DESIGN OF WORK METHOD IN ORDER TO DECREASE ILLNESS RATE CAUSED BY MUSCLE AND NERVE DUE TO UNPROPER WORK METHOD USING OCRA INDEX IN INSTALLATION DEPARTMENT POS INSTALL WOODEN LH AND ROUTING WIRING IN PT. XYZ

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Abstract

Health is an important form of human capital. It can enhance worker's productivity by increasing their physical capacities, such as strength and endurance, as well as their mental capacities, such as cognitive functioning and reasoning ability. Such in Vehicle logistics division, there is still 16% of total disease in PT XYZ are caused by nerve and muscle. By divide it into departement category, the most common disease is in Installation Operation which contributed 60%, it means that from the 16% disease caused by nerve and muscle 60% of infected operator are work in Installation Operation. In Installation Department operation there are five lines that have responsibility to install the available or given car. From the five lines, the most common is in line 2 which contribute 25%. Then identify each job in line 2 is the next step, and the most common is in Pos 2D which responsibility to install the wooden LH and routing. Then, the exisitng condition is assess by OCRA Index which evaluate four main collective risk factors based on their respective duration, which are repetitiveness, force, awkward posture and movements, and lack of proper recovery periods. Then, from the given result of assessment will be used as parameter to give an improvement which in term of an improvement work method. By improving the work system, the gap that has been categorized in OCRA Index has been fixed. In other words the OCRA Index for improvement condition is lower than the existing one. Means that the improvement process are sucessfully decreased the risk of illness from 2,449 to 1,054 by the OCRA Index assessment process.

Key words: OCRA Index, Wooden LH, Nerve and Muscle, Routing, Repetitiveness, Awkward posture

1. Introduction

Health is a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity (World Health Organization, 1946). Health is an important form of human capital. It can enhance workers' productivity by increasing their physical capacities, such as strength and endurance, as well as their mental capacities, such as cognitive functioning and reasoning ability. (Savedoff and Schultz 2000; Schultz 1999a, 1999b, 2002; Schultz and Tansel 1992; Strauss and Thomas 1998). While employee have to spend their time to check or even heal their unhealth condition instead of doing their work and it is considered as unproductive condition.

Such as PT. XYZ facing 800.000 Sales era in 2020 Vehicle Logistics Division as part of supply chain must prepare all resources to accomodate this situation (Yard, Transportation, and Resources). It needs to optimize and effective the logistics resource. Based on Polyclinic visit data (Jan-May 2014), some illness has significantly impacted to efficiency of the resource. Based on the same data, which is polyclinic visit data from January to May 2014, some diseases have defined, and most common diseases that cause unproductive activity in PT XYZ, Vehicle Logistics Division area are shown in Figure 1.

The data show that the most common disease consecutively are nerve and muscle, respiratory disease, and gastritis. Since the highest common disease is nerve and muscle, and also respiratory system and gastritis are disease that caused by viruses or bacteria or categorized as external factor, then managing the illness or disease that caused by nerve and muscle is decided.

By breakdown the data, there is still 16% of total disease in PT XYZ are caused by nerve and muscle. By divide it into departemen category, the most common disease is in Installation Operation which contributed 60%, it means that from the 16% desease caused by nerve and muscle 60% of infected operator are work in Installation Operation. In Installation operation there are five lines that have responsibility to install the available or given car. From the five lines, the most common is in line 2 which contribute 25%. Then identify each job in line 2 is the next step, and the most common is in Pos 2D which responsibility to install the wooden LH and routing.

