BUSINESS PROCESS ANALYSIS OF A SOUTH AFRICAN STATE-FUNDED HEALTH CARE FACILITY

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Henriëtta Steenkamp

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ABSTRACT

BUSINESS PROCESS ANALYSIS OF A SOUTH AFRICAN STATE-FUNDED HEALTH CARE FACILITY

HENRIETTA STEENKAMP

(9717558)

Supervisor:	Prof. P. Kruger
Co-Supervisor:	Dr. G. Warren
Department:	Industrial and Systems Engineering
University:	University of Pretoria
Degree:	Master of Engineering (Industrial Engineering)

The environment in South Africa has changed dramatically with regard to health services during the past five years especially for state-funded hospitals in the public sector. At the Johannesburg Hospital the admittance of chronic patients has increased considerably over the past five years, thus increasing the workload for the physiotherapists. In spite of the increased workload the staff complement of the Physiotherapy Department has decreased from forty-one to eighteen staff members due to the severe budget constraints. This investigation was initiated to determine whether the department was operating optimally under present conditions, and what the major problem areas were.

This document describes the methods used and results obtained during the investigation. Several known techniques such as the brainstorming and nominal group technique were used during the facilitation of workshops. Timesheets were completed over a six-month period and interviews were held with the personnel in the department. The approach followed with the statistical analysis of the timesheets was to use confidence intervals to compare the standard treatment times with the actual treatment times. Hypotheses testing were used to determine whether it would be possible to standardise on similar treatments in different treatment areas. The required capacity was calculated based on the amount of time spent on direct patient care by the physiotherapists during the six-month period of the investigation.

Several major issues were identified during the workshops that need to be addressed. Important conclusions drawn were that there was indeed a shortage of staff in the physiotherapy department. It also became clear that standardisation of treatments in different treatment areas is not possible. There is a need for a recognition system and teambuilding exercises, which should have a favourable impact on the motivation of employees. A maintenance plan for equipment needs to be implemented and interdepartmental communication needs to improve.

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LIST OF ABBREVIATIONS

AIDS	-	Acquired Immune Deficiency Syndrome
CVA	-	Cardiovascular Accident (Stroke)
e.g.	-	For Example
et al	-	and Others
etc.	-	Etcetera
HIV	-	Human Immunodeficiency Virus
IC drains	-	Intercostal Drains
ICU	-	Intensive Care Unit
Incl.	-	Including
min.	-	Minutes
no	-	Number
OPD	-	Out-Patient Department
PUVA	-	Psoralen Ultraviolet A
Std	-	Standard
UVB	-	Ultraviolet B Light

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CHAPTER 1

1. INTRODUCTION

1.1. STATEMENT OF THE PROBLEM

The environment in South Africa has changed dramatically with regard to health services over the past five years, especially for state-funded hospitals in the public sector. There has been a reduction of the budget allocations to hospitals in the public sector because of a decision to increase funds for primary health care. Primary health care focuses on basic health services provided by clinics. Treatment of children under six and expectant mothers are treated at any public hospital at no cost to the patient. This concession has lead to an increased demand for these services at tertiary care hospitals such as the Johannesburg Hospital. This decision was taken in order to provide more adequate health services to the entire population of the country. In previous years persons living in rural areas were particularly neglected.

It was reasoned that should the provision of primary health care be adequate many secondary treatments would not be required. In spite of neglect of primary health care services under the previous government, excellent services were available in the public or state funded hospitals.

In South Africa, HIV/AIDS is becoming an escalating problem. South Africa can expect four to six million of the 43 million inhabitants to die by 2010 of AIDS. This would result in approximately 2 million orphans (The Economist, 24 Feb 2001). This will have a

major impact on the economy of the country. The occurrence of HIV/AIDS has an especially significant impact on all health services, particularly those in public hospitals. The admittance of patients suffering from various AIDS related chronic diseases is on the increase.

The admittance of chronic patients to the Johannesburg Hospital has increased considerably during the past five years, thus increasing the workload for physiotherapists. Much of the work of physiotherapists is related to the treatment of patients with chronic diseases, however, in spite of the increased workload for physiotherapists the staff complement of the Physiotherapy Department has decreased from forty-one to eighteen staff members due to severe budget constraints. Various opinions exist about whether or not the staff complement is adequate to deal with the number of patients requiring treatment.

This study focuses specifically on the effects of the various changes in the Physiotherapy Department of the Johannesburg Hospital and to determine the subsequent steps indicated to reach an optimal solution to the various challenges facing the department.

1.2. BACKGROUND ON THE PHYSIOTHERAPY DEPARTMENT

The Physiotherapy Department at the Johannesburg Hospital consists of eighteen full-time physiotherapists, six part time physiotherapists and five physiotherapy assistants. The eight treatment areas within the department are:

- Intensive Care Unit (ICU)
- Neurology
- Paediatric
- Orthopaedic
- Exercise Rehabilitation
- Medical
- Surgery and
- Adult Outpatient areas.

There is a joint professorial head i.e. Head of the hospital as well as the university department. Under this head there should be an assistant director who is head of the hospital and a senior lecturer who is head of the undergraduate teaching programme. During the time of the study there were serious staff restrictions and the position of assistant director was frozen. A senior physiotherapist acted in the capacity of the assistant director with significantly increased responsibility but without any additional financial rewards. This individual was totally disinterested but was the only one willing to accept the appointment.

The Physiotherapy Department treats patients who are ill and have been admitted to the hospital and there is also an outpatient section where patients come for once off or regular treatment. In the Physiotherapy Department the most common outpatients are patients with neuromusculoskeletal problems and dermatological problems.

Each of the staff members works in only one treatment area unless there is an emergency and input is needed elsewhere. There are five supervisors (senior personnel designated at 'chief physiotherapists') covering these treatment areas, each working in one of the treatment areas. The Surgical, Exercise Rehabilitation and Outpatient areas do not have supervisors but this is regarded as non-essential as some of the most senior physiotherapists work in the Surgical and Exercise rehabilitation areas. In the Outpatient area there are also experienced physiotherapists.

1.3. THE APPROACH OF THE STUDY

Due to the weakening economy in South Africa, available funding for all services have decreased. It therefore becomes essential to establish optimal practices to deal with the changing environment. It is however not always clear what the optimal approach is and therefore it requires active investigation to determine it.

The initiation of this study was to determine how to realign the department to the new circumstances. Identification of problems was the first concern and the second focus point was to find solutions to the problems in the Physiotherapy Department of a state-

funded hospital. Problems experienced in the Physiotherapy Department were probably generic to several departments in any state-funded hospital. It would be beneficial to see whether Industrial Engineering principles were applicable to a department in a state-funded hospital.

Industrial Engineering Principles were applied in the process of determining and addressing the relevant issues. Information was obtained by conducting workshops, by personal interviews with the physiotherapists and physiotherapy assistants, as well as the completion of timesheets and doing statistical analyses of the timesheets.

Workshops were facilitated and several known techniques such as the brainstorming technique and the nominal group technique were used. Due to the staff cuts capacity constraints were identified as a major problem. The available capacity would affect quality of treatment, motivation and quality of work life of employees. During this study it also became clear that low motivation was another major problem. Due to escalating costs, maintenance of equipment is not adequate, resulting in an unnecessary reduction of equipment life cycles. Lack of availability of equipment could have significant consequences and in extreme cases could even affect life expectancy. Other unrelated issues were salaries, communication and a dirty environment.

The approach followed with the statistical analysis was to use confidence intervals to compare the standard treatment times with the actual treatment times. Hypotheses testing were used to determine whether it would be possible to standardise on similar

treatments in different treatment areas. The required capacity calculations were based on the amount of time spent on direct patient care by the physiotherapists during the six-month period. In 2000 the Physiotherapy Department performed an audit and the results of the audit (De Charmoy and Eales, 2000) were compared to the results obtained in this study. The information of the audit was based on one day's data while the data collected for statistical processing in this thesis was collected daily for a six-month period.

In a working environment affected by limitation of funding it needs to be determined how to manage funds optimally and how to minimise costs while maintaining an acceptable level of quality.

1.4. ORGANISATION OF THE THESIS

Chapter 2 discusses the method of analysis and some results of the data collection process. Chapter 3 discusses the statistical methods used to analyse the timesheets. Statistical analyses were performed to determine standard times for treatments, whether work could be standardised across treatment areas within the Physiotherapy Department and what the load and required capacity was over a six-month period. Chapter 4 discusses the results of the statistical tests. Thereafter Chapter 5 addresses the major issues found during the analysis of the problem. Chapter 6 deals with recommendations.

CHAPTER 2

2. DATA COLLECTION AND RESULTS

2.1 INTRODUCTION

This study started with the initiation of an analysis phase, to identify the required changes the Physiotherapy Department needed to make. This chapter explains the data collection procedure, some of the results obtained during the analyses phase as well as conclusions.

2.2 PROCEDURE

The researcher facilitated workshops with the entire Physiotherapy Department of the Johannesburg Hospital. Each workshop was held on a Friday during a two-hour session. A vision, mission and the core values were identified for the department in addition to the fifteen most pressing or frustrating problems. Techniques used during the workshops were Facilitation, Brainstorming (Reicher, 1999) and the Nominal Group Technique (Delbeck and Van den Ven, 1971).

During the second workshop, the group agreed to complete timesheets to provide information on the available capacity. The supervisors assisted in the development of the timesheets. Statistical analyses were performed to determine standard times for treatments, whether work could be standardised across treatment areas within the Physiotherapy Department and what the load and required capacity was over a six-month period.

2.3 FACILITATION

To ensure optimal use of time, the use of specific facilitating skills assisted the researcher in the running of these workshops. The facilitator's role is to ensure that the group reaches a specific goal as required for a specific intervention. The facilitator assists the group in keeping the focus on the goal and to ensure that all individuals are involved. The facilitator therefore plays an essential role in the smooth running of the workshops. All individuals should be involved to ensure commitment to the decisions taken and to obtain the best possible input (Reicher, 1999).

At the start of the workshops, the group agreed to adhere to specific workshop rules. The reason for defining specific rules is because of the group size. It is much easier to manage a large group if some ground rules are in place.

These rules for the workshops were:

- No criticism of ideas
- Listen to the person talking
- Confidentiality
- Not too much dialogue
- Not to answer the beeper or cell phones unless a medical emergency occurred.

The group consisted of the eighteen physiotherapists, six part time physiotherapists, five physiotherapy assistants, the head of the department as well as the secretary. There were five supervisors; the rest of the physiotherapists differed in age and

experience. The physiotherapists worked in different treatment areas, these areas operated independently of each other. Although all were able to do the work in all the treatment areas, due to preference and experience they only worked in a treatment area, other than the usual, if there was an emergency. During the workshops, the observation was that there was a tendency for individuals to want to protect their treatment area. This made the need for the department to focus on a central goal even more important and to make the physiotherapists aware that the focus is on improving circumstances for all.

