

UNIVERSITY OF WITWATERSRAND, JOHANNESBURG

**Possibility of Recycling Orthopaedic Appliances Waste in Luanda;
Case Study Centro de Medicina Física e Reabilitação de Luanda.**

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**Submitted in Accordance with the Requirements for the Degree of Masters
of Geography**

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DEDICATION

I dedicate this work to all the people living with disability in Angola and also to my mother Basilia, my father Morais, my sisters Erica, Nair and Jesuelma, and my nephew Erivaldo.

DECLARATION

I declare that this thesis is my own, unaided work. It is been submitted for the Degree of Masters of Science at the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination in any other University.

The author of this dissertation is a Kimbundu native speaker, and a Portuguese second-language speaker. English is her third language. The research report has been submitted to an English language editor before submission. Nevertheless, the author assumes responsibility for the inevitable grammatical, conjugational and sentence-structure errors that might appear sporadically throughout the text.

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Date: 25 July 2017

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ABSTRACT

In Angola, there is a high demand for orthopaedic appliances equipment, primarily as a result of the former civil war (Kapapelo, 2016), but also more recently due to lack of resources, endemic diseases such as poliomyelitis and meningitis, and an increase in road accidents among other things (República de Angola, 2015). There are eleven regional medical centres across Angola, but presently Centro de Medicina Física e Reabilitação de Luanda (CMFR) is the only hospital providing orthopaedic and prosthetic services across the country. It receives a large number of patients with different physical injuries who require this kind of service, resulting in the high demand for those orthopaedic appliances. Under the current circumstances, the CMFR finds it difficult to cope with this situation.

Given the high demand, and the lack of adequate resources at the national level, this thesis asks the question: why is there not a greater emphasis on the recycling of orthopaedic and prosthetic appliances? The thesis investigates why recycling of orthopaedic appliances waste is not happening at national level, with a particular focus on waste management regimes at CMFR. The findings interrogate the challenges faced by doctors and hospital administrators at CMFR, including the lack of capacity to execute its core mandate efficiently. This undermines the potential of increasing the local recycling and manufacture of orthopaedic appliances, which would be able to help in reducing expensive foreign importation of orthopaedic appliances materials, increase access, and thus reducing the long waiting-list for orthopaedic appliances equipment by people with disability at national level.

The initial findings showed that practices of mixing orthopaedic appliances waste with other types of both medical and urban waste in open dump areas are some of the current aspects which impede the implementation of a recycling system. The study findings also discovered that most of the stakeholders in CMFR have a very low level of commitment to managing orthopaedic and prosthetic appliances waste effectively, and / or feel disempowered to drive such initiatives in a context of a hospital already over-capacity. However, the lack of technical and financial capacity of these stakeholders and the absence of a coordinative framework greatly impede the proper orthopaedic and prosthetic appliances waste management practices at CMFR. The study therefore argues that improving orthopaedic appliances waste management largely depends on these critical factors: an effective and relevant legal framework with a specific focus on orthopaedic appliances waste management, skilled workers, and institutional strengthening in terms of funds to invest in orthopaedic appliances waste management. These issues need to be addressed in order to implement an orthopaedic and prosthetic appliances waste recycling system at CMFR.

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List of acronyms

CMFR- Centro Medicina Física e Reabilitação de Luanda (a medical institution in the field of physical medicine and rehabilitation, a public healthcare facility).

LARDEF- Liga de Apoio a Integração de Deficientes (an association for people with disabilities that help people with disabilities that find it difficult to have access to an orthopaedic appliance, jobs, schools etc).

ELISAL- Empresa de Saneamento e Limpeza de Luanda (an urban waste collection company that is in charge of collecting all urban waste in Luanda)

UNITA- União Nacional para a Independência Total de Angola (one of the parties that caused civil war conflict for many years in Angola from 1975 to 2002)

CHAPTER ONE

INTRODUCTION

1.1 The research question

In Angola, there are many people with severe disabilities resulting from endemic diseases such as poliomyelitis and meningitis, road traffic accidents, non-communicable diseases as well as armed conflict, who need orthopaedic and prosthetic equipment. The number of people with disabilities is still increasing due to the high rate of poverty in vulnerable communities, since disabilities are often linked to poverty (social and economic issues).

