

**LUNG  
CANCER**

**#1 CAUSE OF  
CANCER DEATH**

**2021**

**DNH703 & DNH803 APPLIED  
DESIGN RESEARCH 1 & 2**



# **RESEARCH DISSERTATION**

**INNOVATING CARE DELIVERY FOR LUNG CANCER  
PATIENTS IN PALLIATIVE CARE**

**LARA KHOURY  
10168826**

# ACKNOWLEDGEMENTS

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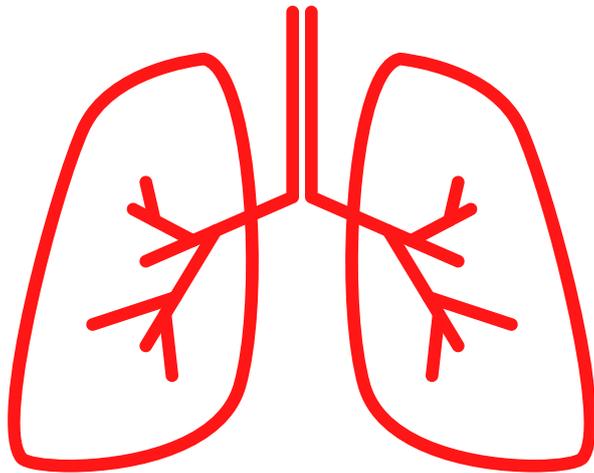
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# ABSTRACT

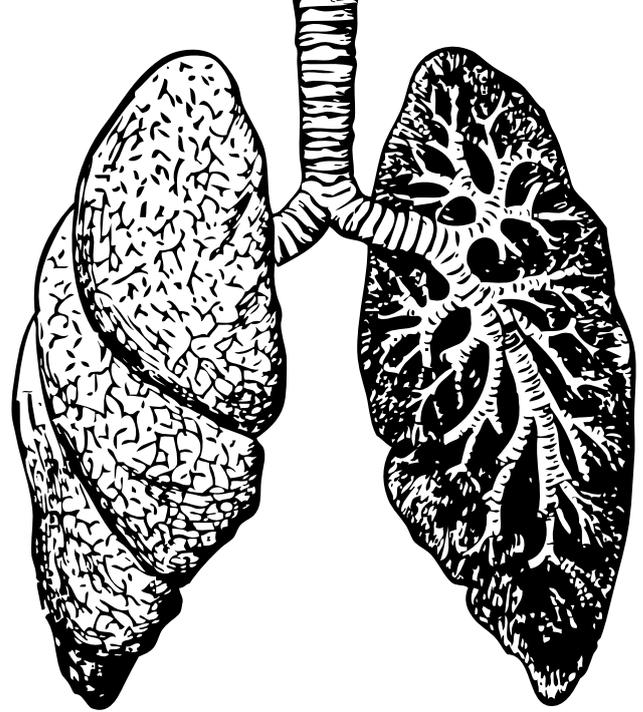
Within the healthcare sector, palliative care patients with lung cancer face barriers with access to care, causing disruptions with their general well-being and quality of life. Thus, research is needed to unveil the problems or barriers within healthcare to understand why they are preventing quality access to care. Rigorous methods have been executed to uncover insights and develop deep findings to pinpoint opportunities for change. The research topic has been investigated through qualitative research such as interviews, surveys and observations involving highly valuable participants. The series of interviews especially provided a rich dataset and was implemented to delve into existing healthcare approaches and deeply understand user needs. The combination of methods provided insights from various perspectives. The findings uncovered the struggles the user experiences throughout their journey with lung cancer. From the start, lung cancer patients deal with a lengthy investigation process to perform diagnosis, which ends up delaying treatment. During their battle, they experience disabling symptoms and further negative side effects from treatment involved. Towards end-of-life where conditions worsen, patients are left questioning their dignity and self-efficiency as daily tasks become a struggle. Moreover, the findings uncovered the disparities within the context, including communication gaps, limited care delivery modes, practices disempowering patients, delayed treatment plans, challenges with cost efficiency and more. Thus, the discussion suggested opportunities to target the elevation of access to care. This includes implementing viable product or system designs targeting the user with the objective to elevate access to care and quality of life. Three design recommendations include a portable chest drain to enable self-managed treatment, a communication system to improve patient's self-efficiency and an oncologist hub to execute faster diagnosis and prevent delayed treatment. The final design is a portable suction drain designed to relieve breathlessness at home.

# SECTION 1

## 1.0 INTRODUCTION



Lung cancer remains the leading cause of cancer-related death worldwide (Avancini et al, 2019). Development of the disease, side effects and severity of the symptoms, significantly decline the quality of life of patients due to its disabling symptoms. People with severe chronic breathlessness, and those around them, suffer with a deprived quality of life due to experiencing or observing this disabling symptom (Avancini et al, 2019). Defining quality of life is based on the five functioning dimensions such as physical, psychological, cognitive, social, and life roles (Polanski et al, 2016, 1). Sufferers of lung cancer often experience a build-up of mucus blocking their airflow, making it difficult to breath (Lim, 2016). They are often stuck in hospital to receive their treatment such as, adjuvant chemotherapy, and radiation therapy (Lim, 2016). These treatments are burdened by side effects that further decline quality of life. This often leads to these patients questioning their dignity as daily tasks are almost impossible.



The aim of this project is to research scholarly literature and conduct research methods that will lead to insights, concepts, and a developed holistic understanding on user needs. The research will aim to uncover patient's needs, lived experiences and challenges faced in palliative care. It will also aim to explore medical interventions and technology advancements, to understand the direction the healthcare sector is heading to. The end goal is to create a genuine, real-world product development based on patient-centered approaches which will enable lung cancer patients to improved access to care and quality of life.

The next page presents an overview of the project structure and what this dissertation involves

# 1.2 PROJECT STRUCTURE

The introduction is the 'so what' of the report and aims to provide a background of information relating to the research topic

The literature review contains an array of academic sources covering a range of topics from patient needs and barriers within the healthcare sector.

The methodology presents deep findings on the user through highly valuable participants involved in the research

The discussion executes what the findings mean and what opportunities are work addressing

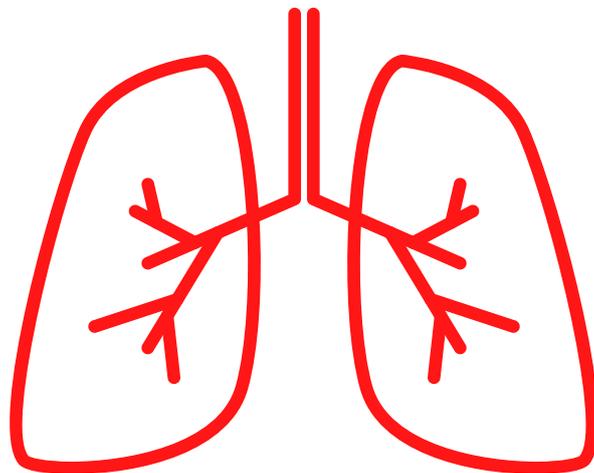
The proposal cover the design objectives and considerations

The conclusion provides a summary of results



# 2.0

# LITERATURE REVIEW



## **2.2 HEALTHCARE ELEVATING WELLBEING**

Giambattista, 2017 identified that emotional sensorial approach for product design leads to an effective therapeutic product or environment for the user, improving their overall well-being and experience. The extensive research methods included provided valuable insights such as direct observation made on users and their interaction with medical products. It included a valuable 'Design for Care' model, which is a useful framework for designers (Giambattista, 2017). This is useful as designers can use this framework to generate an evaluation of healthcare products. Overall, the information presented is highly valuable with research relevant to the discussion that will be made in this dissertation around patient care in therapeutic terms and their quality of life. Epping-Jorden et al (2014) investigated the hospital's position of improving quality of life through innovative design for patients with severe conditions. This is an essential area as chronic conditions are progressively the primary concern of healthcare systems across the world.

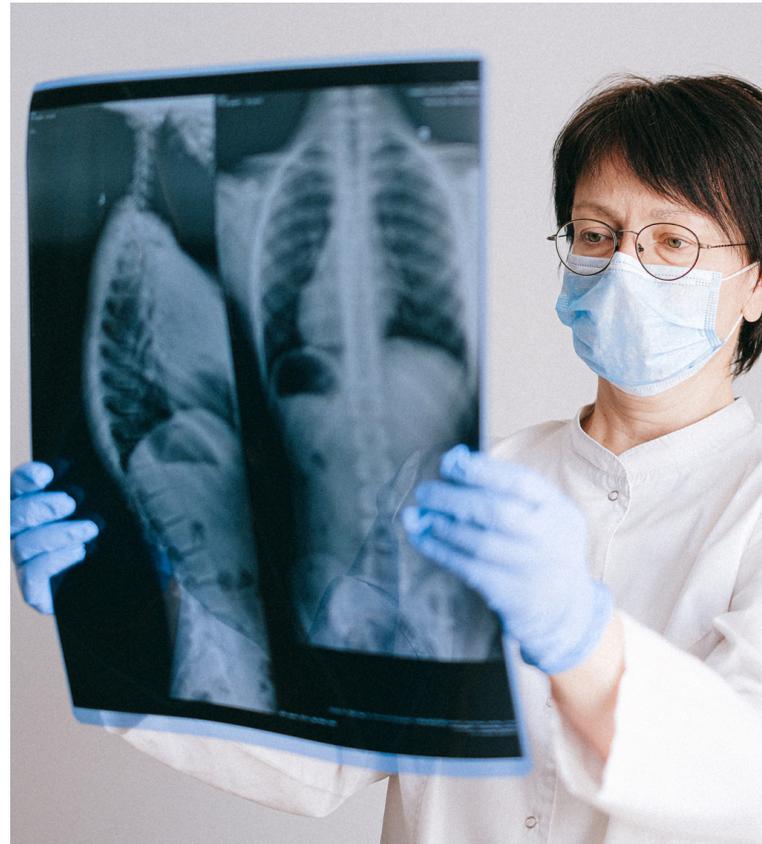
## **2.3 UNDERSTANDING PATIENT'S ENVIRONMENT**

Wittry et al (2018) identified the value of rehabilitation medicine for receiving palliative care and detailed the environment to gain an understanding on the patient's daily experiences in palliative care. Wittry formed solutions that best prioritize the user's experience through therapeutic approaches explained. Moreover provided an multidisciplinary model of care which aims to improve patient's quality of life. It discussed interventions for distressing symptoms in patients receiving rehabilitation or palliative care (Wittry et al, 2018). It concluded with the suggestion for physiatry to improve patient's quality of life, which is a possible path towards a design solution. Tiep et al (2015), covered the topic on pulmonary rehabilitation and palliative care for lung cancer patients. The main concept presented covers pulmonary rehabilitation, which can include self-management skills, oxygen therapy and breathing retraining as a few examples. These self-management practices and rehabilitation are becoming more prevalent in healthcare for patients with lung cancer (Tiep et al, 2015).

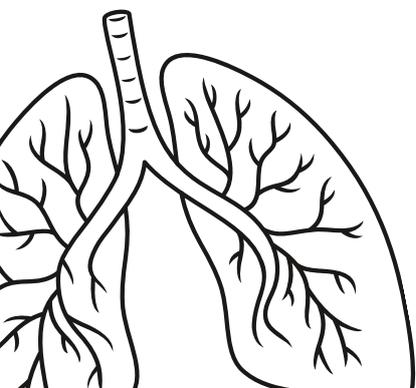
## 2.1 ROLE OF DESIGNERS AND INNOVATION IN HEALTHCARE

Role of designers and innovation in healthcare

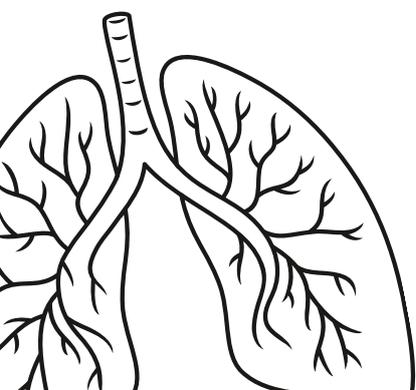
Nusem et al (2021) has showcased numerous case studies outlining the different types of innovation within medical design. The critical appraisal of previous case studies provides valuable insights highly relevant for this research dissertation. The question that naturally arises is, how can design contribute to the practice of healthcare? A major pattern consistently shown throughout the resource, is the demonstration of design's role in creating value in healthcare. The literature covered significant gaps within medical design such as areas needed most for innovation (Nusem et al, 2021). Their analysis on design for empowerment, highlighted the insufficient focus on patient's experience during care (Nusem et al, 2021). Lee (2019) identified a model for designing healthcare services that is based on improving patient experience.



Lee explored design thinking in co-creating quality healthcare with designers for innovative systems and interventions. It also presented understandings into patient's experiences to understand the crucial elements needed when designing healthcare products and services. Thus, showcased design methodologies to develop patient experiences, quality of care, value, and overall satisfaction



The literature also presented an examples of health care systems which aims to boost patient's self-efficacy and quality of life. Self-empowerment is needed due to patient's lose in abilities, as identified by Nusem et al (2021).



## 2.5 SELF MANAGED CARE

Booth and Johnson (2019) discussed improving the quality of life of people with advanced respiratory disease and highlighted the essential prioritization of symptom management. The article also suggested ways to incorporate person-centered care into clinics for patients suffering from respiratory issues. It identifies the five ways to well-being which defines the meaning of well-being and examples for it (Booth and Johnson, 2019, 11). Gysels & Higginson (2008) discussed access to services for patients with chronic obstructive pulmonary disease through investigating the experience of breathlessness in patients with data from in-depth interviews. The study addressed issues in healthcare, the main ones being, access to services and these services unfortunately discrediting the patient's experience with breathlessness. The literatures enable the understanding of the symptoms of breathlessness in cancer and chronic pulmonary disease. The literature concluded with key results highlighting the difficulties of living with breathlessness including the emotional impact it imposes and the restrictions affecting their lives profoundly (Booth et al, 2013, 15).

## 2.4 CARE DELIVERY

Telemedicine is a form of care delivery which is discussed by Hernandez et al (2014) through their study on delivering telemedicine interventions in chronic respiratory disease. The study covered the basic principles of the application of telemedicine for patients with chronic respiratory disease and outlined the advantages and limitations of telemedicine interventions (Hernandez et al, 2014, 1). Sicotte et al (2011) provides an overview of the impact telemonitoring at home to support improved care for patients with pulmonary diseases. The study reported a very positive result with patients' satisfaction and empowerment. The study by Lewis et al (2010), presented an opposing statement, showcasing that telemonitoring was not linked to improved changes of quality of life in those with the disease. The information presented from these studies does not provide a clear answer due to the varied results. Chen et al (2016), presented a more in-depth study on home-telemonitoring. The study involved was conducted due to the lack of information known on the benefits of home-telemonitoring for rural lung cancer patients (Chen et al, 2016). The intervention presented in the article established a feasible protocol which enhances traditional practice. This is a relevant source and aligns with the research topic as it showcased an intervention involving self-managed individualized care at home, encouraging patient-centered experiences.

### 2.4.1 TELEHEALTH & COST EFFICIENCY

Thaker et al 2013 presented a case study and telemedicine model of care for a hospital in Northern Queensland, Australia. The literature proposes results from this study to expose the cost saving and access of care benefits for the healthcare system and patients in palliative care. The study concluded that overall, a telemedicine model of care leads to costs efficiency and should be implemented more throughout hospitals across the nation.

### 2.5 COMMUNICATION

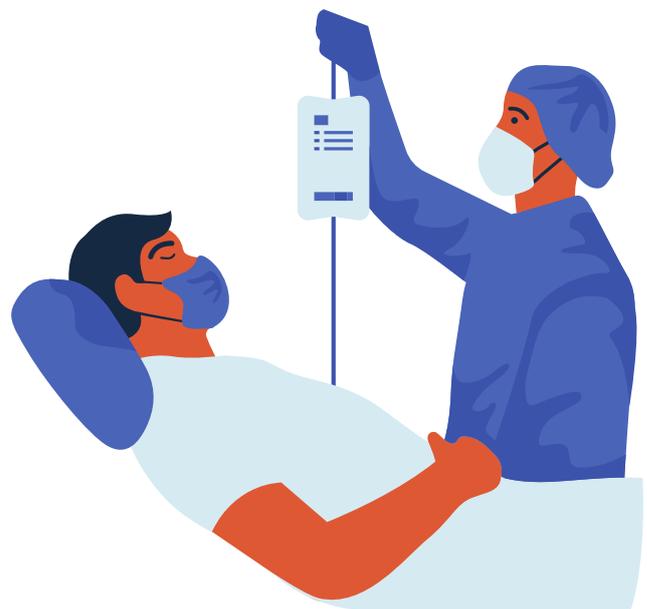
Ghandi et al, (2016) identified problems present in the referral process and communication between doctors and specialists when transferring important data in referral documents. The literature identified this critical component of quality care and the need for effective physician to physician communication. The article explained the outcomes of poor communication such as delayed diagnosis, delayed treatment, increased litigation risk, and unnecessary testing.



## 2.6 PATIENT EXPERIENCES

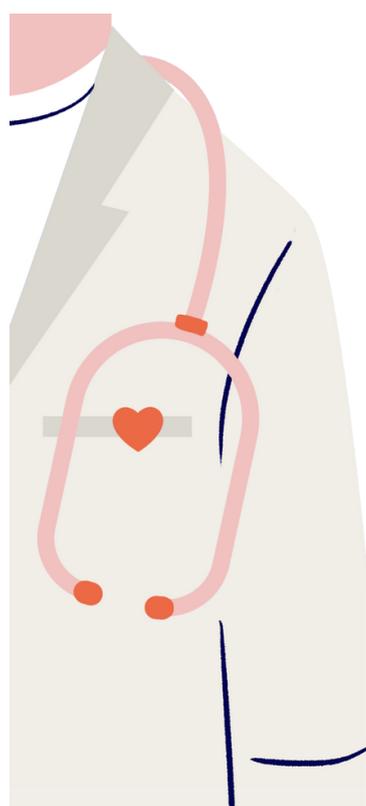
The patient interviews involved in the study identifies the psychosocial needs of carers through the patient's point of view. Understanding perspective from carers is important as patients often become reliant on their carers with their role to provide constant support (Ferreira et al, 2020, 2). Ferreira et al (2020) discussed patients' and carers' coexistence with chronic breathlessness. The information presented provided the researcher valuable insights with the key takeaway point being to possibly design breathlessness interventions that target the patient and carer both separately and together to effectively target their needs (Ferreira et al, 2020, 10). Ek et al (2011) provided an in-depth view of patients' perspective through patients' stories about living with advanced pulmonary disease. The study included compelling stories that enabled the researcher to further understand the end-user's experience of living with chronic lung issues. The literature concluded on building a person-centered nursing care that is developed upon patient's experiences to promote identity and dignity (Ferreira et al, 2020).