Facilitation of the group was difficult due to the size of the group as twenty-nine individuals attended each session. It may have been beneficial to break the group up into smaller groups. This was difficult due to the fact that groups would then have to be scheduled at various times and there were time constraints from the physiotherapists' side. It would also have been far more difficult to obtain a consensus decision if the physiotherapists were not all together when making the decisions. Originally, it also seemed like a good opportunity to bring everyone together as a team.

2.4 DEFINING VISION AND CORE VALUES

The reason for firstly defining the vision and core values was to ensure a common understanding and a common objective for the department as a whole. To define the vision as a department, physiotherapists had to focus on what they saw as the goal of

the department, and what the essential contribution of the department was. They defined a vision based on how they would like to see the department develop.

According to Chase and Aquilano (1995), the two essential messages to communicate to the employees are, first to make it clear that there is a need for action and secondly the vision should be clear. In the Physiotherapy Department, it was clear to all, that there were many problems and a need for change. Therefore, the starting point was to define the vision. Ideally, the objectives for reengineering should be included in the vision. The objectives of reengineering in this instance would be to ensure optimal physiotherapy treatment under the present external conditions.

The application of brainstorming techniques helped the definition of the vision and core values. When using the brainstorming technique the group generates as many as possible ideas in a short period (Reicher, 1999). The facilitator explained the reason for the brainstorming session as well as the technique. Participants then gave ideas for the vision and core values, the facilitator wrote them down on a flip chart but did not allow any discussion of any of these ideas at this stage.

The department defined their core values to clarify as a group the manner in which they wanted to deal with each other, with patients, other hospital staff and the community. Values help to direct decisions and actions. The department agreed on what the culture should be based on, within the department.

There is a critical relationship between human resources and change and the achievement of goals. The process of the group defining the vision and core values as well as identifying major concerns within the department was also conducive to developing a greater sense of belonging to a group and to working together.

2.4.1 Vision

The Physiotherapy Department's vision is:

To provide through teamwork in a good working and learning environment, the best possible, most effective physiotherapy service

This vision was a consensus vision, the group having decided on it together. The head of the department thereafter had posters made with the vision. At the year-end function, several of the retired physiotherapists that had a significant influence on the department before retirement were invited. The hospital director overseeing the Physiotherapy Department was also invited. This event launched the vision. The vision is on display in the department at important locations.

2.4.2 Core Values

Eleven core values were identified. They were:

1. Respect for individuals
2. Empathy
3. Integrity - honesty

4. Accountability
5. Ethical Conduct
6. Commitment
7. Role Models to the community and the students
8. Respect for cultural diversity
9. Effective communication
10. Acknowledgement of performance
11. Responsible and reliable physiotherapists

2.4.2.1 Description of core value

- Respect for individuals – To have regard for each other and oneself, to consider opinions and differences and to treat each other with dignity and without judgement.
- Empathy – To sympathise with and be compassionate to patients, to help and be merciful with patients. Treat the patients holistically and with dignity. Extending empathy to staff members and being understanding of their problems.
- Integrity – honesty. Keeping promises and admitting mistakes. Direct all the actions of the physiotherapists in the department at upholding the departmental name and ensuring that members of the department are reliable and that outsiders see the physiotherapy profession as such. When it is not possible to keep a promise, notify affected parties.

- Accountability – Accept responsibility for the success of the department. Prepared to account for one's own conduct
- Ethical behaviour – Morally correct behaviour
- Commitment – To pledge, involve or bind oneself to the department and to provide the best possible service
- Role models for students, patients and each other – Setting an example with regard to the conduct as a physiotherapist and as physiotherapy assistants. Instruct the students in these values as well.
- Respect for cultural diversity – Acknowledge language barriers, different behaviour norms, and unfamiliar religious customs of all cultures. Realise that culturally diverse teams have strength. Make an effort to get to know the behaviour norms of each other, discuss differences. Extra time may be required to acquire these skills.
- Effective Communication - Communicate regularly and openly, listen to each other irrespective of position. Clear communication channels should be established and be obvious to everyone. Sub-ordinates should say what they really think. Communication should be in a clear and understandable manner. Attempt to understand each other.
- Acknowledge performance – recognise, show that performance has been noticed, express appreciation of individuals publicly (e.g. at departmental meetings). Better performance should be encouraged

- Responsible and reliable individuals – Accountable, well grounded, trustworthy, dependable and providing a quality service.

2.5 KEY ISSUES IN THE DEPARTMENT

After establishing the vision and the core values, the next step was to identify the key issues within the department. The technique used in the workshop to identify these issues was the nominal group technique (Delbeck and Van den Ven, 1971).

Nominal group technique is one of the seven tools associated with a quality improvement cycle. The selection of this technique for this specific workshop was because of the supervisors, physiotherapists and the physiotherapist assistants as well as the head of the department were together in the workshop and participation from all parties was required. Time was also very limited as the physiotherapists were very busy and needed to interrupt work to attend workshops. With the nominal group technique it is possible to overcome some of the problems related to group problem solving, such as:

- Too strong a leader dominates the group
- Certain members do not participate because others dominate
- Some members are shy
- Some members use persuasive politics
- Time is wasted by unnecessary discussion
- A certain way of thinking is followed that is totally off-course
- Cultural differences hinder the discussion.

The issues that were apparent during the workshop were non-participation and some unnecessary discussion. Cultural differences were also apparent during the workshops. During open discussion, not all the individuals present in the workshop participated. By using the nominal group technique, it was possible to obtain the input of all the individuals. Unnecessary discussion was not possible when using the nominal group technique as the ideas are not discussed but merely given and captured on the flip chart.

The group followed strict procedures to ensure effective decision-making in terms of time and creativity. It is possible to address only one problem at a time, when this technique is used.

Benefits of the technique are (Delbeck and Van den Ven, 1971) :

- Thoughts are stimulated and structured
- It reduces group interaction and saves time
- It assists in finding creative solutions
- It assists in reaching consensus decisions
- Good ideas are easily separated from the rest
- It prevents the position and authority of a person as well as politics from confusing the decision making process

The group leader has specific duties when using this technique and should be careful not to play too strong a role (Delbeck and Van den Ven, 1971). In this instance the

group leader had no personal involvement in the department and could easily remain uninvolved and stick to the defined role of the group leader. The specific duties of the group leader include, keeping time for every step, to keep record of every idea given by the group and to ensure that ideas are to the point. The leader needs to ensure that discussion and critique of ideas do not hamper the process. The leader should explain the voting procedure, keep count of the score and summarise the results of the exercise.

The specific steps followed in the workshop were:

- Each participant received a set of cards for the purpose of the exercise.
- Each participant wrote down a list of ideas on areas that needed improvement.
- The leader then recorded each person's ideas on a rotation-basis and each idea was numbered.
- Every participant submitted one idea per round.
- Participants removed the ideas from their own list, as they or others in the group submitted same ideas.
- The facilitator recorded all ideas that were similar to ensure that the originator should not feel embarrassed and withdraw from further discussion.
- All ideas recorded were visible to all participants present.
- After ensuring that all the ideas were exhausted, the facilitator needed to ascertain whether the members all understood the meaning of each idea.

Most ideas were very clear and no further explanation was required.

Time did not permit the discussion of the various ideas. Combination and rephrasing some ideas eliminated some points. This only happened when all participants were comfortable with the results. Other ideas remained although they were similar to ensure that no one withdrew from the discussions. Time was also a limiting factor and discussion of some points was not possible in the available time. These points remained as the group leader felt it would be best to leave them rather than lose the group's interest in the exercise.

Each participant then used the cards originally handed out. They wrote each idea on a separate card. They then wrote the number of the idea in the topmost left corner of the card. The participants then rated ideas from the most important to least important. The most important idea got the highest number, corresponding with the number of ideas generated e.g. for 10 ideas generated, the most important idea is assigned a 10, the worst idea is given a 1.

As time was limited, it was not possible to determine the most important issues in the workshop. The cards were gathered and analysed outside of the workshop. From the listings of the participants, it was possible to obtain the fifteen major areas for improvement. The ideas with the highest scores were most important. If ideas had the same score, the idea with the most single votes was the more important idea.

The fifteen major areas that required improvement according to the participants were:

1. Salary
2. Staff Shortage
3. Leave
4. Blocked telephones
5. Low Motivation
6. Work over weekends and overtime is badly planned – not optimised.
7. Not enough time to give best service or more than adequate service.
8. Implementation of decisions/solutions. Not everyone is involved.
9. Inadequate time and opportunities for learning. No time for individual professional growth or interests.
10. Lack of equipment – not repaired, dirty and not maintained.
11. Dirty environment – not because of a shortage of staff.
12. Stress.
13. Teambuilding exercises, courses and congresses.
14. Communication – staff do not always know what is going on.
15. Career development of assistants.

Issues 2, 7, 9, 12 and 15 are directly related. It is due to staff shortages that there is no back up in the event of individuals being unable to be at work due to circumstances out of their control e.g. sick leave. Staff shortages are also directly responsible for the lack of time to provide the best service to patients and for staff to spend time on learning and individual professional growth. It also makes it difficult to help assistants to develop

their careers. The shortage of staff and the related constraints is probably the largest contributor to stress. From personal interviews with individuals, it became clear that one of the main reasons why physiotherapists apply for a position at the Johannesburg Hospital is because they still believe it to be an excellent opportunity for learning. That is also why it is especially frustrating to individuals when they do not find time to learn and grow professionally as they could be earning a lot more elsewhere.

2.6 CONCLUSION

This chapter discussed the human issues in the Physiotherapy Department. It described the method of identifying the most pressing issues. The chapter also covered various techniques available to ensure optimal input from groups and their effective use in the workshops.

Ensuring common vision and core values provide direction for the department to focus on for the future and the principles this would be based on.

Based on the workshops it seemed as if the biggest problem was insufficient capacity. This would also have an impact on several other issues such as low motivation, leave, lack of communication and a feeling of not being part of a team. Further investigation was therefore essential to determine whether there really was a shortage of staff and if not then to determine the actual cause of the problems.

CHAPTER 3

3. STATISTICAL METHODS

3.1 INTRODUCTION

This chapter explains the statistical methods used for the analysis of the data gained during this study of the Physiotherapy Department. During the initial analysis of the department, it became apparent that there were probably capacity constraints. To confirm that there was indeed a shortage of staff, the physiotherapists agreed to complete timesheets and statistical methods were used to analyse the timesheets and determine available capacity. Statistical tests were also undertaken to determine standard times for treatments and whether work could be standardised across treatment areas within the Physiotherapy Department.

3.2 TIMESHEETS

To confirm that there was indeed a shortage of staff, the physiotherapists agreed, during the second workshop, to develop and complete timesheets. If concrete evidence is available, it is much easier to motivate for additional personnel from authorities. The agreement from the staff was to complete the timesheets for a period of six months.

Subsequently the development of the timesheets in conjunction with the supervisors followed (See Appendix 1). Each treatment area of the department required different timesheets as the direct patient care or treatment types differed in each area. Each supervisor (chief physiotherapist) also indicated the standard time various treatments

should take. The supervisors were of the opinion that if time spent on a patient is less than the standard time indicated, treatment of the patient was not adequate.

