

The wasted Disposables in Dutch Hospital's health care pathways

Abstract

The Dutch health care system is a large drain on the Dutch national budget. With the Dutch hospitals costing 20 billion euros yearly. Six billion euros, of the total 20 billion euros are spend on goods and materials. If a part of these goods are wasted within the health care system, the costs of this system could be reduced by reducing this waste. This paper has researched the possible waste reduction possible in health care pathways by researching three health care pathways in Dutch hospitals.

This paper answers the research question: *How can the possible wasted disposables be reduced in health care pathways in Dutch hospitals?*

This question is answered with the creation of a framework based on multiple case studies created from research done in the three health care pathways, Percutaneous Coronary Intervention, Cataract and Hip Fractures. These health care pathways are visualized using IDEF0 diagrams, and the disposable flows are shown in matching tables. To provide constructive solutions to possible wasted disposables within health care pathways in Dutch hospital in general, a framework is constructed. This framework generalizes health care pathways to four basic steps, diagnostics, pre-operation, operation and post operation. The main solutions to reduce the chance of wasted disposables within health care pathways, is to improve the amount of standardization of disposables used and needed, and improve the communication and collaboration between parties within the health care pathways. These solutions are based on the case studies and the literature research on the Dutch health care system in general, Dutch hospitals and the goods logistics within the Dutch health care system. This also provides an answer to the research question, on how to reduce disposables being wasted in health care pathways in Dutch hospitals. This thesis research is conducted on three care pathways are researched in multiple hospitals, but not all Dutch hospitals. Different results could be reached when researching other health care pathways or different hospitals, but the framework provided in this paper could be valid for these different situations. Both the validity of this research and the constructed framework has to be researched in subsequent research studies. These subsequent research studies have to verify if the conclusions derived in this research is valid for other health care pathways and if the framework is applicable and if it has achieved its objective.

Introduction

The Dutch health care system is a large drain on the Dutch national budget and counts for 15.6 percent of the GDP in 2013 (CBS, 2014) (NEVI, 2011). These expenses will increase in the future, because of the increasing percentage of elderly and the new medical procedures probably becoming more expensive and specialized. To keep these expenses in check, the Dutch health care system is going through a lot of new cutbacks and changes aimed at qualitative improvements to maintain the current quality level with a smaller budget.

A part of the expenses made within the Dutch health care system has to be contributed to the 155 Dutch hospitals (Dutch Hospital Data, 2013). These hospitals had a total cost of 20.4 billion euros in 2012. Around six billion euros of these total costs were for the acquisition of goods and materials. These costs are increasing yearly with an average growth of 5.9%.

Based on interviews with logistics managers of different Dutch hospitals, it is not clear how many disposables are wasted within these hospitals. This inability to define the amount of wasted goods in Dutch hospitals, creates the research purpose of this paper. Because if disposables are wasted, while this could have been prevented, it would mean that the costs for disposables in hospitals is needlessly high. This research paper focuses on the construction of a framework to reduce the possibility for disposables to be wasted. Therefore, the identification of the wasted disposables in Dutch hospitals is the first goal of this research. Secondly, a framework will be constructed that provides solutions that will reduce the possible wasted disposables within hospitals.

The central research question of this research is:

How can the possible wasted disposables be reduced in health care pathways in Dutch hospitals?

This main question provides the bases for the main research objective of this paper. This main objective is to create a clear image of solutions to reduce the wasting of disposables in health care pathways in Dutch hospitals.

Research scope and definitions

This scope provides a framework and rules on which the research is conducted. In this research three health care pathways are selected and researched. These three health care pathways are chosen by five different factors. Of these five factors, the first three factors are required for every health care pathway to be researched. While a minimum of only one of the last two factors is compulsory. These factors and the specific health care pathways were determined on the basis of two interviews with health care pathway specialists in two Dutch hospitals.

1. A relatively large influx of patients yearly.
2. A relatively short throughput time
3. Multiple departments have to be moved through, preferably a surgery
4. Part of the procedure can be scheduled
5. After the procedure in the cure facility aftercare is scheduled in a different facility

Based on above mentioned factors the following pathways are selected for this research:

- Percutaneous Coronary Intervention¹
- Cataract²
- Hip fractures³

The definition of waste

The different actions that take place in a health care pathway can all produce waste. This paper defines three different types of actions (Rich, 1997).