It was identified that a significant experience of lung cancer patients is recovering from surgery. Handy et al (2002), discussed what happens to patients undergoing lung cancer surgery and their quality of life, before and after the surgery, sharing insights into their experiences and emotions. Results from the study concluded that lung cancer patients' functional health status becomes significantly impaired after under-going surgery (Handy et al, 2002, 4). This is due to the nature of the surgery being very severe. Therefore, interventions focusing on risk prediction and postoperative intervention are needed to improve patient's functional outcomes and quality of life after experiencing lung cancer surgery (Handy et al, 2002, 4).



## 2.7 CURRENT INTERVENTIONS

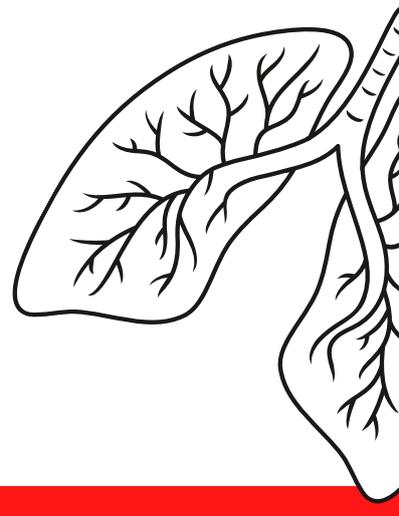
Lim (2016) discusses end-of-life care in patients with advanced lung cancer, and provides an in-depth overview of the detection, pathological diagnosis, and therapeutic interventions for lung cancer patients. The article delivers key areas of end-of-life care such as explaining the process of recognizing when a patient is approaching the end of life (Lim, 2016, 4). It also includes viable information for care givers (clinicians and family) that enable them to improve their assistance for those suffering lung cancer. Moreover, the necessities for improving quality end of life care (Lim, 2016, 6).



The following literature explored pulmonary medicine, including advances in management of lung conditions such as asthma, pneumonia and more. The literature presented several existing medical products and interventions to explore, targeted to patients suffering from disabling lung issues. Senanayake et al (2018) explored patients experiences of coping with the chronic and life limiting disease, idiopathic pulmonary fibrosis (IPF). This article established effective methods of improving the quality of remaining life in such patients (Senanayake et al, 2018, 1). The information presented provides a valuable healthcare perspective through the delivery of in-depth evaluation of the multiple impacts on an IPF diagnosis. It is vital to understand the user's perspective, and this source communicated this well for the researcher to identify the patient's thoughts, feelings and needs in a healthcare context. Tsiligianni and Kocks (2020) provided a in-depth analysis, identifying the need for understanding how symptoms impact daily functioning with validated and uniform measures or tools. They conclude with valuable insights which enables clinicians to take appropriate action that target patient's needs.

Salakari et al (2015), identified the effects of rehabilitation among patients with advanced cancer. The findings state physical exercise was associated with substantial improvement in general well-being and quality of life (Salakari et al, 2015, 7). They emphasised the need for timely rehabilitation at appropriate volumes to improve efficiency in healthcare costs, which are importance design considerations for patient-centered design. Moreover, the study state the importance of providing opportunities for independent practices to sustain self-empowerment and maintain quality of life for patients (Salakari et al, 2015, 8).

To extend on the topic of physical exercise in rehabilitation, Avancini et al (2019) supported the discussion on physical activity and exercise as the most significant nonpharmacological intervention proven to improve fatigue, quality of life, pulmonary function, strength, and psychological status in lung cancer patients (Avancini et al, 2019). The article strengthens this statement by providing an in-depth review of evidence. The most significant finding suggests that integrating exercise in lung cancer as an intervention within a multidimensional approach, considering also nutritional and psychological aspects, will be an effective strategy (Avancini et al, 2019, 9). The statements presented lead to considerations and opportunities for the design solution.



Karenovics et al (2017) identified results of short-term preoperative exercise therapy for lung cancer patients, opposing the previous literature. The study argued that short-term preoperative exercise therapy does not improve long-term outcome after lung cancer surgery. The article identified that a lack of exercise is a possible modifiable risk factor for long-term recovery and quality of life in lung cancer patients (Karenovics et al, 2017, 21). However, results indicate that short-term preoperative rehabilitation with a year-long high interval training does not improve pulmonary function and aerobic capacity for lung cancer patients. This literature has provided unique findings and insights into methods and approaches targeting lung cancer patients.



### 2.7.1 COMPARING INTERVENTIONS

Abdelghany et al (2018) discussed the non-invasive ventilation (NIV) device for patients with chronic pulmonary disease. NIV is the delivery of oxygen via a face mask and is a well-established therapy for treatment of respiratory failure (Abdelghany et al, 2018, 1). The literature compared non-invasive and invasive ventilation and provided an overall understanding on the influences (Abdelghany et al, 2018). Josifyan et al (2019) provided further insight into the health impacts from the patient's point of view in their study revealing the cognitive and affective attitudes toward noninvasive ventilation. It identified the aftermath experiences with acute respiratory failure. A statement from a patient was "I had the feeling that I was trapped", describing a negative experience of this medical device. The study validates the unpleasant or traumatic nature of the NIV experience. Furthermore, emphasised on the role of affective attitudes. This presents an opportunity to improve an uncomfortable experience possibly through redesigning the NIV device or implementing a system to reduce anxiety for these patients. This study has provided relevant information on an existing medical device and has broaden understandings on patients' experiences.

Munshi and Hall (2021) recently discussed a solution for respiratory support during the Covid-19 Pandemic, using a helmet as a NIV device. The previous literature provided a helpful overview of NIV face masks, however, Munshi and Hall (2021) argued the NIV helmet interface having advantages over face masks with a greater tolerance and more positive end-expiratory pressure for patients. It is necessary for as a designer to research new and more effective medical devices, which this article has effectively presented through evidence from trials. The statements in that article are supported with the information presented in a study by Munshi and Ferguson (2020) on evolving issues in oxygen therapy. The key relevant finding from this study is the statement on how medicine has evolved from “more is better” to “less is more” when approaching interventions for oxygen therapy (Munshi and Ferguson, 2020). This was a relevant source providing insights into the recent shifts in medicine

## 2.8 QUALITY MEASURES & TECH

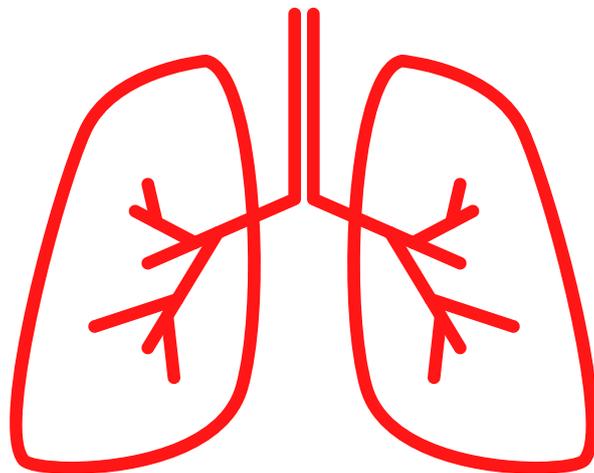
Saver et al (2015), addressed significant issues in quality measures in healthcare. The literature stated limited evidence supporting traditional quality measures that lead to improved health outcomes. It exposed a gap within healthcare and the inappropriate approaches made towards healthcare quality ratings (Saver et al, 2015). They identified the need for more patient-centered outcomes which aligns with the purpose of this dissertation. Madara (2015) also expresses this issue within healthcare and stresses the significance of intrinsic versus extrinsic motivation for medical doctors.

They critically stated that current medical wearable products impede care as the technology used to track patient data is not always 100 percent accurate. Dr Al-siddiq stated that medical devices will have a very positive impact on healthcare and patients and predicts wearable technology for healthcare will boom in coming years (Tschider, 2018, 177). The literature identified the need for quality measures and tools used to help quantify healthcare processes with the help of patient data tracking through wearable devices and electronic medical records. Thus, the future of innovative healthcare will include technology advancements as such.



# 3.0

# RESEARCH DESIGN



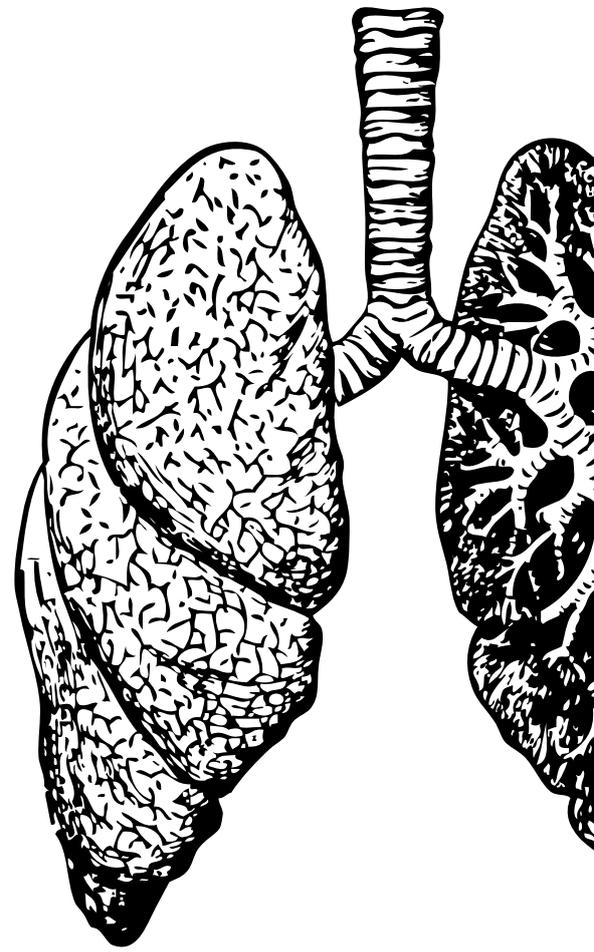
# REFLECTION ON METHODOLOGY

The methodology approach involved a lot back and forth tactics, for example, a survey response would present a unique finding which would lead to additional interviewing to investigate that finding further. The series of interviews allowed for in-depth investigations and thorough research. The tour/concurrent protocol provided limited findings, and many health experts emailed to, did not respond to the survey. This led to more rigorous interviewing to uncover the needed information. Pilot studies permitted the researcher to make refinements on the chosen interview/survey questions to ensure they are open-ended, purposeful, and clear



## 3.1 QUALITATIVE RESEARCH

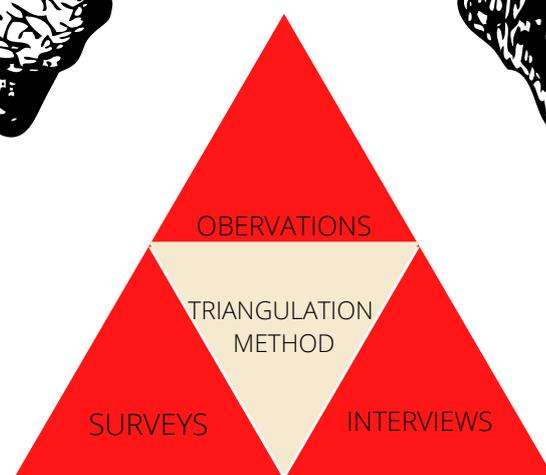
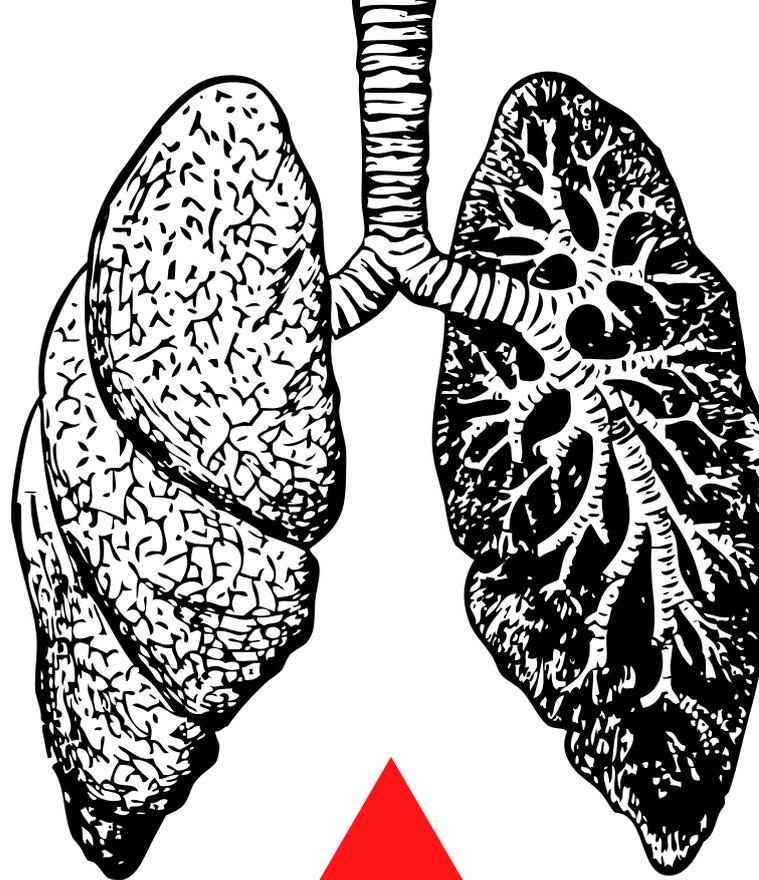
Qualitative research is defined as a variety of explanative procedures which strive to define, decode, and expose deeper meaning through description (Al-Busaidi, 2008). It is dissimilar to quantitative research, which is rational and is inclined to analyse phenomena in terms of trends and frequencies (Al-Busaidi, 2008). Qualitative research methods are receiving increasing recognition in health care related research, as well as innovation in health care development and human-centered design (Al-Busaidi, 2008, Nusem et al, 2020). Researchers in health care with the goal to improve quality of health care, highly benefit from qualitative research methods, as this form of research proposes an array of methods to be utilized for distinguishing what is essential to both patients and carers. Therefore, it is an essential component of health care research and development as it permits researchers to reach areas not willing to quantitative research (Al-Busaidi, 2008, Meyer, 2000). This includes information such as patient satisfaction, patient interactions with health care providers or carers, in addition to understanding attitudes, beliefs, and behaviour (Al-Busaidi, 2008)



Research methods enable the researcher to fully understand the context of use while identifying and understanding user needs (Janny, 2021). The use of triangulation in qualitative research involves the use of multiple methods to enable the researcher to develop a comprehensive understanding of the research area (Carter et al, 2014). Moreover, triangulation is a highly viable research strategy to test data and evaluate convergence and dissonance of key themes (Farmer et al, 2006).

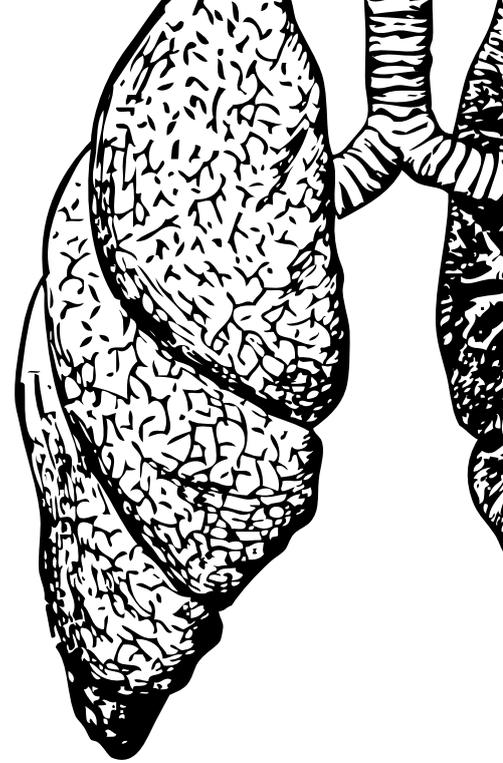
## 3.2 TRIANGULATION STRATEGY

The researcher followed the triangulation strategy through conducting a range of research methods such as concurrent protocol observation, semi-structure interviews and surveys. The key participants involved in the study were industry experts in the innovative medical field and medical professionals. The participants were chosen to provide insights into the user's needs, wants, challenges and experiences, and to identify gaps in healthcare that needs to be addressed. The other group of participants involved were family of lung cancer patients that hold a deeper understanding on the perspective of patient's daily experiences, needs and pain points. According to Al-Busaidi, 2008, qualitative research methods are the most suitable for this approach of uncovering information with an emphasis on the user groups' lived experience.



Triangulation, Khoury (2021)

Moreover, Al-Busaidi, 2008 stated that the questions for qualitative research should focus on inquiring the meanings people make of their experiences, studying their context and interpersonal environment and identify gaps or areas needed for development due to the lack of knowledge of the subject. Moreover, this approach is well suited for locating the meanings that people place on events, processes and structures present in their lives, and their assumptions, perceptions, and presuppositions (Al-Busaidi, 2008).



## 3.3 The participants involved

Who are they?                      Their value to the study                      Method involvement

<ul style="list-style-type: none"> <li>-Industry experts in medical design development</li> <li>-Doctors, researchers, and managers</li> </ul>	<ul style="list-style-type: none"> <li>-Experience in medical design research</li> <li>-knowledge on the design development process for creating innovative health care</li> <li>-Experienced in collecting and providing qualitative data</li> </ul>	<ul style="list-style-type: none"> <li>-Observation</li> <li>-Semi-structure interviews</li> <li>In-depth interviews</li> </ul>
<p>Health care workers such as doctors and nurses providing direct care to patients with lung conditions</p>	<ul style="list-style-type: none"> <li>-Knowledge and experience of hospital environment such as palliative care and rehabilitation</li> <li>-With these patients every step of the way and are part of their diagnosis process</li> <li>-Witnesses their daily experiences and understand their quality of life</li> </ul>	<ul style="list-style-type: none"> <li>-Surveys with open-ended questions</li> </ul>
<p>-Friends and family witnessing a loved one suffering from a lung condition</p>	<ul style="list-style-type: none"> <li>-Experiences the pain and burden with the patient</li> <li>-The ones that understand the end-user the most</li> <li>-Most connected with the end-user</li> <li>-Deeper perception on their quality of life, needs, wants and pain points.</li> </ul>	<ul style="list-style-type: none"> <li>-Surveys with open ended questions</li> </ul>

# 3.4 OBSERVATION METHOD 1



To identify key research findings and reveal deeper meanings from a qualitative study, a detailed and methodical analysis was conducted using varying research techniques. According to Janny, 2021, the concurrent think aloud technique used when observing data is an effective user research method. This technique provides more in-depth information than simply observing scenarios. Advantages include, empathy building through observing the occurrences the end-user is experiencing. It enables primary analysis of interaction processes between different stakeholders (Janny, 2021). The researcher identifies unforeseen situations in front of their eyes and observes how it is resolved. This research method is low time and cost (Janny, 2021).

This research method can foster a rich understanding of a setting, and the motivation and behavior of participants in an environment (Ahmad et al 2019). This method was combined with conversation, to allow for discussions based on what is happening to further understand the scenarios

The above research method was fulfilled with Professor John Fraser at the Critical Care Research Group-CCRG, located at The Prince Charles Hospital, Fourth Ave, Chermside QLD 4032. The method involved pen and paper to write down key field notes during the tour. Discussions with Professor John covered general insights into existing medical devices and discussions on a current CCRG research project on oxygen therapy. Audio recording was not used to keep track of discussion. Documentation such as consent forms and field notes were organized for the data analysis. Data will not be stored in the cloud and QUT will have ownership over data for storage for 5 years.