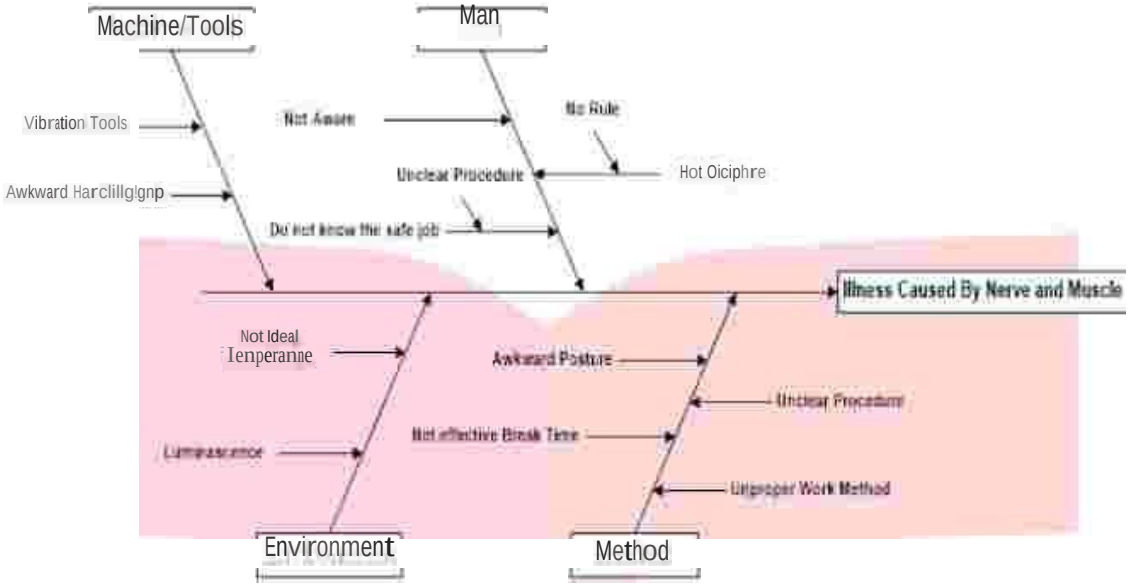

Figure 2 Fishbone Chart

From the breakdown data information shown that there is still 16% gap of the illness rate that caused by nerve and muscle and from its cause analysis by using fishbone diagram which shown in figure 2, it means that ergonomics work analysis need to be conducted.

Then, based on the explanation above, the objectives of the research is reduce illness rate caused by muscle and nerve due to un-proper work method in Installation Department, Vehicle Logistics Division, PT. XYZ.

2. Research Methodology

Variable data that used in this research are the polyclinic visit data, existing posture data, and work detail data.

After determine the highest percentage of illness in Vehicle Logistics Division, which are digestion system, respiratory system, and nerve and musle. Because of the controlled factor and also external factor, so it decided to neglect the cause of nerve and muscle illness. Then, the data devided by the department category and also line category, its result shows that the most effected illness is in Pos Install Wooden LH and Routing Wiring in Installation Operation Department. Then we the research is focussing in that area.

The explanation about problem solving systematics that shown in Figure 3 that attached in appendices. The figure explain the research is done by several steps as follow :

1. Problem Identification and Preliminary Stage
   a. Problem Identification and Classification
      This step shows how the researcher get the problem theme and classification of the problem. Then, the research problem and theme in this research is ergonomics work method.
   b. Field Study in Installation Department
      Direct study of object research is the main activity from this step. Monitoring and also problem clarification of the problem object also conduct in this step.
   c. Literature Study
      The study of books and journals about ergonomics work method is conduct in this step. Not only evaluating the literature, in this step also conduct the benchmarking process from any other research related to the ergonomics work method theme.
   d. Research Objectives
      Determining the research objective or aims from given problem are the main activity in this step. The objective will be the parameter research to get the output.
   e. Conseptual Model Determination
      Conseptual Model is thinking way or steps of researcher to solve the problem given. In this step also include the step by step and determining the schedule of the whole process of research.
2. Data Collection and Analysis Stage
   a. Data Collection
      The entire data collection and analysis was completed by primary or even secondary data, by using some form or document that has been prepared beforehand, visits to the selected object. There are six factors that we need to find before the OCRA Index is determined. These following factors are :
      a. Action Frequency Constant (CF)
         The literature, albeit not explicitly, supplies suggestions of “limit” action frequency values, and these range from 10 to 25 actions/movements per minute. On the basis of the above and given the practical

considerations of the applicability of these proposals in the workplace, the action frequency constant (CF) is fixed at 30 actions per minute.

b. Force Factor (Ff)

Force is a good direct representation of the biomechanical commitment that is necessary to carry out a given technical action. It is difficult to quantify force in real working environments. To overcome this difficulty, one could use the Borg10-category scale for the rating of perceived exertion (Borg, 1982). Once the actions requiring exertion have been determined, operators will be asked to ascribe to each one (or homogeneous group) of them a progressive score from 1 to 10. The calculation of the average exertion weighted over time involves multiplying the Borg Scale score ascribed to each action by its percentage duration within the cycle. The partial results must then be added together. When choosing the multiplier factor, it is necessary to refer to the average force value, weighted by cycle duration.