1. Non-value adding actions
2. Necessary but non-value adding actions
3. Value adding actions

All non-value adding actions can be seen as waste, but some of these actions are necessary and can only be reduced by drastically changing the processes involved in the action. This paper will focus on non-value adding actions that are not necessary. This means that the focus of this research is on the wasted disposables due to expiring or improper use. The chosen types of waste are determined from the type of research conducted and information available. This research focuses on types of waste that are avoidable, some waste will always exist in any operation where people are involved, especially in the health care where people are both the operator and the platform where is operated on. This unavoidable waste will not be part of this research.

The health care system

The health care system, as defined in this paper, consists of all parties involved that have a direct connection with the patient and the health care provided. This starts usually with the general practitioner. This party will provide the first health care or redirect to a cure or care facility. The patient will move throughout the health care system to ideally be cured and go back home. This paper focusses

¹ *Percutaneous Coronary Intervention (PCI, formerly known as angioplasty with stent)* is a non-surgical procedure that uses a catheter (a thin flexible tube) to place a small structure called a stent to open up blood vessels in the heart that have been narrowed by plaque buildup, a condition known as atherosclerosis.

² *A cataract* is a clouding of the eye's natural lens, which lies behind the iris and the pupil. Cataracts are the most common cause of vision loss in people over age

³ *Hip fractures* are cracks or breaks in the top of the thigh bone (femur) close to the hip joint.

on the health care system from the moment the patient enters the cure or care facility until the patient is not provided any cure or care anymore.

Actors of the Health care system

Multiple different parties are involved in the health care system and the goods logistics. To reduce the amount of wasted disposables within health care pathways, some of those parties have to be involved to implement the solutions stated in the framework. These different actors will be stated in this chapter and their ability to act, their power, and their interest to act will be researched.

The health care system has many actors This paragraph will provide an overview of the actors involved in this research. This paper focuses on the last 100 meters of the goods logistics supply chain in the cure facilities and the actors involved in this supply chain. The parties that are involved in that specific part of the supply chain are (Rijksinstituut voor gezondheid en milieu, 2014):

1. Physicians
2. Nurses
3. Logistic manager
4. Health care department manager
5. Purchase department
6. Suppliers, distributors and wholesalers
7. Patients

Physician and nurses

Both physicians and nurses are the physical contacts between the patient and the health care facility. They provide the health care that the patient demands. The difference between the two parties is that the physician is the main provider of cure and the nurses are the provider of care. The physician is the person who is ultimately responsible for the patient. Physicians have had the privilege to have a lot of influence in the health care facilities, this influence has decreased in the last years, but their power is still existing.

Logistic manager

The logistic manager is the controller of the logistics department of the health care facility. This department is responsible for the internal transport of goods within the health care facility. In the last year, the importance of this supportive department has increased in the eye of the health care facilities, but the influence of this department has not increased in the same way.

Health care department manager

The health care department manager is the controller of the health care department. The manager is responsible for the well operating of the department, both medically and financially.

Purchase department

This department is responsible for the purchasing of any goods needed in the health care facility.

Suppliers, distributors and wholesalers

The suppliers, distributors, and wholesalers are the organizations that produce or distribute the different goods used in the Dutch health care system. This group of organizations consist of a multitude of

companies, which reduces the amount of power that the individual company has within the Dutch health care system.

Patients

The patients are the parties that require the health care given in the health care system and are the reason for the health care system to exist. Any singular patient has low power, but a large interest in a perfectly functioning health care system

Above mentioned actors have the direct connection with the disposables in the Dutch health care pathways and are the first group of actors that have to implement solutions.

Power interest matrix

The framework that is constructed in this paper will provide solutions for the reduction of wasted disposables in Dutch health care pathways. To implement solutions in a multi actor environment, the power and interest of all these actors have to be researched. With this data, the important actors for the implementation of the different solutions can be found and handled appropriately. The power and interest of the different actors directly involved in the health care pathways and the possible solutions are visualized in a power interest matrix. This matrix is constructed based on information researched in the literature study and the interviews.

