 43 years old
    - Female
    - Had experience caring for obese individuals
- **Interview infos?**
  - 6 - 10 questions
  - 20 - 45 mins long
  - Aiming for 5 responses
    - Rose
    - Jessie's teacher
    - Marina
    - Shannon
    - Sydney & her teacher
    - Teacher from humber

Figure 119 - Research Plan 2

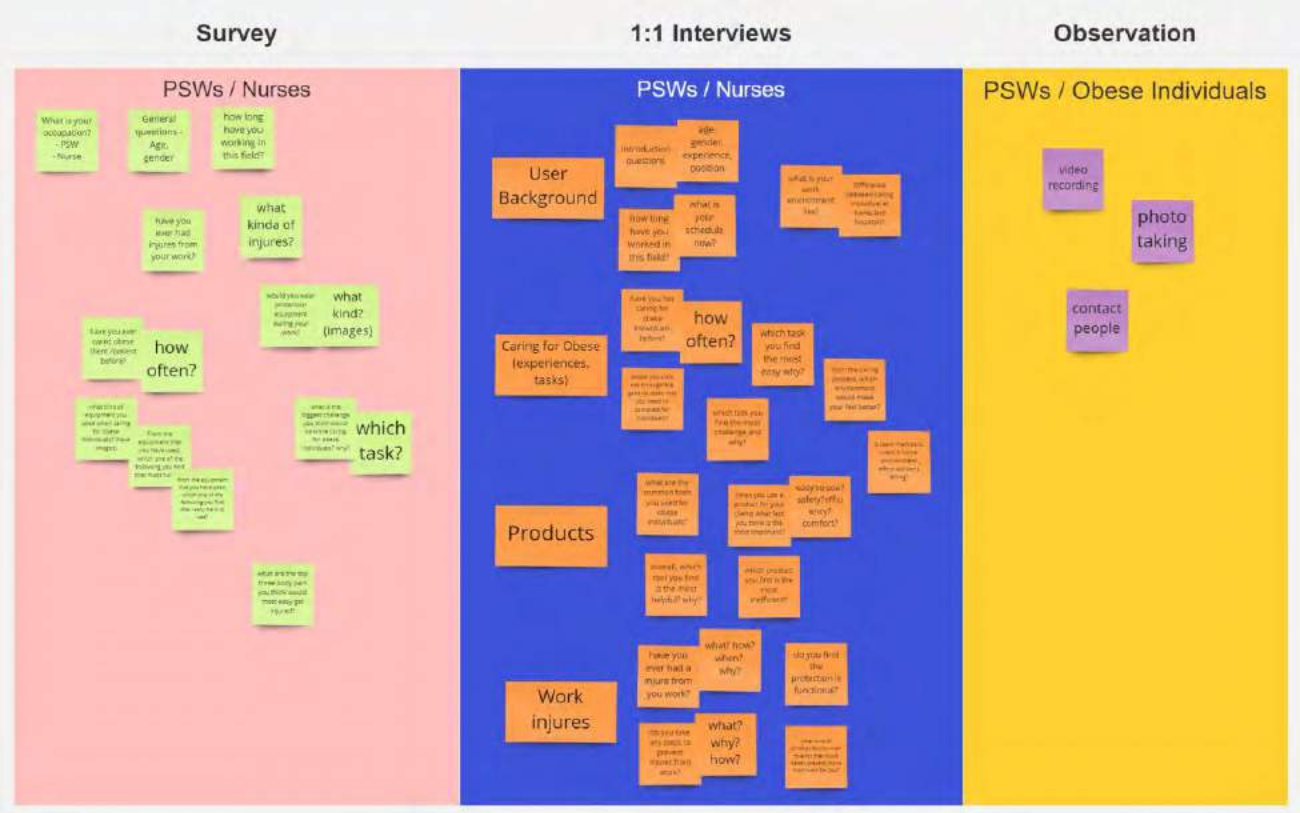

Figure 120 - Research Plan 3

User Observation by Video - Caring for Obese Individuals

Day in the Life of Home Care / May 18th, 2018 / https://www.youtube.com/watch?v=lTv53lhSwKk&list=PL398UKNH6Ozisl42Oqi6p3q0CYHbXSjLs&index=6

Get Ready in the morning

Check the task for the household

Before the care starts, the healthcare providers would go through the Social Work Care Plan and verbally ask clients if there anything change. And clearly repeat the task to make sure clients know what the tasks would be.

Put the sling under the client

The healthcare provider would caring for more than one client per day. For this client, the healthcare providers needs to attach the sling to the lifting tool that help transfer the client. The actions require teamwork, between each action the healthcare providers needs to give clear aaction to client to ensure the safety.

Lift the client from the bed

After put the sling under the client, the hooks are attached to the powered lifting tool, the client needs to help healthcare provider to ensure the safety, which is hold tight to the sling one each side to preventing falling or unbalance. Then healthcare providers would gently arise the client.

Figure 121 - User Observation 1

User Observation by Video - Caring for Obese Individuals

Day in the Life of Home Care / May 18th, 2018 / https://www.youtube.com/watch?v=lTv53IhSwKk&list=PL398UKNH6Ozisl42Oqi6p3q0CYHbXSjLs&index=6

Transferring the client

After the client been lifted, the client would be in the sit position (it allow client full themselve in the position). One healthcare provider would move the client out from bed by using the lifting equipment, another healthcare provider would make the bed to ensure when next healthcare arrive for the night routine.

Located the client on the chair

Two healthcare providers required for locating the client to the chair, it ensure the client is safely transferred from bed to chair. Both healthcare providers would unhooking the lift from the sling, an ensure the client is comfortable and blanched on the chair.

Transfer the client between two space

The transferring allow the client able to use wheelchairs to do other daily tasks (eating, toilet, leisure actives). The sling would be left underse the client that benefit the healthcare providers to do the night routine for the clent.

Check-out & Record the task

After all the procedures, both caregivers would sign off for their completion. It is for the purpose of recording and communicate with next healthcare provider.

Figure 122 - User Observation 2

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PARTICIPANT INFORMED CONSENT FORM

Research Study Topic: How may we better assist healthcare providers caring for obese individuals at home?
Investigator: Han Yang /519-328-3185 /hanyangdesigns@gmail.com
Courses: IDSN 4002 & IDSN 4502 Senior Level Thesis One & Two

I, Tanya Best *(First Name/Last Name)*, have carefully read the Information Letter for the project of how to better assist healthcare providers caing for obese individuals at home, led by Han Yang. A member of the research team has explained the project to me and has answered all of my questions about it. I understand that if I have additional questions about the project, I can contact Han Yang at any time during the project.

I understand that my participation is voluntary and give my consent freely in voice recording, photography and/or videotaping; with the proviso that my identity will be blurred in reports and publications.

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I also understand that I may decline or withdraw from participation at any time, without negative consequences.

I understand that I can verify the ethical approval of this study, or raise any concerns I may have by contacting the Humber Research Ethics Board, Dr. Lydia Boyko, REB Chair, 416-675-6622 ext. 79322, **Lydia.Boyko@humber.ca** or « insert student Name /Phone Number /Email Address ».

Verification of having read the Informed Consent Form:

☑ I have read the Informed Consent Form.

My signature below verifies that I have read this document and give consent to the use of the data from questionnaires and interviews in research report, publications (if any) and presentations with the proviso that my identity will not be disclosed. I have received a copy of the Information Letter, and that I agree to participate in the research project as it has been described in the Information Letter.

Click or tap here to enter text.		Click to enter a date.
Tanya Best	Tanya Best	Nov 1 2021
Participant's Name	Participant's Signature	Date

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- ✓ I understand that the data from this study may be published.

☑ **I have read the information presented above and I understand this agreement. I voluntarily agree to take part in this study.**

Click or tap here to enter text.		Click to enter a date
Tanya Best	Tanya Best	Nov 1 2021
Participant's Name	Participant's Signature	Date

Project Information

Thank you very much for your time and help in making this study possible. If you have any queries or wish to know more about this Senior Level Thesis project, please contact me at the followings:

Phone: 519-328-3185

Email: hanyangdesigns@gmail.com

My supervisors are:

Prof. Catherine Chong, **catherine.chong@humber.ca**

Prof. Sandro Zaccolo, **sandro.zaccolo@humber.ca**

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Faculty of Applied Sciences & Technology
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IDSN 4002 /4502
SENIOR LEVEL THESIS ONE & THESIS TWO

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Research Study Topic: How may we better assist healthcare providers caring for obese individuals at home?
Investigator: Han Yang /519-328-3185 /hanyangdesigns@gmail.com
Courses: IDSN 4002 & IDSN 4502 Senior Level Thesis One & Two

I, MeiLing Bai (First Name/Last Name), have carefully read the Information Letter for the project of how to better assist healthcare providers caing for obese individuals at home, led by Han Yang. A member of the research team has explained the project to me and has answered all of my questions about it. I understand that if I have additional questions about the project, I can contact Han Yang at any time during the project.

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Click or tap here to enter text.		Click to enter a date.
MeiLing Bai		Nov 1st. 2021
Participant's Name	Participant's Signature	Date

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MeiLing Bai		Nov. 1st. 2021
Participant's Name	Participant's Signature	Date

Project Information

Thank you very much for your time and help in making this study possible. If you have any queries or wish to know more about this Senior Level Thesis project, please contact me at the followings:

Phone: 519-328-3185

Email: hanyangdesigns@gmail.com

My supervisors are:

Prof. Catherine Chong, **catherine.chong@humber.ca**

Prof. Sandro Zaccolo, **sandro.zaccolo@humber.ca**

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Vanessa McLean		Nov 1 2021
Participant's Name	Participant's Signature	Date

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Phone: 519-328-3185

Email: hanyangdesigns@gmail.com

My supervisors are:

Prof. Catherine Chong, **catherine.chong@humber.ca**

Prof. Sandro Zaccolo, **sandro.zaccolo@humber.ca**

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Investigator: Han Yang /519-328-3185 /hanyangdesigns@gmail.com
Courses: IDSN 4002 & IDSN 4502 Senior Level Thesis One & Two

I, Vanessa McLean *(First Name/Last Name)*, have carefully read the Information Letter for the project of how to better assist healthcare providers caing for obese individuals at home, led by Han Yang. A member of the research team has explained the project to me and has answered all of my questions about it. I understand that if I have additional questions about the project, I can contact Han Yang at any time during the project.

