

Monash Healthcare Innovation Summer Scholarship 2021/2022

Project Motion

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Executive Summary

Project Motion aims to create a solution that prevents the development of musculoskeletal conditions by providing personalised interventions.

Affecting 1.71 billion people worldwide as of 2021 [1], musculoskeletal conditions can affect individuals of all ages, ranging from juvenile arthritis in the age range of 0 to 16 years, to osteoporosis in the age range of 50 years and over, with risk increasing with age [2]. Hence why it is crucial to raise awareness about these conditions and provide intervention strategies at an early stage. In Australia, musculoskeletal conditions are one of the most common chronic conditions, affecting approximately 1 in 3 Australians [3]. With the coronavirus, musculoskeletal disorder incidence rate has also recently increased due to many people working from home and being unaware of the proper way to set up an ergonomic workspace.

Existing solutions that aim to reduce the risk of musculoskeletal condition development lack personalisation, are often intrusive, and have poor long-term engagement and adherence. Hence, we aim to create a multimodal solution that improves an individual's posture while minimising invasiveness by using non-contact technologies. In addition, we aim to provide personalised feedback to users, and facilitate promotion of health literacy and risk factors by incorporating a user-friendly feedback system. By doing so, we hope to reduce the negative impact of musculoskeletal conditions on the health system, economy, and in individuals' lives.

Objectives

- Prevent the development of musculoskeletal conditions
- Facilitate self management of existing musculoskeletal condition associated symptoms

In order to accomplish the aforementioned objectives, the aim is to create a solution that

- Is patient oriented and provides individualised feedback
- Is inclusive and accessible by the largest possible population of intended users
- Is non-intrusive and allows the user to feel comfortable
- Is intuitive and easy to use
- Has the capability to educate users on how to better self manage their symptoms
- Will benefit not only the user, but also the wider healthcare community
- Has long term adherence and engagement

Gaps Analysis and Process Diagram

The main gaps in existing solutions that our solution aims to fill include the lack of personalised feedback, low adherence and engagement, the intrusive nature (of most wearable technologies), inconvenience, risk of injury, and lack of objective feedback. Poor health literacy is also an issue that was mentioned during user interviews, and the educational aspect is something that current solutions also lack. Moreover, a lot of the existing solutions are for individual use, thus increasing the cost per user. With our proposed solution, we aim to support more than one user on one 'solution', thus reducing the downstream costs.

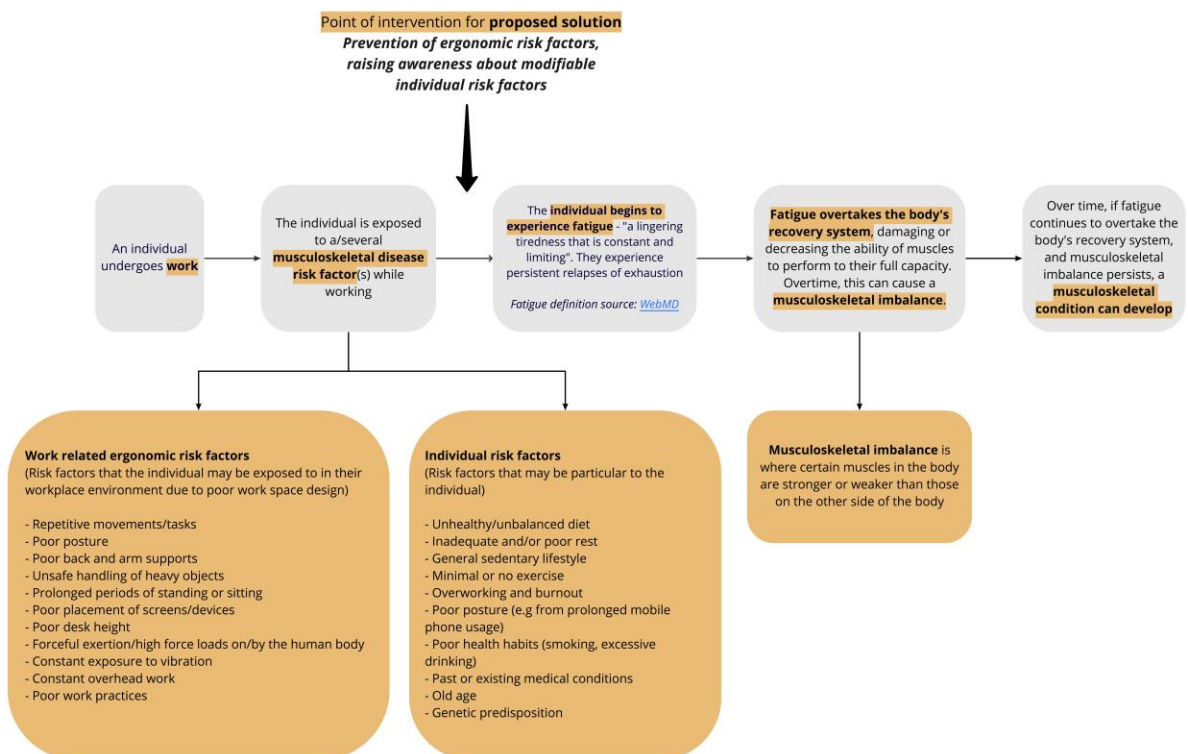


Figure 1. [Process Diagram](#)

Illustrates the process by which an individual develops a musculoskeletal condition due to work related or individual risk factors, or a combination of both. The step at which our solution aims to intervene is shown by the arrow, where we aim to prevent the impact of ergonomic risk factors while raising awareness about the individual risk factors. For musculoskeletal conditions, the development timeline can differ depending on whether the condition is acute or chronic, as well as the severity of the risk factors.