c. Postural Factor (Fp)

The description/assessment of the postures must be done over a representative cycle for each one of therepetitive tasks examined. This must be via the description of duration of the postures and/or movements of the four main anatomical segments (both right and left): shoulder, elbow, wrist, and hand. For classification purposes, it is enough to see that, within the execution of every action, the joint segment involved reaches an excursion greater than 50% of joint range for at least one third of the cycle time. The longer the time, the higher is the score.

The presence of stereotypical movements can be pinpointed by observing those technical actions that are all equal to each other for at least 50% of cycle time or by a very short duration of the cycle (less than 15 sec). The presence of stereotypical movements increases scores for the joints involved. All of these elements together lead to the design of a useful scheme to identify the values of the posture multiplier factor (Fp).

d. "Additional" Factor (Fc)

These factors are defined as additional not because they are of secondary importance, but because each one of them can be present or absent in the contexts examined. The list of these factors is not exhaustive and includes the use of vibrating tools; requirement for absolute accuracy; localized compressions; exposure to cold or refrigeration; the use of gloves that interfere with the required handling ability; objects handled have a slippery surface; sudden movements, "tearing" or "ripping" movements, or fast movements; repetitive impacts (e.g., hammering, hitting, etc.).

There are some factors (psychosocial) that are concerned with the individual sphere and cannot be included in methods considering a collective and occupational type of exposure. There are other factors, definable as organizational (working pace determined by machine, working on moving object), that should be taken into consideration. For every additional factor indicated, variable scores can be assigned according to the type and duration.

e. "Recovery Periods" Factor (Fr)

A recovery period is a period during which one or more muscle-tendon groups are basically at rest which are breaks, visual control tasks, and periods within the cycle that leave muscle groups totally at rest consecutively for at least 10 sec almost every few minutes.

Using the indications supplied by some standards as a starting point, in the case of repetitive tasks, it is advisable to have a recovery period every 60 min, with a ratio of five work to one recovery. On the basis of this optimal distribution, it is possible to design criteria to evaluate the presence of risk in a concrete situation. The overall risk is determined by the overall number of hours at risk. For every hour without an adequate recovery period, there is a corresponding multiplier factor.

f. Duration Factor (Fd)

Within a working shift, the overall duration of tasks with repetitive and/or forced upper-limb movements is important to determine overall exposure. The index calculation model is based on scenarios where repetitive manual tasks continue for a good part (6 to 8 hours) of the shift.

g. Calculation of OCRA Index Result

The OCRA Index calculation is done by provides the necessary parameters for dealing with all of the multiplier factors and calculating the OCRA index by the formula. These results provide the basis for suggesting recommended technical actions in accord with the OCRA index.

h. Classification of OCRA Index Results

By considering the result of OCRA index, the next step is OCRA index classification criteria and indicate the consequent preventive actions to be adopted by the given informations.

3. Improvement Stage

a. OCRA Index Analysis

The steps to be followed for gaining the improvement is analysis the OCRA result. From the result, the complete score for each factors are determined. By those information, then comparing the existing result and the standard will get the improvement criteria in each factors.

b. Improvement Process
After getting the OCRA Index score, the guideline book will be made to help the employee doing their task. By using the OCRA index score as parameters, the employee will know what should they do and not do while working in term of Ergonomics. Not only giving the work guide, this book also will give more information about the ergonomics work environment.

4. Evaluation Stage
From the output of previous stage which is suggestion object, then the result comparison will be processed. The comparison process is conduct to know whether the suggestion is better then the existing condition.

5. Conclusion and Suggestion
At this stage is done by making conclusions from the results of studies in which the output of this research is a proposed work method in term of Guideline Book. This stage also describe in general the benefit and also how improvement condition impacted to the existing condition. Not only that, in this stage there will give the more information about suggestion for further research.

3. Discussion

3.1 Data Collecting

The data that need to be collected are working activities, which will be used to determine the technical activities of the operator for right hand and left hand activities. Second data requirement is operator working time in detail, it include the total workin gtime, breaking time, cycle time, and also the net cycle in each day. The time working data is shown in figure 4.