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Click or tap here to enter text.		Click to enter a date.
Vanessa McLean		NOV 1 2021
Participant's Name	Participant's Signature	Date

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Click or tap here to enter text.		Click to enter a date
ROSE GIBBS		11-19-24
Participant's Name	Participant's Signature	Date

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Email: hanyangdesigns@gmail.com

My supervisors are:

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Prof. Sandro Zaccolo, **sandro.zaccolo@humber.ca**

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Investigator: Han Yang /519-328-3185 /hanyangdesigns@gmail.com
Courses: IDSN 4002 & IDSN 4502 Senior Level Thesis One & Two

I, ROSE GIBBS *(First Name/Last Name)*, have carefully read the Information Letter for the project of how to better assist healthcare providers caing for obese individuals at home, led by Han Yang. A member of the research team has explained the project to me and has answered all of my questions about it. I understand that if I have additional questions about the project, I can contact Han Yang at any time during the project.

I understand that my participation is voluntary and give my consent freely in voice recording, photography and/or videotaping; with the proviso that my identity will be blurred in reports and publications.

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Click or tap here to enter text.		Click to enter a date.
ROSE GIBBS		11-19-24
Participant's Name	Participant's Signature	Date

Appendix C – Field Research (Product)

DATA COLLECTION| Date:09/20/2021

USER		PRODUCT	ENVIRONMENT OF USE
Primary, Secondary and Tertiary		**Benchmarked Products**	**Various Environments of Usage**
Categorize by job-title/position, job-functions, caretakers etc. and list the challenges faced by each category (Person who would interact with patients or products)		Categorize by current product types or compatible products and list the challenges of each product section. (listed the most frequent used and affordable equipment fro both primary and secondary users)	categorize by different scenarios used by different users or type of products and list the challenges of environment off usage

PSWs - Personal Support Worker (Primary User)
• Job duty: PSWs care for people who are ill, elderly or needs help with daily tasks
• Work environment: Work for long-term care facility or in client's home as an employee of a home care agency
• Demographic: The average age of PSWs in community support services is 45.6 years old, 90% of them are female
• Work Hours: 30 hours/week
• Challenges: limited useful tool to help them work easier when transfer bariatric patients. Each patients has different situation (it effect the way of transfer and tool could be used). Musculoskeletal disorders risks.
		**Transfer Belt**
		Function/Feature:
		• It help to secure the patients while transfer (from home to vehicle), and sit on chair or bed
		• Adjustable
		• Anti-slip interior
		• buckle cover prevents accidentally unlocking belt
		• multiple hand grips provide a stable and secure transfer
		Challenges:
		• Hard to grab
		• It may cause arm injure due to the weight of obese individuals
			Get change in the morning
			• PSWs needs to help client sit straight
			  ◦ Use transfer slides
			  ◦ Needs to PSWs
			  ◦ Make sure they hold in position
			• PSWs put the cloth on for client
			  ◦ Make sure they are stable while change
			  ◦ Make sure they feel comfort while and after change

Nurses (Primary User) • Job duty: Autonomous and collaborative care of individuals of all ages, families, groups and communities, sick or well in all settings • Work environment: Work for hospitals, long-term care facility, or communities • Demographic: The average age of nurses is 43.7 years old, 92% of them are female • Work Hours: 36-40 hours/week • Challenges: Musculoskeletal disorder risks from transfer heavy patients (under institution environment)		**Heavy Duty Transfer Slides** Function/Feature: • Help manually move obese individuals • Able to adjust the small section of body part Challenges: • Hard to grab • It may cause arm injure due to the weight of obese individuals • Small equipment needs multiple adjustment before it fully transfer	**Transfer between bed and chair** • Use heavy duty transfer slides to make clients sit straight • Use transfer board move client from bed to chair (manually) • Use heavy duty lifting tool transfer client (powered equipment) • Has to make sure the client is stable • Facing body injure for both worker and clients
Bariatric Patients (Secondary User) • Needs support for daily task • Needs to feel comfortable while transfer • Needs to reduce the injure and healthy issues while transfer • Challenge limited ability for movement		**Transfer Board** Function/Feature: • Compatible • Weight capacity: up to 550 lbs • Sustainable material (birch plywood) • easy to access for both patients and healthcare providers Challenges: • flat surface on both side may face insecure risk • Small interact surface	**Transfer between living room and bedroom** • Use wheel chair for transfer • Obese individuals able to walk by themselves but need equipment for help (non wheel ones) • Challenge for falling • PSWs challenges stairs
Physicians (Tertiary User) • Job Duty: Diagnose health problems, provide advice • Work Environment: Hospital • No Needs to transfer patients • No direct interact under resident environment		**Bed Positioning** Function/Feature: • It helps reduce acid reflux • comfortably elevates upper body • easy to clean due to the vinyl cover • help to secure in position while on the bed • Multi-function (use for both upper body and feet) Challenges: • No handle for user to grab • Healthcare providers needs to hold obese individuals in place while move the positioning	**Help obese individual do exercise** • Physiotherapist help client to improve the muscle while reduce injure more joints • Needs folding walker for reduce effort • Needs belts for secure the body • Healthcare providers needs to ensure the safety
Physician Assistances (Tertiary User) • Job Duty: Supports physician in a range of health care setting and work alongside physician, nurses and other members of interprofessional health care team to provide patient care. • Work Environment: Hospital • No needs to transfer patients • No direct interact under resident environment		**Wheelchair** Function/Feature: • Up to 450 lb • Dual crossbar • choice of arm and leg styles • adjust hemi height Challenges: • Expensive for customize the product	**Go washroom** • PSWs needs to transfer client from chair to toile • PSWs needs to cleaning the client • PSWs needs to ensure safety for clients • PSWs needs to put cloth back on for clients • Prevent slippery from toilet • Make sure place client in the right position
Physiotherapists (Tertiary User) • Job Duty: assess patients, plan, and carry out individual designed treatment to maintain, improve, or restore physical functioning and mobility. • Work Environment: Hospital and/or physiotherapy institute • No Needs to transfer patients • Needs to adjust the posture for patients • No direct interact under residential environment		**No-Lift Booster** Function/Feature: • Prevent lifting for healthcare providers • Smooth surface make sliding easier • Lightweight materials • Foldable that easy to store and use Challenges: • It still would cause musculoskeletal disorders due to move obese individuals	**Use the kitchen and help them eat** • Transfer client from sofa to chair • Cook for client (if needed it) • Feed client (if need it) • Needs to make all items accessible for clients

Physiotherapy Assistants (Tertiary User) • Job Duty: help physiotherapist assess patients, plan, and carry out individual designed treatment to maintain, improve, or restore physical functioning and mobility • Work Environment: Hospital and/or physiotherapy institute • No Needs to transfer patients • Needs to adjust the posture for patients • No direct interact under residential environment		**Bariatric Shifter** Functions/Features: • made from high impact plastic • reduce the effort for lateral transfers • cover the full body size (from upper body to lower part) Challenges: • It still would cause musculoskeletal disorders due to move obese individuals	**Transfer patient to a vehicle** • Secure patients on the wheelchair while transfer • Secure patient on the seat while transit • Healthcare provider needs to keep in mind of stairs (assessable path)
Technicians (Tertiary User) • Job Duty: Assist doctor in diagnosing, testing, and treating illnesses and diseases in patients. • Work Environment: Hospital • No Needs to transfer patients • Needs to adjust the posture for patients • No direct interact under residential environment		**Powered Turning System** Functions/Features: • Automatically rolling the patient • Reduce the effort for healthcare providers • Only one healthcare provider required Challenges: • Expensive for residential individuals • May over roll the patient that cause injures	**Physical therapy treatment** • Healthcare provider needs to transfer clients from chair to bed • Healthcare provider needs to adjust the position for client
Massage Therapists (Tertiary User) • Job Duty: Evaluate client's soft tissue condition, joint quality and function, muscle strength, and range of motion. • Work Environment: Hospital and/or massage therapy institute • No Needs to transfer patients under residential environment • Needs to adjust the posture for patients • No direct interact under residential environment		**Bed Rails** Function/Feature: • Transfer handle for patients over 250 lbs • 600 lbs wight capacity • easy to assemble, no tools required • Made by steel, hard to get damaged Challenges: • Caring obese person needs two healthcare providers at sam time it would interfere the work • Expensive for residential obese individuals	**Adjust the position in bed** • Healthcare provider needs to prevent acid reflux while on the bed • Healthcare provider needs to make sure the comfort for clients while on the bed • Healthcare providers needs to roll or slides clients under different situations • Healthcare provider may facing muscle sore from movement
Family Members (Tertiary User) • Needs to interact with patients • Needs to take care of patients while healthcare providers are away • No needs to transfer obese individuals • May help individuals to adjust posture under proper conditions		**Bariatric Clinical Furniture (Up/Down bed)** Function/Feature: • Obese individuals able to adjust the position by themselves • Reduce the effort for healthcare providers • Build-in bedrails Challenges: • Expensive for residential obese individuals • Wide bed is requires more effort for healthcare provider	**Take bath** • PSWs needs to transfer client from chair to shower chair or bath tube • PSWs needs to cleaning the client • PSWs needs to ensure safety for clients • PSWs needs to put cloth back on for clients
Visitors (Tertiary User) • Needs to interact with patients • No needs to transfer obese individuals • No needs to adjust postures		**Patient Lift** Functions/Features: • Six point extra wide cradle • Adjustable and lock legs in position • 600 lb weight capacity Challenges: • Expensive for individual residential user ($2,000+) • installation challenge for residential user • safety concern for residential user	**Change medicine for individuals** • PSWs needs to positioning the client • Nurse needs to check the wounds and change the medication • PSWs needs to make sure the comfort for client while positioning them

https://miro.com/app/board/o9J_lxcwxx0=/

Table of Benefits

Shoulder Brace	Draw Sheet / Positioning Pad	No-Lift Booster	Bed Shifter	Powered Turing System	Patient Lift	Back Brace	Wrist Support
							
