

DESIGN TOOL FOR TRANSFERRING PATIENT TO IMPROVE NURSES WORKING POSTURE WITH ERGONOMIC APPROACH

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ABSTRACT

Manual patient bed transfer to another hospital bed including lifting, transferring and repositioning is still bringing problem for nurses and also patience. For a nurse manual patience bed transfer can lead to low back pain because the body must bend when move patient into another hospital bed. Based on the evaluation of the posture of the nurse with Rapid Upper Limb Assesment (RULA) the result in bodily posture nurse get that can cause pain at some point. It's in prove with the results of kuisisioner SNQ, showed that posture such work can cause pain if conducted continuously. The objective of this study is to design a concept of interchangeable hospital bed mattresses. The first step of this study is the problem analysis to the patient transfer process and the beds they currently use. This activity was begins trough observation, direct interrogation, and the deployment of Nordic Body Map equipped questionnaire. After the analysis showed the point of the problem, there can be developed a tool design for transferring patient into another hospital bed, the concepts with their fitures which can accommodate requirements of the process, encompass the nurses' anthropometry based bed dimension, the bed mechanical mechanisms, and some supporting fitures. The result of this study are concepts of both hospital wards bed and transit bed which theoretically can eliminate the nurses low back pain.

Keywords: work posture, manual bed transfer, Rapid Upper Limb Assesment, Design Concept

1. INTRODUCTION

Manual patient bed transfer to another hospital bed included lifting, transferring and repositioning is still bringing problem for nurses and also for patients (marras et.al, 1990). For a nurse manual patient bed transfer it can lead to low back pain because they body must bend when patient move to another hospital bed. And the risk is higher than in fabrication, because the nurse do the transfer of patient tends to have low back pain levels of risk even higher than in the field of material handling industry. Because the patient is a man can move relatively large has mass and allowing nurses to the centre of gravity and distance can be changed during patient handling activities For the patients, the transfer process can definitely cause body movement which can cause inconvenience, for example for a patient with a physical trauma. Therefore, it would be very help full if there is something

which can change the traditional technique of patient transfer.

Generally the mechanism of the arrival patient, placed in first time to hospital bed in IGD to have a medical check before transferring patient to inpatient room. Generally, the frequency of the transfer patients between the bed almost the same in other hospitals. While the position of nurses when do transferring patients activities can cause of low back pain because the position of nurse is a bend position. In addition, the activity of the transfer patients to another hospital bed has led not good for patients , especially patients who had injured a broken bone or a concussion because of accident and its high of risk.

Rapid Upper Limb Assessment or commonly called RULA is one of the methods used to analyze the human body posture. The RULA ergonomic assessment tool considers biomechanical and postural

load requirements of job tasks/demands on the neck, trunk and upper extremities.

Based on the evaluation of the posture nurse while do manual transferring patient activities by using RULA, researchers observed that the current posture of the operator can cause discomfort for the operator. It can be seen from the results of the calculation of RULA.

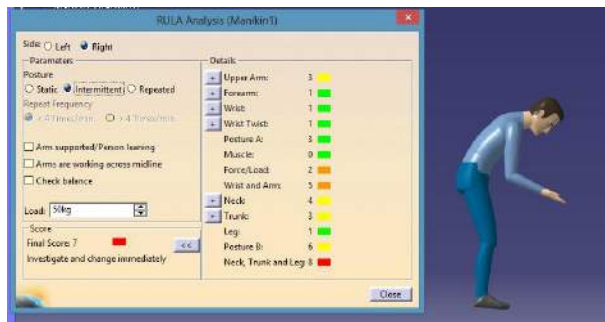


Figure 1. RULA result

The conclusion of using RULA is 7 its mean that the posture of the nurse while do manual transfer patient activities is the condition is dangerous then examination and changes necessary in the immediate.

In addition to using Rula, researchers used a questionnaire SNQ (Standard Nordic Questionnaire). Based on the result, 14% of nurses feel the pain for some parts of their muscle. With most complaints are complaints of pain in the waist as much as 50%. so the nurse feel saturated and fatigue are quite large.