There are three main sections in the timesheets; these sections are: Direct patient care; indirect patient care and "other activities". Direct patient care includes all hands-on treatment of patients. Indirect patient care includes education of the caregiver, teaching the patient and/or the caregiver how to manage the disease; ward rounds; contact with doctors, nurses and caregivers, as well as waiting time. "Other activities" include meetings, administration, their personal education and development, education of other groups (such as nurses and doctors) as well as personal time such as tea breaks and lunch.

The difference between education and management in indirect patient care is:

Education is teaching the patient and or caregiver about a disease, what the disease is and what the symptoms are and how to cope with the disease.

Management is teaching the patient and, or the caregiver how to manage someone with the disease. Typically this will include the medication they need to take, how often and what type of exercises they need to do or how often they need to come back for check-ups etc.

3.3 STATISTICAL ANALYSIS

Microsoft Excel was used to analyse the data obtained from the timesheets. Statistical analysis was performed to determine:

- Standard times for treatments,
- Whether there was sufficient capacity available in the department as a whole (what the load and required capacity was over a six-month period) and
- Whether standardisation could take place across treatment areas.

The approach followed was to first compare the various treatment times to the standard times given by the supervisors. This allows for the conclusion that either the standard times are correct or not, and if not, perhaps whether the standard times need to be adjusted, or whether we should conclude that treatments are consistently substandard. The next step would be to compare performance times, of similar treatments in different treatment areas. This would indicate the possibility of standardising certain treatments across treatment areas. Thereafter a comparison was made of the percentage split between the time the physiotherapists spent on direct patient care, indirect patient care and "other activities" in each treatment area and the possible reasons were identified. This indicates the difference between treatment areas in time spent on various activities and whether there are valid reasons for the time spent or whether there may be an opportunity to optimise times spent with patients. The amount of time needed to treat all the patients that require physiotherapy was then used to calculate the number of physiotherapists required in the department, as direct patient care forms the most critical part of the physiotherapists duties.

To compare the treatment times with the standard times the confidence intervals of the mean of treatment times were calculated and compared with the standard times. Standard times, skewed away from the middle, were a cause for concern and indicate that rework was probably necessary. The confidence intervals were prepared for each individual treatment type. The assumption made to calculate the confidence intervals was that the variance was unknown, but the times of different replications of the same treatment service, had a normal distribution. For treatments where 30 or more observations were available, we assumed the distribution of the sample means has an approximate normal distribution (Hines and Montgomery, 1980). The central limit theorem indicated that under general conditions the distribution of the sample means had an approximate normal distribution as the sample size (*n)* increased (Lehmann, 1986). Therefore it can be assumed that the sampling distribution is a normal distribution for n>30 (Hines and Montgomery, 1980). Only those treatments with sufficient (n>30) data points were discussed. The confidence intervals were only calculated for n larger than 30. Hines and Montgomery (1980) supported the use of the normal distribution for n>30.

Subsequently a comparison between specific treatment times of similar activities in different treatment areas helped determine whether standardisation across treatment areas was possible. Hypothesis tests on the means of the similar treatments were made to determine whether the treatment times were the same or not. Again the

assumption for treatments where more than 30 samples of specific treatments were available, based on the central limit theorem, was the normal distribution.

The percentage of time spent by a physiotherapist on direct, indirect treatment and "other activities" was determined for each treatment area. The various treatment areas had a different distribution of time across the direct, indirect or "other activities" components due to the nature of the treatment area. The supervisors confirmed the results.

The load and capacity was then determined by calculating the average time required per treatment area to treat all the patients that needed hands-on treatment or direct patient care. The average time required per day per treatment area, to treat all patients, summed for all treatment areas, gave the total number of hours, for which Physiotherapy treatment was required in the department. Based on the average percentage of time spent on direct patient care the number of physiotherapists the department required was calculated. A comparison between this number and the current number indicated the capacity constraints.

Insufficient capacity will influence quality of treatments, cost of patient care as well as quality of work-life for physiotherapists. Excessive capacity would lead to unnecessary increase in cost (Chase and Aquilano, 1995) and due to limited funds other departments would suffer. It was therefore essential to determine what the current capacity of the

Physiotherapy Department was, as well as the current load to determine what the need was in the department. This information was also required to determine the optimal capacity levels.

3.3.1 Confidence Intervals

The confidence interval can be interpreted as follows: If many random samples are collected, in (1- α) 100% of the samples the true value of the parameter will be included in the interval. Therefore, it does not make sense to use the probability indication. It makes sense to indicate the percentage (%) confidence we have that it does contain the relevant parameter.

The confidence interval specifies both the upper and lower limit within which (1- α) 100% of the samples will contain the actual parameter. Ideally the confidence interval should be a relatively short interval but indicated with a high percentage of confidence.

The reason for calculating the confidence intervals on the mean was to determine whether the standard times were within the confidence intervals for the mean of each treatment type and therefore accurate. The decision was to use the 95% confidence interval for this exercise.

Assume the following nomenclature

Lower Limit - l

Upper limit - u

Probability – P

Mean - μ

α is the confidence coefficient.

$$l \leq \mu \leq u \tag{3.1.}$$

$$P(l \leq \mu \leq u) = 1 - \alpha \tag{3.2.}$$

We assume that the sampling distribution is approximately normal if the conditions of the central limit theorem apply.

$$P(-z_{\alpha/2} \leq Z \leq z_{\alpha/2}) = 1 - \alpha \tag{3.3.}$$

By rearranging from the standard normal distribution, we obtain the following:

$$P\left(X - \frac{(z_{\alpha/2})\sigma}{\sqrt{n}} \leq \mu \leq X + \frac{(z_{\alpha/2})\sigma}{\sqrt{n}}\right) = 1 - \alpha \tag{3.4.}$$

$$l = x - \frac{(z_{\alpha/2})\sigma}{\sqrt{n}} \tag{3.5.}$$

$$u = x + \frac{(z_{\alpha/2})\sigma}{\sqrt{n}} \tag{3.6.}$$

In the exercise the confidence intervals were calculated by first calculating the sample average (x) and the sample standard deviation (σ) for each data set or times for specific treatment. Each data set was the various times for a specific treatment type in a specific treatment area. The AVERAGE and STDEV functions were used in Excel for this purpose. Then the CONFIDENCE function was used to calculate the confidence interval.

3.3.2 Hypothesis Tests

To measure empirical evidence we use hypothesis tests (Hines and Montgomery,1980). Normally formulation of hypothesis tests is as a pair of incompatible statements about the value of a parameter. The statement is about the population or distribution under study and not the sample taken. The goal is to decide whether a formulated hypothesis is correct or not. To make this decision it needs to be determined whether there is strong evidence against the null hypothesis (H_0) and in favour of the alternative hypothesis (H_1). In the study of the Physiotherapy Department, hypothesis testing was used to verify the theory that similar treatments in different treatment areas should be the same. The use of hypothesis testing could extend to determine whether experimental conditions have changed or to determine conformance.

Two possible errors can occur when making use of hypothesis testing.

- Rejecting the null hypothesis when it is correct, this is called a type I error and the probability of this error occurring is given the symbol α

or

- Accepting the null hypothesis when it is incorrect, this is a type II error and the symbol β indicates the probability of this error occurring.

Tests need to carried out in such a way that the probability of both types of errors are minimised

The true value of the parameter determines the value of β. We can consider β as a measure of the ability of the test to determine the variation from the null hypothesis H_0. The location of the region in which the values of test statistic are, determines the value of α. The value of α can be set at a desired level; therefore, the rejection of H_0 is a strong conclusion. Since β is dependent on the sample size and the extent to which the null hypothesis (H_0) is false - we never accept H_0 we merely fail to reject the null hypothesis. Therefore as a default conclusion it is a weak conclusion. There are therefore two choices, we reject the null hypothesis or we fail to reject the null hypothesis. When doing hypotheses testing we are in fact interested in the validity of the alternative hypothesis. If there is insufficient evidence in favour of the alternative hypothesis (H_1) we reason that the data obtained is not particularly unlikely under the null hypothesis (H_0)

The smallest level of significance to reject the null hypothesis H_0 is called the P-value of the test. The P-value is a significant value because it is useful to know the precision level with which one could reject the null hypothesis.

A hypothesis test consists of the following:

- The null hypothesis (H_0) and the alternative hypothesis (H_1).
- The test statistic, T
- The region in which the values of T will lead us to reject H_0 - the critical region
- The probability of making a type 1 error - the significance level, α

In this instance the hypothesis was set up to determine whether the same type of treatment (direct patient care) in different treatment areas, x and y, needed the same amount of time and could therefore be standardised.

H_0: μ_x (direct patient care) = μ_y (direct patient care) (3.7.)

H_1: μ_x (direct patient care) > μ_y (direct patient care) (3.8.)

The test is called the inference on the difference in means of two normal distributions with unknown variance.

It is not clear whether the two treatment areas have the same variance in treatment times for a specific treatment type and therefore the application of two different statistical procedures is required. The first statistical procedure is for the assumption that variances are equal but unknown. The second statistical procedure is for the assumption that variances are not equal. Rejection of the null hypothesis (H_0) for both these cases indicates that the, null hypothesis (H_0) can be rejected whether the variances are equal or not.

The significance level selected was α = 0.05 this is equivalent to rejecting the null hypothesis with 95% confidence. The degrees of freedom are represented by n1+ n2 – 2.

For the first case where variances are assumed equal but unknown where X_1, X_2, S_1^2, S_2^2 are the sample means and sample variances. Since both S_1^2 and S_2^2 estimate the common variance, the combination of the two is possible.

$$S_p^2 = \frac{(n_1 - 1)\, S_1^2 + (n_2 - 1)\, S_2^2}{(n_1 + n_2 - 2)} \qquad (3.9.)$$

To test the hypothesis we compute the test statistic

$$t_0 = \frac{(X_1 - X_2)}{S_p \sqrt{(1/n_1 + 1/n_2)}} \qquad (3.10.)$$

If H_0 is true t_0 is distributed as $t_{n1 + n2 - 2}$. Therefore if $t_0 > (t_{\alpha/2,\, n1 + n2 - 2})$ then we reject H_0 for a one-sided hypotheses.

For the second case where variances are assumed not equal and unknown where X_1, X_2, S_1^2, S_2^2 are the sample means and sample variances. There is not an exact t statistic available for testing the null hypothesis in this case. The statistic

$$t_0^* = \frac{(X_1 - X_2)}{\sqrt{(S_1^2/n_1 + S_2^2/n_2)}} \qquad (3.11)$$

is approximately distributed as t if the null hypothesis is true. The degrees of freedom in this case would be

$$v = \frac{\{(S_1^2/n_1 + S_2^2/n_2)^2\}}{(S_1^2/n_1)^2 / n_1 + 1] + [(S_2^2/n_2)^2 / n_2 + 1]} - 2 \qquad (3.12)$$

Therefore, for variances assumed unknown, the calculation of the hypotheses is as in the description of the first case above. Although in this case the t_0^* is used for the test statistic and the degrees of freedom $n_1 + n_2 - 2$ is replaced by v. (Hines and Montgomery, 1980)

3.3.3 Other Sources of Information

In most instances, there are no hospital records of the past treatments and times of treatments. The available records in this case were of no value to compare the results obtained in this study with.