Stakeholder Map

Map stakeholders according to direct influence they have on project, and impact the project will have on stakeholders

Involved in
research and
development

Beneficiaries

HISS Program
Contacts

Competitors

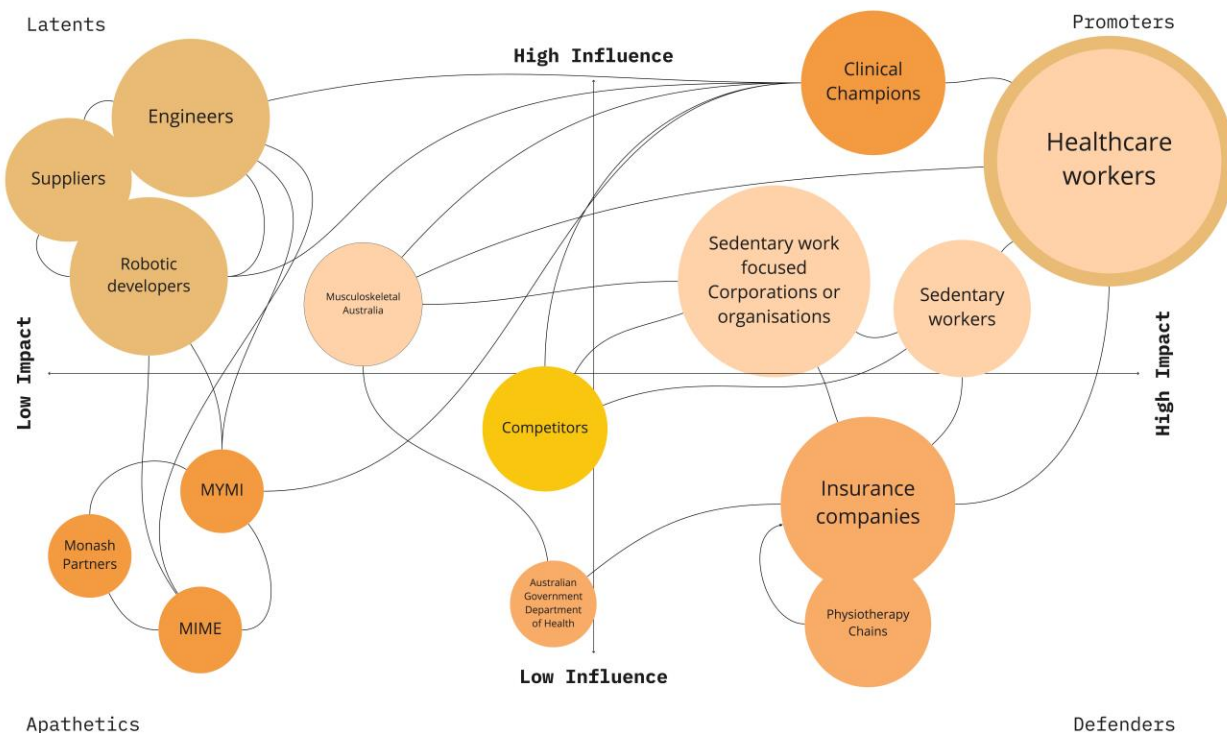


Figure 2. [Stakeholder Map](#)

Depicts the range of stakeholders and the position they hold in terms of the direct influence they have on the project, and the impact the project will have on them. There are four major stakeholder categories: stakeholders who are involved in the research of the problem and development of the solution, beneficiaries of the solution, HISS program contacts, and competitors - existing solutions. Stakeholder bubbles are also sized according to their importance, with healthcare workers being the largest stakeholder as they are not only involved in the research and development phase, but they will also benefit from the solution, as it may potentially reduce the amount of time they spend with patients who present with musculoskeletal condition symptoms, allowing them to direct their care to other patients.

Qualitative Research

As one of the most important body systems, the entire musculoskeletal system - which includes the bones, muscles, tendons, connective tissue, joints and ligaments - provides protection, support and movement to the body. Therefore, with over 150 different types of musculoskeletal conditions, they can all affect various parts of the musculoskeletal system. One major risk factor of musculoskeletal condition development is poor posture [3]. Thus, by improving an individual's posture, the risk of musculoskeletal condition development can be reduced. However, from my research and user interviews, I have found that there is no proper definition for what 'good posture' is, and rather it can vary from person to person depending on their situation. Definitions I have received during my user interviews include those shown in Figure 3.