Although there are eight other orthopaedic centres distributed in other provinces: Centro Ortopedico da Huila, Centro Ortopedico do Kuando Kubango, Centro Ortopedico do Huambo, Centro Ortopedico do Bié, Centro Ortopedico de Benguela, Centro Ortopedico do Kwanza Sul, Centro Ortopedico do Moxico and Centro Ortopedico do Uige.

Currently CMFR is the only centre operating in and manufacturing orthopaedic and prosthetic appliances at national level and it has become difficult for the Centro to handle the high demand for orthopaedic and prosthetic equipment. The Centro is faced with issues such as financial problems, lack of human resources, lack of skilled workers and lack of access to advanced technology. All of these would assist the Centro in effectively providing sufficient orthopaedic and prosthetic appliances. I have noted that many people living with disabilities still experience serious difficulties in accessing orthopaedic and prosthetic equipment not only at local but also at national level.

The assumption is that knowledge about recycling of orthopaedic and prosthetic appliances waste is limited. However, the question about what the current issues associated with orthopaedic and prosthetic appliances waste management in order to recycle orthopaedic and prosthetic appliances waste at CMFR are, remains. This study exclusively assesses the negative impact of poor orthopaedic and prosthetic appliances waste management that delays the implementation of a recycling system at CMFR and increases the enormous amount of waste generated at the source. It also affects the importation of orthopaedic and prosthetic materials needed to manufacture new orthopaedic and prosthetic equipment because of the high demand for such orthopaedic and prosthetic appliances by people with special conditions, which demand creates instability in their life since they need this orthopaedic and prosthetic equipment to be mobile and to improve their lifestyle.

It is crucial that orthopaedic and prosthetic appliances waste has to be well managed through separation, storage, reuse and recovery to promote a recycling system with the intention of utilising orthopaedic and

prosthetic appliances waste to manufacture new orthopaedic and prosthetic equipment. This is an efficient and effective way of alleviating the difficulties for those who depend on orthopaedic and prosthetic appliances for their daily activities.

Some research on medical waste management has been carried out, but most researchers have not looked at the challenges of the possibility of recycling orthopaedic appliances waste in healthcare facilities holistically. They have not considered the entire network of processes, which are generation, storage, separation, recovery, reuse and finally recycling of orthopaedic and prosthetic appliances waste in order to manufacture new orthopaedic and prosthetic equipment. In one study, for example Chima *et al.*, (2014) on Hospital Waste Generation and Management Practices in Owerri, Nigeria, not all stages such as generation, storage, separation, reuse, recovery and recycling of those orthopaedic and prosthetic appliances waste to manufacture new orthopaedic and prosthetic appliances were looked at. Given the scenario mentioned above, I felt there is paucity of research on the possibility of recycling orthopaedic and prosthetic appliances waste to manufacture new orthopaedic and prosthetic equipment in order to minimise the difficulties that many people living with disabilities have in accessing such equipment to improve their lifestyle.

At this stage at CMFR hardly anything has been done to address the current issues related to the proper orthopaedic and prosthetic appliances waste management, and to ascertain strategies that address and ensure best practices to implement a recycling system at CMFR. My objective is to assess the possibility of implementing a process at the Centro to recycle orthopaedic and prosthetic appliances waste in order to manufacture orthopaedic and prosthetic equipment. I will also look at how the network of processes will reflect in the actual lifestyle of many people with disabilities, who need such orthopaedic and prosthetic appliances to move freely.

Therefore, this research report is an attempt to answer the following question:

What are the current barriers to, and future possibilities for, recycling orthopaedic and prosthetic appliance waste at Centro de Medicina Física e Reabilitação de Luanda?

In other words, the aim of the study is to understand the barriers to the recycling of orthopaedic and prosthetic appliance waste management at Centro de Medicina Física e Reabilitação de Luanda and to critically assess the potential of implementing such a programme in the future.

The main objectives of the study, in order to answer the question posed, are:

1. To understand the context of orthopaedic and prosthetic waste management in Luanda at Centro Medicina Física e Reabilitação de Luanda;
2. To analyse the perceptions of recycling and waste management practices at Centro Medicina Física e Reabilitação de Luanda among staff; and
3. To analyse the barriers to recycling.

1.2 Case study site

Fieldwork and data collection for this study was carried out in Luanda, the capital city of Angola (Figure 1), situated in the north-west region of Angola (Figure 2). This region was selected because it is the only one that offers orthopaedic and prosthetic services at national level, at the Centro de Medicina Física e Reabilitação de Luanda (CMFR), located in the Maianga municipality in Luanda. CMFR assists people from all parts of the country and so far it is the biggest and the only centre operating at the moment which manufactures orthopaedic and prosthetic equipment at national level and provides orthopaedic and prosthetic medical services to the population. It employs more than 350 people, but only fifteen technicians in the orthopaedic and prosthetic sector, and receives more than ninety users per day (CMFR, 2008).