# 3.5

## INTERVIEWS

### METHOD 2



Interviews are the next method of qualitative research. A series of semi-structured interviews occurred with the participants. Participant 1 commenced in her home in Brisbane and further interviewing took place via call. The topics to cover during the discussion with this participant included valuable insights into lung cancer patients, their lived experiences, palliative care practices, access to care and the future of care delivery practices. The participant provided such valuable insights for this study. Participant 5, a young doctor, also conducted 3 interviews with the researcher. The other interview participants were short singular interviews. Around 20 interview questions were created as guide for the researcher. The questions are open-ended to allow participants the freedom to share their opinions, insights and knowledge in any way that feels comfortable for them. Semi-structure interviews allow informants the freedom to express their views in their own terms and provides reliable qualitative data (Cohen & Crabtree, 2006).

3 examples of questions are –  
“Do you believe more innovation is needed in healthcare? What areas in particular”?

“What are lung cancer patients daily struggles in palliative care”?

“What life-sustaining medical devices or treatments are currently used on patients suffering from lung cancer/conditions”?

Audio recording occurred to transcribe it into text. Key insights and reoccurring themes were highlighted and grouped together. Additional interviewing with occurred to broaden understandings further.

## 3.6 SURVEYS

### METHOD 3

Surveys is a chosen research method that will be implemented via email to a range of health care experts that directly work with patients suffering with lung cancer/conditions. As well as any family that endure the suffering of watching their loved one suffer from lung cancer/conditions. The main goal of the surveys is to develop a further understanding on the patients and their experiences in hospital and the quality of care they receive. Online surveys with open-ended questions allow participants to express their views and share insights in their own terms at any time online (Cohen & Crabtree, 2006). The people first interviewed had a vast network of potential participants, that were contacted over email to gain survey responses. The survey involved 10 general questions including their role as a care giver and their experiences caring for patients with lung conditions. The researcher also aims to understand their meaning of quality healthcare from their perspective and what they assume it is for the patient.



3 examples of survey questions include

“Explain your role as a care-giver”

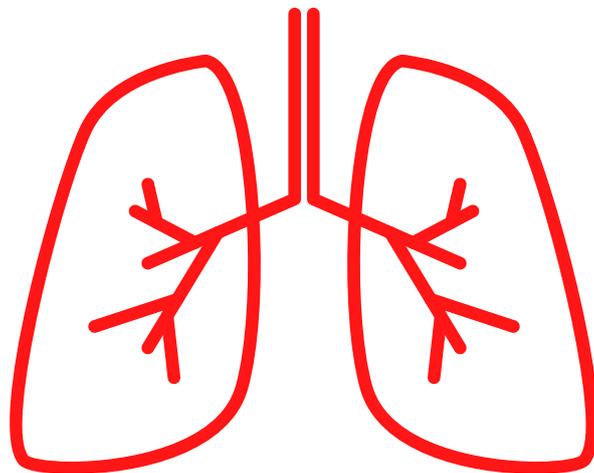
“How would you define the term quality of life for patients suffering from lung cancer/conditions?”

“How would you measure quality health care?”

# SECTION 2

## 4.0

# ANALYSIS & FINDINGS



# 4.1

## QUALITATIVE ANALYSIS

Qualitative methods aim to investigate the perspective and meaning of experiences (Wong, 2018).

The core purpose of collecting data research is to deeply understand patients' needs, thus enable the opportunities for changes to be made in the healthcare system, especially for lung cancer sufferers. The qualitative research processes allow the researcher to empathize with its users. This involves putting oneself in another person's shoes to see the world from that person's perspective (Wong, 2018). In this case, the perspectives explored are those suffering debilitating lung conditions, the health care experts involved, friends, family and carers. Ultimately, the aim is to effectively evaluate the opinions and experiences of the interviewees and consolidate the data to help solve real-world problems.

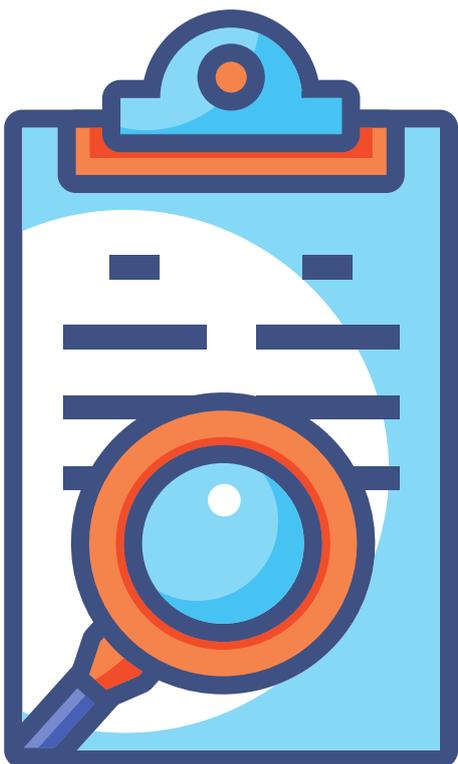


# 4.2

## RESEARCH TECHNIQUES

To identify key research findings and reveal deeper meanings from a qualitative study, a detailed and methodical analysis was conducted using varying research techniques. A data set has been developed through a series of interviews and surveys with industry health experts that resulted in differing perspectives from participants.

Throughout the process, a total of 12 hours of auditory information was retrieved through numerous interviews taken over a period of 80 days. Field notes and information was obtained from a concurrent protocol over a period of 4 hours at the Critical Care Research Group based in Prince Charles Hospital. The survey respondents were the health care workers involved in the care of patients with severe lung conditions and people that personally know or have witnessed someone with debilitating lung conditions. A total of 20 respondents were recorded and provided unique perspectives and findings.



The collected findings from all participants were organized to begin summarizing and ordering the material. The information was read several times to build a sense of the inherent meaning behind the results. A reflection on the categories and particular themes to code for occurred before commencing the color coding system. This allowed the researcher to understand what they are looking for before thoroughly analyzing the collected data set of material. Field notes were written down to record impressions as they come, comment on the environmental contexts, behaviors, or anything that may not be adequately captured through audio. Microsoft Excel was used to record data for the coding process.

**“Qualitative research produces data that are rich and voluminous, shedding light on the lived experience of the “being-in-the-world” and the interactions inherent in complex social phenomena” (Roberts & Wilson, 2012).**

## 4.3 Limitations

*Due to the nature of qualitative research itself and the way discoveries emerge from data sets, limitations can occur with using computer programs (Roberts & Wilson, 2012, Wong, 2008). Hence, the researcher must be predominately involved with categorizing, coding, and identifying patterns. Computer programs such as excel are first used to group together data, retrieve coded themes and search for key words, maximizing efficiency. Ultimately, the computer cannot efficiently extract deeper meanings from the data as this is up to the researcher.*

## 4.4 THE CODING PROCESS

Coding is a crucial part of the qualitative data process and involves breaking apart large volume of raw data or information into smaller portions and then categorizing them (Elliott, 2018). Conducting a comprehensive analysis this way, helps with clearly identifying themes. The codes are essentially labels for allocating identified themes or topics from the data compiled in the study (Wong, 2008). This process entails developing sense of huge amounts of data, reducing its volume, and constructing a coherent chain of evidence from the significant patterns identified (Elliott, 2018). Furthermore, it enables the researcher to pinpoint significant themes, examine commonality, examine similarities and differences, relationships and identify particular topics that may need further research.

Count-if was used to identify reoccurring themes. The identified themes draw together codes from the collected transcript to identify findings in a meaningful and coherent way.

Highlighting using a color coding system, recording notes in the margins, concept maps, and other coding tools enables the analyst to connect with the data (Elliott, 2018). A code book is a data mining technique created to help describe and explore relationships and identify valuable patterns of information to establish clarity of meanings. This data mining technique. Classification is a tool to group elements together from the data set into predefined set of categories. The colour coding allowed this to be showed visually.

The subjects and their assigned colours are the following.



PHRASES THAT SPARK IDEAS

WORTH FURTHER RESEARCH

VALUABLE OPINIONS

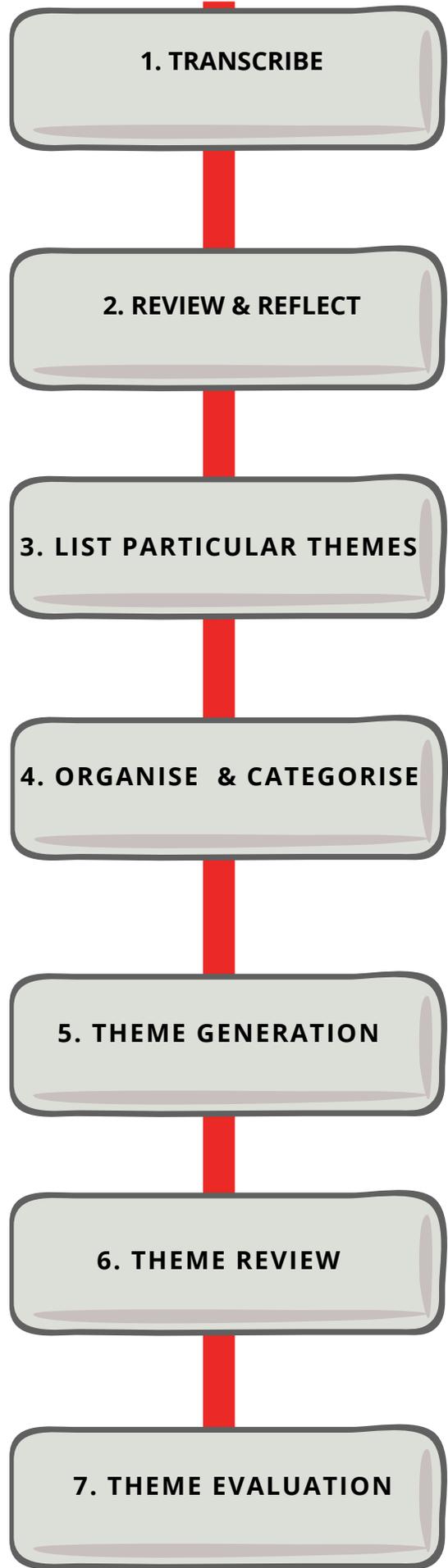
IDENTIFYING PATIENTS' NEEDS

EXPERIENCES & EMOTIONS

GAPS IN HEALTHCARE

# 4.4.1 STEPS INVOLVED

The steps involved includes converting audio material to text and remove unnecessary information. Read material of data set several times to build sense on what it is about. List particular themes to identify by creating a key and building a sense of what to look for. Organise and categorise by highlighting, dividing, moving, and grouping data into categories. Generate defined themes and subthemes. Thoroughly review identified themes and lastly, evaluate the identified themes and form deeper meanings.



## 4.5 THE SUBSTANTIVE QUESTIONS & TOPICS

The substantive question and topics identified from dataset are the following:

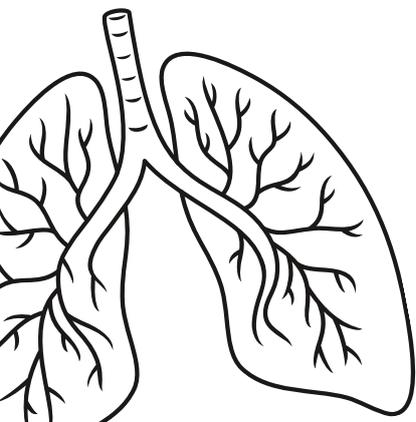
What changes are needed around the process of care delivery that will increase the quality of life of those suffering from severe lung conditions?

How is quality of life defined for patients?

What experiences, challenges, and struggles occur?

What gaps are there in the healthcare system?

How to improve access of care or care delivery to patients?



## 4.6 SUMMARY OF FINDINGS

### Interview participants

Interviewee 1: Specializes in cardiac and vascular interventions, working for a highly regarded provider of innovative products and systems

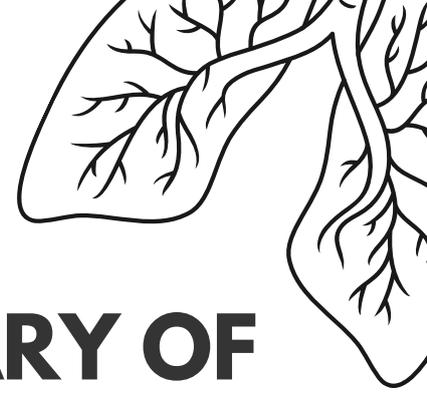
Interviewee 2: Professor and head of Critical Care Research Group

Interviewee 3: Emergency Nurse

Interviewee 4: Educator for hospital ward

Interviewee 5: Junior Doctor, palliative care, grandfather died from lung cancer

The interview series conducted with these health experts resulted in highly valuable and articulated insights. The information collected was reviewed several times and carefully analyzed to adequately code and identify significant meanings and categories.



## 4.6.1 INTERVIEW SUMMARY

1. Innovative products and systems must be designed to reduce health care costs – cost efficiency is a big focus
2. Patients want choice and better access to care and care delivery
3. Lung cancer patients feel stuck and uncomfortable in hospital
4. Discomfort due to fluid buildup, painful and stressful situation for patients
5. In palliative care, comes to a point where all doctors can do is manage their pain
6. Diagnosis process involves lengthy investigation process
7. Lack of communication between doctors in referral process
8. Too many palliative care patients in hospital due to them having to be tied to a wall, preventing them from going home
9. One's own meaning of quality of care may be unique and different to others

## 4.6.2 TOUR SUMMARY

The tour at CCRG involved meeting members of the CCRG research team, learning about current projects in place, observing prototypes such as surgical equipment and discussing gaps in the healthcare sector. The tour did not however provide as rich insights as the interviews or surveys.

### Field notes

1. CCRG biggest focus is improving outcomes for hospital patient
2. Research team involved in many projects which address gaps in healthcare
3. The CCRG community focuses on clinical decision-making and patient management, resulting in improved levels of care for critically ill patients, reduced healthcare costs and improved patient outcomes.



1. Current project include, Acute Respiratory Distress Syndrome (ARDS) – aiming to assist characterizing patients into correct subgroup in hospital to improve patient care

2. Identified that no guidelines available for oxygen therapy – **support is needed** for sick patients **due to the high-dose oxygen practice and risk of harmful effects.**

3. Medical prototypes are **costly** to produce but worth increasing healthcare efficiency

## 4.6.3 SURVEY SUMMARY

The survey resulted in answers across different perspectives. Two surveys were created, 1) for health experts and 2) for anyone that knows / has known someone experiencing debilitating lung conditions. The first survey produced 16 results and the second survey produced 4 responses. Key findings are the following;

1. 100% of health care experts agree with innovative changes are needed across key areas contributing to improving quality of care

2. 100% of participants agreed to quality of care leads to quality of life

3. Care access identified as huge gap

4. Key health experts expressed the need for innovation during the care delivery process

5. Cost efficiency is an important consideration

6. Participants reported it was a struggle watching their loved one endure the disease and regret not spending enough time with them

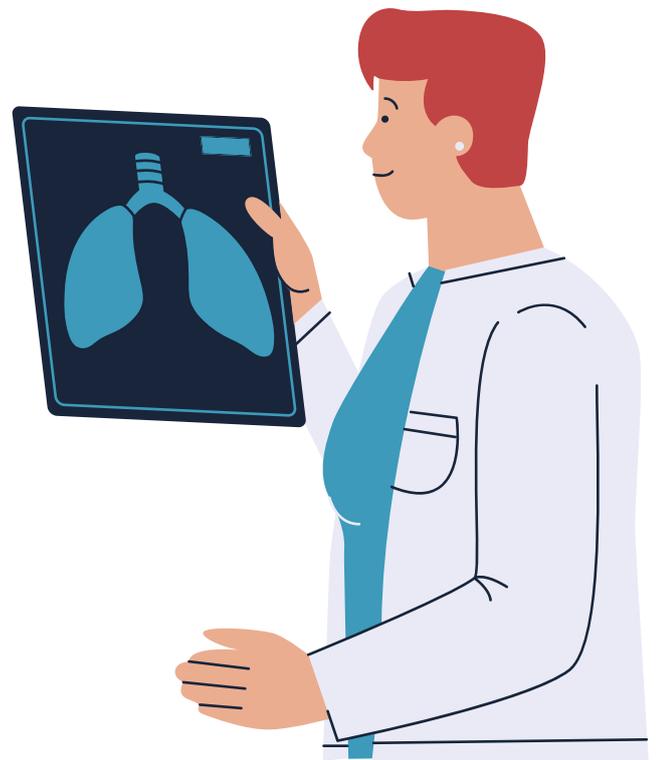
7. Family reported the importance of exercising choice for better access of care and the need for self-management practices to enable self-empowerment and dignity

8. Doctors need to teach family members how to care for lung cancer patient

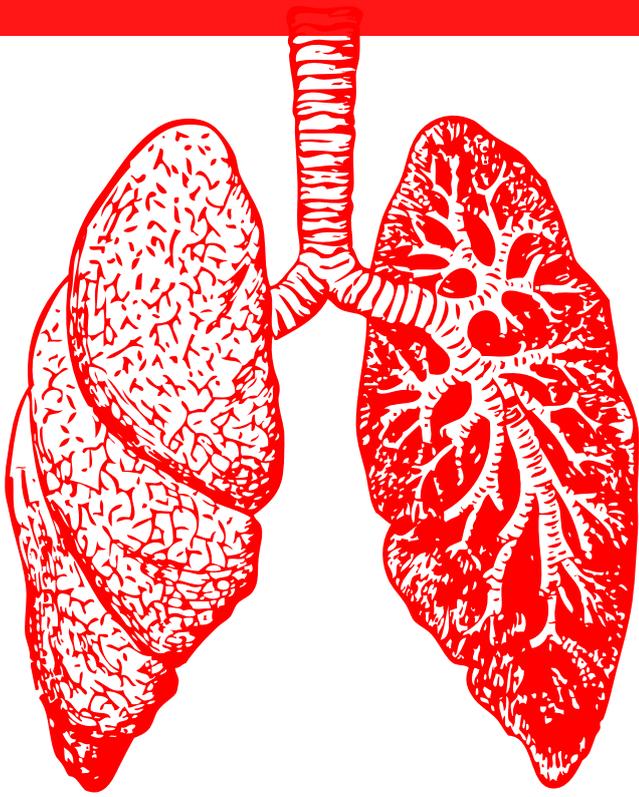
9. Each patient should define their own meaning of quality of life and mode of care

# 4.7 OVERVIEW OF CODING RESULTS

The coding techniques and tools used had identified five prominent themes. The appendix includes a code book with theme frequencies. The table below serves a statistical visual of the most prominent themes. The top themes encompass the needed attention, prevalent requirements, opportunities, and challenges faced within the user and context. The results embodied the valuable opinions, substantial experiences, and insights of the viable participants involved in the study. These findings will inspire necessitated design opportunity recommendations.