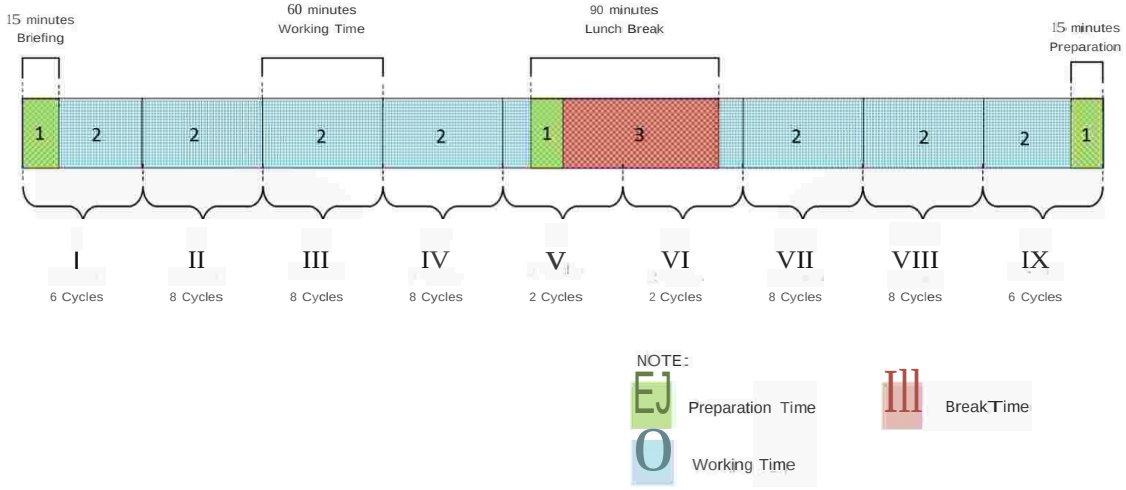

Figure 4 Operator Working Time

The figure 4 shows the detail working time arrangement in existing condition. The total working time is devided into 9 periods, which the blue color shows the working time, red color shows the break time, and green color shows the preparaton time.

3.2 Data Processing

After data collection process, the processing of related data are done in this stage. The very first step in this stage is identify the Actual Technical Action of operator while installing wooden LH and rouring wiring.
From the data collection process, the cycle time is known which is 7,43 minutes or equal to 445,8 seconds. The frequency perminutes are calculated below :

Frequency = (Total Technical Action x 60 seconds) / Cycle Time (seconds)
$Frequency_{Right\ Hand}$ = (172 x 60) / 445,8 = 23,149 technical action/minutes
$Frequency_{Left\ Hand}$ = (98 x 60) / 445,8 = 13,189 technical action/minutes

The total actual technical action can be calculated by multiply the frequency and total working time.

ATA = Frequency x Total Working Time
$ATA_{Right\ Hand}$ = 23,149 x 420 minute = 9722,58 technical actions
$ATA_{Left\ Hand}$ = 13,189 x 420 minute = 5539,70 technical actions

To determine the recommended technical action is using some several steps that have to be done which are force factor, posture factor, additional risk factor, recovery time factor, and duration determination.

Table 1 Factor Score for RTA Calculation

OCRA Factors	Right Hand	Left Hand
CF	30 technical action/min	30 technical action/min
Ff	0,848	0,904
Fp	0,5	0,7
Fc	0,9	0,95
D	420 minutes	420 minutes
Fr	0,75	1
Fd	1,1	1,1

RTA $_{\text{right hand}}$ = 30 Action/min x 0,848 x 0,5 x 0,9 x 420 min x 0,75 x 1,1 = 3970,19 Technical Action
RTA $_{\text{left hand}}$ = 30 Action/min x 0,904 x 0,7 x 0,95 x 420 min x 1 x 1,1 = 7692,66 Technical Action

By comparing the ATA score and RTA score, the result for OCRA Index score is identified. Then, the result will be categorized as a optimum or high risk activities. Since, the OCRA result for right hand is 2,4489 and for left hand is 0,7201. In other words, the righ hand activities is categorized as yellow/red area or need to be improved while the left hand is categorized as optimum condition.