By comparing the results on the value of the score on the rula and snq result, researchers can draw the conclusion that the existing work postures are seriously problems. Therefore, to overcome the problem of improper working posture, it is necessary to design tools for help the manual transfer patient so that the nurse can reduce the level of risk of MSDs (Musculoskeletal disorders)

2. THEORETICAL BACKGROUND

2.1. Product Development Stage

Product is a thing which can be sold by a company for a customer to fulfill their needs. Product development is a set of activity, begin from perception analysis, then end with production, selling and distribution. The product development process generally

comprises the steps of an early-stage or often also referred to as phases. According to Karl T. Ulrich and Steven D. Eppinger in his book, general product development process consist of 6 phase, these are:

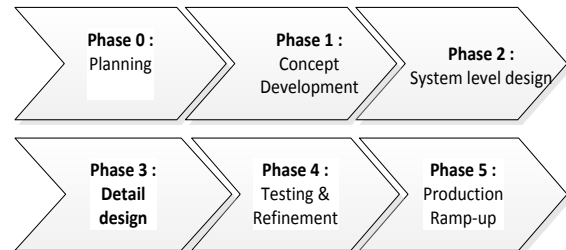


Figure 2. Phases of Product Development

1. Planning Phase

The planning phase is an activity called 'zero phase' because this activity precedes the approval of the project and the process of launching the actual product development.

2. Product Development Process

In development phase, we have to identify the target market, market needs, and concept alternative and evaluate the chosen concept for future development. This concept is a description of shape, function, and design product, it consists of product specification, product analysis, competitor analysis, and economic project analysis.

3. System Level Design

In this phase consist we are define the product architecture and detail product become a subsystem and component. The outputs for this phase are product shape, functional specification from every subsystem, then flow diagram to define the ending of the process.

4. Detail Design

Detail design phase includes full specifications of shape, material, and tolerance of all component units of the product and identification of all standard components purchased from suppliers. Otherwise the process plan and equipment designed for each component are made, in the production system. The output of this phase is to control the recording of the products, images for each component of the product and production equipment, the specification of components that can be purchased, as

well as plans for the manufacture and assembly of products

5. Testing and Refinement

In this phase of testing will be conducted to test the components of critical components such as material test of endurance.

6. Production Ramp-up

At this stage, the product was launched on a small scale in order to get feedback. Product is usually presented in the company's internal scale as input for further evaluation.

2.2. Standard Nordic Musculoskeletal Questionnaire

Standard Nordic Musculoskeletal Questionnaire developed by [3] was used. This questionnaire evaluates the musculoskeletal complaints in nine regions of the body namely neck, shoulders, upper back (UB), elbows, lower back (LB), wrists/hands (WH), hips/thigh/buttocks (HTB), knees and ankle/feet (AF) in the last 12 months, 6 months and within 7 days, respectively. The questionnaire also evaluates the normal activities prevented for an individual due to occurrences of MSDs in one or more of these regions of the body. The questionnaire has queries to find the existing status of MSDs in terms of pain in three specific regions of the body, i.e., neck, low back (LB) and shoulders. Some sections of this questionnaire identify the problems faced by the nurses that are directly or indirectly associated with incidences of MSDs in these specific body regions.

3. RESEARCH METHOD

The first step is to know the problems that exist in the work activities of nurses, especially in the handling of patients. In these observations distributed questionnaires containing data nurse posture while doing the activity. Most complaints that 20% of nurses have complaints on the waist, back, and neck. From that epidemiology, we can reduce the musculoskeletal risk by designing the tools.

The next is the product design stage, namely:

1. Analyze customer needs.

Analyze customer needs adapted to the analysis of the initial problems in nursing, then interview them about what kind of tools you want to use to facilitate their work. To get the data the voice of customer that will be input into the process of identifying the needs of consumers, conducted oral interviews with the 30 people who became the object of the initial research. From the results of interviews with 30 respondents, the data obtained the voice of customer. Voice of the customer is then translated into consumer needs.

2. Determine the alternative Concept

In this part, the alternative concept are designed. The concept is about material mechanism, material selection, and other specification of the product.

3. Concept Selection

After get the alternatives, combine it and choose the suitable one, the good one according to customer needs and other criteria such as ergonomic side, and production scope.

4. Recommended Design

The selection concept will be the input of this stage to design the tools which can help nurses to do their work.

5. Evaluation

This stage will be show us about how the design can help reduce a musculoskeletal risk in manual patient handling.

4. RESULT AND DISCUSSION

4.1 Identifying customer needs

Identification of customer needs done to describe the attributes of a product needs. the method to identification of customer need is an interview conducted with the customer. To get the data the voice of customer that will be input into the process of identifying the needs of consumers, conducted oral interviews with the 30 people who became the object of the initial research. From the results of interviews with 30 respondents, the data obtained the voice of customer. Voice of the customer is then translated into consumer needs.