**THEMES:**  
**PEOPLE**  
**COMMUNICATION**  
**EXPERIENCES**  
**EMOTIONS**  
**ACTIONS**

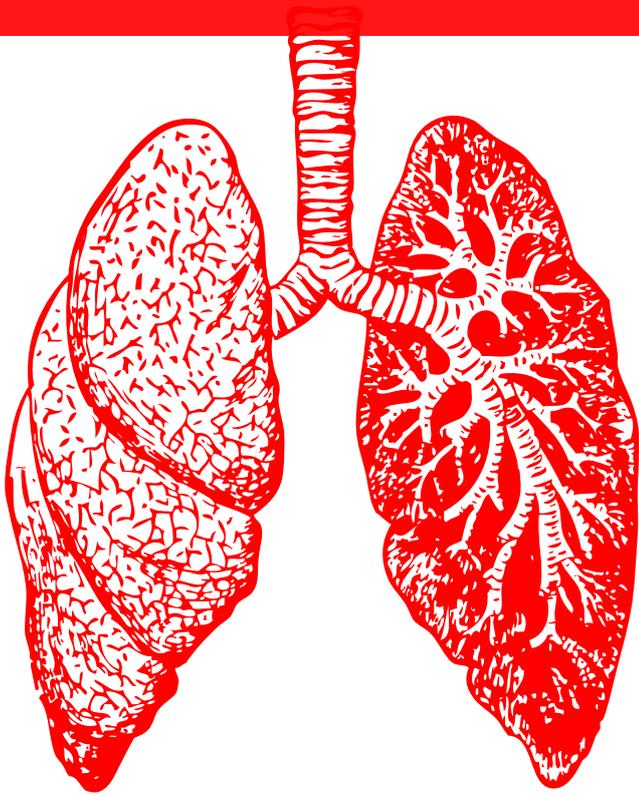


**“If there’s nothing more that the doctor can do, besides managing their pain, why should they stay in hospital, when they can receive the same care at home?” - Participant 1**

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## **4.8 THEMES**

**4.8.1 People:** Besides the user group of those suffering lung cancer, other people mentioned in the research are doctors, nurses, oncologists, cancer specialists and other medical professionals. The patient’s family, friends or carers were also considered in the study. As well as people part of healthcare communities and systems. The most reoccurring theme, referenced 72 times, was the patient, mostly about their lived experiences in hospital and their journey. This enabled a deep understanding of the patients’ needs and ideal experiences. Medical professionals involved in patient’s care was mentioned 32 times. Findings identified includes information on the referral process and the communication or actions taken between doctors during the staging or diagnosis process. Interviewees stated that there is a lack of communication between doctors during the lengthy investigation process. Several times it was mentioned that the people involved in the care of the user group primarily focuses on managing their pain and discomfort levels.



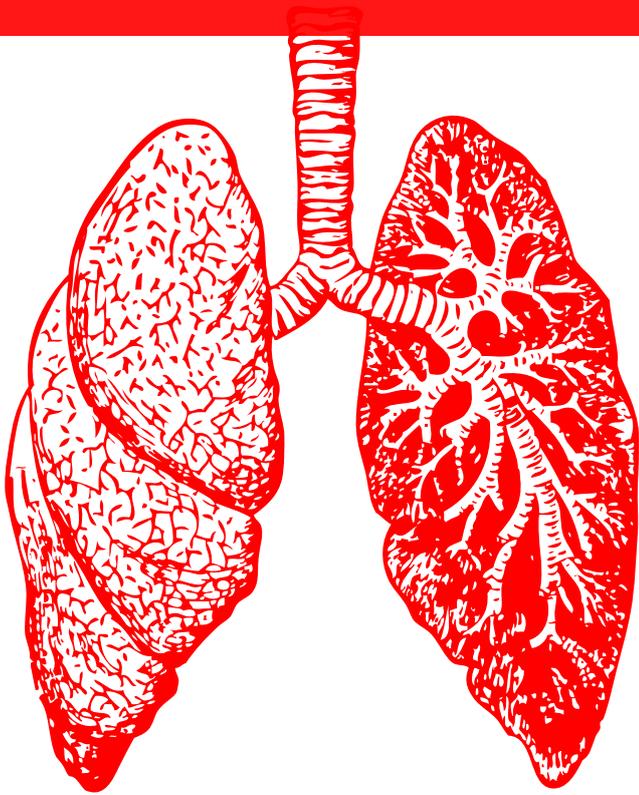
The findings suggest that the people involved in the patient’s care need to focus on patient-oriented approaches and sometimes that means giving patients exactly what they want to make them feel comfortable.

**“If they wish to smoke, you can let them smoke. It is not going to help them, but they are going to pass anyway and if they wish to do so they should be able to. It is all up to them, and that is how it should be” – Participant 5**

#### **4.8.2 Communication:**

The primary research presents a lack of communication between GPs, radiologists and specialists during the diagnosis and investigation process. A cancer specialist stated that this is an issue due to this lengthy process preventing treatment to be given time efficiently. Telehealth and telemonitoring was mentioned a few times throughout, suggesting that nurses should travel to patients more.

**“The investigations involved makes it a lengthy process...the referral process is mainly where the issue lies, there is definitely a gap in the communication” – Participant 1**



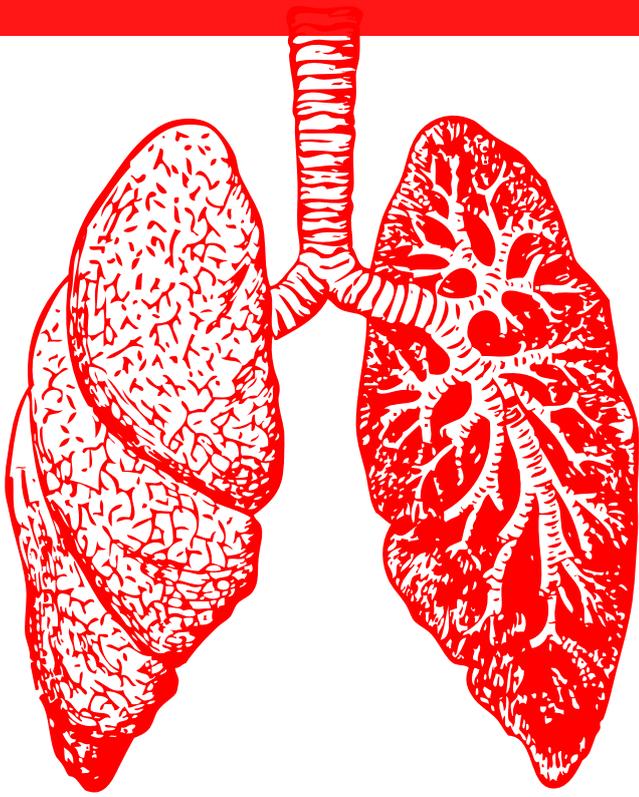
It was also mentioned several times the importance of patient-oriented care and how that includes giving patients a voice and freewill to tailor their care to their definition of well-being. Allowing for discussions around this was suggested to elevate the communication between physician and patient.

**“It’s about focusing on patient-oriented approaches, elevating suffering, facilitating what they wish for through having those end-of-life discussions and allowing enough time to prepare and facilitate it” – Participant 5**

#### **4.8.3 Environment:**

The hospital or care environment was mentioned 30 times, majority referenced when describing and comparing the experiences between care at home and hospital care. The interviewees believed that moving palliative care patients to home would save the hospital or the healthcare system a lot of money. Case studies relating to this topic was reviewed for further understanding and exploration. There are a lot of challenges with this as lung cancer patients need to be present in hospital to receive oxygen therapy or chest drains to manage their discomfort levels and breathing.

**“Lung cancer patients are stuck in hospital, tied to a wall” – Participant 3**

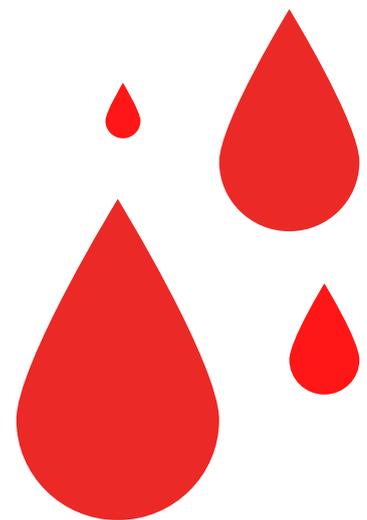


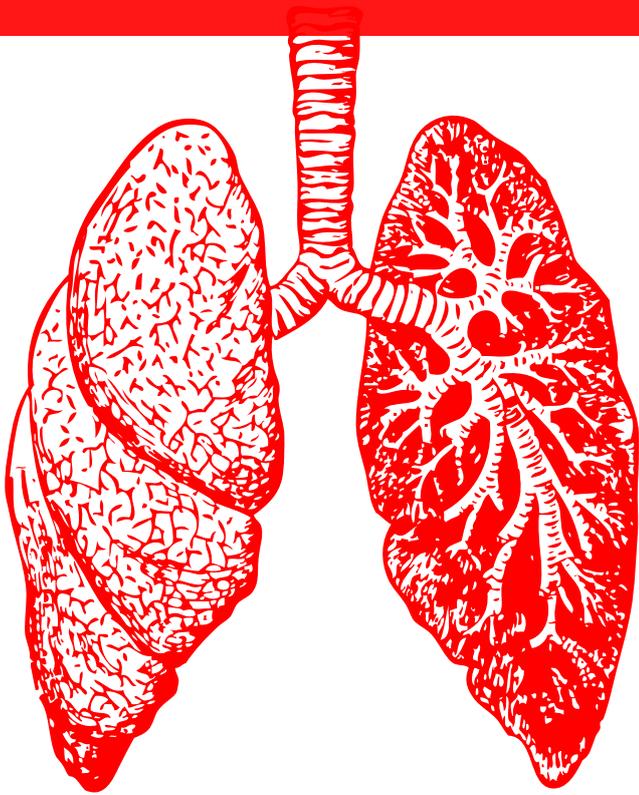
#### **4.8.4 Emotions:**

Emotions: Negative emotions and experiences were referenced 110 times. The interviewees expressed a lot of concern for patients as they described their lived experiences and disabling symptoms. Patients struggle with each breath they try take due to the fluid buildup in their lungs. It was also mentioned that they are not able to leave their bedside, hence the feeling of being stuck and helpless. Patients also struggle with coming to terms with what it means to have an irreversible disease and how they feel about their dignity.

**“It is a really painful and stressful situation, patients really suffer” - Participant 1**

**“With shortness of breath they may feel like they can’t even speak without feeling like they are going to suffocate, or they will cough up blood which is traumatic and that adds to the feeling of breathlessness and suffocation” – Participant 5**





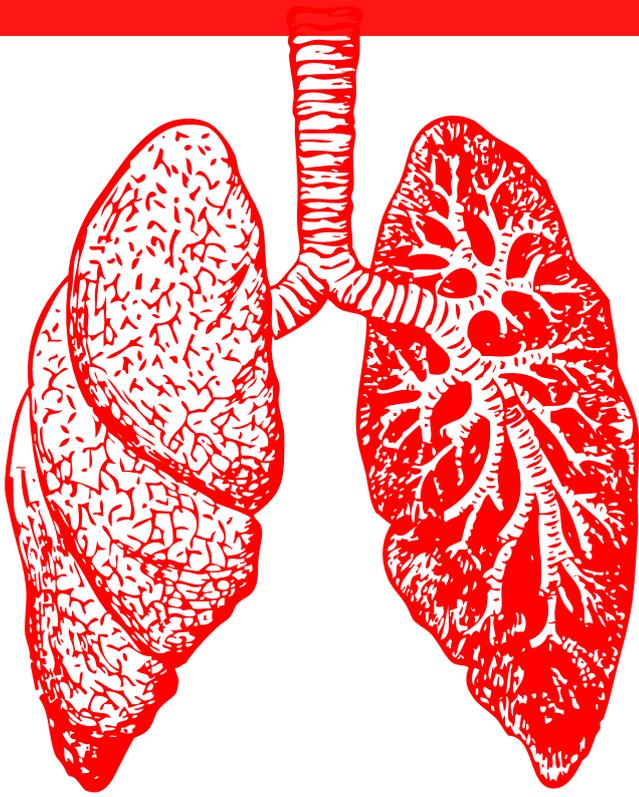
#### **4.8.5 Action:**

Current practices, treatment and interventions was referenced 20 times. The post-surgery and recovery experience was explained as uncomfortable due to the nature of the surgery being very invasive. An interviewee revealed that there are ways through laparoscopic procedures, that they can cut out lung cancer through keyhole surgery. This means less recovery post-surgery, that would ultimately enable the patient to feel more comfortable.

**“With the use of cameras, robotic hands and with various tools, the surgeon was able to move lung tissue out of the way...less invasive surgery means less recovery time” – Participant 1**

Participant 2 from the tour mentioned the need for oxygen therapy guidelines, explaining that high doses of oxygen can lead to harmful effects. Hence, the need for appropriate management and guidelines. This was clarified with Participant 3, which further explained excessive supply of oxygen can lead to severe damage to the lungs. Therefore, support is needed for these patients.

Cost efficiency was a highly referenced topic addressed throughout all methods. The more cancer patients in long-term palliative care, the more costly it is for the healthcare system, as highly emphasized by participant 1, and 3. When Participant 1 was asked about the need for innovation in the health care sector, she expressed agreement for the need for innovation, however, explained that high costs of innovative interventions prevent the introduction of such.



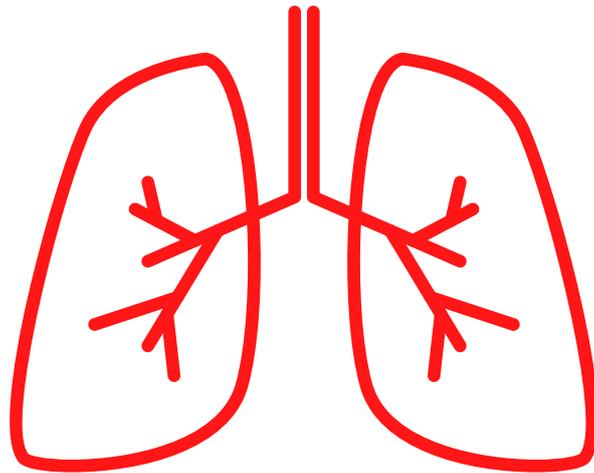
**“People stay in the hospital for too long for unnecessary things, an example would be, less invasive surgeries that get patients recovered out the door faster. However, those things come with a cost. So, our healthcare system does not offer those solutions to patients.”**

Therefore, cost efficiency is a huge challenge for the health care sector and consideration must be made to ensure new intervention not only aim to improve quality of life but reduce health care costs.

Access to care was also highly referenced throughout all methods. Several survey participants mentioned access to care as the biggest challenge or struggle faced by lung cancer patients. Moreover, 100% of survey participants highly agreed this involves patient centered approaches, patients feeling safe, effective communication, timely care and enabling different care delivery options.

# 5.0

# DISCUSSION & RECOMMENDATIONS



# 5.1 DISCUSSION OBJECTIVE

The objective of this discussion is to delve into the key findings of the literature review and the primary research. It will focus on evaluating the findings and presenting overall conclusions. The major findings of this discussion will address the following topics and their sub-topics: access to care (care delivery, costs, quality, self-managed care), quality of life (palliative care experiences, well-being, emotions), and practices (diagnosis process, communication, current interventions).

An extensive review of academic literature identified valuable insights into the care delivery of lung cancer patients in palliative care. The research conducted investigated the topic further in the form of valuable perspectives, opinions, and experiences of those involved in the care of lung cancer patients. Although there are differences and similarities, both forms of research aligned together to form a valuable discussion and significant recommendations. The consolidation of such research will result in the creation of real-world solutions.

## 5.2 ACCESS TO CARE

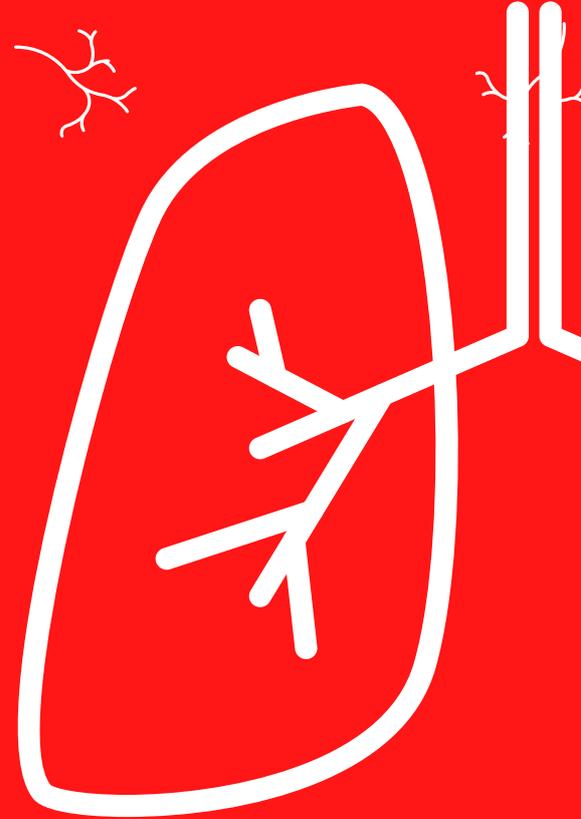
The collected literature and primary research have identified key information and meanings relating to access to care. The literature proposes innovation around telehealth and telemonitoring as part of improving access to care to patients and communication between doctors and patients. Sicotte et al (2011) and Lewis et al (2010) argued that patients' satisfaction will increase from telemonitoring. According to the interview results, many of the responses expressed the importance of innovative healthcare practices that allow different options for care delivery



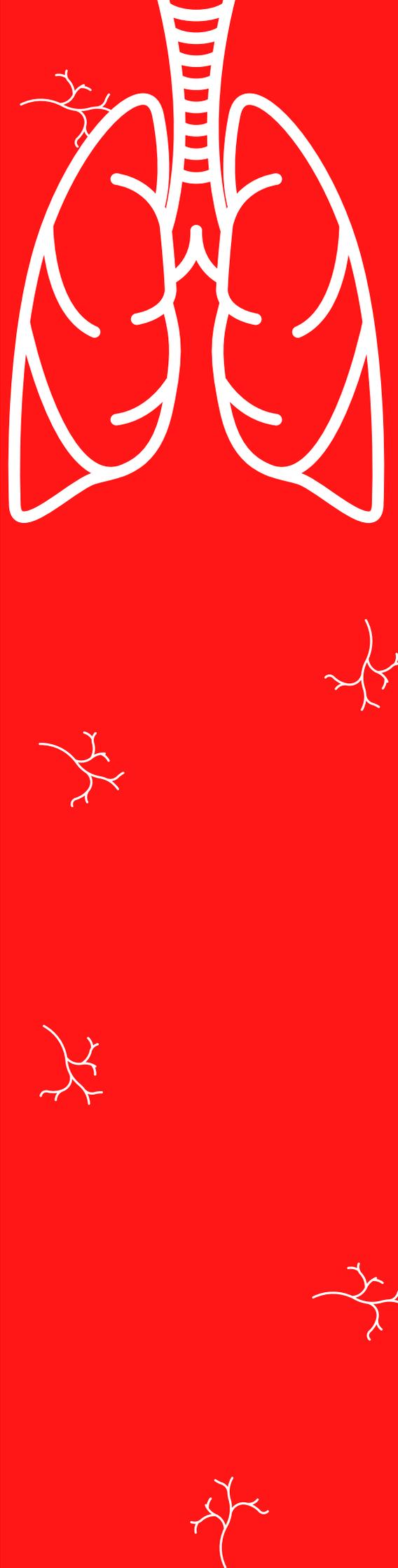
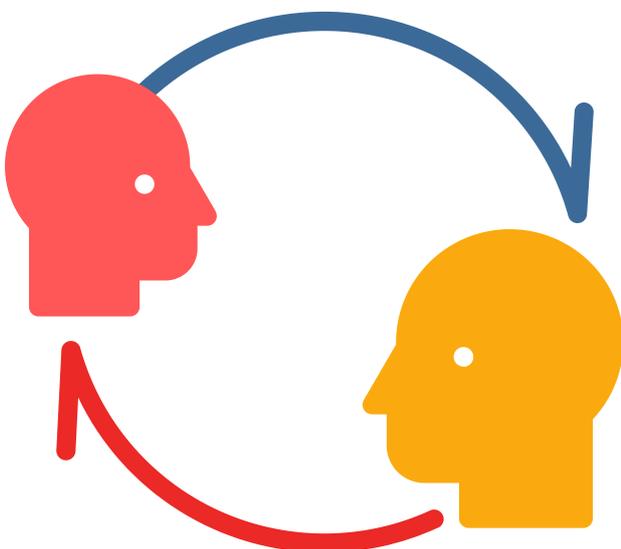
Participant 1 suggested telemonitoring to prevent patients emitting in and out of hospital. Access of care falls under many dimensions. Providing patients with care delivery choices falls under accessibility and acceptability within access of care. Moreover, a reoccurring theme identified in the survey results are challenges relating to access within healthcare. Cancer specialist survey participant reported that lung cancer patients face this significant challenge in palliative care. Moreover, 100% of survey participants agreed that quality access to care involves different care delivery options including patient-oriented approaches and choice with different care delivery options. The collected research clearly identifies a strong link between quality access to care and quality of life. Therefore, the recommended design opportunities must aim to elevate this.