Benefits							
• Adjustability • Durability • Comfort • Lightweight • Easy to clean • Portable • Security	• Eco-friendly • Comfort • Durability • Effort reduce • Easy to clean • Multifunctional • Easy to grip	• Reduce the effort for boosting patients • Reduce caregiver back strain • Better gripping • Duraility • Easy to clean	• Durability • Reduce the effort for lateral transfer • Customizability • Versatility • Easy to grip	• Safety • Secure • Reduce effort for caregiver • Comfort • Convenient	• Easy to use • Versatility • High Capacity • Comfort • Safety • Durability • Efficiency	• Adjustability • Stimulate blood circulation • Comfort • Portable • Easy to use and clean • Affordability	• Adjustability • Durability • Easy to clean • Portable • Safety
User in This Topic							
• Primary user: PSWs	• Primary user: PSWs / Nurse • Secondday User: Obese individuals	• Primary user: PSWs / Nurse • Secondday User: Obese individuals	• Primary user: PSWs / Nurse • Secondday User: Obese individuals	• Primary user: PSWs / Nurse • Secondday User: Obese individuals	• Primary user: PSWs / Nurse • Secondday User: Obese individuals	• Primary user: PSWs / Nurse	• Primary user: PSWs

Table of Features

Shoulder Brace	Draw Sheet / Positioning Pad	No-Lift Booster	Bed Shifter	Powered Turing System	Patient Lift	Back Brace	Wrist Support
							
Features							
• Made from neoprene blend • Has Extender strap • Fastener system • Arm 8" - 16" • Chest 27" - 39"	• Weight capacity 250 lbs • Has 8 reinforced handles • Waterproof materials • Double-side polyester • 24 x 16.69 x 9.7cm	• Weight capacity: 600 lbs • Smooth inner surface • Has two handles • Sewn in handel 46" x 46"	• Weight capacity: 600 lbs • Flexible plastics • Has 14 handles • Handles in an ergonomically correct position • 72" x 28" x 3/26"	• Powered equipment • Only one healthcare provider required • Weight capacity: 820 lbs • Sheet made from cotton • 36" x 88"	• Build-in LED screen • Made from steel • 2 batteries • Electric lift • Weight capacity 1000 lbs • 66" x 53" x 30"	• Made from 60% neoprene, 20% nylon, 10% elastic cotton, 10% velcro • Washtable materials • FDE Reg • 34" x 40"	• Made from elastic, polyester, cotton, and velcro • 22.1 x 11.94 x 2.54 cm
Opportunities							
• How to improve the versatility for healthcare providers' use	• How to keep the multifunctional feature while maintaining the safety while caring for obese individuals	• How to reduce the shoulder and wrist pain point while using the product	• How to keep the simplicity while maximize the comfort	• How to incorporate within residential space (easy installation and use)	• How to make the powered equipment more user friendly within residential environment	• How to improve the functionality while fit for all season and more comfortable	• How to improve the aesthetics and function that more fit into caregiver's lifestyle