In 2000 the Physiotherapy Department performed an audit and the results of the audit were compared to the results obtained in this study. The method followed by the Physiotherapy Department was to conduct an audit in the Johannesburg Hospital on one specific day (De Charmoy and Eales, 2000). They assessed all in-patients, on this day, for pathological condition, the need for physiotherapy and the amount of time required per physiotherapy treatment and the number of physiotherapy treatments required in a day. A senior physiotherapist working in the area and a member of the university staff who teaches and supervises students within that clinical area performed the assessment of each area. The two assessors worked independently to ensure that there was impartiality in determining the needs in the wards. They used information sheets with the following parameters:

- Number of patients in the ward
- Diagnosis of the patients
- Whether or not the patients would require physiotherapy
- If the patient required physiotherapy then the choice of physiotherapy was as follows: respiratory condition, musculoskeletal, ambulation /exercise, neurological or just a check.
- The auditors estimated the number of treatment units - each unit was a 15-minute session thus the figure 2 meant half an hour of treatment.
- Finally, the auditors also estimated the number of contacts the patient should have in a day. That is if the number of units read 4 and the number of contacts was 2 then the patient was assessed to require a two-treatment session for a total of 1 hour. (De Charmoy and Eales, 2000.)

Based on this information the required number of eight-hour units was established. Thereafter it was important to determine time spent on direct patient care daily. To determine the percentage of time spent on direct patient care the auditors randomly chose physiotherapists and assigned them to assessors.

The assessor then arrived to follow the physiotherapist around for a day. The physiotherapists were not aware which day this was going to happen in an attempt to get as true a picture as possible. The assessor then documented throughout the whole day the following categories:

1. Direct patient care

2. Indirect patient care
3. Social - this involved tea, lunch, social telephone conversations i.e. anything not related directly to a patient.

This data was then put together and the average percentage of time spent on direct patient care was established. Based on the percentage of time spent on direct patient care and the number of eight-hour units required, the number of physiotherapists needed in the hospital was determined.

This study is not an accurate indication of the capacity requirements because it only gives a snapshot of conditions in the hospital on a single day. Time intervals of 15 minutes were used to indicate the time required for treatments and one would not be able to determine if physiotherapists used more or less than a complete unit per treatment.

CHAPTER 4

4. RESULTS OF STATISTICAL ANALYSIS

4.1 INTRODUCTION

The objective of this chapter is to describe the results of the statistical analysis of the time sheets completed in the Physiotherapy Department over a six-month period. This chapter also discusses the key issues identified by the statistical analysis and the probable next steps required.

4.2 CONFIDENCE INTERVAL TEST RESULTS

4.2.1 Confidence Intervals - Exercise Rehabilitation

Table 1: Confidence Intervals - Exercise Rehabilitation

In Table 1: The standard times are presented as well as the mean (average) and the confidence intervals of the actual treatment times for exercise rehabilitation. There is also a comparison between the confidence intervals and the standard times as well as an indication as to whether the standard is higher or lower than the confidence interval.

Treatment type	Std. time Indicated In Minutes.	Mean	Std. Deviation	N	Std. Time Vs. Confidence Interval	Lower	Upper
Adult Cardio-thoracic patients. (have undergone valve/open heart surgery)	15	18.72	6.09	74	Low	17.33	20.10
Paediatric cardio-thoracic patients (Have undergone valve/open heart surgery)	35	22.5	8.05	54	High	20.35	24.65
Acute pre discharge	15	19.84	7.24	32	Low	17.34	22.35
Thoracic surgery	35	19.42	8.52		High	16.15	22.70
Other Cardiac exercise. Test	45	31.83	13.36	30	High	27.05	36.61
Cardiac risk factor assess (in patient)	35	19.78	7.38	46	High	17.65	21.91

Std: Standard N: The number of observations

In the exercise rehabilitation area, the standard times were mostly higher than the confidence intervals. This would indicate that either the quality of the work is not adequate or the standard times are incorrect.

4.2.2 Confidence Intervals - Intensive Care Unit (ICU)

Table 2: Confidence Intervals - Intensive Care Unit (ICU)

In Table 2: The standard times are presented as well as the mean (average) and the confidence intervals of the actual treatment times for the Intensive Care Unit. The confidence intervals are also compared with the standard times and an indication is given as to whether the standard is higher or lower than the confidence interval.

Treatment type	Std. time Indicated In Minutes	Mean	Std. Deviation	N	Std. time Vs. Confidence Interval	Lower	Upper
Ventilated patient with complications	45	30.20	2.54	302	High	29.91	30.49
Ventilated patient without complications	30	33.26	7.47	42	Low	31.00	35.52
Non-Ventilated patient with complications	45	23.31	9.74	129	High	21.63	24.99

Std: Standard N: The number of observations

In the ICU area, the standard times were mostly higher than the confidence intervals. This would indicate that either the quality of the work is not adequate or the standard times are incorrect.

4.2.3 Confidence Intervals – Medical

Table 3: Confidence Intervals - Medical

In Table 3: The standard times are presented as well as the mean (average) and the confidence intervals of the actual treatment times for the medical area. The confidence intervals are also compared with the standard times and an indication is given to whether the standard is higher or lower than the confidence interval.

Treatment type	Std. time Indicated In Minutes	Mean	Std. Deviation	N	Std. time Vs. Confidence Interval	Lower	Upper
Chronic Respiratory conditions	45	36.60	10.60	259	High	35.30	37.89
Acute Respiratory condition	15	14.93	3.83	218	Within	14.42	15.44
CVA's /paraplegia	15	15.77	6.25	124	Within	14.67	16.87
Intercostal drain	30	22.55	7.06	46	High	20.51	24.59
Other neurological conditions	30	25.55	6.96	100	High	24.19	26.91

Std: Standard

N: The number of observations

CVA: cerebrovascular accident (stroke)

In the medical area, the standard times were mostly higher than the confidence intervals. This would indicate that either the quality of the work is not adequate or the standard times are incorrect.

4.2.4 Confidence Intervals – Outpatient Department (OPD) 259

Table 4: Confidence Intervals – Outpatient Department (OPD) 259

In Table 4: The standard times are presented as well as the mean (average) and the confidence intervals of the actual treatment times for the OPD 259 area. The confidence intervals are also compared with the standard times and an indication is given to whether the standard is higher or lower than the confidence interval.

Treatment type	Std. time Indicate In Minutes	Mean	Std. Deviation	N	Std time Vs. Confidence interval	Lower	Upper
Skin disease – Psoriasis – PUVA (Light)	20	30.72	27.20	56	Low	23.60	37.84

Std: Standard N: The number of observations

In the OPD 259 area, the standard time is lower than the confidence intervals. This would indicate that the standard time is incorrect.

4.2.5 Confidence Intervals - Surgical

Table 5: Confidence Intervals - Surgical

In Table 5: The standard times are presented as well as the mean (average) and the confidence intervals of the actual treatment times for the surgical area. The confidence intervals are also compared with the standard times and an indication is given to whether the standard is higher or lower than the confidence interval.

Treatment type	Std. time Indicated In Minutes	Mean	Std. Deviation	N	Std. time Vs. Confidence Interval	Lower	Upper
Chronic respiratory conditions	20	26.62	7.18	147	Low	25.46	27.78
Amputees	20	22.04	7.52	112	Within	18.64	23.43
Acute Respiratory conditions	15	18.37	6.60	118	Low	17.18	19.56
Patients Mobilisation	15	16.10	5.06	153	Low	15.30	16.91
IC drains	10	18.93	2.06	117	Low	18.56	19.31

Std: Standard

N: The number of observations

IC drains: Intercostal drains

In the surgical area, the standard times were mostly lower than the confidence intervals. This would indicate the standard times are incorrect.

4.2.6 Confidence Intervals – Neurology

Table 6: Confidence Intervals - Neurology

In Table 6: The standard times are presented as well as the mean (average) and the confidence intervals of the actual treatment times for the neurology area. The confidence intervals are also compared with the standard times and an indication is given to whether the standard is higher or lower than the confidence interval.

Treatment type	Std. time Indicated In Minutes	Mean	Std. Deviation	N	Std. Time Vs. Confidence Intervals	Lower	Upper
CVA (Stroke)	45	30.57	15.51	233	High	28.58	32.56
Head injuries	45	31.99	16.47	115	High	28.97	34.99
Paraplegia	30	38.37	27.06	51	Low	30.94	45.79

Std: Standard N: The number of observations

CVA: Cerebrovascular accident (Stroke)

In the neurology area, the standard times were mostly higher than the confidence intervals. This would indicate that either the quality of the work is not adequate or the standard times are incorrect.

4.2.7 Confidence Intervals – Orthopaedics

Table 7: Confidence Intervals - Orthopaedics

In Table 7: The standard times are presented as well as the mean (average) and the confidence intervals of the actual treatment times for the orthopaedic area. The confidence intervals are also compared with the standard times and an indication is given to whether the standard is higher or lower than the confidence interval.

Treatment type	Std time Indicated In Minutes	Mean	Std Deviation	N	Std. Time Vs. Confidence Intervals	Lower	Upper
Bed exercise and education 1st treatment	30	28.02	4.86	57	High	26.76	29.28
Bed exercise and subsequent treatments	15	18.16	6.41	214	Low	17.30	19.02
Patients Mobilisation	15	24.05	7.64	210	Low	23.02	25.09
Amputees	20	22.10	8.41	60	Low	20.50	23.70

Std: Standard N: The number of observations

In the orthopaedic area, the standard times were generally lower than the confidence intervals. This would indicate that the standard times are incorrect. The Physiotherapists in the orthopaedic area worked more overtime than the physiotherapists in any other area.

4.2.8 Confidence Intervals – Paediatrics

Table 8: Confidence Intervals - Paediatrics

In Table 8: The standard times are presented as well as the mean (average) and the confidence intervals of the actual treatment times for the paediatric area. The confidence intervals are also compared with the standard times and an indication is given to whether the standard is higher or lower than the confidence interval.

Treatment type	Std. time Indicated In Minutes	Mean	Std. Deviation	N	Std. time Vs. Confidence intervals	Lower	Upper
Respiratory – uncomplicated	15	16.31	4.98	84	Low	15.25	17.37
Respiratory – complicated	30	32.06	7.04	129	Low	30.85	33.28
Rehabilitation – exercise chronic	45	40.59	15.35	50	High	36.33	44.84
Orthopaedics	20	15.47	9.29	111	High	13.72	17.17
Neurological	60	47.52	16.36	168	High	45.04	49.99
Rehabilitation exercise – early	20	21.28	6.71	97	Within	19.49	23.07

Std: Standard N: The number of observations

In the paediatric area, the standard times were both higher and lower than the confidence intervals. The paediatric area has some of the most experienced physiotherapists in the department. These results suggests that the standard times should be reworked across the board, because the data was gathered from experienced physiotherapists and are therefore likely to be of low variance.