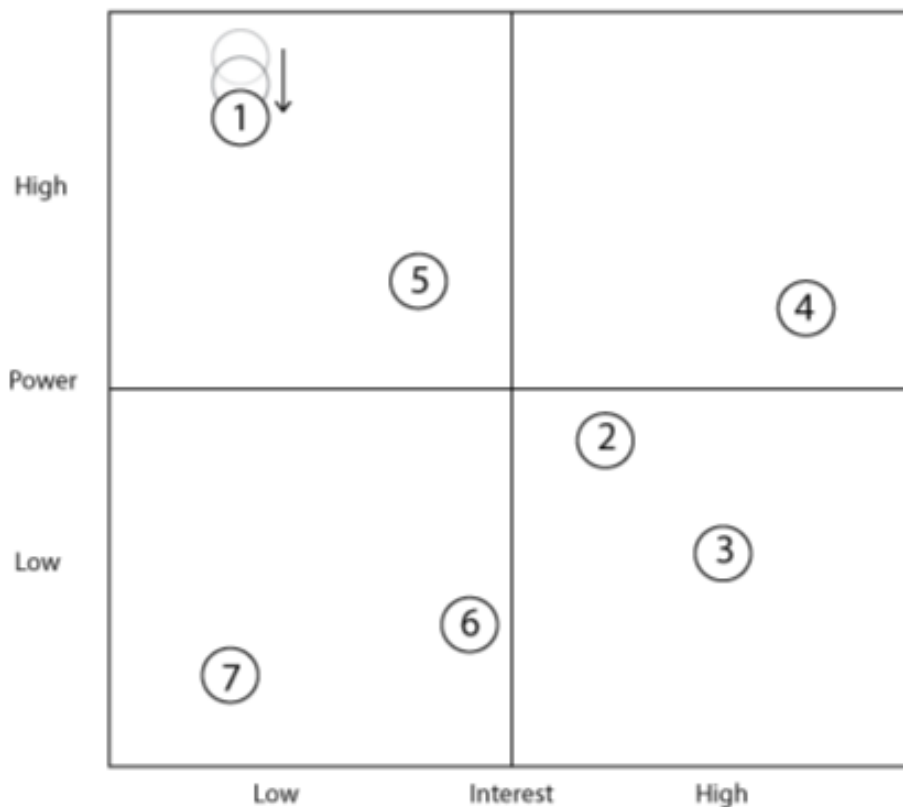


Figure 1 Power interest matrix

As shown in the power interest matrix the physicians and the purchase department are the actors that could be adversaries to change. The physicians have had historically a lot of power in hospitals, but this has been decreasing in the last year. Physicians are relatively stubborn and adverse to change. This is partly because during the study to become a physician, the trainees are learned to do procedures a

certain way and they are not convinced to change this way easily. This actor will need to be convinced to implement the proposed changes that this paper will suggest.

The purchase department is a lot easier to convince to adapt changes. This can be done by involving them early in the process and providing clear proposed profits. The purchase department is probably easily convinced to reduce costs, a by-product of reducing waste. If this is done correctly, this department could also become a collaborator for the implementation of the proposed solutions.

The other parties are all less likely to become important adversaries. This is because these parties have a high interest in reducing the wasted disposables or have limited power within the system.

Case study requirements

The case study is required to fulfil the targets of the analyses requirements. This means that the case studies have to provide a clear image of the state of wasted disposables in the health care pathways. This main requirement can be fulfilled by secondary requirements:

- The health care pathway has to be clearly formulated, even if it is a summarized version of the health care pathway.
- All disposables that are used for the patient in the health care pathway have to be defined per department.
- All costs for the used disposables have to be clearly visible.
- All wasted disposables and the costs for these losses have to be stated.

The Case Studies

To provide answers to the research question, multiple case studies are conducted. These case studies provide an insight in real life situations and the wasted disposables in these situations. This chapter will visualize the different case studies and the results derived from the case study research. Ending this chapter with a list of good and bad practices found in these health care pathways. These good and bad practices will be used in the next chapter by the construction of the framework and the proposed solutions.

Case study PCI: Erasmus MC

This case study research on the health care pathway PCI in the Erasmus MC in the Netherlands. This hospital has an average of 1000 patients following this specific health care pathway a year. With another 500 patients being treated in the intensive care. This health care pathway has three separate phases, within two different departments, the nursing department of the thorax centrum and the Cath Lab.

The amount of wasted disposables in this case study are relatively high. The losses in the nursing department are minimized by using mostly standardized and fast moving disposables with a low cost. Every six months all disposables are checked, if these disposables are unused or rarely used they are not automatically ordered anymore. This is done to reduce the chance of disposables being wasted. The largest amount of wasted disposables can be found in the Cath Lab. An amount of 20000 euros of disposables is wasted in this department yearly, which represents around 0.5 FTE. These disposables are lost because of multiple reasons. Some of the disposables are for research purpose and are, for that reason, only partially used. Other disposables are replaced by newer models and the old models aren't used any more. These losses in the Cath Lab amount to 20000 euros.

Cataract Case study: Maasstad hospital

This case study research on the health care pathway Cataract is researched in a top clinical hospital in the Netherlands. This hospital has an average of 2500 patients following this specific health care pathway. This health care pathway has three separate phases in two different departments, nursing department and the O.R.