Figure 123 - Features and Benefits

Appendix D – Results Analysis

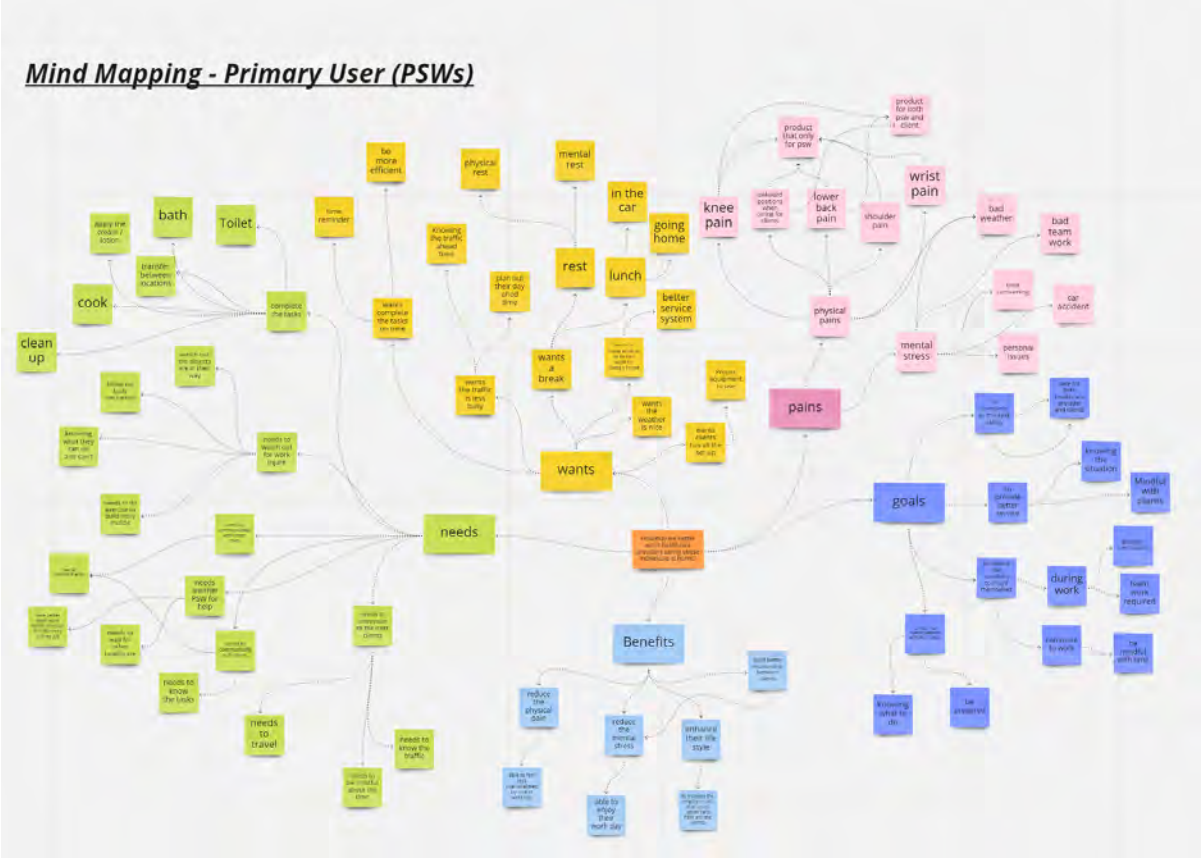


Figure 124 - Mind map 1

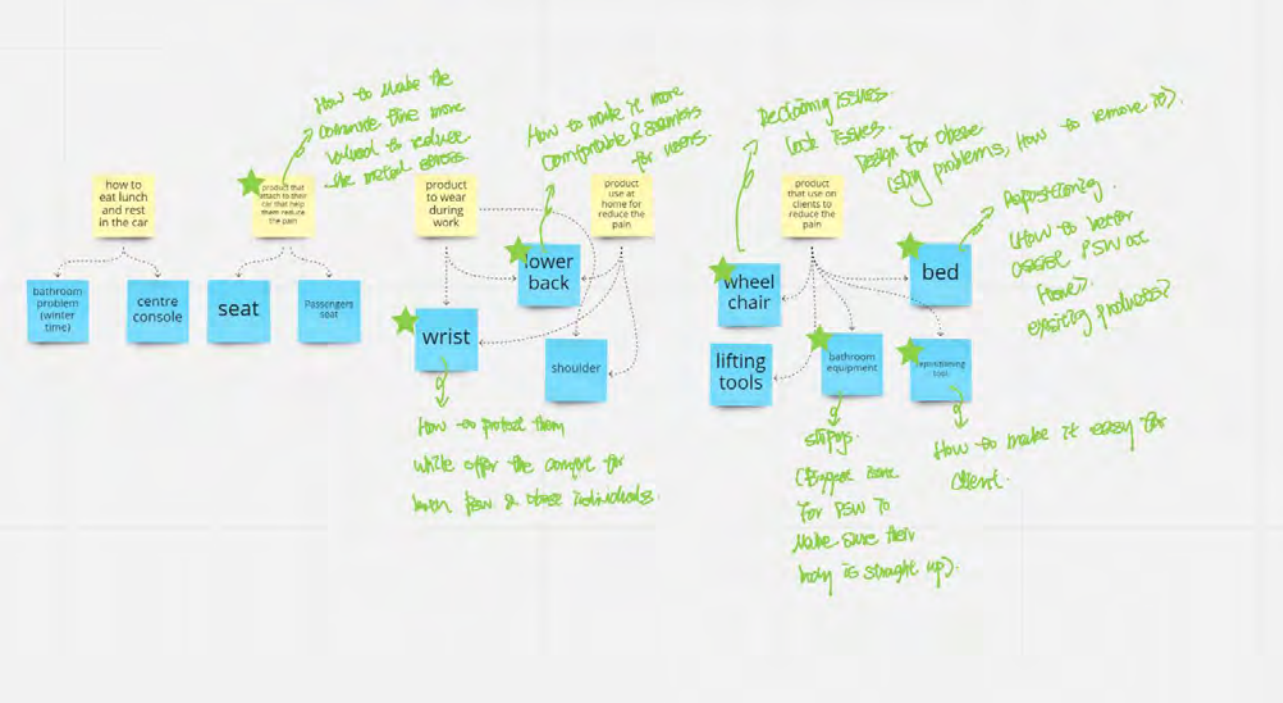


Figure 125 - Ideation

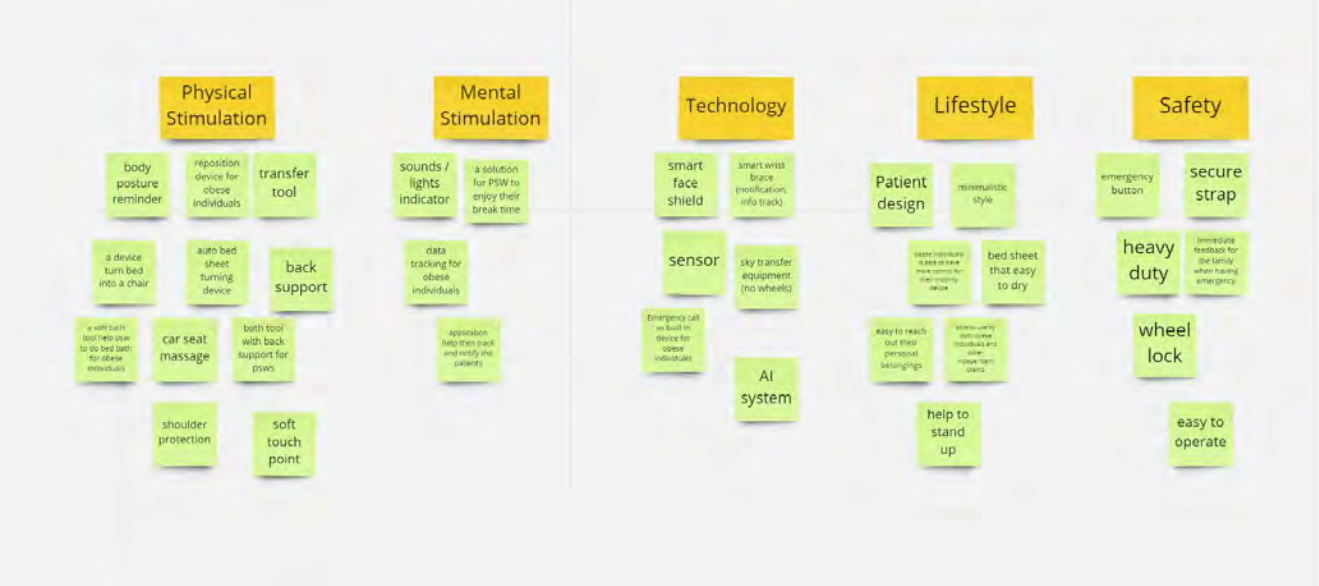


Figure 126 – Analysis

Figure 127 - Benchmarking Product Analysis

Figure 128 - User Observation Results

User Journey Map - Caring for Obese individuals

	Preparation	Check-in	Task 1	Task 2	Task 3	Task 4	Goal	Completion
Storyboard								
User Goals	Get ready for work	Check the tasks for the client	Put the sling under client	Lift the client	Transferring client	Location the client	Transfer the client by wheelchair	Complete the record
User Actions	• Get up at early for the day • Dress up for work	• Verbally communicate with client to make sure the tasks are correct	• Roll over thee clients and put the sling back • Repeat the task to ensure the client propolly lie on the bed	• Hoop up the sling to the lift • Gives instruction to client • Gently lift the client	• To ensure the client is sit balanced • To clear the path for the equipment • Move efficiency but safely • Clean the bed for next caregiver	• Secure the chair • Location the client on the chair	• Two caregiver push the clients to the living room • Ensure to clear the path while transferring	• To record the time the tasks on the booklet
User Thoughts	"Today would be busy for me"	"Hope there is no any changes"	"I wish there is a easy to of doing that"	"I hope he feels comfortable"	"How long do I left for this client?" "I have make sure he is safety"	"It is comfort enough for him"	"I gonna leaving soon"	"I hope I didn't take too long"
User Feelings	Exciting	Neutral	Concerning	Concerning	Worried	Concerning	Concerning	Stressed
Ideas / Takeaway	Enhance the experience with busy day	Improve the effect for communicating	Reduce the effort from healthcare providers	Sounds and digital guidance	Enhance the efficiency	Improve the user experience	Reduce the time and effort for caregivers	Reduce the mental stress

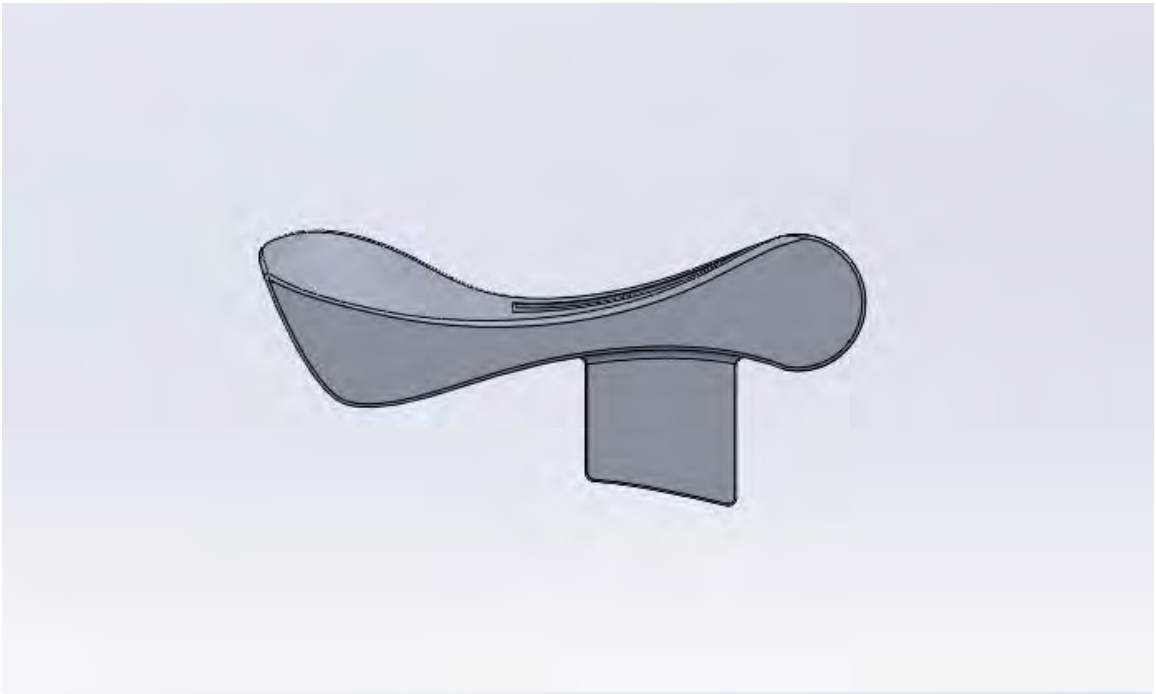
User Experience Map

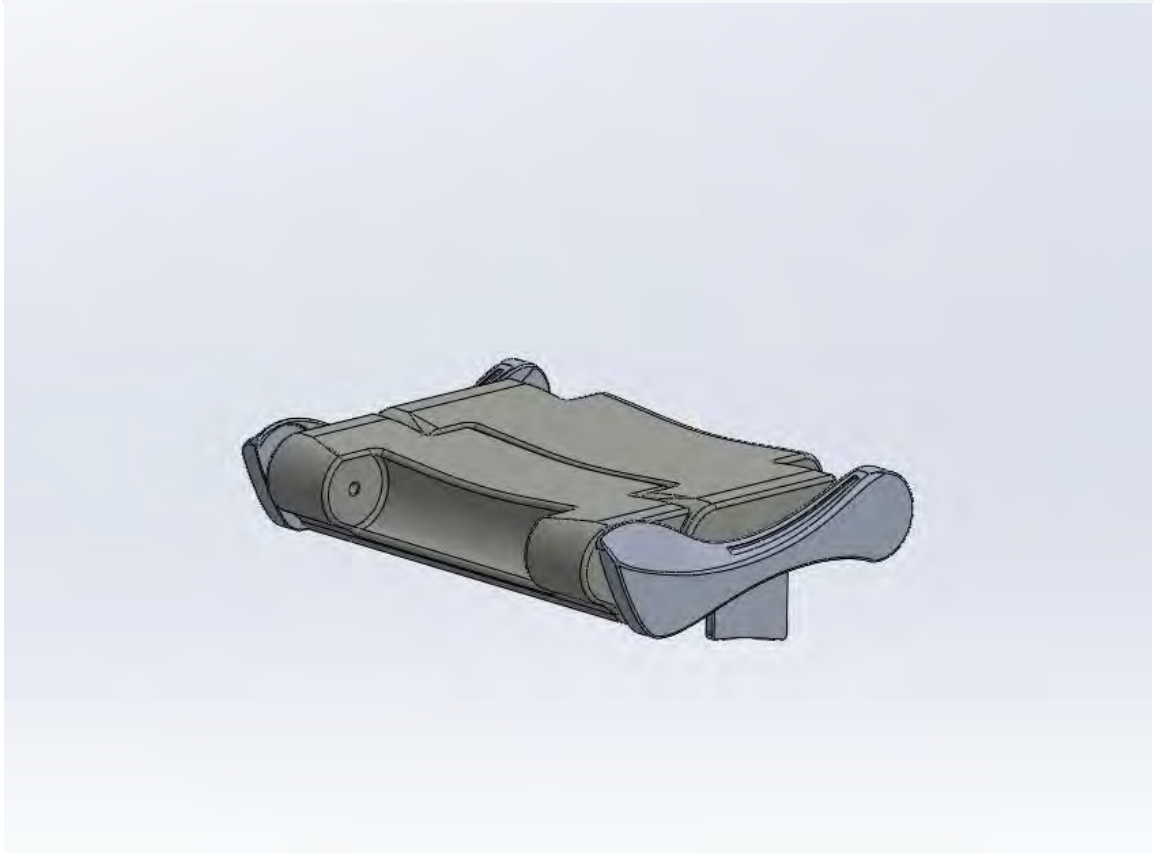
Red: Healthcare Providers
Blue: Obese Individuals
Green: Expected Experience

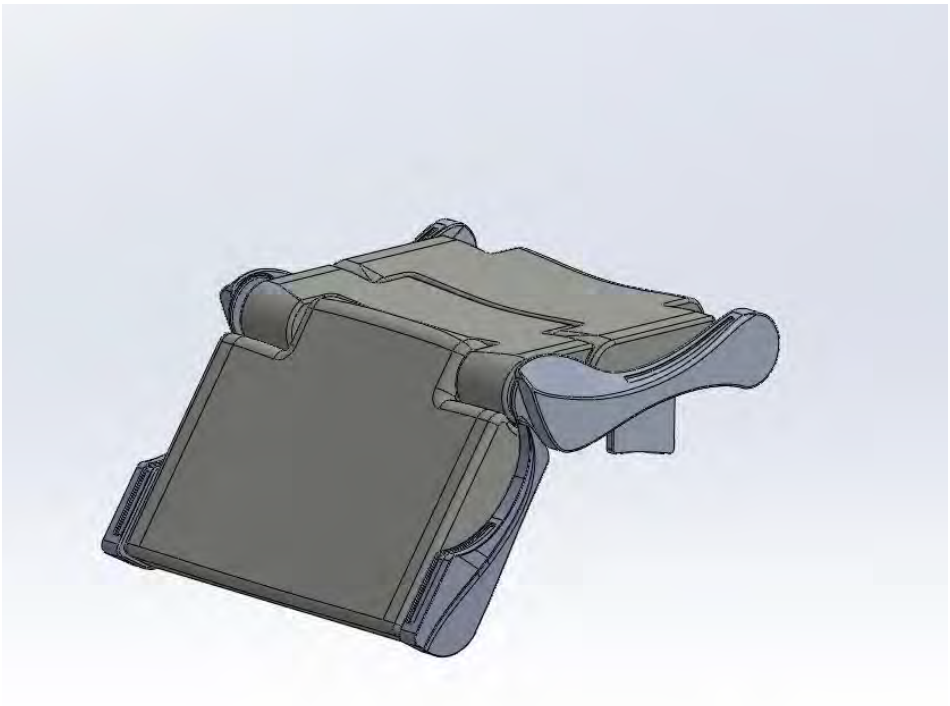
	Planning	Check-in	Task 1	Task 2	Task 3	Task 4	Goal	Completion
Storyboard								
User Goals	Get ready for work	Check the tasks for the client	Put the sling under client	Lift the client	Transferring client	Location the client	Transfer the client by wheelchair	Complete the record
Yeah~								
Ok, ok								
Well...								
Hum...								
Ugh!								
Problems / challenge	Hard to get up and also be thinking ahead the protection from injure	Hard to communicated with the client	Hard to complete by one caregiver, and it's requiring a lot effort	Needs to preventing the accident and aware the time	Needs to ensure the path is clear and client is safe	They need to ensure the client is feel comfort and safe	Require two caregiver, and barriers on the flow, bad posture for caregivers	Limited time may leads to the caregiver rush into the job
Opportunities	How to reduce the work effort for a day	How to improve the communicating to save time	How reduce the physical muscle effort	How to improve the efficiency	How to make the work easier	Improve the workflow of locating	Easier the transfer between two areas	How to reduce the stress from work