4.3 Comparison Between Treatment Areas

The purpose of this section was to determine whether it was possible to standardise across treatment areas. Therefore it was required to determine whether it was statistically justifiable to conclude that the standard times of treatments should depend only upon the type of treatment. The alternative is standard times are dependent upon both the type of treatment and the treatment area where the treatment was performed. The results presented below indicate that the standard times depended upon the treatment type and the treatment area where the treatment was performed.

Although sufficient data is available in some of the tests to permit the assumption that the difference in sample means is normal we take the conservative approach of assuming that the population variances are unknown.

The P-values were calculated using the TTEST function in Excel, a two-tailed distribution was used and the type set equal to 2 for two-sample equal variance and set to 3 for two-sample unequal variance. The P-Values (Hines and Montgomery, 1980)

reported below are the minimum significance levels at which the null hypothesis (H_0) can be rejected in each case. A P-value of 0.05 corresponds to a confidence level of 95%. In all hypotheses investigated, we use a significance level of 0.05 (a standard assumption) to frame our conclusions.

4.3.1 Comparison of treatment of chronic respiratory conditions in the Medical and Surgical areas

The mean value of the treatment sample (and standard deviation in parentheses) were as follows:

- Medical area: 36.60 (10.60) min, n = 259.
- Surgical area: 26.62 (7.18) min, n = 147

H_0: average time spent on chronic respiratory conditions in the Medical area = average time spent on chronic respiratory conditions in the Surgical area.

H_1: average time spent on chronic respiratory conditions in the Medical area > average time spent on chronic respiratory conditions in the Surgical area.

If the population variances are equal the P-value is P = 7.603E-22 < 0.05. If the variances are unequal the P-value is P = 9.715E-26 < 0.05. In either case the P-values are smaller than 0.05. Therefore we can reject the null hypotheses with 95% confidence and conclude that the average time spent on chronic respiratory conditions

in the medical area was higher than the average time spent on chronic respiratory conditions in the surgical area.

The reason for this result is that patients in the medical areas are mostly chronic respiratory patients with superimposed lung infections. Chronic respiratory treatments in the surgical areas are mostly for patients with a chronic lung disease that were operated on for some other reason. In this instance physiotherapy is then required mostly to treat the effects of the anaesthesia on the existing lung diseases and to prevent possible lung complications.

4.3.2 Comparison of treatment of acute respiratory conditions in the Medical and Surgical areas

The mean value of the treatment sample (and standard deviation in parentheses) were as follows:

- Surgical area: 18.37 (6.60) min, n = 218
- Medical area: 14.93 (3.82) min, n = 118

H_0: average time spent on acute respiratory conditions in the surgical area = average time spent on acute respiratory conditions in the medical area

H_1: average time spent on acute respiratory conditions in the surgical area > average time spent on acute respiratory conditions in the medical area

If the variances are equal the P-value is P = 3.745E-09 < 0.05. If the variances are unequal the P-value is P = 5.291E-07 < 0.05. In either case the P-values are smaller than 0.05. Therefore one can reject the null hypotheses with 95% confidence, and conclude that the average time spent on acute respiratory conditions in the surgical area was higher than the average time spent on acute respiratory conditions in the medical area.

The reason for this result could be that in the surgical area a patient with an acute respiratory condition is normally a patient that developed a lung complication during or after surgery and therefore requires and will respond to intensive physiotherapy. In the medical area an acute respiratory condition is normally related to an acute lung disease, patients are very ill and physiotherapists are not able to spend as much time with them as with a patient with a respiratory complication. The results for the treatment times of acute lung treatments in the surgical and medical areas are opposite to the results for treatment times of chronic lung treatment in the same two areas. Acute lung treatment times are longer in the surgical area than in the medical area while chronic lung treatment times are longer in the medical area than in the surgical area.

4.3.3 Comparison of treatment of neurological patients in the Paediatric and Medical areas

The mean value of the treatment sample (and standard deviation in parentheses) were as follows:

- Paediatric area: 47.52 (16.36) min, n = 168
- Medical area: 25.55 (6.96) min, n = 100

H_0: average time spent on neurological patients in the medical area = average time spent on neurological patients in the paediatric area.

H_1: average time spent on neurological patients in the paediatric area > average time spent on neurological patients in the medical area.

If the variances are equal then the P-value is P = 2.06E-29. If the variances are unequal, the P-value is P = 1.51E-37. In either case, the P-values are microscopic. Therefore, we can reject the null hypotheses with 95% confidence and conclude that the average time spent on neurological patients in the paediatric area was higher than the time spent on neurological patients in the medical area.

The reason for the result is that the neurological patients in the medical area are usually still unstable e.g. immediate period after having had a stroke. Physiotherapy in these cases would be limited and doing passive movements and ensuring that the positioning

of patients is adequate, would often be the only requirements. Once these patients are stabilised, they are moved to the neurological wards or outpatient areas.

In paediatric neurology children may have acute brain injury or a chronic condition such as cerebral palsy. In chronic cases they may have been hospitalised due to severe fitting or because they have not been treated previously. These children are stable and the physiotherapist spends much more time with them. Intensive physiotherapy to neurologically affected paediatric patients often have a more rewarding outcome than in the adult patient population.

4.3.4 Comparison of treatment of amputee patients in the Orthopaedic and Surgical areas

The mean value of the treatment sample (and standard deviation in parentheses) were as follows:

- Orthopaedic area: 18.31 (8.41) min, n = 60.
- Surgical area: 22.04 (7.52) min, n = 112.

H_0: average time spent on amputee patients in the orthopaedic area = average time spent on amputee patients in the surgical area.

H_1: average time spent on amputee patients in the orthopaedic area > average time spent on amputee patients in the surgical area.

If the variances are equal then the P-value is P = 0.0023. If the variances are unequal, the P-value is P = 0.0024. In either case the P-values are smaller than 0.05. Therefore we can reject the null hypotheses with 95% confidence and conclude that the average time spent on amputee patients in the area of orthopaedics was higher than the average time spent with amputee patients in the area of surgery. In this instance the average values are basically exactly the same although the confidence intervals are large. The large interval could be the cause of this result.

In the surgical and orthopaedic treatment areas there is not much difference in the actual treatment of patients and therefore it would be expected that the treatment times would be the same as the averages indicate. It is however possible that there may be a small difference. In the surgical area, amputation is normally due to vascular disease. These patients are normally ill and older. In the area of orthopaedics, amputations are normally due to trauma e.g. a motorcycle accident and the patient is usually younger and capable of doing more exercises and for longer periods of time.

4.3.5 Comparison of treatment of mobilising patients in the Orthopaedic and Surgical areas

The mean value of the treatment sample (and standard deviation in parentheses) were as follows:

- Orthopaedic area: 24.05 (7.64) min, n = 210.
- Surgical area: 16.10 (5.06) min, n = 153.

H_0: average time spent on mobilisation patients in the orthopaedic area = average time spent on mobilisation patients in the surgical area.

H_1: average time spent on mobilisation patients in the orthopaedic area > average time spent on mobilisation patients in the surgical area.

If the variances are equal the P-value is P = 2.446E-25. If the variances are unequal the P-value is P = 6.259E-28. In either case the P-values are much smaller than 0.05. Therefore, we can reject the null hypotheses with 95% confidence. This is in favour of the alternative conclusion indicating average time spent on mobilisation of patients in the orthopaedic area was higher than the average time spent on mobilisation of patients in the surgical area.

The reason for the result is that: mobilising a patient in the orthopaedic area involves teaching the patient to walk, as he/she usually needs an aid to walk. Mobilising a patient in the surgical area is mostly a patient that the physiotherapist needs to assist in getting up to walk, after they had a surgical incision, in order to optimise their recovery. Crutches and other aids are rarely indicated.

4.4 DIRECT PATIENT CARE VERSUS INDIRECT PATIENT CARE

Table 9: % Direct Patient Care, Indirect Patient Care and Other

In Table 9: the percentage of time spent on each section direct, indirect or "other activities" in each treatment area is provided.

Treatment Area	% Time – Direct patient care	% Time – Indirect patient care	Other activities
Exercise rehabilitation	41.63%	13.55%	44.83%
ICU	71.81%	9.32%	18.87%
Medical	62.38%	19.84%	17.78%
OPD	69.10%	14.02%	16.89%
Surgical	72.40%	11.77%	15.83%
Neurological	44.85%	23.07%	32.08%
Orthopaedic	52.22%	24.88%	22.34%
Paediatric	59.93%	17.15%	22.52%
Average	59.29%	16.70%	23.89%

ICU: Intensive Care Unit OPD: Out patients' department

Based on the results from the timesheets the average time spent on direct patient care is 59.29%, for indirect patient care the average is 16.70% and the average for other is 23.89%

4.4.1 Explanations for the difference in the percentage between direct and indirect patient care in the various treatment areas

In the exercise rehabilitation area, more time is spent on education and teaching patients how to cope with their chronic diseases. The more effectively patients manage their own diseases, the lower the chances of re-hospitalisation are.

In the Intensive Care Units (ICU), patients are critically ill. Direct patient care forms the largest part of the physiotherapy treatment. Of all the treatment areas, one expects direct patient care to be the highest in these areas. Very little education is possible to the patient but some instructions would be given to staff and family members of patients. The only other component of indirect patient care relevant here is the interaction with the doctors and nurses.

In the medical area, patients are ill and frequently have chronic diseases (e.g. patients with AIDS and a superimposed pneumonia). Direct patient care could be high. There should however be emphasis on education and teaching patients to manage their disease. It seems as if due to time constraints the education and management component is being neglected in this area. This is a problem because if the education and management component were taken care of efficiently re-hospitalisation could possibly be decreased.

In the surgical area, not as much education and management is required. Typically, the problem would be a once-off problem that needs surgical intervention, but is not a chronic problem that requires management over extended periods of time.

In the neurological area much time is spent during the treatment on education of the patient and teaching the caregiver to manage the disease, these patients often have a severe residual disability. Hospitalised patients are more acute and therefore it is to be expected that the direct patient care would be higher than the indirect patient care.

In the outpatient (OPD) area patients attend for specific treatments. A large percentage of the physiotherapist's time is for direct patient care although education is also important. Physiotherapists present the education component mostly to groups of outpatients and therefore this takes up a smaller percentage of their time.

In the orthopaedic area direct and indirect patient care are equally important. Much education and teaching management of the condition happen while treating the patient directly. It is the hospital policy to discharge patients as soon as possible and therefore there is not always time available to spend enough time on indirect patient care as would be desirable.

In the area of paediatrics, education and management of the patient's caregiver is vital. The physiotherapist educates and teaches the caregiver to manage the patient whilst

treating the patient and therefore allocates the time as direct patient care. This type of intervention is possible in the paediatric wards because parents and caregivers ideally spend most of the day with the patients. More critical direct care is required for patients with severe burns or trauma and very little indirect patient care is then required.

4.5 LOAD AND CAPACITY

The purpose of this section is to determine the amount of work or the load that needs to be performed daily and the capacity or the amount of physiotherapy time available to deal with the load.

Table 10: Load and Capacity

In Table 10 the columns are:

Average number of patients not treated: This is the number of patients that physiotherapists could not treat due to time constraints.