3.3 Analysis

The OCRA Index score of right hand is classified in Yellow level thus the left hand score is classified in Green level. Hence, there is still gap that needed to be done to increase the level of the right hand score. The existing score of right hand and left hand score and its gap analysis is shown in table below.

Table 2 Gap for Right and left hand OCRA score

	OCRA Index	**Optimum Score**	**Gap**
Right Hand	2,449	1,5	0,949
Left Hand	0,72	1,5	-

The gap in righ hand OCRA score show that the right hand actions is highly risk of muscoloskeletal disorder and it can effect to the illness rate indirectly. Hence, improvement condition which can be done by increase and improve each factor condition in OCRA index need to be conduct.

Right hand force factor score is 0,848. As it observed, the cause of the high final score 0,848 are because of both highest borg scale score or high frequency. High borg scale causes by technical activities which identify as high borg score scale activities are pull, loosen, and push activities which have 3 borg scale score each, unite which has borg scale score of 2, the cut and install activities which have the score of 1,5. While the high frequency causes by technical activities which identify as high frequency activities are unite activities that has the total time is 53 seconds or 11,9% from cycle time, position activities that has total time is 47 seconds or 10,5% from cycle time,then push and pull that have total time as follow 23,5 seconds and 22,7 or 5,3% and 5,1% from cycle time From the identification above, it can be conclude that there is still chance to improve the system, since there are high borg score and high frequency identified.

From the detail information of postural score assesment, the lowest postural score is come from shoulder position is 48° (abduction 45°- 80°) which has 81,2% time proportion from its cycle time. Not only that type hand grip also a postural segment that has low score. The postural score of hand grip (palmar grip) is 0,7 which has 44% time proportion from total cycle time.

The additional risk factor score for right hand is 0,9. It shows that there is still 62% activities that is still categorized as risk activities. The main activities that categorized as risk activities are caused by vibrating equipment, require high level of accuracy activities, under pressure activities, and non ideal work environment.

Recovery time score for these activities is 0,75. Since the ideal score is 1, so there is still gap that need to be fixed. From the timetable risk calculation shows that from period 2,3,4,7, and 8 still have a risk value about 0,5 each period. Hence, working time and break time need to be rearrange.

Based on Article 77, paragraph 1, UU No.13/2003. Total working duration in this research subject is 8 hours. So, based on the law, working duration of the operator is categorized as safe working duration.

3.4 Improvement

Based on recommended technical action result analysis, the main problem for each factors is identified. By the result, the next step is develop the countermeasures to each factor problem identified. For example problems identified in force factor are high borg scale score in pull, loosen, and push activities which have 3 borg scale score each, mengikat which has borg scale score of 2, then cut and install which have the score of 1,5 activities and high frequency in unite activity that has the total time is 53 seconds or 11,9% from cycle time, position that has total time is 47 seconds or 10,5% from cycle time, pull and push that has total time as follow 23,5 seconds and 22,7 or 5,3% and 5,1% from cycle time activities.

Risk postural score in OCRA Index are caused by the shoulder position (abduction 45°- 80°) which has 81,2% time proportion from its cycle time and hand grip position (palmar grip) which has 44% time proportion from total cycle time. The problem in postural factor is identified, the next step is determine its root cause. From the root cause that have been determined, its countermeassure can be define. From the root cause identification, one of the countermeassure is suggesting the new work posture.

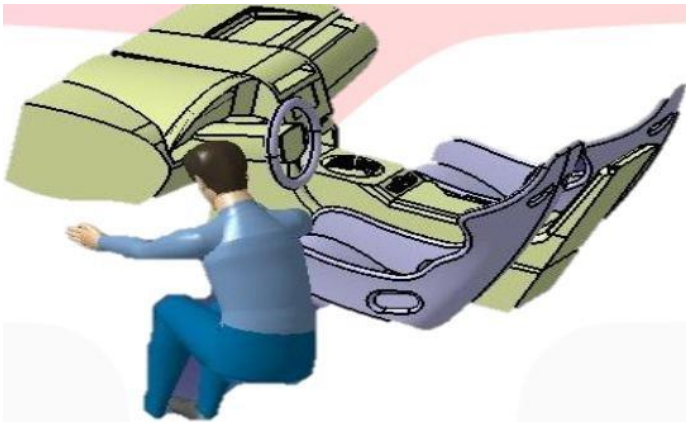

Figure 5 Proposed Operator work posture

In the other hand, the new postur do not cover the palmar hand grip problem. So, the most critical problem in the new posture is palmar handgrip, which has a score 0,7. In other words, the new postural score that shown in figure V.1 is 0,7 which caunted from palmar handgrip type.