In the health care pathway of Cataract only a small amount of disposables are used for the patient. The disposables that are used are largely standardized. In the day nursing department all disposables are

stored in the central storage that is checked regularly. The disposables in the O.R. are stored on a special cart and delivered just in time. This practice is similar to the Lean Six Sigma method as mentioned in chapter 2.4.3. The reason for storing the disposables on this cart is because the O.R. is used for multiple procedures which all need their own disposables. If this practice would not be done, a large amount of disposables would have to be stored in the O.R. for the different operations. Such a large amount of different disposables in one storage can have large repercussions on the amount of wasted disposables. All disposables on the cart are checked regularly, and the cart is checked during every session. If not all disposables from the disposable kit are used during the procedure, these left over disposables are stored in the cart as backup. This concludes that only a small amount of disposables are lost, and that the cost of these losses is very limited.

Hip Fracture Case study: Maasstad hospital

This case study research on the hip fracture health care pathway in a hospital in the Netherlands. This hospital has an average of 450 patients following this specific health care pathway. This health care pathway has three separate phases in three different departments, the nursing department, recovery room and the O.R.

The patient will reside within the health care pathways of hip fractures for multiple days. For most of these days, the patient will stay in the nursing department. The disposables that the patients will use on an average day in the nursing department are highly standardized and have a high throughput rate. This results in a close to zero amount of wasted disposables are produced by the nursing department. During the patient's stay at the hospital, a relatively small time is spent in the operation room for the medical procedure. In this procedure, more expensive disposables are used. These disposables are delivered just in time, specifically for the procedure and these goods have in average a long shelf life. This implies that the amount of wasted disposables, in the operation, is close to zero.

Hip Fracture Case study: Beatrixziekenhuis

This case study research on the hip fracture health care pathway in a general hospital in the Netherlands. This hospital has an average of 100 patients following this specific health care pathway yearly. This health care pathway has three separate phases in similar departments as in the hip fracture case study Maasstad hospital.

The patient moves similarly through the health care pathway as the one in the top clinical hospital, the Maasstad hospital. The difference between the two case studies is the method of the goods logistics. In the Beatrixziekenhuis, all goods and disposables are delivered and checked by the logistics department. The ordering system is based on a min-max system. In this system all goods that are ordered regularly are within this min-max system. In this system goods are ordered if the amount available in the local storage is smaller than the minimum amount stated, and never more than the maximum amount. This system lets logistics staff control and order the needed goods, but could also create waste. In this system the newer goods can be placed in front of the older existing stock, this would mean that the older stock is in danger of being wasted.

In this hospital, the O.R. department has its own local storage of goods. In this storage all regularly used goods are stored here and collected by O.R. staff when needed for a procedure. The storage system used in the O.R. department is similar to that of the other department, a min-max system. The costs of disposables in the O.R. are in average higher than that of most other departments, which makes the waste more costly. While there is a logistic system in use in this hospital that has a chance to create waste, the amount of waste found in the health care pathway hip fractures is close to zero. This is because the amount of disposables used in this health care pathway is limited and standardized. The most expensive disposable used in this health care pathway is the hip prosthesis, which has a long shelf life and ordered for the specific procedure.

Good and bad practices

In the different health care pathways researched in this paper multiple methods are used for the handling and use of disposables. Some of these methods used can be defined as positive for decreasing the amount of losses of disposables, while others have a negative effect. These good and bad practices

are summed up in this paragraph. Both good and bad practices are helpful for improving the existing health care pathways disposable uses. The insight into these practices came from interviews with logistic managers, hospital employees and in the field research.

Good practices

- Standardizing of disposables, especially in the nursing department
- Regularly checks on disposable stored and their shelf lives
- Regularly discussion on which disposables to keep in storage and which to specially order for special situations
- Delivering disposables just in time and specifically for the procedure.
- Standardization of disposables used for a procedure

Bad practices

- Leaving the old model disposables unused, when a new model disposable is available.
- Lack of standardization within some operation rooms.
- Not all disposables are ordered with the hospitals ordering tool, which reduces transparency and increases waste potential.
- Procedure faults that compromise the first in first out practice.

Health care pathway framework

Health care pathways exists for many different health care procedures. As described in the previous chapters, different practices for the goods logistics within these health care pathways exists. This chapter will provide a standardized framework of a general health care pathway This framework provides a structure to compare and benchmark different healthcare pathways and reduce disposable waste. This framework is based on the data researched in the case studies.