## 5.3 SELF-MANAGED CARE

Booth and Johnson (2019) and Wittry et al (2018) discussed the essential prioritisation of symptom management. When describing patient experiences, interview participant 1 stated that the main purpose of palliative care is to manage patient's symptoms.



This finding presents a strong need for symptom management to enable comfort and decrease pain levels. Moreover, the findings suggest targeting care delivery methods that allow for choice, freedom and overall improved access. Interview participant 5, expressed the importance of this approach to enable self-empowerment and dignity. Interview participant 1 explained the positive aspects of patients utilizing self-management practices at home with the help of their own family. This was achieved through effective communication between the physician, family, and patient to allow for the family to manage patient's pain levels at. Nusem et al (2021) and Tiep et al (2015) supports self-management practices, stating that it will lead to boosting patient's self-efficacy, empowerment, comfort levels and overall improve their quality of life in palliative care. Therefore, the findings suggest the need for self-management approaches with effective communication across those involved in healthcare systems.



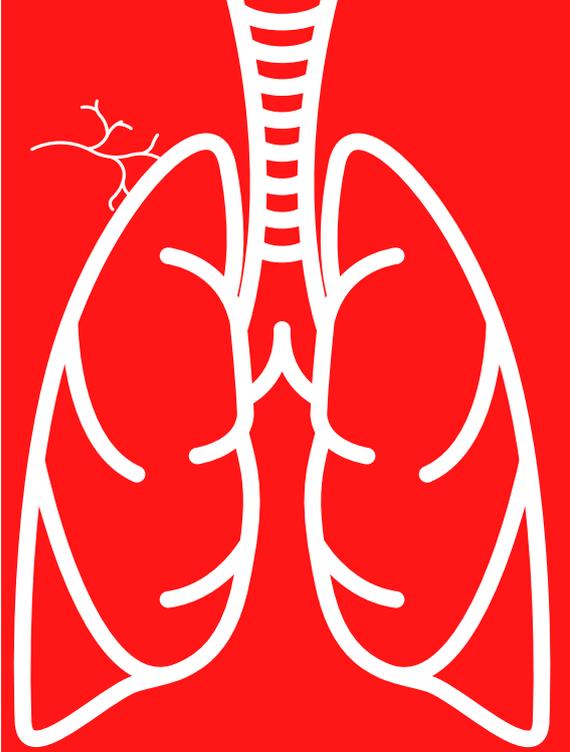
## 5.4 COST EFFICIENCY

Introducing cost-efficient practices into the healthcare sector was a recurring theme across all methods. Salakari et al, (2015) emphasised the need for timely rehabilitation at appropriate volumes to improve efficiency in healthcare costs. Interview participant 1 explained a lot of innovation is not considered in healthcare due to cost of production and technology maintenance, which prevents introducing new innovative interventions aimed to improve access to care. They suggested the need and future development of telehealth and systems in place implementing daily checkups for patients. According to Pang et al (2020) telehealth practices for lung cancer patients holds great promise for reducing the cost of inmate care and has been proven to be an effective intervention for patients with several chronic diseases such as lung cancer. Moreover, an analysis was conducted on the costs of a telemedicine for cancer patients (teleoncology) in Queensland, to compare to the usual model of care present in hospital and health services (Thaker et al, 2013). Thus, the literature and primary research supports teleoncology as a cost-effective intervention with the need for further development.



# 5.5 WELLBEING & QUALITY OF LIFE

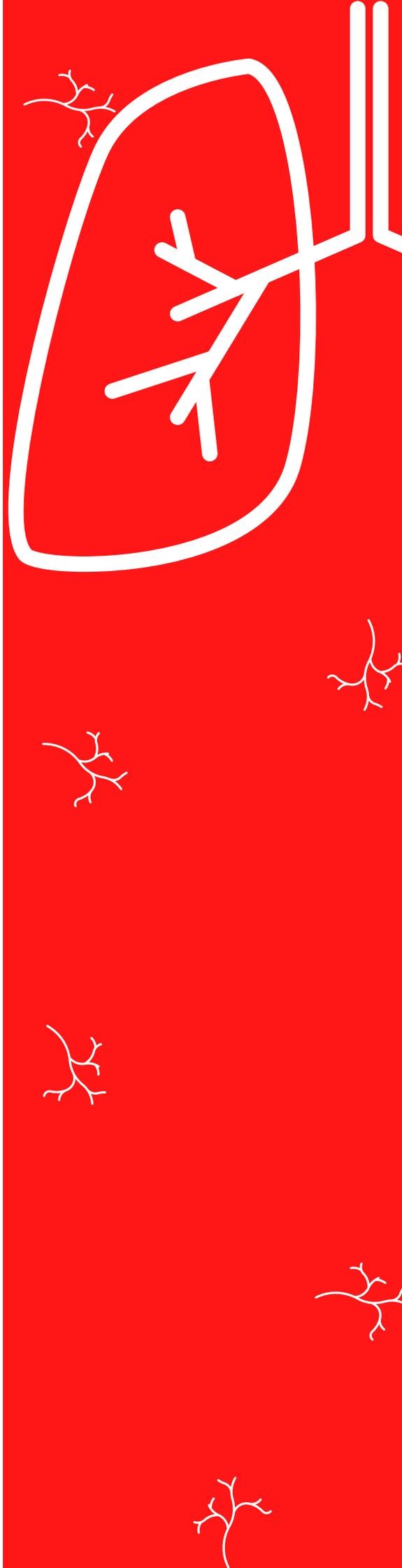
Lung cancer patients profoundly suffer from deterioration physically and psychologically, which exerts a negative influence on their quality of life (Pang et al, 2020). Improving patient's well-being, comfort levels, and access to care, is the essential end goal of the design interventions recommended for development. The interview participants expressed a great amount of compassion for lung cancer patients, while explaining their daily experiences in hospital. The described disabling symptoms result low quality of life. Epping-Jorden et al (2014) identified that chronic conditions are an area that is progressively becoming the primary concern of healthcare systems worldwide with the focus being on palliative care patients. Interview participant 5 explained a dignity challenge for those end-of-life patients as they struggle with simple daily tasks due to disabling conditions. Therefore, increased self-empowerment through self-management practices will allow patients to feel more self-sufficient and in turn, improve their quality of life.



## 5.6 EXPERIENCES & EMOTIONS

The most disabling symptom of lung cancer patients is their chronic breathlessness. It is frightening to experience and observe (Booth and Johnson, 2013). The interview participants expressed a lot of compassion as they described patient experiences and their disabling symptoms such as feeling stuck, tied to a wall, and struggling to breath as they “drown in their own build-up of fluid”. Gysels & Higginson (2008) investigated issues in healthcare and highlighted how poor access to services unfortunately discredits the patient’s experience with breathlessness. The restrictions and emotional impact profoundly affects patient’s lives (Booth and Johnson 2013). Moreover, there is a vast link between delivery care options (such as telehealth) and self-empowerment, as identified by Sicotte et al (2011) and is suggested in the primary research conducted. It is also important to address their dignity, as it was identified that patients struggle with the reality of relying on others as their disease gets progressively worse.

Therefore, patient-centered approaches focusing on developing more positive experiences and high consideration towards patient’s emotions, values and opinions is part of quality access to care. This will allow patients to feel valued, heard and worthy, which will elevate self-empowerment, improved experiences and quality of life for the user.



## 5.8 PRACTICES

The collected primary research and literature identified several current practices in place that demonstrate quality care practices. Nusem et al (2021), highlighted the inadequate focus on patient's experience during care and the need for patient's needs and requirements over technological advancements. However, technological advancement can play a key role in improving patient's quality of life. An interviewee discussed the invasive procedure of lung cancer surgery, comparing it to open heart surgery. However, keyhole surgery is a much less invasive procedure that requires less recovery time for the patient. As identified by Sihoe (2020), this keyhole approach is known as video-assisted thoracoscopic surgery (VATS). The surgery involves tiny video cameras and operating instruments to pass through the cuts, performed from outside the chest. A keyhole approach results in shorter hospital stay, faster recovery and fewer side effects. Therefore, less invasive procedures can drastically improve quality of life for lung cancer patients.



Furthermore, the collected research suggest new and innovative practices in healthcare will need to be assessed based on what value it brings to healthcare, before deciding if it is worth implementing. A survey response discussed the important of new interventions holding a strong value proposition that will lead the healthcare system to cost and time efficiency. Queensland Health (2017) discussed the need of a future where patients are appointed in their own healthcare with clear access and understanding. Such approaches will lead to improved clinical practices and systems, that also lowers costs and strain to the healthcare system.



# 5.9 DIAGNOSIS & COMMUNICATI ON

The interview data identified a gap within communication between doctors causing delayed diagnosis and treatment plan. Survey results suggested that the referral and staging process is a lengthy investigation. Further interviewing on this topic revealed that the investigation process is mainly prolonged due to communication issues within the referral process. Gandhi et al (2016) identified major challenges with the current referral system were lack of timeliness of information, communication, and inadequate referral letter content. The literature further explained physician-to-physician communication is vital to the success of an outpatient referral. The referral process involves communication between many physicians and specialists. Thus, endeavors aimed to improve the referral system could improve patient satisfaction and quality of care. Optimal communication including the transfer of relevant information sent from the referring physician and specialist involved is vital.



This is because a lack of communication can lead to delayed diagnosis and then treatment for lung cancer patients as explained by Gandhi et al (2016) and the interview data. Also, the importance of facilitating the opportunity for discussions around one's quality of life and what it means to them is an important part of patient-centered care as described in the interview data. Therefore, communication and discussions need to be made allowing the patient to voice their wants, needs, care delivery of choice and personal definition of quality of care.



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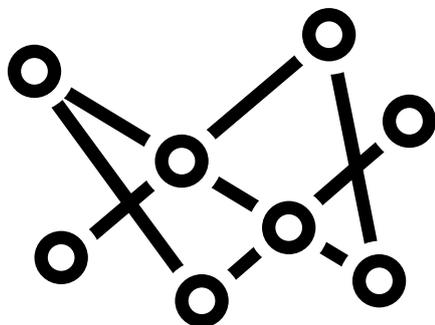
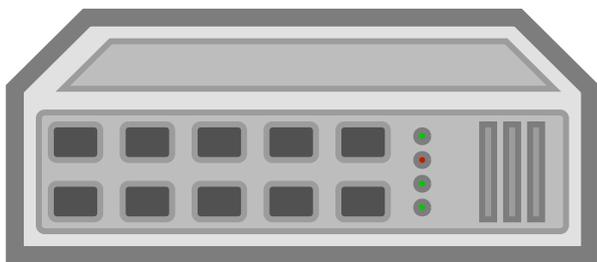




# 5.10 RECOMMEN DATIONS

The discussion identified gaps within healthcare and opportunities to address the user's needs. This part of the dissertation will explore ideas and opportunities with their strengths and possible limitations. The design solution concepts will cover the following areas. Access to care, communication within healthcare systems, the referral process, and well-being.

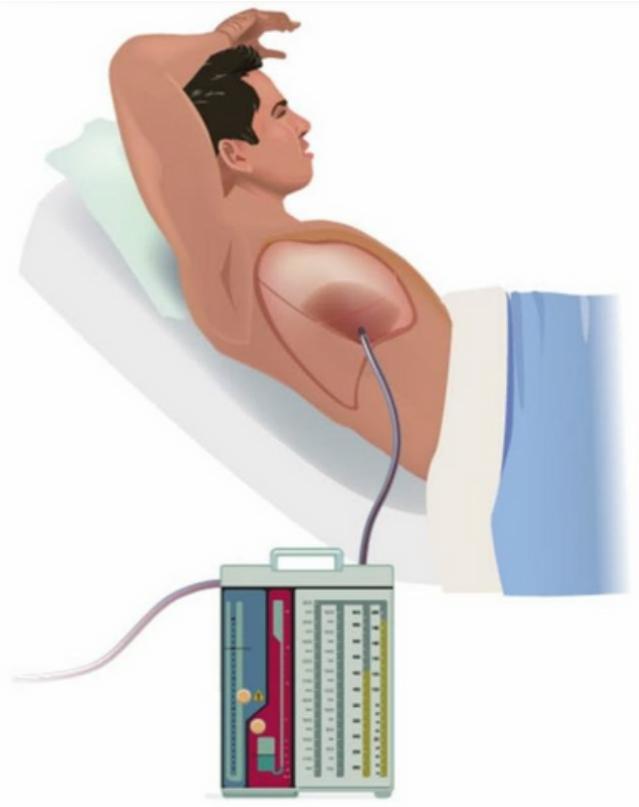
## 5.10.1 IDEA 1 ONCOLOGIS T HUB



The research identified a lack of communication in health care systems and the need for a better system of transferring information across different channels during the referral process. An interviewee stated that the increase in private clinics across Australia, and private hospitals that offer outpatient scans, has accelerated the diagnosis process. Organising oncologist appointments from there and the overall investigation process the identified challenge. More so, the time it takes for referrals to be sent from scan to GP to the specialists can be a lengthy process. This idea involves a centralized hub for GPs to organize their patients onto an available oncologist to slow down delays. The centralized hubs will be implemented across different areas for doctors to pick up patients and travel to the hub to assess and complete referrals and diagnosis on the same day. As opposed to GPs writing a referral to any specialist, which involves waiting for it to be received and for an appointment to become available. This process can take days to weeks, causing delays with diagnosis and treatment. With most lung cancer patients having poor prognosis, this is an opportunity to address. Limitations include high costs for vehicle and hub development. This design solution addresses the need for rapid investigating and diagnoses, so a treatment plan can be implemented as soon as possible for patients.

# 5.10.2 IDEA 2 PORTABLE CHEST DRAIN

The research addressed the discomfort and disabling symptoms experienced by lung cancer patients several times. It was identified that many patients in palliative care wish to receive care from home, however, due to having to be tied to a wall and attached to a chest drain, this is not always possible. The chest drain is inserted to allow draining of the pleural spaces of built-up fluid. This allows for expansion of the lungs and restoration of negative pressure in the thoracic cavity (Bruce et al, 2006). In many cases, patients are stuck in hospital due to the attachment of chest drain or constantly visit hospital to receive this form of treatment. The design solution here is to create a portable chest drain for lung cancer patients to be able to use at home through a suction cap on top of the chest drain that allows for a self-operating product, easy to manage for patients. This would allow for self-managed treatment and improved access to care. Limitations include the viability of the self-suction aspect of this design and the risks involved in unsupervised self-managed care.