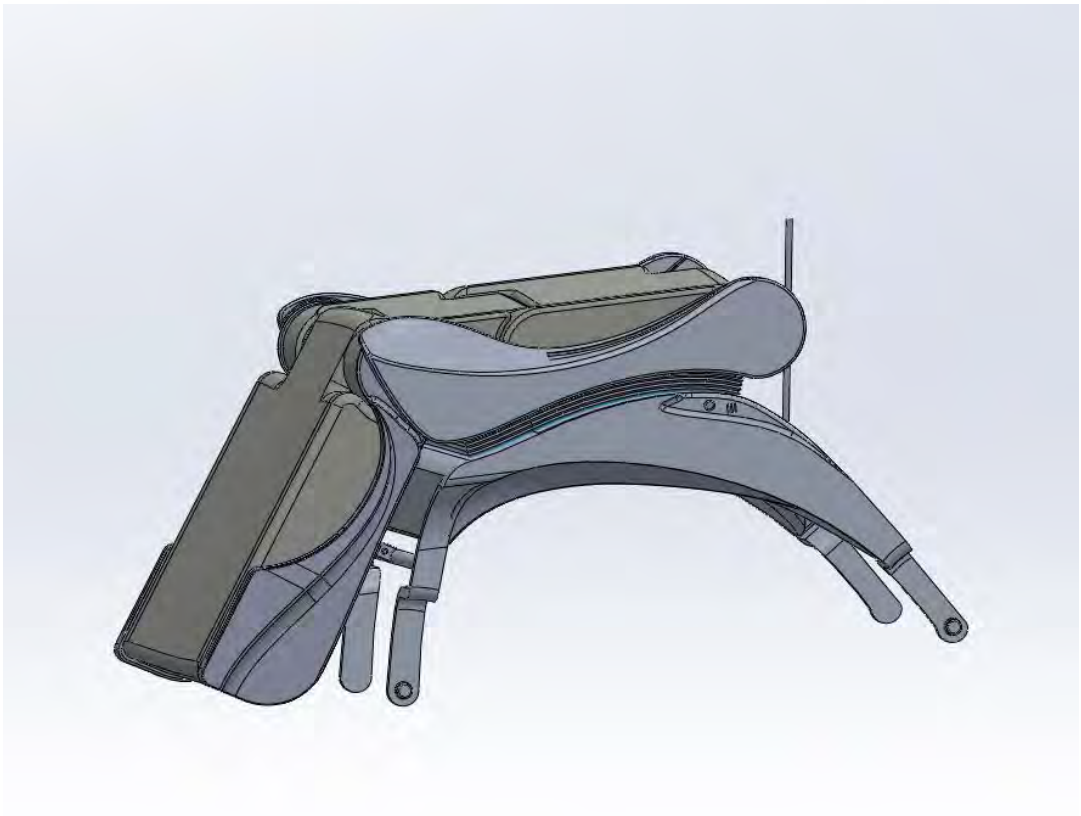
Figure 129 - Analysis for Observation

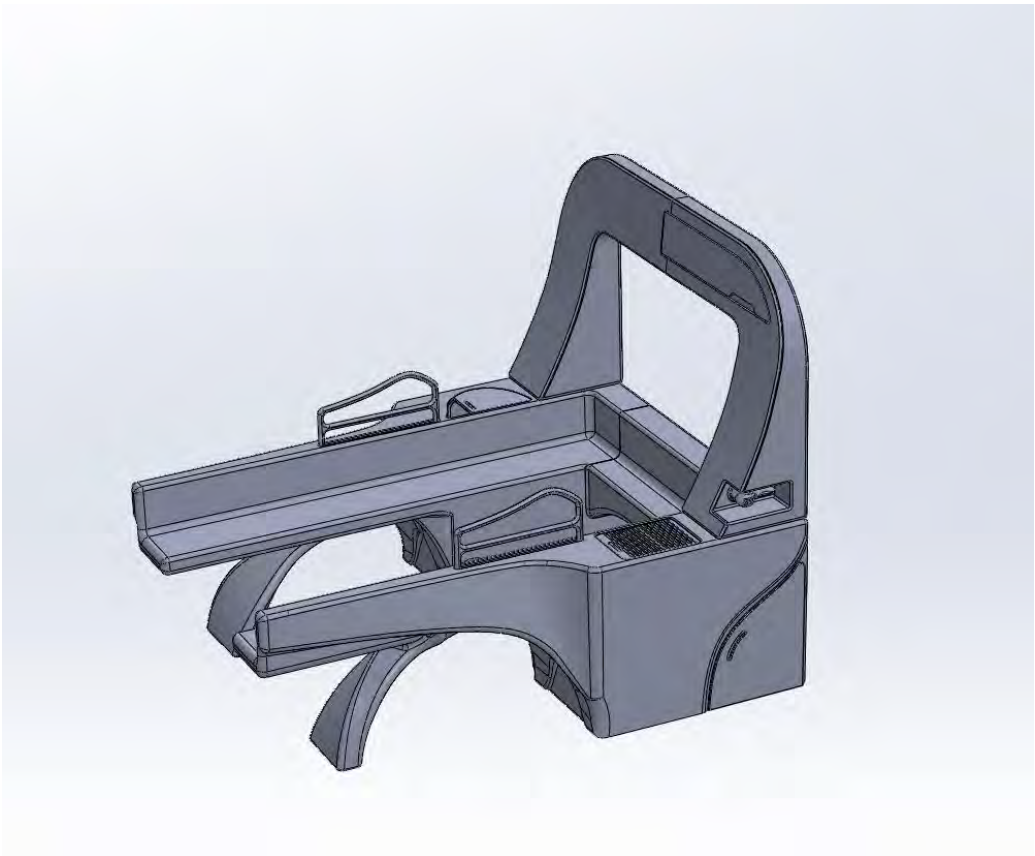
Appendix E – CAD Development

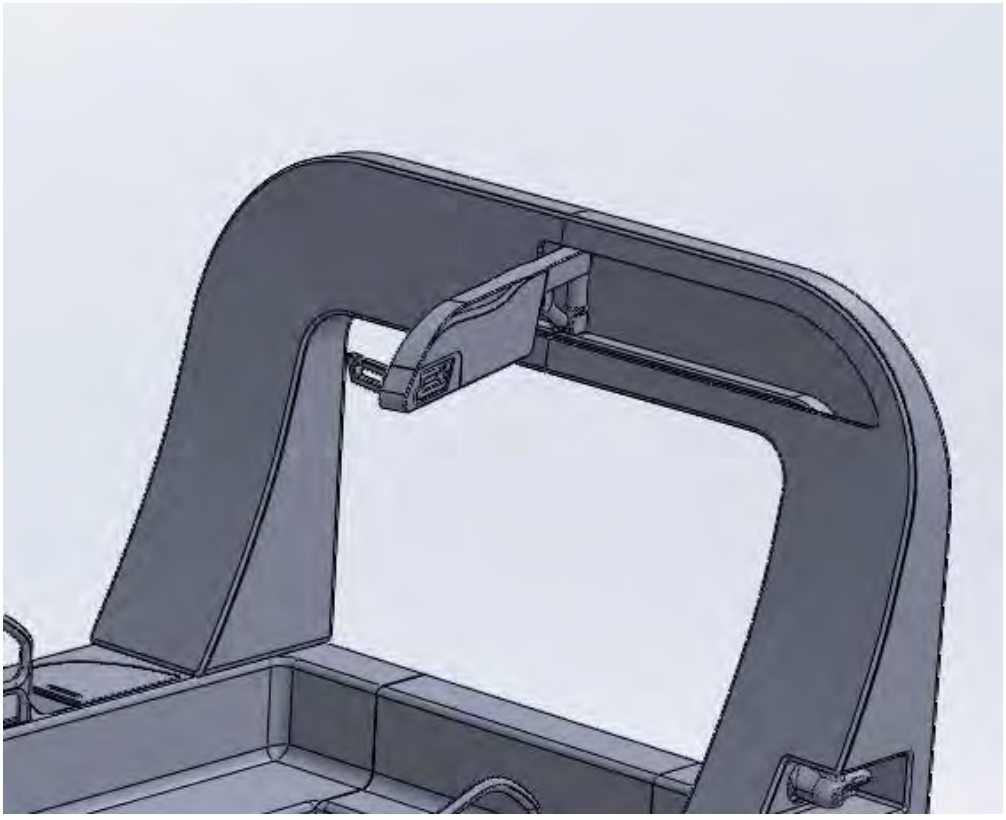












Appendix I – Approval Forms and Plan

THESIS TOPIC APPROVAL:

Student Name:	Han Yang
Topic / Problem Definition:	How may we better assist healthcare provider caring for obese individuals at home?