The framework created in this research will be divided into the three steps of the health care pathways: the pre-operation, operation and post-operation steps. This framework will describe the main waste reduction solutions per step and which actors are involved to implement these solutions. This framework provides simple and practical solutions to reduce the possible wasted disposables, based on the good and bad practices found in the case studies and the actor analyses.

Pre-operation

The pre-operation step of a healthcare pathway is often situated in a care ward of the hospital. In this department patients wait and are prepared for the operation. Some care wards are for specific health care pathways, but often this is not the case. In these instances, the patients within the care ward are waiting there for different operations or procedures. In both cases, different disposables are needed. In the case if the ward is specifically for one health care pathway, any disposable reduction methods has to focus only on the specific health care pathway. If the ward is for multiple different patients groups with different health care needs, any disposable reduction methods needs to be implemented on a department or hospital level. Any disposables needed by the ward are stored in locale storages in this ward. There are different methods to resupply these storages, but the preferred method should make sure that the disposables are used on a first in first out bases. This would ensure that the disposables are not wasted within the storages. A preferred method to ensure this first in first out method, is the use of a two bin system. In this system any disposable is stored in two bins, one for use and the other as storage. If the bin for use is empty it is resupplied by the storage bin and the new disposables are placed in the storage bin. This system is a simple and effective method to use, both by the supplier and user side of this system.

The main solutions to reduce the amount of waste within this step of the health care pathway are:

- Standardize the disposables used and stored in this health care pathway
- Standardize the use of the same type of disposables throughout the hospital, use one or a few models per disposable type.
- Optimize the distribution of disposables by using demand prediction or known patient planning

- All disposables should be used in a first in first out method (FIFO).

Operation

The operation step of the health care pathway is mostly done in a operation room or a similar department. These rooms are specialized rooms optimized for a medical procedure on, most often, a single patient. Because of the level of sterilization needed in these rooms, the cost for the use and maintenance of these rooms is high. The medical procedures conducted in these rooms are specialized and the disposables needed are also often specialized for these procedures. This ensures that the average cost for disposables used is higher than that of the pre- and post-operation steps.

The main solutions to reduce the amount of waste within this step of the health care pathway are:

- Standardize the disposables used in this health care pathway, preferably in disposable kits per operation per patient.
- Standardize the use of the same type of disposables throughout the department or hospital
- Deliver disposables just in time on transportable storage, to reduce the amount of storage within the O.R. department.
- When the standard type of disposable is changed, because there is a newer model or another supplier, the old standard type of disposable should first be used until the stock of this disposable is empty.

Post-operation

The post-operation step of the health care pathway is often situated in the same or a similar care ward as the pre- operation step. This step is similar to the pre-operation step both in disposables used and the solutions to reduce possible waste. There are two main differences between the two steps. Firstly, the patients will have moved through the system for a longer time than in the pre-operation step. This means that in this step almost all health care pathways can be seen as planned health care pathways. And the waste reduction solution proposed in the pre-operation step for planned health care pathways can be used. Secondly, after this step the patient will leave the hospital and go to their home or a after care facility. If the information on when a patient will leave the hospital and what types of disposables are needed for this patient is shared in advanced with the after care facility or organisation, these facilities and organisations can plan and optimize their logistics of disposables. This would improve the waste reduction of disposables on a general health care system level. This can only be implemented when the different parties involved communicate clearly and collaborate.

Framework overview

There are multiple different health care pathways within hospitals. All these health care pathways use disposables and there is the chance that these disposables are wasted. This framework provides methods to reduce this potential waste. The first and main point needed for change within a multi actor environment is communication and collaboration between actors involved. To optimize the disposables distribution and reduce waste, the amount of disposables needed and used has to be known. This knowledge is inherently connected to the health care demand of the patients. If the parties within the system communicate, the knowledge of the amount of patients, what they need , where they are and where they will be in the near future, is clear for all parties involved. With this knowledge, both the goods logistics can be optimized and possible waste reduced. Even when communication is optimized, some of the demand can still be hard to predict,. The disposables needed for these emergency procedures have to be stored within the hospital. To minimize this storage, all disposables of the same type should be standardized, for every type of disposable. This can be done on a department level, but most gain comes when this is implemented on hospital level.

Lastly, there is a theoretically simple but unpractical solution to reduce the waste of disposables. If all disposables were tracked and traced, no disposables have to be wasted. This track and tracing of disposables is already done on a small scale with expensive disposables in some hospitals. To track and trace the disposables, the information on these disposables have to be stored in a computer software system, from where it can be updated and monitored. This could ensure that no disposables are wasted or expire. This is unpractical to implement in a hospital, because the cost of inputting and monitoring all the data would be too high.

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