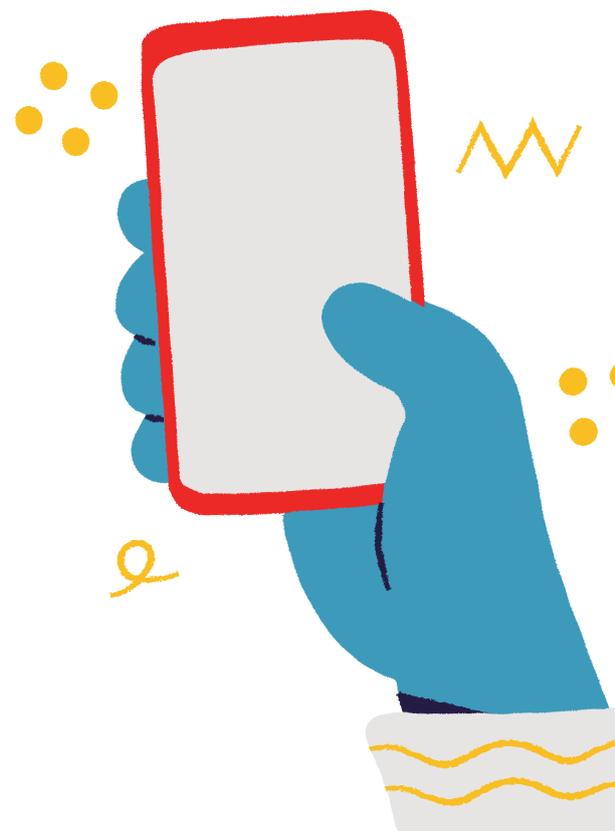
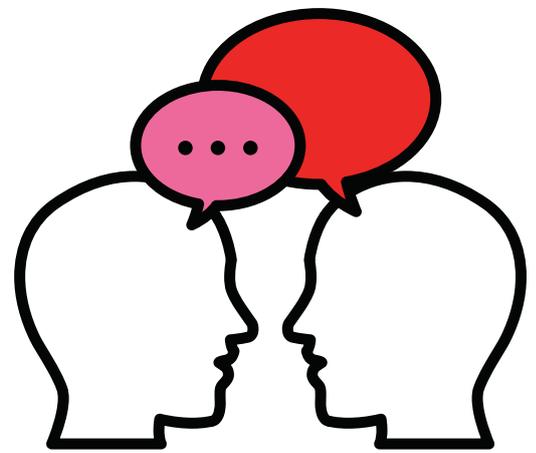
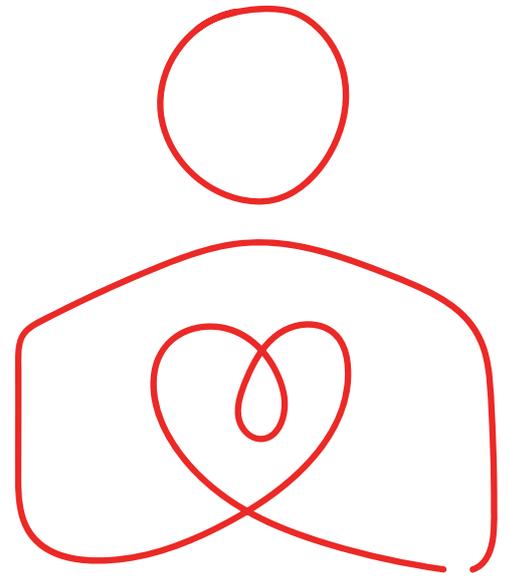


suction cap + chest drain



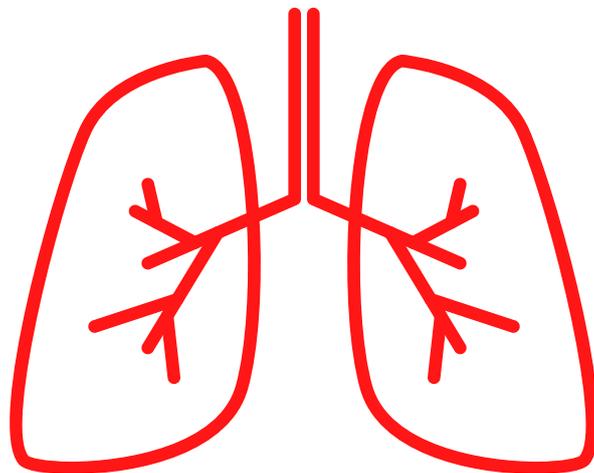
# 5.10.3 IDEA 3 COMMUNICATION

As identified in the research, a significant part of improving access to care, is giving patients the freedom of choice with their care delivery. This can be addressed through an accessible communication system. This idea presents a process in place where patients and families can easily request and access a telehealth service where doctors or nurses can come to them. This addresses patients and their family's need for more choice, control, and access to their care. This potential idea would involve an app service that discloses patient information, records, notes and advice from doctors, accessible to those involved in the user's care. This will result in higher awareness and access to necessary information to allow the patient and those involved in their care to be more active in managing their symptoms. It also provides better communication to all involved in the healthcare system. There are potential risks and limitations involved, such as breaching privacy if information is accessible to unwanted people or systems and patients or families accessing too much control that conflicts with the physician's care. Overall, the telehealth outreach service and app will improve access to care, strengthen patient's self-empowerment, and improve their overall care experience. It will also decrease health care costs as research suggested. These are strong elements that will highly contribute into improving quality of life.



# SECTION 3

## 6.0 PROPOSAL



# 6.1 THE PROPOSAL

The proposal will further investigate the design objectives, context, and criteria for the design solution. It will outline how the health community will capitalize on the opportunity and provide an effective research-based design solution.

## DESIGN INTENT

The design intent is to develop a product and or system which effectively and efficiently improves quality of life for lung cancer patients

## OBJECTIVE

The following objectives were formulated based on the research findings and will guide the design development process. These objectives will provide guidance and ensure that the final design solution addresses the user needs, identified gap and design intent.

- The design will aim to improve access of care for patients
- The design will aim to reduce hospital costs in the healthcare system
- The design must be patient-oriented and easily accessible for patients, physicians and those involved in the patient's care



# 6.2 JUSTIFICATION

Design solutions developed for lung cancer patients must be patient-orientated, as this approach is increasingly receiving more recognition in the health care sector, especially within palliative care. The palliative care sector is not only administered at the end of life and is a sector in healthcare which focuses on relieving pain, stress, and other symptoms to improve quality of life for patients, even while receiving cancer treatment (Wittry et al, 2018). The collected research including insights from viable perspectives has captivated on the significance of patient-centered care approaches aimed to elevate quality of life for lung cancer patients in palliative care.

Topics relating to access of care was referenced the most, suggesting that design approaches focusing on improving access to care is the direction to take. The research suggested the need for facilitation of patients having their voice heard through discussions around what quality of life means to them with their physicians. This can then enable treatment plans and care delivery options based on their own needs. Research stated that it is often these patients receive delayed treatment due to challenges relating to communication in the diagnosis process. Moreover, lung cancer patients often receive poor prognosis and must come to terms with accepting they have an irreversible condition that is likely to progressively worsen over time. This results in many challenges with self-management and one's own dignity. The nature of lung cancer symptoms often means patients must stay in hospital due to the need of a chest drain to remove excess fluid buildup in their lungs or the need for help to do daily activities such as showering or using the bathroom. The number of challenges patients must face, as identified in the research data set, highly executes the need for design solutions that will improve access of care and quality of life for these suffering patients.



## 6.3 CONTEXT

The solution is intended to effectively improve quality of life for lung cancer patients through innovating care delivery process and improved access to care. The focus is on patient-centered design that empowers patients through self-management and individualized care helped implemented through their definition of quality of care and what it means for them. The design solution will facilitate what they wish for by elevating their access to care, allowing for options in the delivery of care. It is to ultimately ensure they are managing their pain levels effectively, feel empowered and comfortable. These approaches fit well with palliative care, as this sector in medicine focuses on what patients want, unlike traditional paternalistic medicine.



## 6.4 DESIGN CRITERIA

### **FUNCTION**

#### MUST

- Be operational within the context of aiding symptoms of the user
- Functioning components are safe to use
- User friendly with clear and intuitive function of use for the user to easily understand
- Aid in the improvement of access of care for patients

#### SHOULD

- Appropriate size that is reasonable for use in a care setting
- Easy to store when not in use
- Managed and maintain without hefty costs or hurdles

#### MUST NOT

- Weigh an excessive amount that is too heavy to manage
- Cause harm in any way, shape, or form
- Involve lengthy or complicated set-up
- Confusing for patients or physicians to use or understand

### **SUSTAINABILITY**

#### MUST

- Developed with consideration of sustainable materials where viable
- Local Australian developers, manufacturers used where possible to be economical friendly
- Packaging and other material used must utilize sustainable or recyclable materials where possible

#### SHOULD

- Should consider other alternatives that may be more sustainable where possible
- Sustainability should be just as important as a consideration as costs

### **USABILITY**

#### MUST

- Allow for all people involved (patients, physicians, family) to easily understand its usability
- The user interface must be easily operational if used by a person with minimal technology skills
- Safety shut-off automation when not in use



### SHOULD

- Have features that will help assist certain symptoms or medical conditions
- consider ergonomic measurements

### MUST NOT

- Have a user face that is too complex, or cause confuses

### **AESTHETICS**

#### MUST

- Semiotics must convey reliability
- Clean and minimalistic as possible
- Convey consistent brand image
- Clear safety warnings
- Signify a high level of quality with a detailed finish

### SHOULD

- Colours involved are appropriate for the context situated environment
- Aesthetic which is approachable and reassuring

### MUST NOT

- intimidating, uncommunicative or confusing aesthetic for the user

### **MAINTENANCE**

#### MUST

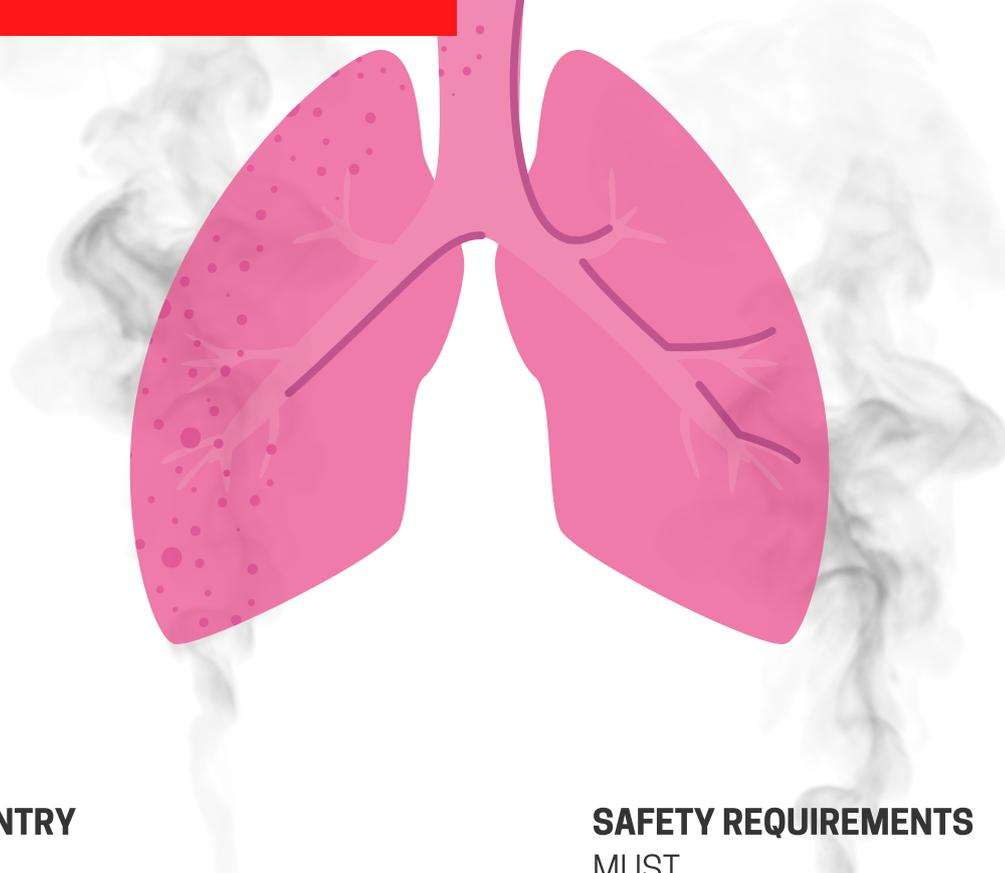
- Allow for easy general care, storage and maintenance by the user
- Clear instructions guide that effectively communicates use and support

### SHOULD

The design should include parts that can easily be replaced if needed  
Quality of product allows for product longevity

### MUST NOT

Contain parts that can easily be damaged or broken off  
Require frequent support and maintenance



## **MARKET ENTRY**

### MUST

- Meet specific user needs and Australian standards
- Joint venture with healthcare companies and or systems that align with the same core values of wanting to improve quality of life for patients
- execute marketing techniques to communicate an effective value proposition
- Well researched intervention to ensure a point of difference from similar products present on the market

### SHOULD

- Be a viable and long-term product, aligning with the future technological advancements in the medical field

### MUST NOT

- Must not infringe patents and trademarks
- High risk or illegal in any way

## **SAFETY REQUIREMENTS**

### MUST

- Successful quality testing to ensure safety
- Safety messages are clear on product and are compliant with health and safety standards
- 

### MUST NOT

- Cause harm for the user in any way

# 6.5 PROPOSED DESIGN SCHEDULE

## PHASE 1: W 1- 2

ADDITIONAL  
RESEARCH  
IDEATION  
MARKET RESEARCH  
FEEDBACK

## PHASE 2: W 3-5

IDEATION  
CONCEPT REFINEMENT  
CONFIRM  
DESIGN DIRECTION  
INITIAL PROTOTYPING

## PHASE 3: W 6-8

DESIGN FREEZE  
RESEARCH MATERIALS  
& MANUFACTURING  
FEEDBACK  
USER TESTING &  
PROTOTYPING

## PHASE 4: W 9-11

FINAL PROTOTYPING  
FINAL USER TESTING  
COST-ANALYST  
BOM  
BRANDING DESIGN

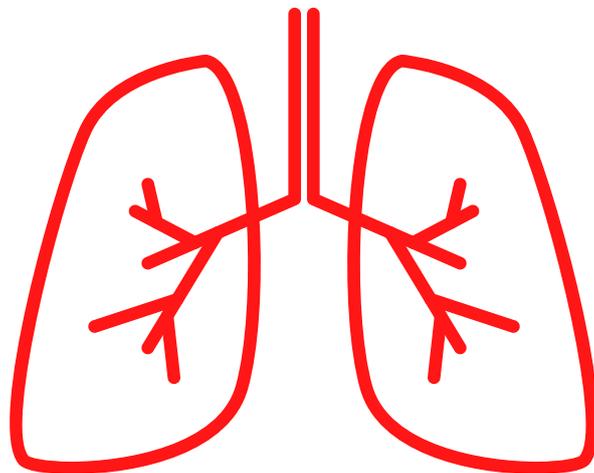
## PHASE 5: W 12-14

PRESENTATION  
SUPPORTING DOCUMENTS  
PRESENTATION MATERIAL  
FINAL MODEL REFINED

# 7.0

# JUSTIFICATION

# CHAPTER



## 7.1 INTRODUCTION

The market potential for medical devices is projected to grow from \$455.35 billion in 2021 to \$657.98 billion in 2028 (Burglund et al, 2021). Furthermore, there is a significant demand for portable medical devices for home care settings. The Portable Suction Drain is a design solution that responds to these market demands and the projected direction in the healthcare system. The targeted user of this design solution are people suffering from the leading cause of cancer death, lung cancer. Therefore, the Portable Suction Drain is a highly viable design solution that will create impactful positive changes to the health care sector.

The justification chapter aims to explain the development of the physical design, the manufacturing details and any other relevant details involving the development of the product design. The portable suction drain has been developed to allow lung cancer patients the choice of home care delivery and enable self-empowerment through self-managed care.

## 7.2 DESIGN ANALYSIS

### 7.2.1 DEFINING THE PROBLEM

Lung cancer patients or those with respiratory issues suffer disabling symptoms such as breathlessness. The nature of traditional treatment is described as inconvenient and uncomfortable by the patients and their caretakers. In-depth research through qualitative methods has identified that the environment and treatment course to manage symptoms is an unpleasant experience. Participant 5, a Doctor from the Logan Hospital was asked in an in-depth interview about their emotions and experiences stated,

*“With shortness of breath they may feel like they can’t even speak without feeling like they are going to suffocate, or they will cough up blood which is traumatic and that adds to the feeling of breathlessness and suffocation.”*



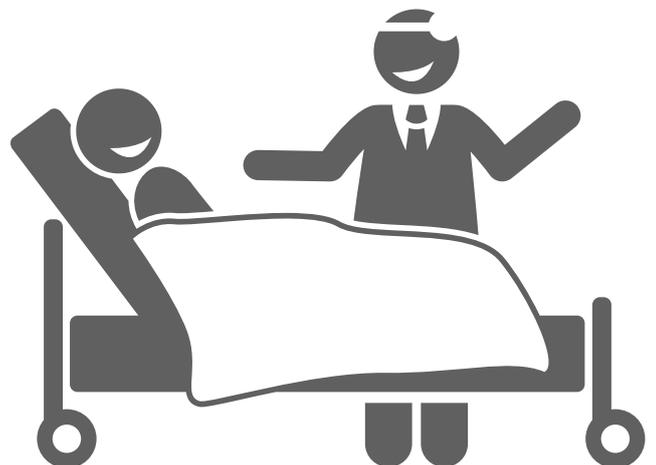
Therefore, when developing a product, it must work towards the overall experience and care of the patient to improve their well-being as they go through a traumatic experience with their health. Moreover, when exploring the patient's journey, they are required to spend a lengthy amount of time, to just manage their symptoms, or as Participant 3 stated *"Lung cancer patient are stuck in hospital, tied to wall."* This is referring to the use of traditional chest drains that are powered through wall suction, causing patients to feel stuck in hospital.

The main pain points identified in research are the following:

- 1) The disabling symptoms reducing well-being**
- 2) Lack of care delivery choices and control**
- 3) The uncomfortable environment and nature of traditional treatment**

Overall patients want better access to care and receive care that is designed for their well-being. The final product accomplishes the following.

- 1) Improved access to care by transforming hospital care to home care**
- 2) Elevated self-empowerment through self-managed care opportunity**
- 3) Enhanced care journey experience and overall well-being**



## 7.2.2 DESIGN CRITERIA

The final product includes the following design features.

- 1) It is small, lightweight, yet sturdy enough to be portable for travel and can be used in any environment.**
- 2) Minimalistic and user-friendly design to look less traumatizing and more comfortable for use - traditionally medical equipment can look distressing for patient.**
- 3) Intuitive use with minimal steps and controls - Involves as little steps and controls as possible to not confuse the patient and encourage self-managed care.**
- 4) Cost efficient and adds value to the healthcare system as suggested through market research and research methods.**
- 5) Safe to use for patient by including anti-slip base and sterile kit**

## 7.2.3 HOW IT WORKS

The components include a battery powered suction drain to power the suction with a set pressure setting. The canister includes a window for patients to not be as exposed to their fluids and also be able to record output. The connector between these two components allows for the patient tube to be inserted. The product requires a short and easy setup which involves cleaning the catheter tube before attaching to connection tube which is then inserted into the device. There is a set pressure to avoid unnecessary options for the user. The pressure is -20 millimeters of mercury to allow for gentle suction suitable for at home care. Once the patient is done draining the fluid, they remove the tube and pop off the top components to pour out liquid into a toilet. The bigger alcohol wipes are given to help patient disinfect device after use. The suction reduces the air pressure inside the container causing a negative pressure principle. A 2cm water seal is needed to ensure air does not enter the pleural cavity and allows air to exit from the pleural space on exhalation.

## 7.3 BUSINESS CASE

### 7.3.1 DELIVERY OF PRODUCT

A delivery system is integrated in the design solution. The product will be packaged and delivered to the patient's home. A virtual doctor appointment will instruct the patient on using the product, cleaning, and rules to follow. A step-by-step guide will be provided with the delivery of the product to enable appropriate use. Maintenance and checkup appointments will occur every 3 months or when needed by a travel nurse to ensure everything is running smoothly. The system design integrated into this design solutions elevates accessibility and adds sustainable value to the healthcare system.

### 7.3.2 IMPLEMENTATION INTO THE HEALTHCARE SYSTEM

For this medical device to reach the targeted user, it needs to be Therapeutic Goods Administration (TGA) approved. A sponsor such as a person or company who is legally responsible for supplying a medical device must apply to the TGA to include the device on the Australian Register of Therapeutic Goods (ARTG). A risk-based approach done to assess the device before it can be lawfully sold in Australia (TGA, 2021). The classification for this medical device falls under Class I with low-medium risk.