Average Number of treatments per day per treatment area: This is the average number of treatments each area needs to perform daily. It sometimes happened that a patient required more than one treatment from a physiotherapist per day. Therefore, this table indicates the number of treatments and not the number of patients treated.

Average time required per day per treatment area: This is the average time in minutes that each area is busy with some form of treatment (direct patient care).

Average time required per day - including the patients not treated: This is the average time, in minutes, required for treatments to ensure that all patients were

treated. (Calculated from the average number of treatments per day plus the average number of patients not treated per day)

Average Treatments per day per physiotherapists: This is the average number of treatments each physiotherapist in the various areas performed daily.

Treatment Area	Avg. no. of patients not treated	Avg. no of treatments/ day/ area	Avg. time required/ day/ area	Avg. time required/ day incl. Patients not treated	Avg. no. of treatments/ day/ physiotherapist
Exercise rehabilitation	0.22	4.26	141.23	141.23	4.26
ICU	0.25	37.65	774.78	3564.33	8.19
Medical	0.38	16.69	372.74	666.10	9.34
OPD	-	8.26	326.29	548.10	6.12
Surgical	-	16.12	317.53	317.53	16.12
Neurological	3.09	22	452.23	1302.25	7.64
Orthopaedic	0.49	28.91	596.96	2003.13	8.62
Paediatric	0.65625	21.69231	611.06	1711.54	7.75
Total		155.5823	3592.82	10254.21	68.04
Average		19.4478	449.1025	1281.776	8.505

OPD: Outpatient Department

Based on the information as stated in table 10 it is apparent that the total number of minutes required to treat all the patients within the department were 10254.21 minutes. The time required is for daily treatment, on average, for all the treatment areas.

4.5.1 Required Capacity

In the study performed by Hospital and the WITS University (De Charmoy and Eales, 2000) the load was determined and the results obtained were that there were on a given day 746 patients of those 394 of them required physiotherapy treatment. It was determined that these patients required 132 hours of treatment. Based on their assumption that the Physiotherapists spent 45% of their time on direct patient care they therefore would require 36.5 full time physiotherapists.

Based on the results obtained over a six months period, the number of hour's patients for which treatment was required, daily, was 171 hours (Total minutes for all the treatment areas 10254.21). Based on the previous calculation that indicated that an average of 59.29% of the physiotherapists' time was spent on direct patient care, the department would therefore require 34 full time physiotherapists (171/ 0.5929/ 8.5 = Number of full time physiotherapists)

4.6 CONCLUSION

Based on the supervisor's opinions that treatments are not adequate where the time spent on patients was less than the standard time indicated, the results of this study

indicates that the quality of the treatments patients received requires further investigation.

The standard times are not correct. This study could be used to determine more accurate standard times to enable the supervisors to have more accurate expectations of performance times.

The comparison made of similar treatments in different treatment areas indicated that in all cases the treatment times were different. Therefore, it would not be possible to standardise across treatment areas.

In conclusion it can be said that since physiotherapists spend an average of 59% of their time on direct patient care, 171 hours would require 34 full-time physiotherapists at the Johannesburg Hospital to effectively treat the patients seen by them in the period over which the study took place. This is a clear indication that there is a need for more Physiotherapists in the department. The current complement of physiotherapy staff is 18 full time physiotherapists; the department is understaffed by 46%.

CHAPTER 5

5. ADDRESSING THE KEY ISSUES

As stated previously the fifteen major issues that required improvement were:

1. Salary
2. Staff Shortage
3. Leave
4. Blocked telephones
5. Low level of Motivation
6. Work over weekends and overtime is badly planned – not optimised.
7. Not enough time to give best service or more than adequate service.
8. Implementation of decisions/solutions. Not everyone is involved.
9. Inadequate time and opportunities for learning. No time for individual professional growth or interests.
10. Lack of equipment – not repaired, dirty and not maintained.
11. Dirty environment – not because of a shortage of staff.
12. Stress.
13. Teambuilding exercises, courses and congresses.
14. Communication – staff do not always know what is going on.
15. Career development of assistants.

This chapter discusses how the Physiotherapy Department addressed these issues.

5.1 SALARY

Salary is something the department could not change as salaries are dependent on the Gauteng Department of Health. It was however decided to show appreciation of the physiotherapists, by developing a recognition system. It would probably not be possible to do this by paying them a bonus but could possibly be done by sending the physiotherapists on courses; conferences or congresses.

5.2 STAFF SHORTAGES

Under this heading the other issues also addressed are:

- Inadequate time to give optimal service (7)
- Inadequate time and opportunities for learning (9)
- Stress (12) and
- Career development of assistants (15)

After statistically analysing the timesheets, it became apparent that there was indeed a capacity constraint. The theory on capacity constraints and capacity planning was investigated to determine an approach to the problem.

5.2.1 Capacity planning

A definition of capacity:

Capacity is the rate at which the system can provide a service.

A definition of load:

Load is the rate at which patients impose on the system (Russel and Taylor, 2000).

To do capacity planning one needs to look at capacity as dependent on the production requirements or the specific load. The Physiotherapy Department needs to treat all the hospital patients in the various treatment areas that require physiotherapy treatment. The number of physiotherapists available defines the capacity. The number of patients that require physiotherapy defines the load. The objective of strategic capacity planning is to determine the overall level of resources required, that will best support the departments long-range objective. In the Physiotherapy Department, the long-range objective as defined in the vision, is to provide an optimal service while still maintaining a learning environment. Capacity levels have a critical impact on the organisation's ability to react, the cost structure as well as the management and staff support requirements. Inadequate capacity as well as excess capacity would have a negative impact.

If capacity is not adequate in the Physiotherapy Department, the result is that some patients are not treated or some treatments are inadequate. This has an impact on the long term cost of patient care. Optimal physiotherapy interventions can reduce hospitalisation times.

If capacity were excessive, the physiotherapists would be under-utilised. Due to financial constraints, it would not be possible for the hospital to maintain under-utilised

staff, as there are many other expenses in a hospital to be considered. Maintenance of many other services and equipment is required in the hospital.

The optimal operating level needs to be established. This is the level of capacity where the process works at the lowest cost for the volume of output required.

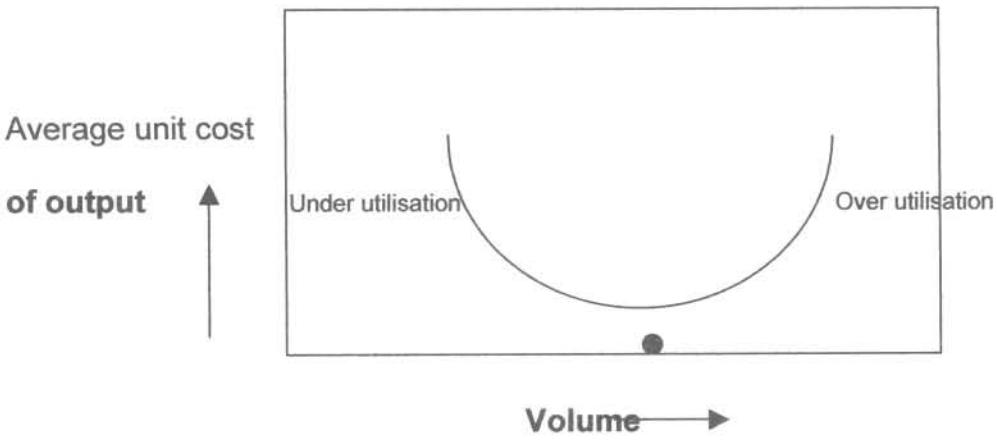

Figure 1: Best operating level

Service capacity is time and location dependent. Services cannot be stored; the capacity must be available when required. The Physiotherapy Department can treat some patients later but this leads to cost implications with patients remaining in hospitals for longer periods. For some patients, delayed treatment could have an impact on rehabilitation outcome.

When planning capacity in the service environment it is important to consider the relationship between the service utilisation and quality. The best operating point is near 70% of the maximum capacity (Chase and Aquilano, 1995). This operating level

provides enough time to serve customers individually without creating major capacity constraints when unexpected demand should occur. A capacity cushion should be in place to deal with sudden and unexpected demand. To determine the capacity requirements of the Physiotherapy Department, the time the department is required to spend in treatment or direct patient care, was determined. By analysing the current trend in increased admissions due to chronic disease linked to HIV/AIDS and the forecasted, increase in HIV/AIDS it is clear that the need for physiotherapy treatments will increase. Based on the statistical analyses there is currently a capacity constraint in the Physiotherapy Department. The Physiotherapy Department is operating with a negative capacity cushion.

Demand is far more volatile in a service environment. The processing time of each customer or patient is also a variable that differs according to the needs of each patient. In a hospital, the demand is also volatile as seasons have an influence on the demand. In winter months or immediately after the festive periods, there is typically a higher demand for treatment. When the operating point goes above 70% the quality of treatment typically declines. Therefore, one of the essential considerations when planning capacity for services is the effect of capacity on the quality of service. In health care, planning resource levels is difficult due to the volatility of demand and the pressures of cost containment as well as the consequences of inadequate capacity. In this document the capacity calculations were at 100% utilisation and not at the suggested 70% as would be preferable.

When deciding about what level to increase capacity to, the following needs to be considered:

- The certainty and volume of the anticipated demand
- The departments strategic objectives in terms of growth and quality of service
- Cost implications of expanding or not expanding

In the Physiotherapy Department, it is clear that capacity is not adequate to meet the current demand. It is also clear that the trend is for the demand to increase. It could be useful to do further investigations to determine the anticipated demand and calculate the optimal capacity levels based on that.

Possible solutions are:

- Create a floating unit, which could move between any treatment area as demand changes.
- To initiate the recruiting process as soon as the number of physiotherapists drops below 29 physiotherapists based on the current demand. The recruiting process should start as soon as the number of available physiotherapists is less than five below the required number for the demand.

5.3 LEAVE

The leave allocation problem is very severe, contractual leave benefits are currently being systematically eroded, in practice to mitigate the effects of understaffing. Huge accumulations of untaken leave result.

The various types of leave to take into consideration are:

- Normal leave, 30 days
- Study leave days
- Special leave for sport, courses, conferences and congresses
- Sick Leave
- Unpaid leave and
- Maternity leave

During the workshops, the participants indicated the minimum number of physiotherapists needed in each treatment area at any point in time.

The table below indicates the results of this:

Table 11: Number of physiotherapists required

Treatment Area	Number of Physiotherapists
ICU	2.5
Paediatric	1.5
Medical	1.5

Surgical	1.5
Orthopaedic	1.5
Neurology	2.5
OPD	0.25
Exercise rehabilitation	0.25

In the table above 0.5 or 0.25 implies half or quarter of a day is required of a physiotherapist and not a physiotherapy assistant. Similar requirements for the number of physiotherapy assistants in each treatment area on a daily basis are not available currently.