TOPIC DESCRIPTIVE SUMMARY (Preliminary Abstract)

Healthcare providers play an essential role in Canadian society. The duties of a Personal Support Worker (PSW) are to help take care of those who are ill, elderly, or need extra support for daily tasks (OPSW, n.d.). Therefore, it is vital to keep healthcare providers safe and reduce their chance of getting injured in their workplace. According to the 2014 Canadian Community Health Survey, over 5 million adults are obese; according to the 2015 Canadian Health Measure Survey, 30% of Canadians are obese and may require medical support to manage their obesity (Obesity Canada, 2021). More importantly, people who experience immobilization from obesity and ageing require extra daily support from healthcare providers, such as rolling over, standing, and transferring between a bed and chair. This work environment increases the possibility of PSW developing physical injuries. This thesis proposes an in-depth study of healthcare providers' challenges when caring for obese individuals at home. Qualitative and quantitative research will be used to collect data on these challenges with interviews, surveys, and user observation. This information will advise a one-to-one human-centred design solution that better assists healthcare providers in caring for obese individuals at home.

Student Signature(s):		**Instructor Signature(s):**	
Date:	05/10/2021	**Date:**	07 October 2021

Figure 130 - Approval of Thesis

Appendix J – Advisor Meetings and Agreement Forms

IDSN 4002 /4502
SENIOR LEVEL THESIS ONE & THESIS TWO
INFORMATION LETTER

HUMBER
Faculty of Applied Sciences & Technology
Bachelor of Industrial Design / FALL 2021 & WINTER 2022

Research Study Topic: How may we better assist healthcare providers caring for obese individuals at home?

Investigator: Han Yang /519-328-3185 /hanyangdesigns@gmail.com

Sponsor: Humber ITAL, Faculty of Applied Sciences & Technology (IDSN 4002 & IDSN 4502)

Introduction

My name is Han Yang, I am an industrial design student at Humber ITAL. I am inviting your participation in a research study on various problems that healthcare providers face while caring for obese individuals at home. Healthcare providers play an essential role in Canadian society. The duties of Personal Support Work (PSW) are to help take care of those who are ill, elderly, or need extra support for their daily tasks. Therefore, it is vital to keep healthcare providers safe and reduce their chance of getting injured in their workplace. The results will be contributed to my Senior Level Thesis project.

Purpose of the Study

This study is being conducted as an aid in designing an evidence-based solution that would better assist healthcare providers caring for obese individuals at home. According to secondary research, 30 % of Canadians are obese and may require medical support to manage their obesity. More importantly, people who experience immobilization from obesity and ageing require extra daily support from healthcare providers. This work environment increases the possibility of PSW and other healthcare providers developing physical injuries. This thesis proposes an in-depth study of healthcare providers' challenges when caring for obese individuals at home. Qualitative and quantitative research will collect data on these challenges with interviews, surveys, and user observation. This information will advise a one-to-one human-centred design solution that better assists healthcare providers in caring for obese individuals at home. With your help, I plan to address the problem correctly and accurately. This study is primarily based on understanding ergonomics, human interaction design activities, and user experience aspects of the research area.

Procedures

If you volunteer to participate in this study, you will be asked questions about the machine, device, equipment, or /and vehicles related to your work. You will be asked questions about the tasks, workflow, and interaction with the client, patients, or healthcare providers. You will be asked questions about the user experience of certain products, overall job tasks. Your activities in interacting with clients, patients, or healthcare providers will be observed and documented. Your activities will be documented using digital or video cameras while operating the machine, tools, clients, and other healthcare providers.

Confidentiality

Every effort will be made to ensure confidentiality of any identifying information that is obtained during the study. In the case of being recorded visually, your face will be masked /blurred or hidden. The information and documentation (photographs) gathered are all subject to being used in the final presentation of the study.

Participation and Withdrawal

Your participation in this study is entirely voluntary and you may interrupt or end the study and the session at any time without giving a reason or fear of being penalized.

If at any point during the session, you feel uncomfortable and wish to end your participation, please let the moderator know and they will end your participation immediately.

Humber Research Ethics Board

This research project /course has been approved by the Humber Research Ethics Board. If you have any questions about your rights as a research participant, please contact Dr. Lydia Boyko, REB Chair, 416-675-6622 ext. 79322, **Lydia.Boyko@humber.ca**

INFORMATION LETTER

Conditions of Participation

✓ I understand that I am free to withdraw from the study at any

time without any consequences.

✓ I understand that my participation in this study is confidential. (i.e. the researcher will know but will not disclose my identity)

✓ My identity will be masked.

✓ I understand that the data from this study may be published.

☐ **I have read the information presented above and I understand this agreement. I voluntarily agree to take part in this study.**

Click or tap here to enter text. Click to enter a date

Participant's Name Participant's Signature Date

Janny Phommalaydit Oct 24/21

Project Information

Thank you very much for your time and help in making this study possible. If you have any queries or wish to know more about this Senior Level Thesis project, please contact me at the followings:

Phone: 519-328-3185

Email: hanyangdesigns@gmail.com

My supervisors are:

Prof. Catherine Chong, **catherine.chong@humber.ca**

Prof. Sandro Zaccolo, **sandro.zaccolo@humber.ca**

PARTICIPANT INFORMED CONSENT FORM

Research Study Topic: How may we better assist healthcare providers caring for obese individuals at home?

Investigator: Han Yang /519-328-3185 /hanyangdesigns@gmail.com

Courses: IDSN 4002 & IDSN 4502 Senior Level
Thesis One & Two

I, Janny Phommalaychit (First Name/Last Name), have carefully read the Information Letter for the project of how to better assist healthcare providers caing for obese individuals at home, led by Han Yang. A member of the research team has explained the project to me and has answered all of my questions about it. I understand that if I have additional questions about the project, I can contact Han Yang at any time during the project.

I understand that my participation is voluntary and give my consent freely in voice recording, photography and/or videotaping; with the proviso that my identity will be blurred in reports and publications.

Consent for Publication: Add a (x) mark in one of the columns for each activity

ACTIVITY		YES	NO
Publication	I give consent for publication in the Humber Library Digital Repository which is an open access portal available to the public	☑	☐
Review	I give consent for review by the Professor	☑	☐

Privacy

All data gathered is stored anonymously and kept confidential. Only the principle investigator /researcher, « insert student Name here » and Prof. Catherine Chong or Prof. Sandro Zaccolo may access and analyze the data. All published data will be coded, so that visual data is not identifiable. Pseudonyms will be used to quote a

participant (subject) and data would be aggregated.

I also understand that I may decline or withdraw from participation at any time, without negative consequences.

I understand that I can verify the ethical approval of this study, or raise any concerns I may have by contacting the Humber Research Ethics Board, Dr. Lydia Boyko, REB Chair, 416-675-6622 ext. 79322, **Lydia.Boyko@humber.ca** or

« insert student Name /Phone Number /Email Address ».

Verification of having read the Informed Consent Form:

☐ I have read the Informed Consent Form.

My signature below verifies that I have read this document and give consent to the use of the data from questionnaires and interviews in research report, publications (if any) and presentations with the proviso that my identity will not be disclosed. I have received a copy of the Information Letter, and that I agree to participate in the research project as it has been described in the Information Letter.

Click or tap here to enter text.		Click to enter a date.
Participant's Name	Participant's Signature	Date
2 Janny Phommadeychit		Oct 24/21

HUMBER
Faculty of Applied Sciences & Technology
Bachelor of Industrial Design / FALL 2021 & WINTER 2022

IDSN 4002 / 4502
SENIOR LEVEL THESIS ONE & THESIS TWO

PARTICIPANT INFORMED CONSENT FORM

Research Study Topic: How may we better assist healthcare providers caring for obese individuals at home?
Investigator: Han Yang /519-328-3185 /hanyangdesigns@gmail.com
Courses: IDSN 4002 & IDSN 4502 Senior Level Thesis One & Two

I, MeiLing Bai (First Name/Last Name), have carefully read the Information Letter for the project of how to better assist healthcare providers caing for obese individuals at home, led by Han Yang. A member of the research team has explained the project to me and has answered all of my questions about it. I understand that if I have additional questions about the project, I can contact Han Yang at any time during the project.

I understand that my participation is voluntary and give my consent freely in voice recording, photography and/or videotaping; with the proviso that my identity will be blurred in reports and publications.

Consent for Publication: Add a (X) mark in one of the columns for each activity

ACTIVITY		YES	NO
Publication	I give consent for publication in the Humber Library Digital Repository which is an open access portal available to the public	☒	☐
Review	I give consent for review by the Professor	☒	☐

Privacy
All data gathered is stored anonymously and kept confidential. Only the principle investigator /researcher, « insert student Name here » and Prof. Catherine Chong or Prof. Sandro Zaccolo may access and analyze the data. All published data will be coded, so that visual data is not identifiable. Pseudonyms will be used to quote a participant (subject) and data would be aggregated.

I also understand that I may decline or withdraw from participation at any time, without negative consequences.

I understand that I can verify the ethical approval of this study, or raise any concerns I may have by contacting the Humber Research Ethics Board, Dr. Lydia Boyko, REB Chair, 416-675-6622 ext. 79322, **Lydia.Boyko@humber.ca** or « insert student Name /Phone Number /Email Address ».

Verification of having read the Informed Consent Form:

☒ I have read the Informed Consent Form.

My signature below verifies that I have read this document and give consent to the use of the data from questionnaires and interviews in research report, publications (if any) and presentations with the proviso that my identity will not be disclosed. I have received a copy of the Information Letter, and that I agree to participate in the research project as it has been described in the Information Letter.

Click or tap here to enter text.		Click to enter a date.
MeiLing Bai		Nov 1st. 2021
Participant's Name	Participant's Signature	Date

HUMBER
Faculty of Applied Sciences & Technology
Bachelor of Industrial Design / FALL 2021 & WINTER 2022

IDSN 4002 / 4502
SENIOR LEVEL THESIS ONE & THESIS TWO

INFORMATION LETTER

Conditions of Participation

- ✓ I understand that I am free to withdraw from the study at any time without any consequences.
- ✓ I understand that my participation in this study is confidential. (i.e. the researcher will know but will not disclose my identity)
- ✓ My identity will be masked.
- ✓ I understand that the data from this study may be published.