## 7.4 ERGONOMICS STUDIES AND PRODUCT USABILITY

The purpose of studying ergonomics within the context of this product design is to find improvements in the way it will be used. Patients feeling 'tied' to a wall while on the traditional chest drain in hospitals will not elevate their well-being or care experience. Products designed for comfortability and functionality will ensure a happier and healthier experience. User testing ensured appropriate sizing that was comfortable for this portable device while still being big enough for the internal electronic components. The device is to be vertically standing and placed on a flat surface. A cylindrical grip of the hand will comfortably hold over half the circumference of the device with one hand for a short amount of time, based on the 99th percentile male and female. This is a hands free device which ensures minimize hand strain of a product with a radius of 48mm. A small switch control with ridges was chosen as fingertip control allows for less errors.

### 7.3.2 IMPLEMENTATION INTO THE HEALTHCARE SYSTEM

Safety is an important consideration for any product design. There are potential risks associated with contamination if the catheter exit site, patient tube and the device itself is not properly disinfected. Therefore, gloves, a sterile mat and alcohol wipes, as well as an easy step by step guide are provided to prevent contamination and ensure appropriate use. It is also important for the device to stand vertical. A rubber footing at the bottom of the canister provides anti-slip grip to avoid spillage.

There is a filter in the canister that acts as protection and should help prevent decontamination of the electronics by stopping droplets from entering the unit. If decontamination occurs or any kind of issue, the device must be returned for service. During maintenance services, a device test will occur to check any significant obstructions in the system or quality issues which may prevent the device from working its best.

For cleaning, patient should use a cloth or sponge that is dampened with mild detergent to clean the surface of the device, then wipe it with a cloth or sponge dampened with water. Followed by drying with clean cloth or paper towel. Alcohol wipes are also provided for disinfecting the device.

Effective communication between the patient and doctor through follow up consultations and visits from travel nurses will minimize potential risks. It will also allow the patient to report their output and other relevant information to their doctor.

## **7.5 EVALUATION OF CONCEPTUAL STAGE**

### **7.5.1 INTIAL PHASE OF RESEARCH**

The conceptual stage involved the intellectual process of developing research findings into design solutions. A succinct research problem and purpose has been determined through thorough evaluation and critique. This process started with a literature review on the topic to understand the conceptual framework of the study. This enabled a developed understanding on patient's needs within the healthcare sector. The findings expressed needed support and solutions around telehealth and converting traditional hospital care to home care. Vast qualitative research methods involving several industry experts further conveyed the need for access to care. Furthermore, the need for patient centered design targeting improved well-being and self-empowerment was identified, supported and evident throughout all research methods.

## 7.5.3 CONCEPT EVALUATION

The initial stage of concept required brainstorming potential ideas that will overall improve access to care, self-empowerment, and well-being for the user. As well as effectively developing care delivery within the healthcare sector. Manual and battery powered designs were explored and is evident in the DDR. The final concept is a portable chest drain, powered by a portable suction unit to revolutionize traditional treatment. Below are a few images to showcase CAD development

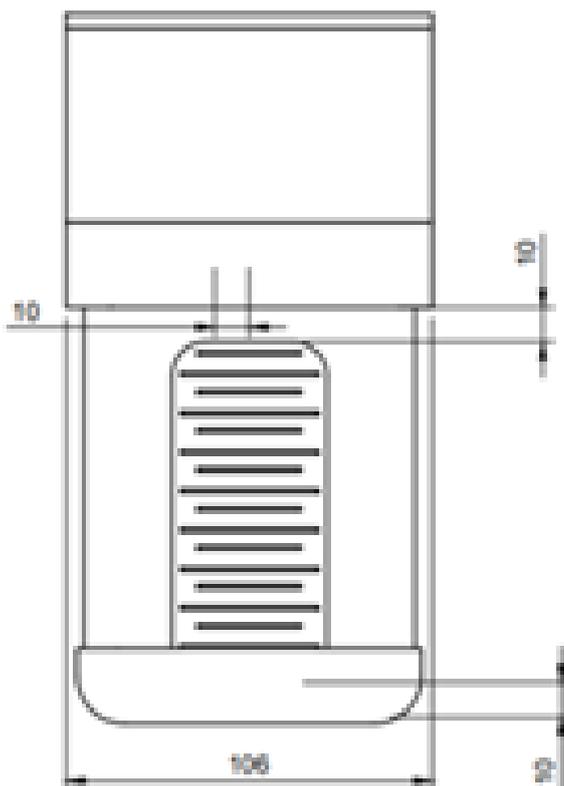
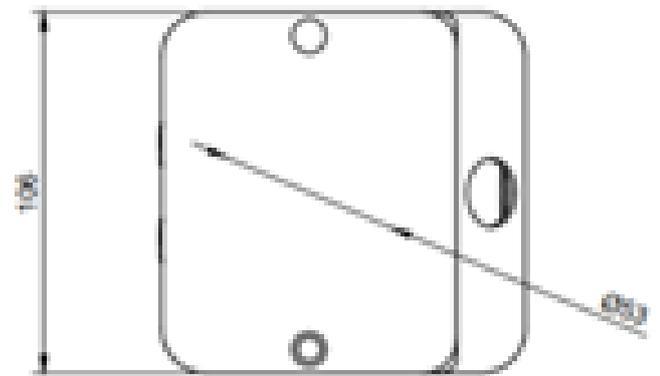
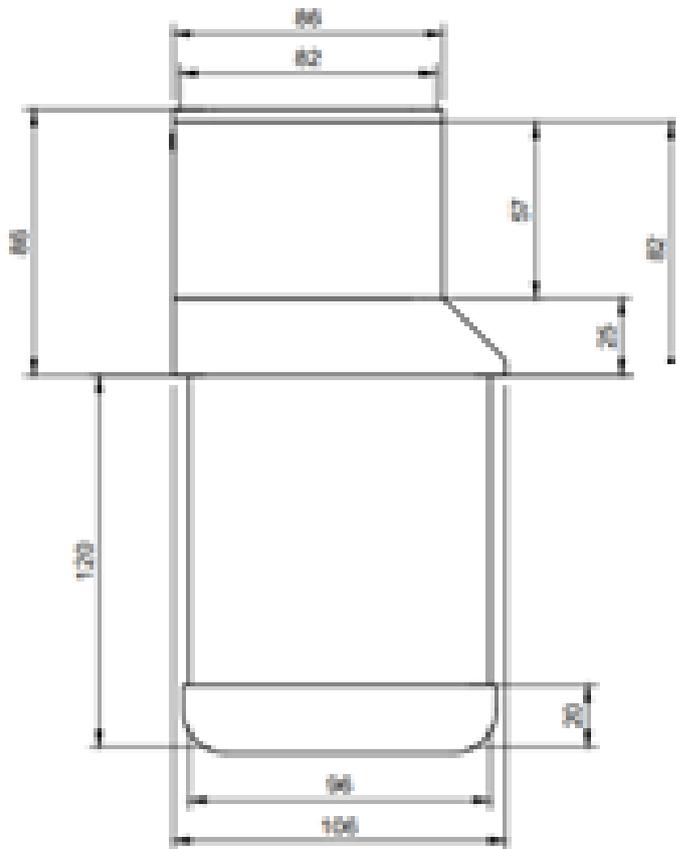


## 7.6 MATERIAL CONSIDERATION

### 7.6.1 CHOSEN MATERIALS

The materials chosen are medical grade quality including the collection canister being made with a shatter proof glass window. rubber footings on the bottom will provide grip to the surface and is widely used for medical appliances. The other components are made from Polypropylene, a cost-effective medical grade plastic material used where steam-sterilized medical devices are necessary (BMP Medical, 2021). The 10x14mm flexible silicone tube chosen is appropriate for suction use. The electronic components include a rechargeable battery, motor and fan appropriate to deliver negative 20 millimeters of mercury.

## 7.6.2 DIMENSIONS & PRODUCT FEATURES



## Key features & their purpose:

**Window view:** Fluid such as mucus or blood can be displeasing to patients which is why the canister is solid with a small display window. The glass window can be used to record output with erase marker

**Intuitive use:** A single push button was placed on the top of the device to keep the design as minimal as possible for the user. One control button with a set pressure is user-friendly for the user as this avoids confusions. When button is pushed, the device will produce gentle suction of -20 millimeters of mercury as recommended by health experts.

**Canister:** The collection canister has a 700ml capacity limit, with extra room to avoid over filling.

**Suction unit:** The internals inside the suction unit include a 9v battery pack, motor, fan and protection filter. These are the electronics needed to demonstrate gentle suction

**Colours:** The device is mainly white with black and clear components. It is kept minimal and the chosen white colour adds a fresh and calming feel. The black button was chosen to be easily seen by any user. This compliments the user-friendly aspect of the design.



## 7.7 MARKET POTENTIAL

There is huge market potential in medical devices as it is estimated to grow. The global medical devices market is projected to grow from \$455.34 billion in 2021 to \$657.98 billion in 2028. People die from lung cancer more than any other cancer. According to Burglund et al (2021) there is a significant shift towards homecare settings which is boosting the demand for portable devices. Moreover, the rising prevalence of chronic conditions and treatments of those suffering from such diseases is exerting pressure on the healthcare system. The overall cost of treating a patient in a hospital are significantly higher with longer hospital stays are associated with the higher economic burden. For instance, the traditional use wall mounted suction drain means patients are required longer hospital stays. Due to this shift, medical researchers are actively investing in the development of advanced portable devices for the treatment of chronic conditions. However, such devices may include a comparatively higher acquisition cost and subsequent maintenance costs which may be a barrier with cost efficiency needs in the healthcare sector.



# 7.8 ECONOMIC AND COST ESTIMATION.

Cost efficiency is a very important factor in healthcare; therefore, the cost estimation is an important part of factoring the viability of this product design. Many revolutionary ideas do not make it to the market due to high cost, which is why this product aims to be as low cost as possible or under \$500. Below is a cost estimation of the product and service all together. Below is the Bill of Materials

To note, Patients that can independently treat their self-care and require less assistance or guidance from nurses/doctor will overall cost less

Patients that need more assistance or have no one to care for them at home will require frequent visits from travel nurses and doctor consultations, as well as more collection canisters depending on the severity of their condition. Therefore, will be more costly

Part number	Part name	Description	Qty	Cost (\$)
P1	Suction unit casing	Printed casing components for suction unit	1	18.00
P2	Battery	Rechargeable battery pack	1	29.95
P3	Filter	Filter protection	1	3.00
P4	Fan	Propellor fan for suction	1	3.00
P5	Motor	mechanical power in the form of suction with air flow.	1	14.60
P6	Grommet	Silicon grommet around tube	1	3.10
P7	Button	Square shaped control push button	1	1.10
P8	USB port and charger	USB port for charging	1	27.05
P9	Patient tube	Patient tube for travelling fluid to canister	1	16.95
P10	Canister with window view	Collection canister	1	8.10
P11	Rubber footing	Anti-slip footing	1	0.30
P12	Packaging	Package box with protection	1	10.00
S1	Delivery cost	Delivery cost average (depends on location)	1*	20*
S2	Maintenance costs	Maintenance costs yearly	1*	65*
S3	Travel nurse	Check-ups, set ups, demonstrations from nurse/hour	1*	53.06
S4	Doctor consultations	Short consultation from a doctor	1*	39.50
				<b>312.65</b>

BOM List

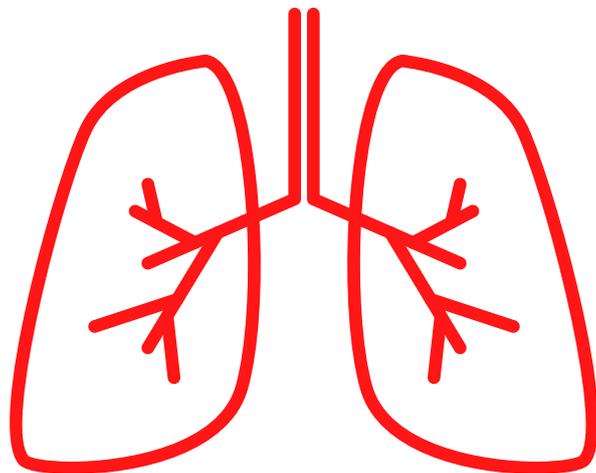
## 7.9 ECONOMICS AND VALUE

According to the World Health Organization [WHO], an intervention that costs less than \$120,000 per quality-adjusted life year would be considered cost-effective according to the WHO rule. Moreover, a portable medical device designed for symptom management at home will drastically decline the number of patients staying in hospital for long periods of time. Also, it will dramatically increase quality of life measures for patients.

The proper goal for any health care delivery system is to improve the value delivered to patients. Value in health care is measured in terms of the patient outcomes achieved per dollar expended. Since this product is responding to the market needs in the medical sector and patients needs as identified through thorough qualitative research, then this product is highly valuable and cost effective.

# 8.0

# CONCLUSION



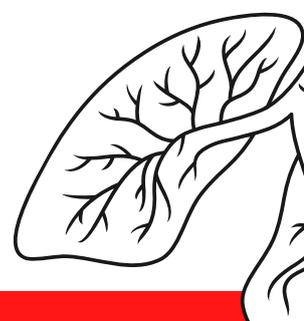
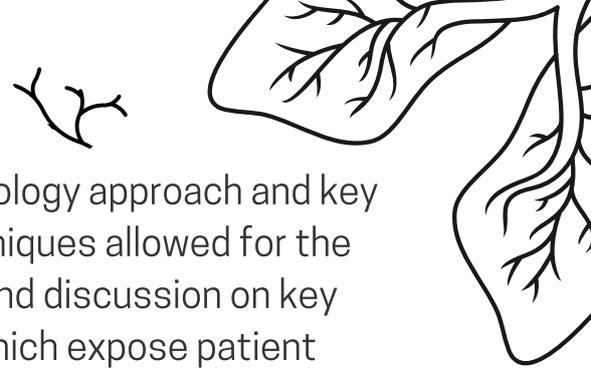
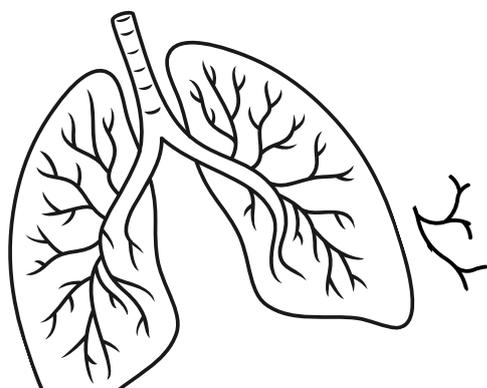
Not only is lung cancer the most common cancer worldwide, it is also the deadliest. Patients suffer with disabling symptoms which not only impacts them physically but emotionally. This dissertation has identified the challenges experienced by these patients in palliative care. To summarise, the key user challenges are as followed:

- Their struggle with dignity and personal definition of quality of care
- Struggles with completing daily tasks and losing independence or self-efficiency
- Communicating their wants, needs, and mode of delivery of choice to their physician or care givers
- The likelihood of poor prognosis
- Access to care and treatment on time, and more.

The primary research and literature has covered the topics and answers needed to form effective recommendations and identified opportunities. The key findings address the need for more patient-oriented approaches that elevate access to care and improve quality of life

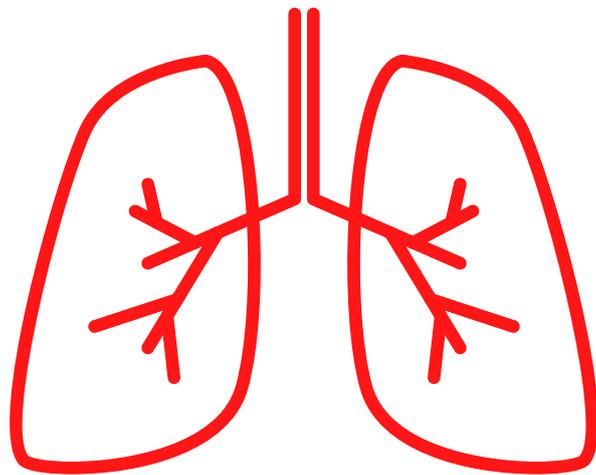
The methodology approach and key mining techniques allowed for the evaluation and discussion on key meanings which expose patient needs and healthcare opportunities. The developed recommendations and design criteria were based on the findings to create viable real world concepts that effectively target user needs

The research and development process has resulted in a final model - a portable suction drain for lung cancer patients to relieve breathlessness at home. This was designed to revolutionised traditional wall-mounted chest drain systems used in hospital. Overall, this is a design solution that will enhance the healthcare system and thoroughly improve the well-being of many of those suffering.



# 9.0

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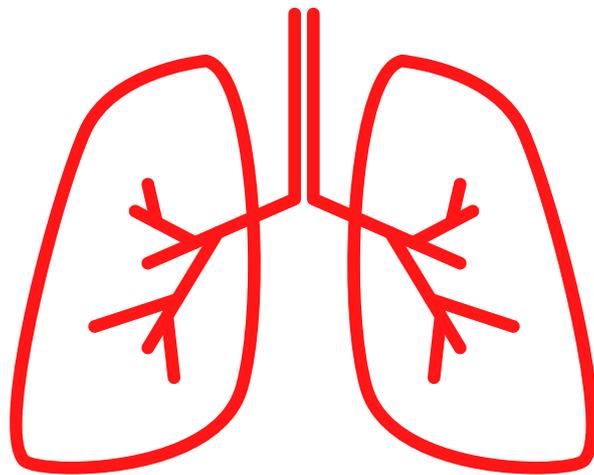


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# 10.0

# APPENDIX



# LEADERSHIP INITIATIVE 1

An informal peer-review was conducted via a video call with 4 members that have previously worked together on past projects, Lara Khoury, Dominic Fakhry, Kyle Knuckey and Dominic Ferro. An informal process of a peer review allows for a discussion on each person's own leadership abilities, skills, and traits. Moreover, helping to appraise leadership practices of others and oneself. Building leadership skills is a journey and forming a discussion around it, leads to giving and receiving honest feedback that will enable everyone to advance in their leadership journey (Basadur, 2004). Each person had a chance to talk about their current initiatives and plans. A growing leader will take initiative in asking for and proving feedback on improving their leadership traits and practices and involve others in thinking together in innovative ways (Basadur, 2004). A quality leader is honest and is willing to help others, which was demonstrated by each person involved. Overall, this was a successful peer review which involved an in-depth discussion that provided valuable insights to enable further improvement on leadership abilities.



Fig 5 Leadership Initiatives Period (Khoury, 2021)



fig 6: screenshot from online peer-review (2021)

The Online Medical Device Seminar – Sharpen your Skills 2021, presented by several industry experts, provided exceptional advice and teaching on developing skills for those working on innovating medical devices. The seminar was found through LinkedIn, a powerful platform for those on a leadership journey. A group of experienced industry experts shared their latest best practices on how to eliminate problems in the medical device development process. The Seminar also happens to be highly relevant to this dissertation as they explained human-centered development as a driver of medical product innovation. The seminar also provided the chance to connect with these industry experts on LinkedIn and use this as a net-working opportunity. According to Venters et al (2014), this is known as micro sharing, where social networking tools and systems are used to allow people to form connections and collaborations. Therefore, is a highly effective tool for collaboration, learning and building leadership (Venters et al, 2014). It is highly beneficial to have made connections with these highly regarded experts in an industry of high interest.