The above also indicates that at any point in time at least 11.5 physiotherapists are required to be present in the hospital. Approval of leave is therefore dependent on the number of physiotherapists that will be available in the hospital at any point in time. Leave allocation needs to be according to the requirements of each treatment area. Problems identified with the above were that in the medical area there are only 1.5 physiotherapists anyway and nobody really wants to work in that area. During the workshop, the agreement was that all the physiotherapists would be willing to work in the medical area on a rotation basis when one of the physiotherapists in that area was on leave. Physiotherapists also agreed that they would take turns when taking times off during the most popular leave periods such as over Christmas. Physiotherapists

involved in post-graduate studies unfortunately also have to take study leave at the end of the year. This was another problem that created much frustration.

It is therefore essential that leave be co-ordinated from a central point to ensure that there are enough physiotherapists in the hospital at any given point in time. It is also important to ensure that leave is allocated fairly to all staff members and that a few individuals do not always go on leave in December while others always have to work during that time. By monitoring the leave centrally, it would immediately become apparent when there is a problem with the number of physiotherapists in the department. The involved treatment area would be alerted to the need immediately and it might be possible to make alternative arrangements. Alternative arrangements would be to scale down on some treatments or by obtaining physiotherapists to help, from other hospitals in the vicinity, on a short-term relief basis if possible.

The head of the Physiotherapy Department motivated for the position of an Assistant Director of the Physiotherapy Department. The duties of the Assistant Director included the control of all leave for staff in the department. To assist the Physiotherapy Department with the planning of leave, a leave schedule was developed in Excel. When a physiotherapist applied for leave the Assistant Director enters an L in the spreadsheet at the relevant dates. Excel Formulas then calculated the number of Physiotherapists that are available in the hospital at that time and it also calculates the

number of days each used for leave. (See Appendix 2 for example of the leave schedule for January.)

5.4 BLOCKED PHONES

To address the problem of blocked telephones the University made their telephones available for emergency telephone calls for hospital staff. As the university's Physiotherapy Department is next to the hospital's Physiotherapy Department this was easily arranged. The department also applied for a public telephone from Telkom to be located in the staff room. This has proven to be a very lengthy exercise. Installation was still not completed eight months after applying.

5.5 LOW LEVEL OF MOTIVATION

An investigation of a few of the motivational theories could help to address low motivation and determine ways to improve motivation. It is important to understand the various theories because normally they need adjustment to suit the specific environment and usually a combination of theories may be required.

It is very important for any organisation to try to ensure that employees are motivated as motivated workers want to deliver high quality services and they are more likely to be productive. Unfortunately, there is no standard set of principles to apply to ensure that employees are motivated.

5.5.1 Motivational Content Theories

There are two categories of motivational theories; they are the content and the process theories. This section will first describe the content theories and thereafter discuss the process theories. The content theories focus on factors within the person and tries to determine the specific needs that motivate them. Some of the most commonly used content theories are Maslow's need hierarchy, Alderfer's ERG theory, Herzberg's two-factor theory and McClelland's learned needs theory (Gibson, Ivancevich, Donnelly, 1994) .

5.5.1.1 Maslow's need hierarchy

Maslow's need hierarchy defines five levels of basic needs that drive motivation (Gibson et al, 1994) .

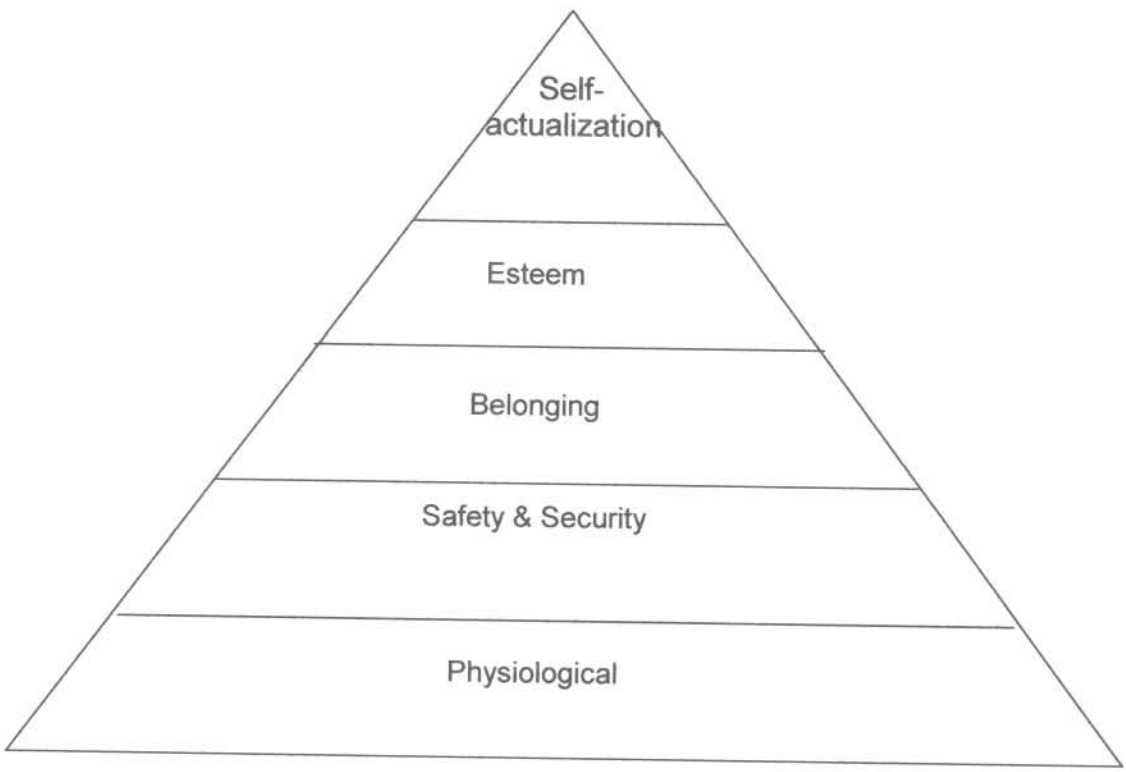

Figure 2: Maslow's Need Hierarchy

Physiological - the need for food drink shelter and the relief from pain

Safety and security – the need for security from threatening events and surroundings

Belonging, social and love – the need for friendship, interaction and love

Esteem – the need for self esteem and esteem from others

Self–actualisation – the need to fulfil oneself; by maximising the use of abilities, skills and potential.

In the Physiotherapy Department, one of the major concerns was the lack of time for further development. As one of the main reasons for physiotherapists to work in the state-funded hospital was to develop optimally, they could not meet their need for self-actualisation when there is capacity constraints. As time is a problem and individuals can not reach this goal, this affects their motivation.

5.5.1.2 Alderfer's ERG theory

Alderfer agrees with Maslow that needs is hierarchical but suggests that the need hierarchy only involves three sets of needs and they are (Gibson et al, 1994):

- Existence – the need for food, water, pay and working conditions
- Relatedness – the need for meaningful social and interpersonal relationships
- Growth – the need to make creative and productive contributions

In the Physiotherapy Department, there is a need for relatedness and a need for growth. Again, capacity constraints affect both of these, as there is not enough time to get to know colleagues or to learn, as they would like to. The capacity levels of the department would therefore affect these motivational issues.

5.5.1.3 Herzberg's two-factor theory

Herzberg's two-factor theory (Gibson et al, 1994), the two factors referred to here are the dissatisfiers-satisfiers also called the hygiene-motivators or extrinsic-intrinsic factors. Two conclusions he made from the initial study were that:

There is firstly a set of extrinsic conditions such as salary, job security, working conditions, status, company procedures, quality of supervision and quality of interpersonal relations. If these are present, they do not necessarily motivate employees but if they are absent, they result in dissatisfaction among employees. Because these ensure that employees are not dissatisfied, they are the dissatisfiers or hygiene factors.

Secondly, there is a set of intrinsic conditions such as achievement, recognition, responsibility, the opportunity for growth and the work itself. The absence of these conditions does not necessarily lead to dissatisfied employees but when they are present, they build strong levels of motivation. Therefore, these are satisfiers or motivators.

Extrinsic factors affecting the physiotherapists are salary, job security, working conditions, quality of supervision and quality of interpersonal relations. When looking at issues raised by the physiotherapists it is clear that these factors are not favourable in the Physiotherapy Department. Nearly all these factors are negatives for physiotherapists. Salary and working conditions were specific complaints raised by the

physiotherapists. Job security is high but capacity constraints affect the quality of supervision as well as quality of interpersonal relationships.

Intrinsic factors affecting the physiotherapists are achievement, recognition, responsibility, the opportunity for growth and the work itself. The physiotherapists have a large amount of responsibility and mostly they enjoy the work itself. Problems in this specific environment are recognition of effort as well as professional growth.

5.5.1.4 McClelland's learned needs theory

McClelland's learned needs theory (Gibson et al, 1994) is closely related with learning concepts. He believes that the development of many needs is due to the culture of a society. Three of these learned needs are the need for achievement, the need for affiliation and the need for power. McClelland proposes that when one of these learned needs are strong in a person, its effect is to motivate the person to use behaviour leading to its satisfaction. For example a worker with a high need for achievement would set challenging goals and use skills and abilities to achieve them (Gibson et al, 1994). McClelland also claims that the need for achievement can be learned and therefore the development is possible by providing training. This should improve motivation and the level of performance of the employees.

As discussed before the physiotherapists mostly have a high need for development and achievement. The circumstances are not very favourable for the physiotherapists to achieve the goals set out by them.

5.5.2 Motivational Process Theories

The process theories look at external factors that motivate individuals. There are four process motivation theories (Gibson et al, 1994). The major process theories are:

- reinforcement
- expectancy
- equity
- goal setting

5.5.2.1 The reinforcement theory

The reinforcement theory (Gibson et al, 1994) is based on the fact that consequences influence behaviour. Behaviour modification is individual learning by reinforcement. Organisational behaviour modification is the systematic reinforcement of desirable organisational behaviour and the non-reinforcement or punishment of undesirable organisational behaviour. Therefore, for instance financial rewards or personal recognition could reinforce positive behaviour. Punishment occurs when something positive is taken away and this weakens the behaviour.

5.5.2.2 The expectancy theory

Expectancy refers to the belief that a particular result will follow a particular action. The probability of the result is also an important consideration. The expectancy theory (Gibson et al, 1994) sees behaviour, as the result of what employees believe will happen in the future. Three major principles derived from the expectancy theories are:

- Performance is a function of motivation and ability;
- Motivation is a function of a person's preference for a particular outcome, resulting from the behaviour and the expectancy that a particular outcome will follow the particular behaviour;
- The person's preference for a particular outcome is a function of the total preference to rewards and punishments that the particular outcome is likely to produce. The level to which the particular outcome is instrumental to achieve a reward or punishment also influences the person's preference.

By using this theory, it is possible to develop motivational programs. First it needs to be determined what the rewards or punishments are that are important to employees. Then the managers should link the rewards or punishment to specific outcomes such as productivity or absenteeism. Actions as well as words should make the probability of a reward or punishment occurring after a specific outcome clear.

5.5.2.3 The equity theory

The equity theory (Gibson et al, 1994) assumes that employees compare their efforts and rewards with others in the similar work situations. If an individual therefore works for rewards in a company, they would like to know that treatment of all is equitably at work. Equity exists if an individual feels that the ratio between their effort and rewards are equivalent to the efforts and rewards of other employees.