☑ **I have read the information presented above and I understand this agreement. I voluntarily agree to take part in this study.**

Click or tap here to enter text.		Click to enter a date
MeiLing Bai		Nov. 1st. 2021
Participant's Name	Participant's Signature	Date

Project Information

Thank you very much for your time and help in making this study possible. If you have any queries or wish to know more about this Senior Level Thesis project, please contact me at the followings:

Phone: 519-328-3185

Email: hanyangdesigns@gmail.com

My supervisors are:

Prof. Catherine Chong, **catherine.chong@humber.ca**

Prof. Sandro Zaccolo, **sandro.zaccolo@humber.ca**

Appendix K – Supportive Raw Data

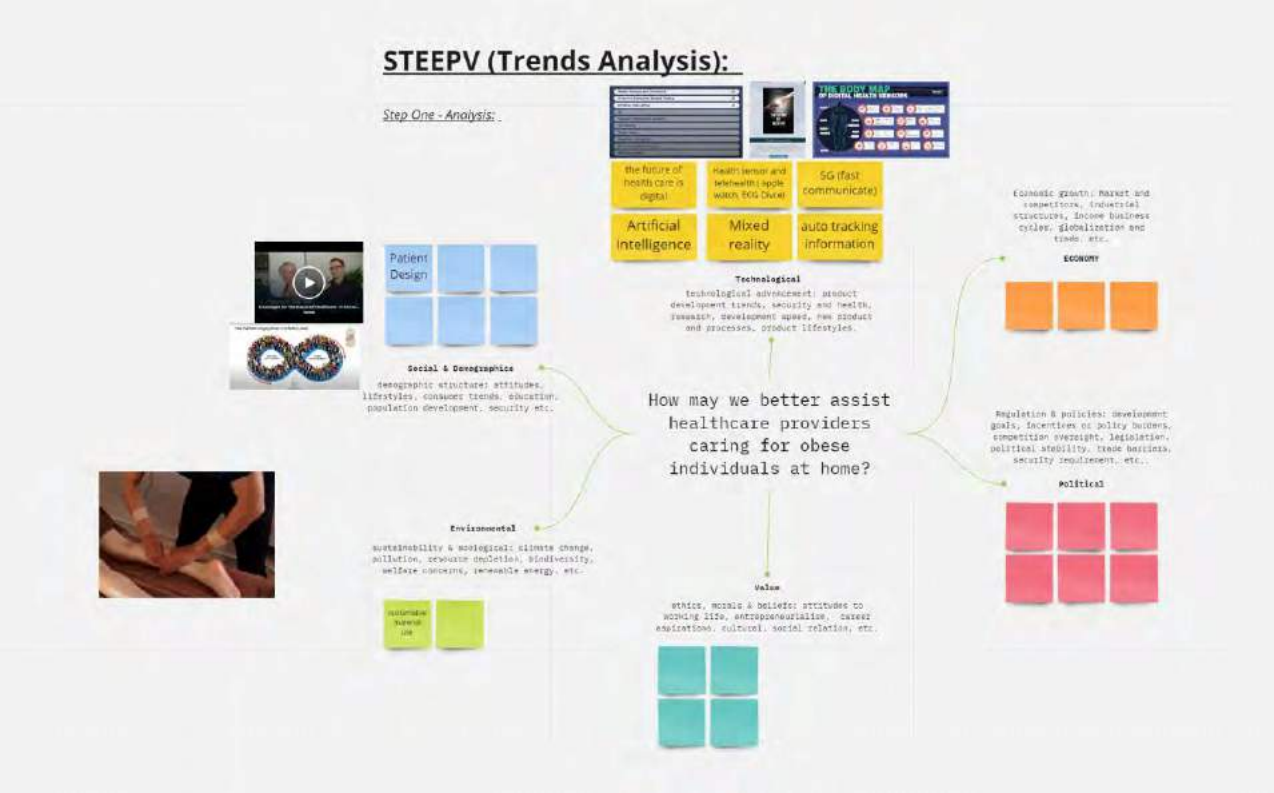


Figure 131 – STEEPV

Assignment 1- Preliminary Lecture Review and Information Search

This objective of this report is to quick assess a thesis topic area considered using both scholarly and consumer research tools. The search tools that used for this report are Humber Library Search Engine and Google. The thesis topic under consideration of this search is PSW(Personal Support Worker) and bariatric patients' safety at residential environment. The area been focused for this search are finding the functionality and ergonomic of the current solution and/or equipment that help PSWs access obesity at residential space; moreover, the user interaction and experience with the product, and current problem for healthcare provider when they access bariatric patents.

Search Topic

Thesis Topic: PSW (Personal Support Worker) and bariatric patients' safety at residential environment

Background: In Canada, nearly 30% of the adult experience obesity, patients with obesity are at higher risk in hospital setting for injury, complications and longer in-hospital stays due to inadequate facility design, equipment, or staff competencies in their care. From the research, the average age of PSW in Canada is 45 years old. To better protect PSW isn't only benefit for the worker but also provide better secure for bariatric patient while personal care.

Problem Statement: Most patients with bariatric needs personal support work to help them or guide them for daily routine, it ensures to lower the injure and health risk for both patients and works. But, individuals who living with obesity or individuals who living in large bodies report challenge accessing health care service in institution and community setting that meet their needs. The key problems are:

- Limitation of access to equipment and furniture that will support their body weight and/or body size
- Limited equipment that help PSWs (Personal Support Work) to easier and safter access bariatric patients at residential environments
- Limited knowledge about bariatrics care needs for both family members or health caregiver
- Limitation of reaching, moving, or adjust posture while caregiver away
- Weight bias and stigma from health care practicians

Needs Statement: Due to current situation, most of the bariatric patients' needs professional caregiver to help and/or guide for their daily routine. Then from both ends of this relation:

- PSWs need safter method and equipment for transfer bariatric patient at residential environment that would benefit both worker and patients.

- Bariatric patients need better and safter experience with the equipment during and off the help of caregivers

How is this need being addressed currently? According to research, over the past decades progress has been made by several groups of healthcare professional and designers to create room in hospital that are safe and accessible for patient with bariatric care needs and the staff that work with patents. In Canada, there is a list of resource and recommendation to promote quality care for hospitalized patients with bariatric care needs. However, in the current industry is lack of the product or resource that help PSWs better access the bariatric patients while transfer or move them.

Key Article 1

Method

A key article for this topic was sourced and selected. Required article content (Abstract, Introduction, and Conclusion Section) was copied and highlighted.

- Search Engine: Humber Library Discover Proxy
- Key Words: "Bariatric wheelchair user Experience"

Finding

Citation:

Broome, C.A., Ayala, E. M., Georgeson, K.A., Heidrich, S. M., Karnes, K., & Wells, J.B. (2015). Nursing care of the super bariatric patient: Challenges and lessons learned. *Rehabilitation Nursing*, 40(2), 92-99. https://doi.org/10.1002/rnj.165

Key Content: Reproduced below

Abstract

Purpose

The purpose of this article is to describe the care of a "super bariatric" patient.

Design and Methods

We used a case study approach to describe the complex interdisciplinary care challenges posed in the care of a super bariatric patient at a Veterans Administration Hospital in the Midwest.

Findings

Nurses and other healthcare providers discovered ways to provide high-quality patient-centered care under challenging conditions and also ensure the safety and well-being of nursing staff and other providers.

Conclusions/Clinical Relevance

An interdisciplinary, patient-centered approach with advance planning and coordination is necessary to ensure the delivery of safe, high-quality nursing care to veterans with complex health problems who are "super bariatric."

Introduction

Bariatric patients can present unique challenges for nurses. These challenges will increase as the incidence and severity of obesity increases in the population. The purpose of this article is to describe the care of Mr. K., a "super bariatric" patient, using a case study approach, to share valuable lessons learned in preparing for and delivering patient-centered care. Mr. K. weighed 550 pounds and had a body mass index (BMI) of 73 when admitted to our hospital. We will focus on challenges and lessons learned regarding equipment, patient care, and effects on staff. In this case study, we have changed the details to protect the patient's confidentiality.

Language shapes our perceptions, opinions, feelings, and reactions to others and that is true for the language used to describe patients (Zuzelo & Seminara, **2006**). Bariatric patients are classified based on their BMI using the following language: Obese (BMI > 30), morbidly obese (BMI > 40), super obese (BMI > 50), and super super obese (BMI > 60) (Taylor, Leitman, Hon, Horowitz, & Panagopoulos, **2006**). A common and accepted medical term to define a 500+ pound patient, such as Mr. K., is "morbidly obese." The word "morbid," however, is synonymous with "morose," "gloomy," "dark," "bleak," "dreary," "sullen," "nasty," "grisly," "gruesome," and "grotesque" (Kipfer & Chapman, **2010**). Before our experience of caring for Mr. K., we were not familiar with the literature indicating that obese patients are self-conscious about their weight; are afraid they will hear disparaging, negative, or inappropriate comments from healthcare providers and staff; and have a history of negative experiences with the healthcare system (Camden, **2009**; Camden, Brannan, & Davis, **2008**; Medical Care for Obese Patients, **2007**; Pantenburg et al., **2012**). Most of our staff had never taken care of a "morbidly obese" patient like Mr. K. Although we knew it would be a new and challenging experience, we did not anticipate how challenging it would be. As a result of this experience, we chose to use the term "super bariatric" to describe our patient. We wished to counteract the negative stereotypes associated with the term "morbidly obese" and to emphasize the positive lessons learned in caring for Mr. K. (Gumble & Carels, **2012**).

Equipment

The equipment needed to care for Mr. K. presented numerous challenges including the amount of equipment needed, sling availability, bed and ceiling lift compatibility, bed assembly, and the recall of lift equipment requiring special operating instructions. All of these challenges were compounded by the physical layout and space limitations of Mr. K.'s room. The safe patient handling coordinator was an integral member of Mr. K.'s interdisciplinary team and was instrumental in helping the nursing staff meet these challenges.

Larger rooms are necessary to accommodate all of the equipment needed to care for the bariatric patient (Hignett & Griffiths, **2009**; Muir & Archer-Heese, **2009**). The hospital did not have rooms designed to handle the seven pieces of bariatric equipment required in Mr. K.'s care. Because of the size and layout of Mr. K.'s room, the equipment could obstruct access to Mr. K. and cause delays in care while it was rearranged. To accommodate the essential equipment and provide the necessary unobstructed space, the bathroom door had to be removed (See Figure **1**)

Figure 1

Open in figure viewerPowerPoint

Photos of Mr. K's room with all of the essential equipment needed for his care.

