# Description of Innovative 3I (Intelligent, Informatics and Interactive) Bed Project

## Background

The world is experiencing the major challenge due to the demographic shift. The low birth rate and rising cost of health care service force the society rethink about its model of welfare system and technology applied in this process. According to the estimation, the aging rate of China will rise from 10% in 2012 to 20% in 2025.[1] The whole country is very much eager finding new technology to offset the negative effect due to the "one child policy". Unlike China, Denmark has already been as an aging society for years, the country has a well-established welfare system and advanced telemedicine technology. This character has become an opportunity for Denmark to export its newest technology to the Chinese market.

Intelligent bed is an emerging concept in the recent years. It is originated from medical bed, but equipped with different high-tech components based on the individual needs of patients, relatives and nurses.[3,4] Most of the published results in this field are at the level of feasibility study, a more comprehensive and grounded research is required. What's more, the whole research is lack of clinical practice, but focused on the engineering design for achieving some specifics functions.[5] The whole process is in short of participation from patients, relatives and nurses.

## Aim of the Study

The overall aim of the Phd study is to:

- investigate and evaluate elderly and severely ill patients, relatives and healthcare professionals' experiences and acceptance towards the concept of intelligent bed in the Danish context at the regional Level;
- pilot the concept of the intelligent bed and identify the needs of elderly and severe patients, relatives and healthcare professionals in the Chinese context at the regional Level;
- develop a new theoretical approach on how to transform telemedicine technology into the Chinese context.

## State of Art

A review of articles was initiated before the submission of Phd study plan. Three data bases including "*PubMed*", *"Google Scholar"* and *"IEEE Xplore"* were designated as the search engines. The key words including: intelligent bed, telemedicine, ehealth, teleheath, welfare technology, Clinical practice, smart home, welfare system, China and Denmark. We have thereby found 258 articles, and 128 articles are identified as relevant. However, we were unable to find the studies which are similar design to ours.

There are some reported studies which are very much relevant to ours. The smart home technology is using different sensors to monitor the indoor and outdoor environment around the house, provide convenience on controlling appliances to inhabitance via internet. However, the target of this technology is common people without specific focus as our study. What's more, there is a lack of scientific report on how the users actually feel about the smart home technology. One study has reported that a robot arm was developed to assist the users

reaching things. Another study proposed a sensor system which detects the position of the users in bed.

There are only a limit number of studies which using the term "intelligent bed". One of the studies described the safety functions of the intelligent bed including: power on/off, brakes locked, lowest position and bedrail in safe position. Another study reported about a scale function to assist the health professionals weighting the patients. Additional functions were found to do the vertical and horizontal movement to rotate the patients who are disabled.

The overall review of literatures has revealed several disadvantage in this field. First, the target group is not identified clearly, some studies have involved the common and healthy participants, which may intervene the outcome of the studies. Second, there are a large number of the studies focus on the preliminary engineering design with less focus on the clinical practices, especially the feedback from the users including patients, relatives and health professionals. What's more, there is a lack of discussions on economic feasibility and political implications. Third, the functions of the intelligent bed is yet to be developed due to the various health conditions of the patients and the forms of health care service they received.

### Research Design

The first part of the study is initiated at a Danish nursing home and also with some elderly patients who is living at home. Most of the patients are servilely ill and may disabled for several years. The study will also include relatives and health professionals who works in the nursing home. The second part of the study will be initiated at the rehabilitation department of a Chinese hospital. The reason for not choosing the Chinese nursing home is due to the fact that China is still lack of development in this area. Most of the nursing home is private owned and considered as low credibility, underdeveloped in the Chinese context. The elderly patients are thereby flooded into the hospital and the rehabilitation department is gradually become a quasi nursing home. To ensure the validity and reliability of the study, it is then decided to choose a Chinese hospital.



Fig 1. The picture of the Chinese hospital



Fig 2. The Intelligent bed in Denmark

The overall research design is inspired by case study approach.[6] It is an intensive investigation which applied both qualitative and quantitative methods within the local context.[7] The data collection techniques including:

semi-structured interview, surveys, participant observation and documentary study. Data triangulation strategy will be deployed when conducting the research to ensure the validity and reality of the research. [8] The data obtained will be analyzed via Nvivo.

Before the research formally started, the application was submitted to the local ethical committee. After the approval, the potential participants will receive the description of the study and ask the questions if not clearly illustrated. All the participants will sign the informed consent before the test started. The whole process has follows the rules of Helsinki Declaration.

**Expected outcomes**

The expectation of the outcomes including:

- report and discuss the different user experiences of severely ill patients, relatives and healthcare professionals both in Denmark and China;
- identify different factors which influence the patients', relatives' and health professionals' choices on applying the intelligent bed technology;
- improve the theories on technological transformation from developed countries to developing country with focus on telemedicine technology.
- Help the Danish industries to develop the intelligent bed technology which fits into the local context.

**References**

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