A FEW LEADERSHIP PROGRAMS WERE COMPLETED VIA SKILL SHARE. THE LEADERSHIP PROGRAM COVERED KEY STRATEGIES TO MAKE LEADERSHIP DECISIONS AND BROADENED UNDERSTANDING ON HOW THE BRAIN THINKS, JUDGES AND FORMS DECISIONS TO IMPROVE CRITICAL THINKING SKILLS. THE LEADERSHIP SKILLS MASTERY COURSES EXPLAINS HAVING A CLEAR PICTURE OF THE FUTURE IS CRITICAL FOR ACHIEVING LIFE GOALS AND IS KEY WHEN IN LEADERSHIP POSITIONS. ALSO LEARNT ABOUT THE 4 C'S AND 4 E'S OF LEADERSHIP AND CREATING AND TACKLING SMART GOALS. OVERALL, IT WAS AN INSIGHTFUL PROGRAM THAT TARGETED THE MOST IMPORTANT LEADERSHIP SKILLS TO MASTER AND USE FOR THE FUTURE.

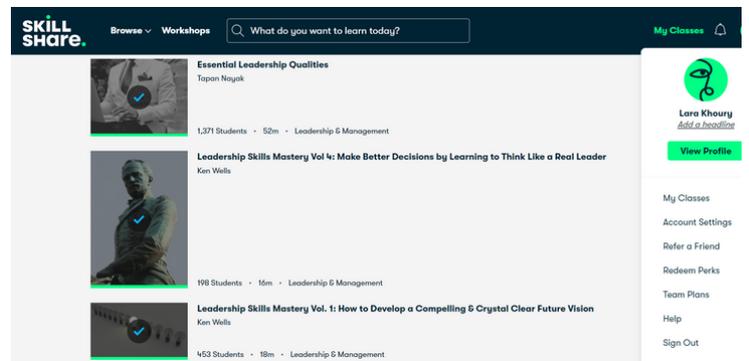


Fig 7: Screenshot of completed Skill Share courses (2021)

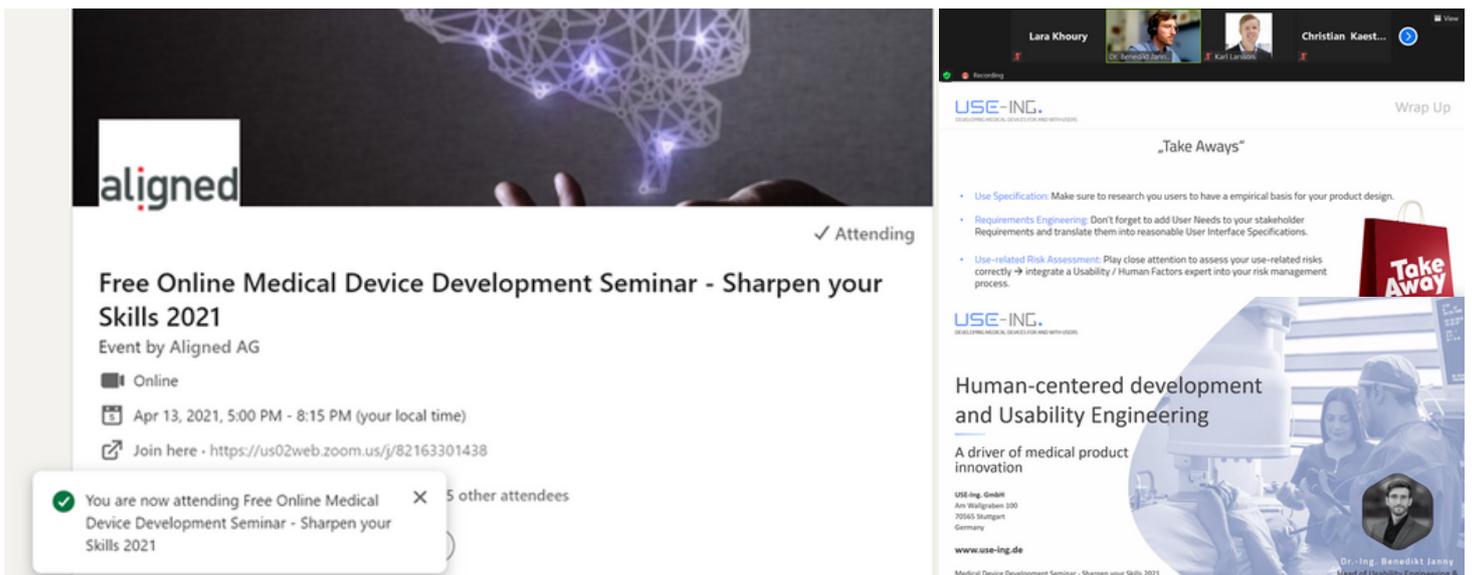


Fig 8: Screenshots of Zoom Seminar (2021)

# LEADERSHIP INITIATIVE

## 2

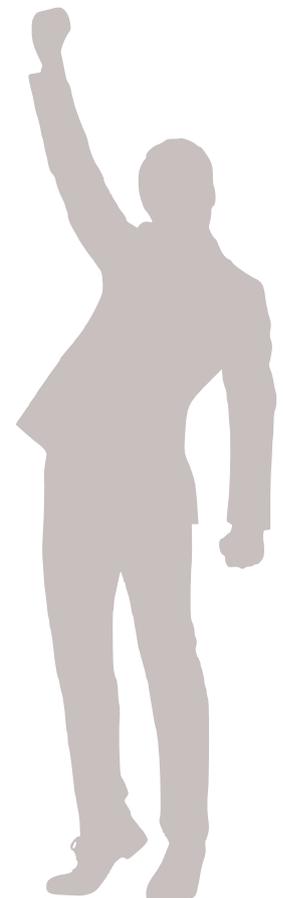
### Leadership initiative

The leadership initiative firstly involves learning about myself to better understand my strengths and weaknesses. I have discovered this through completing the Myers Briggs personality type indicator, which is an introspective self-report questionnaire that indicates differing psychological preferences to enable people to understand how they perceive the world and make life decisions. The result from each type reveals their leadership styles. According to the in-depth research on my personality type – INFJ, I have discovered the possible struggles that impact my leadership abilities.

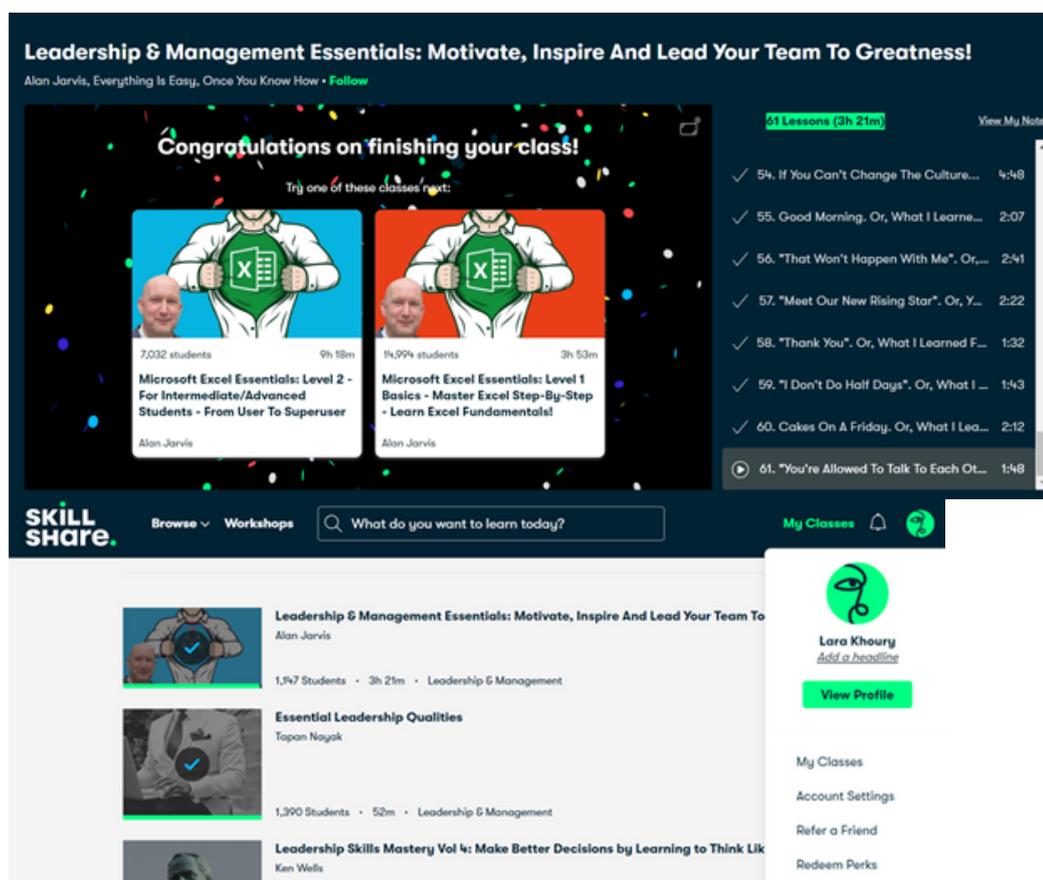
These include

- The struggle with presenting visions clearly
- Sharing thoughts and ideas out loud with others due to keeping visions internalized
- Dealing with negative feedback
- Dealing with conflict situations
- Getting too bogged with research

Through past experiences, I have struggled with these things listed. I also have a very shy personality, so conducting interviews face to face for data collection was anticipated as a struggle. However, through this leadership journey, I have formed ways to conquer these weaknesses to improve not only my leadership abilities but my confidence. This has enabled skills beneficial for conducting research methods such as interacting with industry experts, conducting interviews with participants and reaching out to potential survey participants.



The tour experience with CCRG, was quite nerve wracking at first with the anticipation of meeting many new people in the healthcare industry. However, it turned out to be an insightful and successful day due to my confidence with expressing my visions and opinions, as well as sticking to the questions I had prepared. The interviews were also a positive experience, as I confidently reached out to many people in the health industry. Unfortunately, many people did not get back to me but the people that did, allowed me to successful retrieve valuable insights from them. The success of this research method was due to my organization and preparation of interview questions and topics. Learning about my personality type and leadership style, I learnt that INFJs are the perceptive leader, and are passionate, insightful, and visionary in their leadership practices. This was very much the case, as this research topic was something I was very passionate about and genuinely was excited to learn more through highly regarded people in the healthcare industry. The passion and drive helped me confidently initiated the research. Moreover, SkillShare allowed me to complete a 3-and-a-half-hour leadership and management course. The course tutor explained that turning vision into reality requires passion. Thus, this passion will eventually lead to mastery and success. This emphasizes the importance of being an inspiring, passionate, and motivated leader, which in turn will inspire those around you. The passion I demonstrated in the emailed sent to potential participants contained passionate yet professional language, which engaged and convinced those reading to feel inspired to participant in a meaningful study. Leaders need to be vocal and excited, otherwise, participants will not sustain the energy and focus necessary to successful work with you.



screenshot taken on SkillShare (2021)

# INTERVIEW QUESTIONS (GUIDE)

1. Do you believe more innovation is needed in healthcare? What areas in particular?
2. How will healthcare improve in the next 5 to 10 years?
3. What are your thoughts on innovating the process of care delivery for patients with lung cancer? Do you think the healthcare system can change to provide this for patients?
4. In terms of therapeutic well-being, do you believe patients that are serious ill, such as those with lung cancer, should spend more time recovering/receiving treatment at home or stay in hospital besides medical experts.
5. What are your thoughts on intensive care patients and self-managed treatments?
6. Do you believe there should be more solutions that provide care for patients at home?
7. What does the day-to-day life look like for lung cancer patients?
8. How can we improve their quality of life?
9. What life-sustaining medical devices or treatments are used on these patients?
10. How does rehabilitation work towards their well-being?
11. What happens to those patients that are irreversibly ill and are likely to decess while on treatment?
12. Is there anything in place for the families that must endure seeing their loved one seriously ill?
13. Are there products/services that aims to improve the well-being of lung cancer patients?
14. How was it like experiencing witnessing a loved one endure the illness?
15. What daily challenges do you think lung cancer patients in palliative care experience?

# Survey questions & data samples

If you work in healthcare, what is your job title?

Short answer text

Explain your role in healthcare

Long answer text

Do you believe more innovation is needed in healthcare?

- yes
- no
- Other...

How would you describe quality healthcare that improves the quality of life for patients?

- patient-centered
- allows patients to feel safe
- effective communication
- different care delivery options
- timely
- Other...

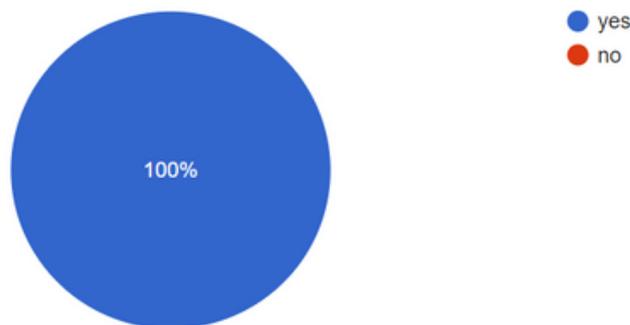
What daily challenges do you think lung cancer patients in palliative care experience?

Short answer text

Do you believe the delivery of care process needs to change? Explain why?

Do you believe more innovation is needed in healthcare?

16 responses



How would you describe quality healthcare that improves the quality of life for patients?

16 responses



# Code Book + themes

Theme	Description	References
<b>People</b>		
Patient	Whenever the patient is mentioned	72
Clinician	Whenever a doctor/nurse/health worker is mentioned	32
Family member	Whenever a family member is mentioned	17
<b>Communication</b>		
Travelling	Whenever travelling or telehealth is mentioned	5
Doctor to doctor	Whenever doctors communicating together is mentioned	8
<b>Environment</b>		
Hospital	Whenever the hospital care environment is mentioned	30
Care at home	Whenever care at home is mentioned	14
Community	Whenever community is described or mentioned	10
<b>Emotions</b>		
Compassion	Whenever compassion or concern is expressed	34
Negative emotions	Whenever a negative emotion is expressed	65
Negative experience	Whenever a negative experience is described	45
Positive emotions	Whenever a positive emotion is expressed	7
Positive experience	Whenever a positive experience is described	7
<b>Action</b>		
Current intervention	Whenever a current intervention was mentioned	6
Costs	Whenever the important of cost-efficiency was brought up	8
Treatment	Whenever a form of treatment was mentioned	5

# COLOUR CODED THEMES & QUOTATION FROM INTERVIEWS

CODE	QUOTATION
	<p>Chest drains is one of them            have to go back into hospital because they don't have suction available at home            we not only do surgery, but also the devices that we use to manage and care for patients after surgeries            find ways to get them out of hospital because that would save the hospital or the healthcare system money            teach the patient or the patient's care, how to manage            same treatment whether they are in hospital or at home            process in place where doctors can check on them daily            Nurses on the road will be significantly less.</p>
	<p>as surgical equipment and intensive care products            how long diagnosis takes            nebulizer to try and get their lungs moving            The different stages, have different complications            cost of nurses and doctors looking after patients at a hospital vs. taking care of them at home            the first place it will spread to is the lungs            called a functional scan, we can see the behaviour of the tumor            PET scan            crack their chest open, like in heart surgery and go digging. It used to be like a full open chest surgery            Laparoscopic surgery... lung keyhole surgery</p>
	<p>more cost-efficient systems            cost efficiency within healthcare and quality enhancement.            I don't think people should be in hospital for long term palliatively.            that would save the hospital or the healthcare system money            teach the patient or the patient's career, how to manage            process in place where doctors can check on them daily</p>

The first thing a doctor looks for is an x-ray of the person's chest  
not just old people that were smokers  
not necessarily a long process  
it is a lot of investigations...It depends on the reports and doctors...  
not so much the diagnosis process

Being at home is more common.  
there's nothing more that the doctor can do, besides managing their pain, why should they stay  
in hospital?  
*Palliative care is a really beautiful aspect of medicine because it focuses on what the patients  
wants*  
*Everything can really benefit from innovation*  
*comment on one's own quality of life than on any other given person*  
*medicine traditionally has been very paternalistic*  
*certain types have such poor prognosis*  
*diagnosed very late and end up only having a month or two of living*

*only in there because she needed suction.*  
*a more comfortable environment*  
*surrounded by their friends and family.*  
less invasive surgeries that get patients recovered out  
helping them be comfortable  
live in the comfort of their own home. Hmm.  
fluid build up  
We get them to do a CT scan after a blood test  
Her husband was taught ways to manager her pain by the doctors  
If the patient prefers that, then they should be able to be able to receive care at home rather  
than going in and out of hospital  
*about focusing on their value rather than focusing on treatments, treatments that may delay  
them from passing but may come with additional suffering*  
*the ability to continue to appreciate and engage with certain pleasures*  
*retain some level of independence, to be able to dress myself, have showers on my own, have  
some level of decency and not require full support*  
*Focus on patient-oriented approaches, elevating suffering, facilitating what they wish for, its  
often allowing them to have those discussions, end of life discussions and allowing enough time  
to prepare and have it, to ensure they are comfortable, they can live for less time but live more  
comfortably*

*patients staying in hospital and stuck there*  
*feel stuck in hospital*  
no visitors and eating terrible food that you're not happy eating  
tied to say an IV line  
uncomfortable... cannot get around not breathing.  
a lot of pain with every single breath that they take

unbearable. Patients really suffer  
gasping for air, really bearing down in their diaphragm and literally struggling to breath and wheezing  
They are not actually able to leave their bedside really  
really painful and stressful situation  
constantly suffocating  
Fluid accumulating in their lungs  
drowning in their own fluid  
fluid build up  
We get them to do a CT scan after a blood test  
They get them done throughout their treatments  
*a common symptom is shortness of breath so they may feel like they can't even speak without feeling like they are going to suffocate or they will cough up blood which is traumatic and adds to the feeling of breathlessness and suffocation*  
*lose a lot of weight and muscle mass*  
*feel tired and sick and lethargic*  
*coming to terms with what it means to have cancer and your dignity*  
*rely on others as their disease gets progressively worse*  
*That dignity challenge is a big struggle*  
*they complain that their grandkids don't visit them enough*

*...no use for them to stay in hospital*  
*keep going back to hospital for treatments.*  
*stay in the hospital for too long for unnecessary things,*  
*those things come with a cost.*  
*healthcare system does not offer those solutions to patients*  
*the lack of communication between the GP and those that do the scans*  
*referral process that is the issue*  
*There is a gap in the communication.*  
*struggle to adapt and change clinical practices to actually reflect new changes within research*  
*mental health, chronic diseases and palliative care*  
*nature of these changing systems, it take many more years for these changes to happen*

*to improve surgical systems and also hospital infrastructure.*  
*surgical tool that I have never seen before*  
*now we are cutting lung cancer out through a tiny hole through a laparoscopic procedure, with the use of cameras and robotic hands with various tools to move lung tissue out of the way.*  
*Laparoscopic surgery*  
*lung keyhole surgery*