The main activities that categorized as risk activities are caused by vibrating equipment, require high level of accuracy activities, under pressure activities, and non ideal work environment. Those causes are refers to work environment of operator. Here are the ideal work environment which written on Keputusan Menteri Kesehatan Republik Indonesia No. 1405/MENKES/SK/XI/2002. The improvement point to reduce the additional risk are vibration, noise, temperature, and luminescence.

In working period 2,3,4,7, and 8 still have a risk value about 0,5 each period and its identified as a problem. Hence, working time and break time need to be rearrange. Here are the new working arrangement that devide into improved working time and break time.

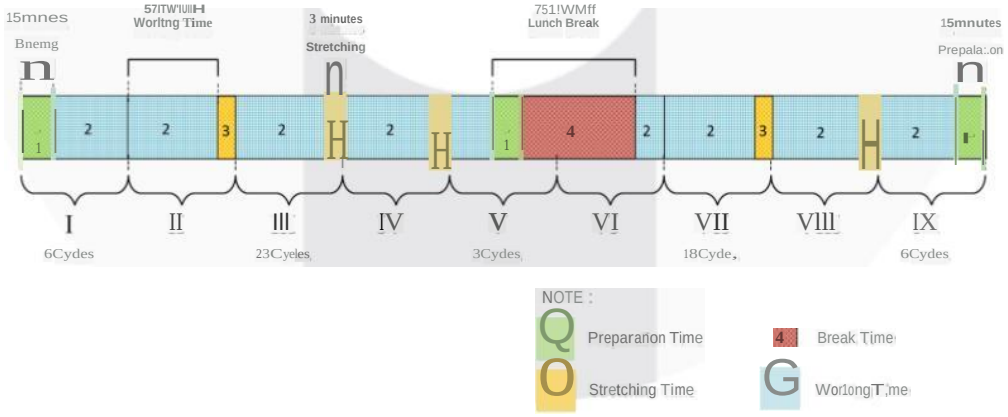

Figure 6 New Working time arrangement

The green color represent the time needed for operator prepare the whole equipment and theirself before they start working. The blue color show the regular working time, and red color represent the break time while the yellow one shows the time allocated to strecth activities.

Stretching time is time allocated to reduce the ergonomics risk related to work activities. Stretching time is conduct in every hour in period 2, 3, 4, 7, and 8 which spend in arround 3 minutes.

3.5 Result Comparison

To know whether the suggestion is better then the existing condition or not, the result comparison process is conducted. This test is done by recalculating the OCRA Index based on the factors that have been improved. The result comparison is done if the improved score of OCRA Index is smaller or saver than the existing score.
Here are the detail calculation process of improved OCRA Index score:

Table 3 New Factor Score for RTA Calculation

OCRA Factors	Right Hand
CF	30 technical action/min
Ff	1
Fp	0,7
Fc	0,95
D	420 minutes
Fr	1
Fd	1,1

In the force factor, by using economic motion principle the un productive kind of movement is can reduce, so it can be conclude that the improvement force factor condition is 1. Since, in postural factor improvement the abduction position can be fixed while the palmar grip is still exist, so the smallest factor that refers to postural factor is 0,7 that come from the palmar grip action. Then by providing the ideal work environment the additional factor condition is improved to 0,95. The risk value in period 2-4 and 7-8 can be downgrade until 0 by giving stretching time in each periods. So the recovery time value will be 1. While the CF, D, and duration factor are fixed.
The detail of OCRA Index calculation is as follow below :

$RTA_{\text{right hand}}$ = 30 Action/min x 1 x 0,7 x 0,95 x 420 min x 1 x 1,1 = 9216,9 Technical Action

From the RTA calculation result, then the nex step is calculate the OCRA Index which comparing the ATA from the existing condition and improved RTA score. Then, the result is 1,054. In other words, the improved condition in right hand activities OCRA score ≤ 1,5 and it categorized as optimum condition.