The nursing staff received training annually on the use of lifts, however, there were many details unique to repositioning a super bariatric patient that were unanticipated and required the staff to "think outside the box" when problems arose. One example is the first time the ceiling lift was used to move Mr. K. from the bariatric chair to the bed. The ceiling lift was unable to raise Mr. K. high enough to clear the bed's mattress. To meet this challenge, the mattress was deflated and a slick sheet was used for transfer. To prevent this problem in the future, a lower profile bed was ordered. However, a bed change presented another challenge because it required Mr. K. to wait on the uncomfortable, bariatric (yet too small for this patient) cart that resulted in physical discomfort and emotional distress. His distress increased with each successive bed change as he anticipated the pain and discomfort. Unfortunately, Mr. K. had to change beds a total of three times within the first week of admission.

A second equipment challenge occurred when, after a few initial transfers, the overhead bariatric lift failed leaving the patient suspended above the commode. Physical therapy and safe patient handling staff immediately assisted in returning Mr. K. to bed using two inflatable pieces of equipment, a Hoverjack and Hovermatt. These were inflated underneath the patient, and he was then laterally transferred back to bed. The lift was outdated and the batteries had failed to recharge, in part due to inadequate time on the charger. A replacement lift was installed.

Inconsistent labeling of equipment also complicated care. There is no industry standard for labeling equipment as "bariatric." Because of this, different pieces of equipment marketed as bariatric can have very different weight capacities. Inconsistent weight capacities caused confusion and delays at the point of care when a piece of equipment turned out to be unsuitable due to weight limitations. In Mr. K.'s case, the bariatric commode was unusable, adding to his distress and discomfort until weight-appropriate equipment was located.

A valuable lesson learned from these equipment difficulties was the importance of coordination and communication among patient and staff. McGinley and Bunke (**2009**) recommend being proactive, anticipating a "patient's needs from door to door," working as an interdisciplinary team, and using assistive equipment properly to prevent injury.

Reminders about equipment operation were posted on the walls, and in-service education was provided to individuals on all shifts to ensure that all users were comfortable with the equipment and aware of Mr. K.'s unique needs. These actions were consistent with Muir and Archer-Heese's suggestions that lifting plans be "established based on the Safe Patient Handling assessment findings, and communicated in a readily accessible place in the patient's room" (p. 3, 2009). Our experience with Mr. K. exposed limitations in our response to equipment failures and highlighted the value of effective communication and teamwork. We are now labeling all equipment with weight capacities and have a central posting of equipment weight capacities. We have trained special peer leaders to bring expertise to all shifts and trained staff to always return the lift to the charger.

The importance of checklists was a particular lesson learned. The care of a super bariatric patient is a rare event in this hospital, and rare events pose the risk of knowledge decay. Checklists were developed as a means to consolidate the lessons learned. We established a series of checklists for use by everyone along the care continuum in the hospital when patients over 500 pounds are admitted (Muir & Archer-Heese, **2009**). Using Atul Gawande's Checklist for Checklists (Gawande, **2010**), key stakeholders were consulted. The stakeholders were multidisciplinary as recommended by McGinley and Bunke (**2009**) and included nursing staff, laundry workers, maintenance workers, bed coordinators, and safe patient handling staff. This work resulted in a short, one-page checklist. The unit clerks and charge nurses are trained on the implementation of the checklist annually.

Summary Statement:

1. Bariatric patients can present the unique challenge for both nursing and caregiver due to the increasing population of bariatric patients
2. The equipment nurses and other healthcare providers uses today still has a lot of safety concern
3. Most of the equipment are used for institution or facility is because the bariatric patients needs to have large space to use all the equipment
4. Most of time the equipment cannot help the nurses and healthcare provider, therefor they needs to transfer the patients manually

Key Article 2

Method

A key article for this topic was sourced and selected. Required article content (Abstract, Introduction, and Conclusion Section) was copied and highlighted.

- Search Engine: Google Scholar through Humber proxy
- Key Words: “Experience with manual transfer obesity patients”

Finding

Citation:

Samaei, S., Mostafaee, M., Jafarpoor, H. and Hosseinabadi, M., 2017. Effects of patient-handling and individual factors on the prevalence of low back pain among nursing personnel. *Work*, [online] 56(4), pp.551-561. Available at: <https://content.iospress.com/articles/work/wor2526> [Accessed 19 September 2021]

Key Content: Reproduced below

Abstract. BACKGROUND: Patient-handling is one of the main tasks of nursing personnel; it imposes compressive and shear forces on nurses' lower spine. The aim of this study was to determine the prevalence of Low Back Pain (LBP), risk factors in the incidence of such disorders, and patient handling risk assessment among nursing personnel. METHODS:This study was carried out on 243 randomly selected nursing personnel who played a role in handling the patients (58 wards). Patient Transfer Assessment Instrument (PTAI) checklists alongside Standardized Nordic Musculoskeletal Questionnaires (NMQ) were used for data collection. The statistical analyses such as independent t-test and Chi-Square test were used. RESULTS: Prevalence of LBP among nursing personal was 69.5% in the previous 12 months. Significant correlations were found among age, working hours per week, work experience, BMI, gender and shift-work. Results of PTAI index assessment revealed that more than 90% of subjects were in medium and severe risks of LBP. PTAI index scores were significantly associated with LBP ($P < 0.05$). CONCLUSION: PTAI index is regarded as an efficient tool for risk level classifications and identification of effective factors on LBP incidence among nursing personnel involved in patient transfer. In this regard and for the aim of ergonomic intervention towards the reduction of LBP incidence among nurses, the modification of improper factors which are identified in PTAI index such as the use of advanced patient handling equipment, increase in work posture guidance and work arrangements, can be mentioned. Keywords: Patient Transfer Assessment Instrument, risk factor, risk assessment, patient handling

1. Introduction Low back pain (LBP) is one of the most common musculoskeletal disorders among nurses and other ∗Address for correspondence: Majid Bagheri Hosseinabadi, School of Public Health, Shahroud University of Medical Sciences, P.O. Box: 31988-83319, Shahroud, Iran. Tel./Fax: +98 26 3468 2126, Mobile: +98 912 943 0588; E-mail: majidbagheri1989@ gmail.com. healthcare workers [1–5]. The prevalence of LBP among nurses is the same and even more than in other occupational groups such as office workers, marketing personal, transportation operatives, construction, etc. [6–8]. LBP imposes large costs to employees and societies [9] and might have numerous consequences such as reduced quality of life, occupational disability, absence of sickness and changing and/or leaving a profession [10, 11]. 552 S.E. Samaei et al. / Effects of patient-handling and individual factors on the prevalence of LBP Not only was the LBP the cause of 6.3% of longterm absence of sickness

in Danish nurses between 2004 and 2005, but also it was 8.7% of compensation claims by nursing personnel in four U.S. states between the period of May 2006 and October, 2009 [10, 12]. In addition, two thirds of the health care staff had complained about low back pain during the last year [13]. High prevalence of musculoskeletal disorders, especially LBP, increases the costs of care, loss of working days and turn-over rate among nurses [14, 15]. The etiology of LBP is complicated and includes physical, psychosocial, individual, socio-cultural and organizational work factors [16–18]. All of these factors do not have the same effects on LBP. Physical factors in patient-handling such as weight of the patient, asymmetric nature of the load, frequency of lifting, and awkward postures in patient support have been reported to be a major contributing factor to LBP among health care workers [16, 19, 20]. Patient-handling has a burden of severe biomechanical load on spinal parts of the body that impact the prevalence of LBP among nurses [21]. Schlossmacher and Amaral research showed that the prevalence of low back pain symptoms in nursing professionals was approximately between 15% and 72% and the main cause was the transfer of the patient from bed to chair [22]. Previous studies have shown that the ergonomic intervention has included LBP learning and awareness, trainings such as patient-handling techniques, lifting teams and transferring equipment, which can decrease the loads and injuries related to patienthandling tasks [23, 24]. Training on safe patient transfer techniques besides work modifications has been approved as a cost-effective intervention method that could lead to the reduction of musculoskeletal loads [25]. Karahan and Bayraktar reported that training alone is insufficient for preventing LBP; however, it is one of the most efficient and cost-effective ways to prevent LBP [26]. Different methods, including subjective and objective methods have been developed in the assessment of work techniques during patient transfers which indicated whether a certain technique was used or not [27]. In this regard, Patient Transfer Assessment Instrument (PTAI) is an objective method for assessing the load of patient handling that was introduced in 2005 and revised in 2007 [28]. PTAI can be used for evaluation of the ergonomic working postures and the workers' skills during patient handling [29]. The evaluation method was carried out by observing 15 factors in which nine factors can be investigated by the assessor's observation of how subjects work, and the last six factors can be assessed based on workers' interviews [27, 29]. Standardization of PTAI methods was conducted based on other patient handling and transfer methods (MAPO, DINO, Care Thermometer, Dortmund Approach). In addition, PTAI has been accepted by ISO's Technical Report 12296 (Ergonomics -Manual handling of people in healthcare units) [27]. PTAI mostly surveys the ergonomic occupational posture and patient transporter's skills. Since there were no mechanical facilities in almost all the studied hospitals, PTAI seems to be an appropriate method for this study. The critical issue shows the importance of the ergonomic occupational postures as well as increase in staff's skills. Thus, PTAI method, which relies on the ergonomic occupational postures and staff's skills, has been used in the present study. The results of using the PTAI presented useful information about influential factors on the occurrence of LBP among nursing personnel. Consequently, the control and modification of these factors can reduce the prevalence of LBP among nursing personnel and improve their services [30]. The aim of this study was to determine the prevalence of low back pain, assess the risk of developing LBP in patient handling, and distinguish the major risk factors affecting the prevalence of low back pain among nursing personnel. Few studies have been conducted using the PTAI in order to assess the risk of LBP occurrence among patient handling personnel by this method. Determination of the most important factors causing LBP can be an index to finding the ergonomic intervention in order to improve working conditions. Therefore, considering the identified risk factors can result in decreased prevalence of LBP.

Summary Statements:

1. The safety concern is not only for the bariatric patents but also for the caregiver
2. A lot of the nurses and other healthcare provider are experience serious musculoskeletal disorders due to lifting, transfer, and mover patients and/or equipment
3. The ergonomic occupational postures as well as increase in staff's skill, which mean that musculoskeletal disorders are more likely cause by the early stage of their career

Broome, C.A., Ayala, E. M., Georgeson, K.A., Heidrich, S. M., Karnes, K., & Wells, J.B. (2015). Nursing care of the super bariatric patient: Challenges and lessons learned. *Rehabilitation Nursing*, 40(2), 92-99. https://doi.org/10.1002/rnj.165

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