



THE FUSA CHAIR: WHERE FUNCTION AND SAFETY MEETS AESTHETICS

Find out what led to the innovation of the FuSA chair that will be deployed in 2024.

By Tjut Rostina, CHI



The first-of-its-kind, the FuSA chair is an articulation and actualisation of interdisciplinary healthcare collaboration for patient care.

It epitomises creative solution to issues faced by healthcare professionals, patients and their next-of-kin during their hospitalisation stay at the inpatient area.

Scheduled for full deployment in 2024 in both Tan Tock Seng Hospital (TTSH) and the Tan Tock Seng Hospital - Integrated Care Hub (TTSH-ICH), the FuSA chair promotes early mobilisation and rehabilitation while providing a supportive healing environment with caregiver involvement, ensuring a smooth transition back to home.

But what led to this innovation?



Human-Centred Design

The care of a patient extend beyond those delivered by healthcare staff, and often, while patients recuperate in the hospital, some caregivers would choose to accompany them for long hours, and often through the night.

While the hospital deploys various single-purpose chairs for administrative and patient-specific needs, it is not uncommon to receive feedback from caregivers, that the existing visitor chairs are uncomfortable for resting.

In fact, rehabilitation-specific chairs for patients such as recliners and geriatric chairs occupy a large footprint. Altogether, these single purpose chairs consume space dedicated for patient care, presenting a constant logistical challenge to balance between visitor and patient rehabilitation needs within a confined patient area.

While there was a spectrum of multi-functional chairs in the market, the challenge was to find one that would fulfil the 3-in-1 specific needs of the hospital, which were facilitating patient rehabilitation, rest by patients' caregivers, and seats for patients' visitors.

This opened up the opportunity to embark on a human-centered design innovation project to develop a multi-functional FuSA chair that caters to the needs of patients, next-of-kin and healthcare professionals.

Innovators Assemble

The development of the high-fidelity prototype started in Jul 2020. A workgroup led by Loo Wei Hann from CHI's Kaizen Office, and Sister Wee Fong Chi from TTSH Nursing, with subject matter experts from various departments was formed to look into different aspects of the project.

The members of the workgroup were:

- Kaizen Office: Chua Jia Xiang, Keith Lee Jie Xuan
- Nursing: Lim Mei Ling, Nat Liew Hai Meng, Loo Yen Leng
- Occupational Therapy: Joanna Giam Yu Ting
- Physiotherapy: Hannah Wong Su-En
- Infection control: Joanna Tan Yujun
- Hospitality & Environmental Services: Lim Kewei Daryl James

Through a collaborative development approach, TTSH partnered industry expert Systmz with the mechanical and engineering expertise to continually test and refine the requirements through usability assessment.

The team also engaged in conversations with the target user groups to understand their needs further.



The Solution

The development of the FuSA chair went through a few phases of iterations to ensure it met our key requirements. Following were the key phases of development:

- **Proof Of Concept (Low-Fidelity Prototype)**

CHI's Kaizen Office facilitated a Makeathon for multi-functional chair during Value Festival 2017 in collaboration with different disciplines.

Prior to the Makeathon, needs analysis was conducted and shared with the participants for the 3-in-1 needs. Function and Safety meets Aesthetics (FuSA) chair, which met the 3-in-1 requirements was selected as the winner for the Makeathon. After which, feedback was collected from various key stakeholders to refine specifications for mid-fidelity prototype.

- **Proof Of Value (Mid-Fidelity Prototype)**

In Dec 2018, the development of the mid-fidelity prototype was awarded to an industry partner for proof of value. The mid-fidelity prototype was unveiled in May 2019. Further input was sought from staff, patients and visitors for the mid-fidelity prototype. The feedback allowed us to proceed to the next stage of development.

- **High-Fidelity Prototype**

In July 2020, a workgroup with members from various departments has been formed to look into different aspects of the project.

The development of the high-fidelity prototype required collaboration with an industry partner. In this collaborative relationship, the industry partner, Systmz, provided the mechanical and engineering expertise for the project while TTSH provided the usability assessment.

Below are the 3 prototypes during this phase:

- Engineering prototype - To have mechanically sound product to determine structural stability and weight-bearing capability in different modes, with due consideration for materials, ergonomics and aesthetics
- Beta prototype - To have near-final prototype ready for testing with immediate users of final product to determine necessary accessories, usability and safety.
- Pre-Production prototype - Final product prototype for evaluation with all users (patient/next-of-kin/visitor/staff) before the mass-production of the FuSA chairs.