4. Conclussion and Suggestion

From the whole process of this research, the conclutions that can be state are the existing condition in wooden LH operator, installation department is not in optimum condition which shown by the high illness rate in that area, also by the OCRA Index score that state the right hand activities of operator is in yellow area.

The improvement result and system improvement which translated to guideline book proven to solve the gap from its exiting condition compare to ideal condition. It proven by the OCRA index result score is decreased from 2,4489 to 1,054.

Suggestion for further research are the research should conduct the trial and implementation process, and monitor the illness rate in the related object area. Then, cover more detail about postural factor.

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Appendices

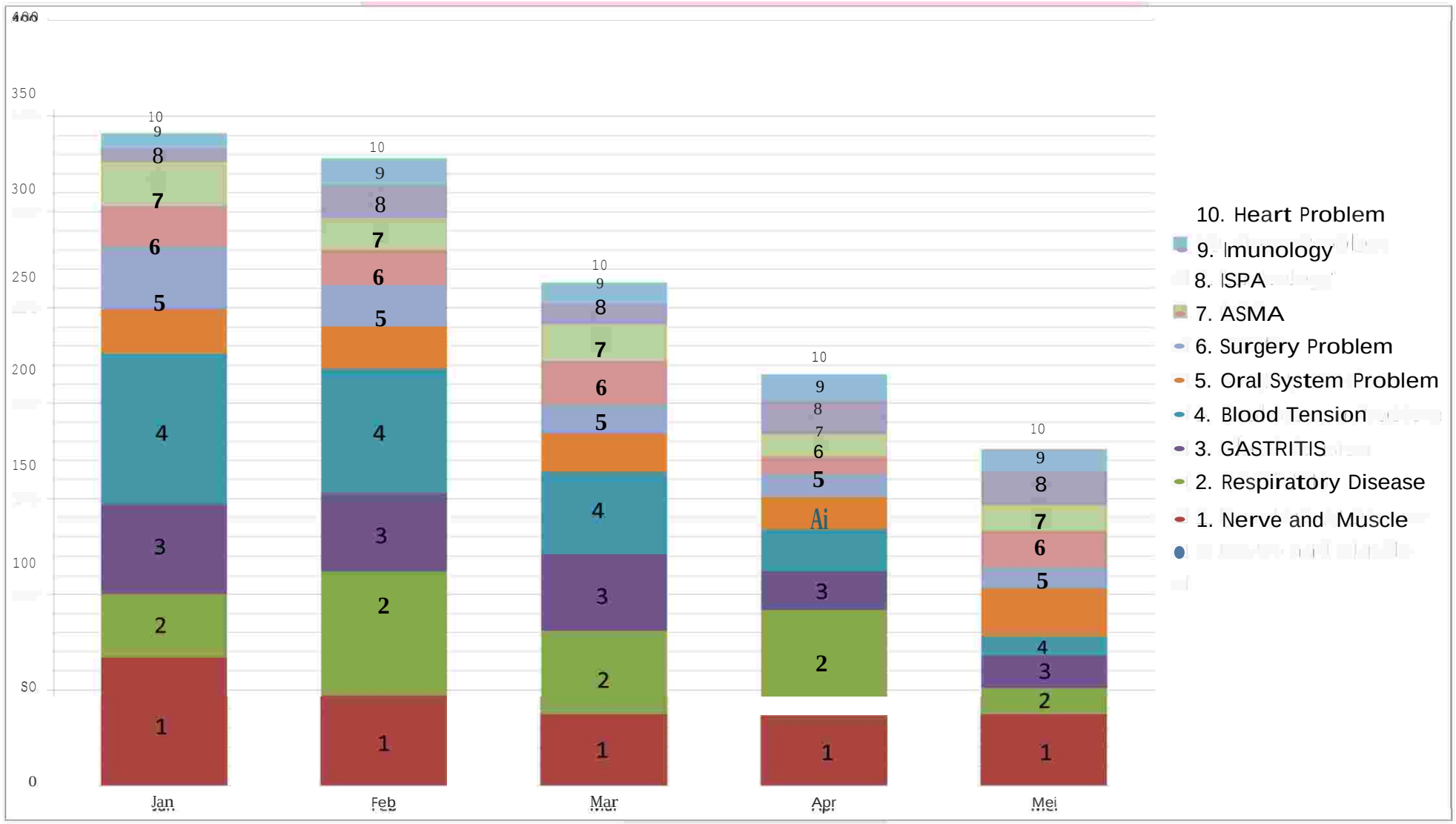

Figure 1 Illness rate in Jan to July 2014 Polyclinic visit data

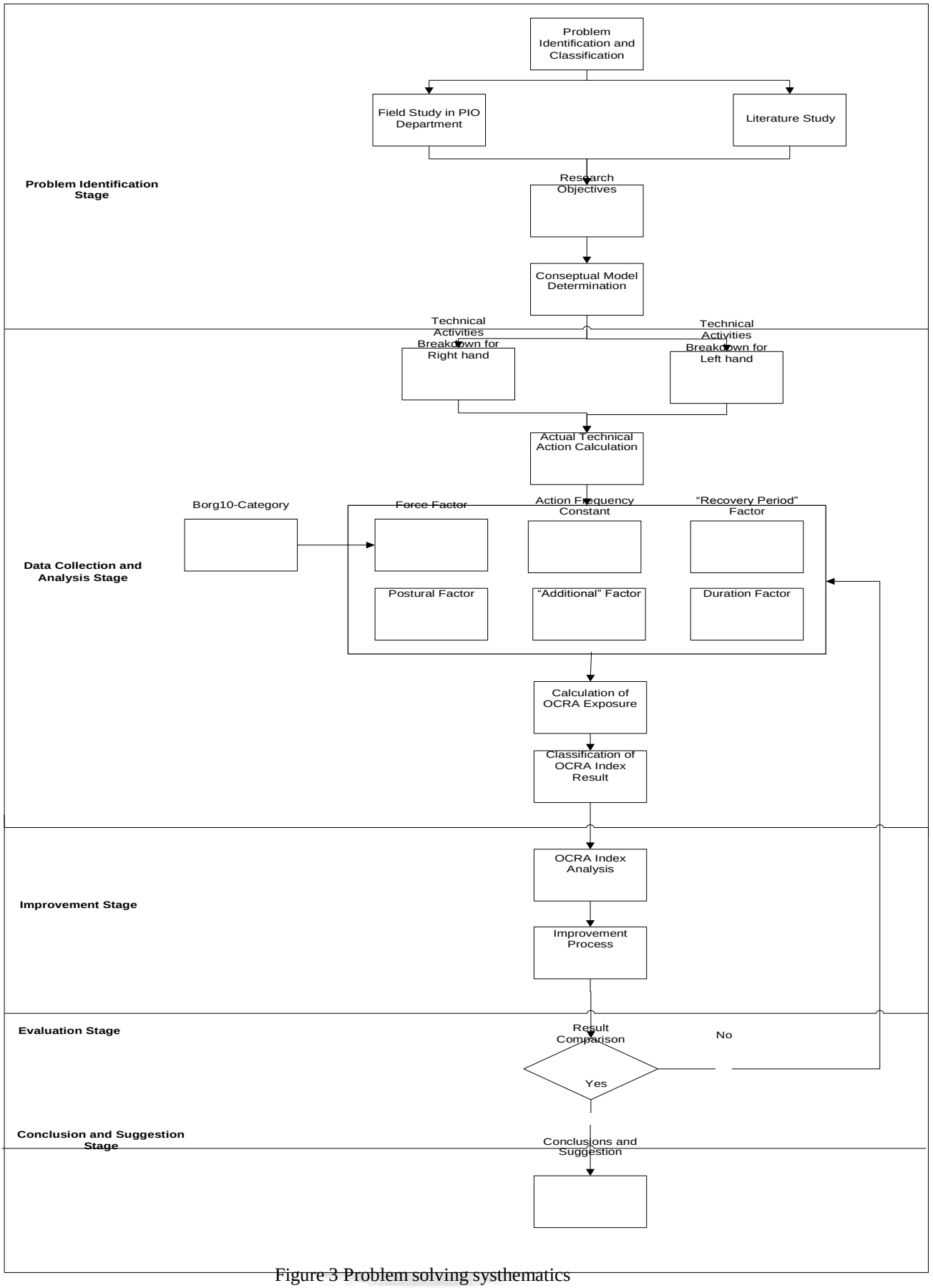

Figure 3 Problem solving systhematics