The head of the Physiotherapy Department should be aware of this and put mechanisms in place to ensure equity. As it is not possible to reward individuals financially for their efforts, rewards should be changed in such a way that the individuals feel that the rewards are in line with the rewards of other employees in the same field, for the same amount of effort. Specifically learning or training opportunities would be a favourable way to reward physiotherapists in this environment as often that is the sole reason for wanting to work in a training hospital.

5.5.2.4 Conclusion

All three of the above theories clearly indicate a need for a recognition system in the Physiotherapy Department. The recognition systems must be clearly communicated to all and address the needs of the various individuals.

5.5.2.5 The goal-setting theory

The goal setting theory (Gibson et al, 1994) suggests that an individuals main goals and intentions are the primary determinants of behaviour. To establish a goal-setting program the management needs to determine whether the people, organisation and technology are suited for such a program. Then employees need to be prepared for such a program by increasing the interpersonal interactions, communication, training and action plans for the goal setting program. Managers and subordinates need to emphasise attributes of the goals they need to understand. Based on intermediate reviews adjustments can be made to establish goals. Final reviews will assist to check whether goals are set, modified and accomplished. The goal difficulty and acceptance are important aspects to consider when establishing this program.

The Physiotherapy Department should first try to change the environment, then establish a recognition system and then thereafter establish whether a goal setting program is appropriate.

5.5.3 The Managers Role

Managers do however have an impact on the motivation of employees and they should intervene to establish an atmosphere that encourages, supports and sustains improvement. Ability, competence and opportunity play a role in motivation. Managers ought to be sensitive to the variation of individuals' specific needs, abilities and goals. As role models, managers can influence employees. When employees note that valued

outcomes can be realised through performance, a major component of the motivation strategy has been successful. Goals that direct behaviour also form an important part of a motivational program. Also managers should try to provide jobs that offer equity, task challenge, diversity and a range of opportunities to satisfy individual needs.

Based on all the theory of motivation it comes as no surprise that the physiotherapists have a problem with motivation. To change this the head of the Physiotherapy Department needs to make as many of the negatives into positives or at least into acceptable standards to ensure higher levels of motivation. Although it may not be possible to address the salary issue, if all the other factors are more favourable it would have a definite influence on the motivation of the individuals. Firstly the working conditions need to be addressed then the capacity constraints have to be addressed and then learning and development opportunities need to be created.

Then it would be favourable to use the process theories to help motivate the physiotherapists. The recognition system established should take into account the specific needs and constraints within the Physiotherapy Department. A recognition system would reinforce positive behaviour. The whole department should be aware of the recognition when given to an individual. The recognition system should also include appropriate actions against individuals when they behave in a negative or unacceptable way. It may be appropriate to set up a questionnaire to determine what appropriate rewards or punishment would be in this environment. All employees in the department should know exactly what the result would be of good or poor performance.

5.6 OVERTIME WORK

The planning, scheduling and co-ordination of overtime work are currently a problem. A physiotherapist must be available for work after hours but may sometimes be called out to do non-critical work that could just as easily have waited for normal working hours. This causes enormous frustration, as there is no financial reward for work outside of the normal working hours.

A list needs to be compiled of the critical treatments that should be performed over weekends or after hours. The supervisors should meet with the medical staff of each treatment area and they should be clear on what the critical treatments are in that area that will respond to physiotherapy. A knowledgeable individual needs to assess the patients and contact physiotherapists according to critical needs.

5.7 LACK OF EQUIPMENT

Maintenance of equipment is inadequate in the Physiotherapy Department. This results in an unnecessary reduction of the equipment life cycle. The reduced life cycle of equipment could have significant consequences. Some of the equipment is essential for treatment. The effect of not being able to provide these treatments, due to unavailable equipment, has an effect on the quality of life of patients.

The department compiled a list of all the equipment in the department. The Physiotherapy Department has to develop a maintenance plan for their equipment. It would be optimal to adopt a preventative maintenance plan. The maintenance plan will help to ensure that there is no disruption of treatment due to malfunctioning equipment. A time-based maintenance plan will be optimal in the Physiotherapy Department. A further investigation should determine the optimal time intervals for this type of maintenance plan. Factors to consider in determining the time intervals are:

- The time intervals within which the equipment will work optimally,
- The cost of maintenance versus the cost of not maintaining equipment,
- Money available annually for maintenance as well as
- Equipment that is most critical.

The optimal time period for a piece of equipment to work can be determined in conjunction with the manufacturer.

The Assistant Director is responsible for the annual budget for the department and needs to incorporate a section for maintenance of equipment.

5.8 DIRTY ENVIRONMENT

To address the dirty environment the Physiotherapy Department was repainted. The head of the Physiotherapy Department called a meeting with the cleaning staff and made it very clear that it was unacceptable to have a dirty department. The head of the

department said that she would take appropriate action unless a change was apparent. Several incidents occurred involving a specific cleaning lady. The head of the department fired her and that seemed to have a positive impact on the group's performance. The department locked the toilets for a period with the arrangement that the keys were obtainable from a secretary. Due to internal politics this arrangement ended and within one day someone stole all the toilet seats and toilet paper and the place was dirty again.

5.9 TEAMBUILDING

Due to time constraints, there has not been time for teambuilding exercises. The department has however made an effort to hold a year-end function and ensuring that all the members could be present. A secretary decorated the staff room to change it into a less clinical environment. New curtains were donated to the staff room by one of the suppliers of medical equipment. The chairs were also arranged in a informal conversational manner. This seems to have attracted more staff to the staff room at lunch and tea breaks. The staff room is for the physiotherapists to use when they have a break. This is often the only contact the physiotherapists have with physiotherapists in other treatment areas.

It may be possible to do teambuilding exercises without incurring high costs. It may be beneficial to use students from other environments such as Industrial Psychology to do

the teambuilding exercises with the department. The Assistant Director could investigate such an option for the next year-end function.

5.10 COMMUNICATION

Issues discussed under this point are:

- Communication (14) and
- Implementing decisions taken (8)

This issue was another reason to motivate for the position of Assistant Director. A senior physiotherapist filled this position. Other duties included in this profile is to attend and participate in management meetings, co-ordinate and manage physiotherapy services. This individual will also be responsible to ensure that communication is open between physiotherapists and that decisions taken are communicated and implemented.

CHAPTER 6

6. CONCLUSIONS AND RECOMMENDATIONS

Based on the results it is clear that there is not adequate capacity to deal with the load and that additional physiotherapists are required. The recommendation is to present these results to the relevant superintendents of the hospital and use the information as motivation for more physiotherapists. The relevant superintendents as well as the relevant individuals of the Gauteng Department of Health need to be aware of the need within the department and the probable consequence of inadequate service.

If the hospital cannot appoint the full number of physiotherapists required, based on the current economic state of the state-funded hospitals, they need to decide which non-critical services can be reduced if any.

Physiotherapists play a critical role in rehabilitation. Several interventions would be useless if there were no physiotherapists involved e.g. saving a hand of a patient by a surgeon has no value unless someone can teach the individual how to use the hand again. Physiotherapists influence the duration of hospitalisation; as well, as reduce re-hospitalisation of patients with chronic diseases. It is therefore clear that the optimal functioning of the Physiotherapy Department would have a definite impact on costs and the minimisation thereof. The cost implication needs to be considered when making a decision involving the Physiotherapy Department.

The standard times were not accurate; the data from this study would probably be useful in other future studies.

A separate investigation to determine the implications of optimal physiotherapy services on costs should provide useful information to all health-care facilities that employ physiotherapists. A specific issue of interest is the period of hospitalisation, and how physiotherapy treatments influence the duration of this period. Cost comparisons can then determine the cost of each day a patient spends in the hospital.

Standardisation of treatments in the different treatment areas is not possible as was determined by this study.

It is recommended that a separate study is performed to determine the quality of treatments. The concern is the statement of the supervisors that treatment times lower than indicated standard times implies inadequate treatments.

Reasons for such a high "other" component under exercise rehabilitation should also be investigated.

There is a need for the development and implementation of a recognition system. It seems certain that a recognition system would have a favourable impact on the motivation of employees.

It is critical to implement a maintenance plan for equipment. During the annual budget planning it is very important to include a section for maintenance.

If it is possible to have teambuilding exercises without incurring high costs, it could be beneficial to have these exercises at least at the year-end functions.

During this study it became clear that there were numerous other possible applications of Industrial Engineering in the medical profession.

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Physiotherapist/Assistant _____ Full-time/Part-time_____

Date Unique Identifier

Exercise Rehabilitation

	Treatment	Mon	Tue	Wed	Thu	Fri	Sat	Sun
A	Adult Cardio - Thoracic pts. (have undergone valve MVR)							
B	Paeds cardio thoracic pts (Have undergone valve MVR)							
C	Acute pre D/C							
D	Thoracic O's							
E	Cardio thoracic grp class exercise							
F	Acute Lung redn O CPT							
G	Exercise Lung O CPT							
H	Breathing excs./postural drainage							
I	Other Cardiac excs. Test							
J	Cardiac Group education							
K	Respiratory grp classes /relaxation							
L	Cardiac risk factor assess (inpt)							
M	Cardiac risk factor assess (outpt)							

2	Direct patient time/ groups							
3	Indirect patient time							
3.1	Writing reports							
3.2	Discussion around patient - to DR, pt, OT, SR, ST, Family & ward rounds							
3.3	Phone for appointment							
3.4	Return patient calls							
3.5	Collect assisting devices							
4	Meeetings							
4.1	Unit Meetings							
4.2	Staff Meetings							
4.3	Exec Meetings							
4.4	Others							
5	Admin							
5.1	Stats							
5.2	Getting things repaired/fixed							
5.3	Filing - forms, leave, repairs eettc							
6	Own Education & Development							
6.1	Ward Round							

6.2	Reading							
6.3	Continued education in Unit							
6.4	Training Club/Lectures/Fridays							
7	Education of other groups							
8	Supervision of own assistants							
9	Supervision of students							
10	Tea/Lunches							
11	Personal general - general personal issues e.g taking the car to the garage							
12	Standing time							
12.1	Stairs/walking/lifts							
12.2	Waiting for patients							
12.3	Bedpans							
12.4	Waiting on phone							
12.5	Cleaning patients							
13	No of patients not treated							

APPENDIX 2

Leave Schedule for a Month

Month		Jan																														Total leave taken
Physio Name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	
Enter Name	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0
Enter Name	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0
Enter Name	1	1	1	1	1	1	L	L	L	L	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	4
Enter Name	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0
Enter Name	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0
Enter Name	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0
Enter Name	1	1	L	L	L	L	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	4
Enter Name	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0
Enter Name	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0
Enter Name	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0
Enter Name	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0
Enter Name	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0
Enter Name	1	1	1	L	L	L	L	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	4
Enter Name	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0
Enter Name	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0
Enter Name	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0
Enter Name	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0
Enter Name	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0
Physiotherapists available in Hospital	18	18	17	16	16	16	16	17	17	17	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	