The Approach

A design thinking and agile development approach was adopted in the development with the following principles:

- Iterative and incremental design - through a process of testing, feedback, and refinements.
- Collaboration and teamwork - multiple key stakeholders identified and involved in the design process.
- Human-centred design - focus on meeting the needs of patients, next-of-kin and healthcare professionals.
- Flexibility and adaptability - allow for changes and adjustments as needed.

Facilitate Better & Safer Patient Care

With the convertibility from chair to bed, caregivers feel encouraged to accompany patients throughout the night, a factor aligned with the care model for ICH. Thus, enabling healthcare professionals to focus on patients who require higher level of care needs and attention.

Prolonged bed rest can lead to several complications, affecting patients both psychologically and physiologically. Psychologically, it could result in learned helplessness and depression. Some of the physiological impacts with limited movement results in decreased muscle strength, blood flow and deconditioning.

Sep 2017
Proof of Concept



May 2019
Proof of Value



Aug 2021
Engineering Prototype



Apr 2022
Beta Prototype



Jan 2023
Pre-production Prototype



With the above iterative development approach, it enabled the team to gather user feedback early in order to fine-tune the design and ensure that all requirements are met.



There are several types of patient profiles within both ICH and TTS: patients recovering from neurological illnesses, spinal cord injury and post stroke condition whom require facilitated rehabilitation care. Amongst which, they would have lower trunk control, poorer sitting balance, higher fall risk and experiences postural hypotension.

To support patients in their rapid recovery journey, staff would sit patient out of bed for longer period time to recondition their physical fitness. With the long duration of sitting required, comfort and safety is of utmost importance.

- Recline Function

Currently, Mobile Geriatric Chairs in the wards do not have the reclining function and unable to facilitate patient rehabilitation. This would be an issue when patients seated on such chairs experience dizziness or light-headedness, and need to be transferred from chair to bed.

To address this, the FuSA chair is equipped with the reclining function allowing hypotensive patient to be lie supine, without the need to be transferred back to the bed.

The FuSA chair convertibility from sitting to lying position could also be advantageous for nurses in emergency situations. If a patient were to suddenly become unwell while sitting in the chair, nurses would be able to render appropriate medical attention to stabilise the patient in a supine position before transferring patient back to the bed.

- Additional seating

Another issue that was flagged was that there are insufficient chairs in the wards especially during peak visiting hours. With FuSA chair, the bed to bench convertibility feature will allow up to 4 visitors to be seated on the bench mode.

- Added Features

Besides the 3-in-1 featured requirements, FuSA offered some additional features which are not commonly found in existing geriatric chairs. The image below are the additional key features that enable better and safer care to our patients:

Foldable & height adjustable headrest – provide better neck support

Adjustable armrest – ability to flush with bed for safer bed transfer

Medical rails at each side - flexibility of attaching IV drip stand (front and back) for diverse needs of patient

Wheels central locking system - accessible at both sides to reduce motion waste



Multi-angle adjustable backrest - can be reclined down to 180 degrees horizontally (bench / bed mode)

Modular tray – for patient to have meal. The modular tray can be detached and stored at the back of chair

Multi-angle adjustable legrest – provide better calf support

Integrated footrest with anti-slip feature - fall prevention



Going Forward

The development of the FuSA chair demonstrated how to redesign care delivery to patients, and allow healthcare professionals to focus on other patients who require higher level of care.

It exemplifies the possibility of ground up innovations and instil confidence for staff to innovate and improve in order to meet future challenges.

Furthermore, to benefit the entire healthcare industry, the FuSA chair would be available to market through the collaborative partner, Systemz.

The FuSA chair, designed with safety in mind throughout the entire development, was met with positive feedback from patients, next-of-kin and healthcare professionals.

The project had successfully attained the ability to fulfil the requirements of a multi-functional chair that caters to the needs of patients, next-of-kin and healthcare professionals.

With its hospital wide deployment, it would be a welcome sight in wards and a testament on how innovation would deliver better healthcare!



Project co-leads Mr Loo Wei Hann (left) and Sister Wee Fong Chi.

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