"Posture that has no unintentional
consequences or secondary complications"

Occupational Therapist

"Wrists at a flat angle and back is well supported"

Medical Intern

"Sitting in a position for a long time and not feeling pain"

Digital Health Expert

Figure 3. Various definitions of 'good posture' from user interviews

Despite their respective authors all having some affiliation with the healthcare industry, the three definitions of 'good posture' are different, suggesting that good posture is dynamic and can differ from person to person. However, in general, good posture involves training your body to stand, walk, sit and lie in a way that you place the least strain on your muscles and ligaments.

From 12 user interviews that were undertaken, in addition to poor posture, other activities or risk factors that users identified as potentially resulting in or exacerbating musculoskeletal condition development included existing disabilities such as cerebral palsy, vacuuming or raking, as well as stress and being angry [4].

100% of sedentary workers interviewed mentioned that the biggest barrier between them and obtaining good posture was that they were too focused on their tasks to notice their posture changing. In addition, motivation and mental blocks were common issues.

Quantitative Research

Musculoskeletal conditions affect approximately 1.71 billion people worldwide as of 2021, with 568 million of those people being impacted by lower back pain, the most common type of musculoskeletal condition and leading cause of disability in 160 countries [1].

In Australia, 1 in 3 Australians live with a musculoskeletal condition, and musculoskeletal conditions continue to be a common chronic condition. Reviewing data obtained from the Australian National Health Survey from 2017 to 2018 relating to the most common chronic conditions affecting Australians, musculoskeletal conditions made up 35.2%, which included back problems (16.4%), arthritis (15.0%) and osteoporosis (3.8%) [3].

Musculoskeletal conditions cost the Australian healthcare system AUD \$9.2 billion in both direct and indirect costs in 2017 [5].

87% of serious claims (104,776 claims) due to worker absences in Australia from 2019 to 2020 were due to injury and musculoskeletal disorders [6], highlighting the impact that such conditions have on the everyday lives of so many individuals. Among these, traumatic joint/ligament and muscle/tendon injuries were the most common, accounting for 43% of injury and musculoskeletal disorder claims. In addition, the median working time lost due to injury and musculoskeletal disorder claims in 2018 to 2019 was 6.4 weeks, a 61% rise from 4.0 working weeks in 2000 to 2001 [6].

In 2021, the average number of days spent in hospital for admitted acute patients was 5.8 days for musculoskeletal interventions for infection or inflammation of bone or joint with a minor complexity, 13.4 days for intermediate complexity, and 23.7 days for major complexity [7], as shown in Figure 4.

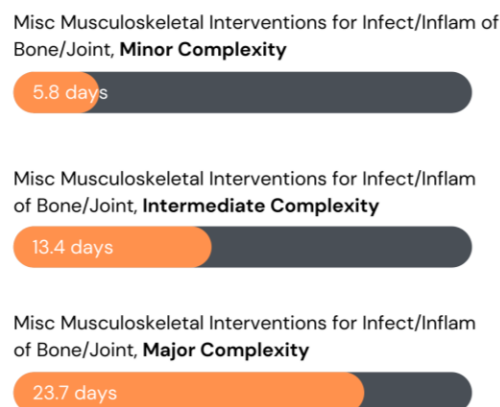


Figure 4. Average number of days spent in hospital for varying complexities of musculoskeletal interventions for infection or inflammation of bone or joint

Business Model and Market Analysis

Currently, the solution is likely to be in the form of a multimodal system that will uptake user input using a camera and sensors, and provide personalised feedback. The solution would likely need to receive endorsement from healthcare professionals before being introduced into workspaces. The desired solution would be a strong competitor in the field due to its unique features of being multimodal and having an educational aspect. It is likely that IP protection would be required. User tests would need to be conducted to ensure that the solution is as intuitive to use as possible.

As one of the world's leading causes in disability, the market for musculoskeletal conditions is quite large, and will continue to increase, particularly with the incidence rate of musculoskeletal conditions increasing around the world due to the coronavirus [8]. As of 2017, the global market for musculoskeletal diseases was at USD \$57.4 billion, and is forecasted to reach USD \$83.5 billion by 2023, with a compound annual growth rate of more than 5.5% from 2018 to 2023 [9].

Our proposed solution offers the option of two concurrent business models, a business to business or business to consumer model, as well as a leasing model.

The solution can be sold privately to consumers or to companies and corporations that have primarily sedentary workers, who would then distribute them to their employees. Insurance companies may also be interested in the solution, as it could potentially reduce their long-term costs for funding musculoskeletal conditions. Both the corporations and insurance companies also have a separate motivation of reducing their liability for employees getting injuries relating to musculoskeletal conditions on site.

The solution can also be leased out. Physiotherapy clinics could have the option of leasing such a solution for patients' follow up therapy, and then have the solution returned once their therapy is complete, similar to existing leasing models with TENS machines. Educational institutions could also be leased the solution for spreading awareness about the importance of good health and posture. This would work towards improving health literacy, potentially resulting in less musculoskeletal condition cases in the future.

Team



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