Table 1. Customer Needs

NO	Text
1	consumers want the design of tools for transferring the patient is comfortable to use and to minimize pain when displacement
2	consumers want the selection of materials for patient transport convenient tools to be used
3	consumers want a design tool is safety while the consumer use it
4	nurses want a more practical design tools used
5	nurses wanted design tools can facilitate the transfer of the patient without making a mess of hospital beds
6	nurses want a design easy to use tools

Ergonomic Simulation

In this stage of the analysis of the ergonomics of product designs using the Rula method and simulated by using catia software. This step is performed to determine the posture of the nurse when using the new design of tools for manual transferring patient. wherein, ergonomics analysis of the proposed design is as follows:

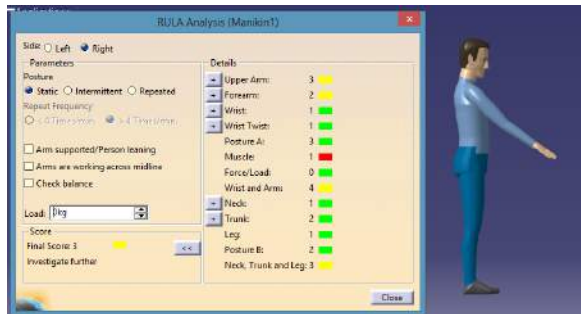


Figure 3. Rula design result

The conclusion of using RULA is 3 its mean that the posture of the nurse while do manual transfer patient activities is better then the existing posture while do manual transfer patient activities.

4.2 Determine alternative concept

This research identify 3 alternative discussion.

Table 2. Alternative Concept

PART	Alt 1	Alt 2	Alt 3
Bottom mattress	Synthetic leather	polyester	cotton
Middle mattress	Synthetic leather	polyester	nylon
Top mattress	cotton	parachute	dacron
Type of strap	Nylon with foam grip	Canvas grip strap	Canvas grip strap
Grip existence	Yes	No	Yes

Concept 1

This concept adapt a synthetic leather and dacron for material of the mattress. There is a foam inside the mattress. The synthetic leather aim to coat the foam that is in and aims to facilitate the transfer of patients because the material is quite slippery. There is some kind of belt with a nylon for the grip, this is to pull the patient when transferring activity. Moreover, the belt in this product seems to be a tackling the risk of accidents when doing patient handling.

Concept 2

The second concept use a polyester for material of the mattress. Because this material more slippery then the synthetic leather, so the activity can be done easily. There is no belt for protect the patient. And the belt for pull the patient has no grip on it.

Concept 3

This is use a cotton for a bottom of the mattress, nylon to cover a middle of the mattress and cotton which is use for the top of the mattress. There are a grip made by canvas, and there is a safety belt to protect the patient from handling activity.

4.3 Concept selection

From that concept alternative, the mattress should be made from a slippery material so the polyester is the best choice. Then the best choice for the middle of the mattress tis a synthetic leather, to make the mattress more comfort and more rigid when it use. And the top material of the mattress use a cotton to give a patient more comfortable when they are using this product. The next is a grip. A grip must be made from ergonomic material we use nylon to cover the foam so when the nurse use it to doing the handling

activity, the arm will not harm. Then the important thing is the safety belt for the patient must be exist. And this product can be folded for easy storage.

Table 3. Alternative of Parts

PART	Alt 1	Alt 2	Alt 3
Bottom mattress	Synthetic leather	Polyester	cotton
Middle mattress	Synthetic leather	polyester	nylon
Top mattress	dacron	parachute	cotton
Type of strap	Nylon with foam grip	Canvas grip strap	Canvas grip strap
Grip existence	Yes	No	Yes

4.4 Recommended Design

From the chosen concept will be define the fixed design, before it be evaluated. The design is as follows:

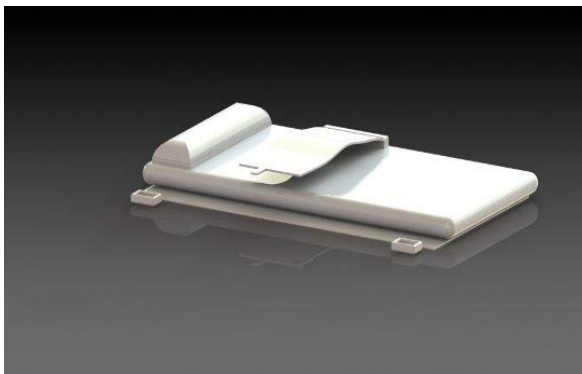


Figure 4. Design Concept

5. CONCLUSION

The conclusions of this research are:

1. There is a problem with nurse working posture because the angle of the posture by rula show the problem.
2. The basic concept of the tool has been develop to solve this problem, and will be improve more in detail in other research.

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