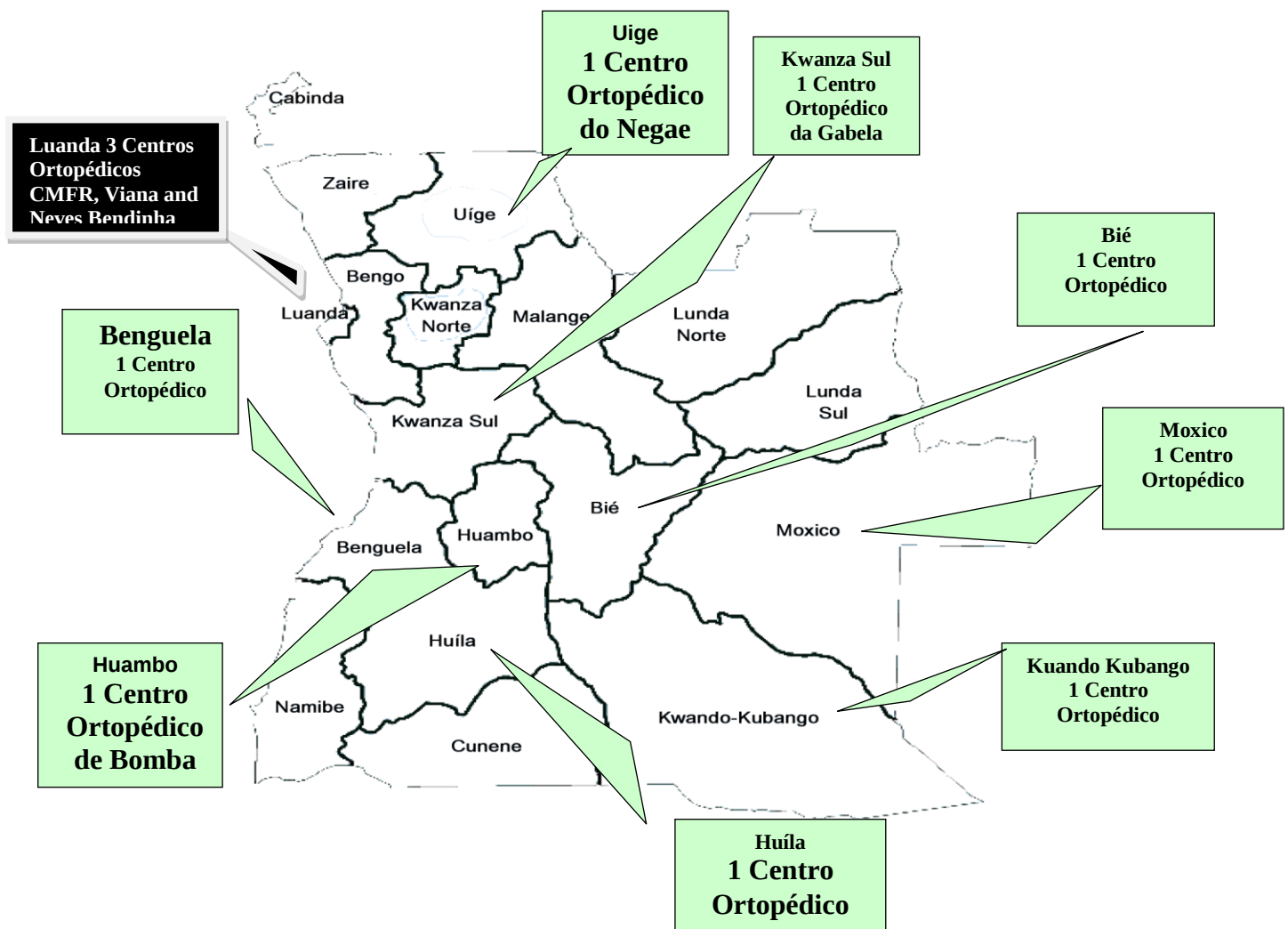


Figure 1. Source Ministério da Saúde, 2014 (Map of Angola indicating the Centros Ortopédicos in Angola)

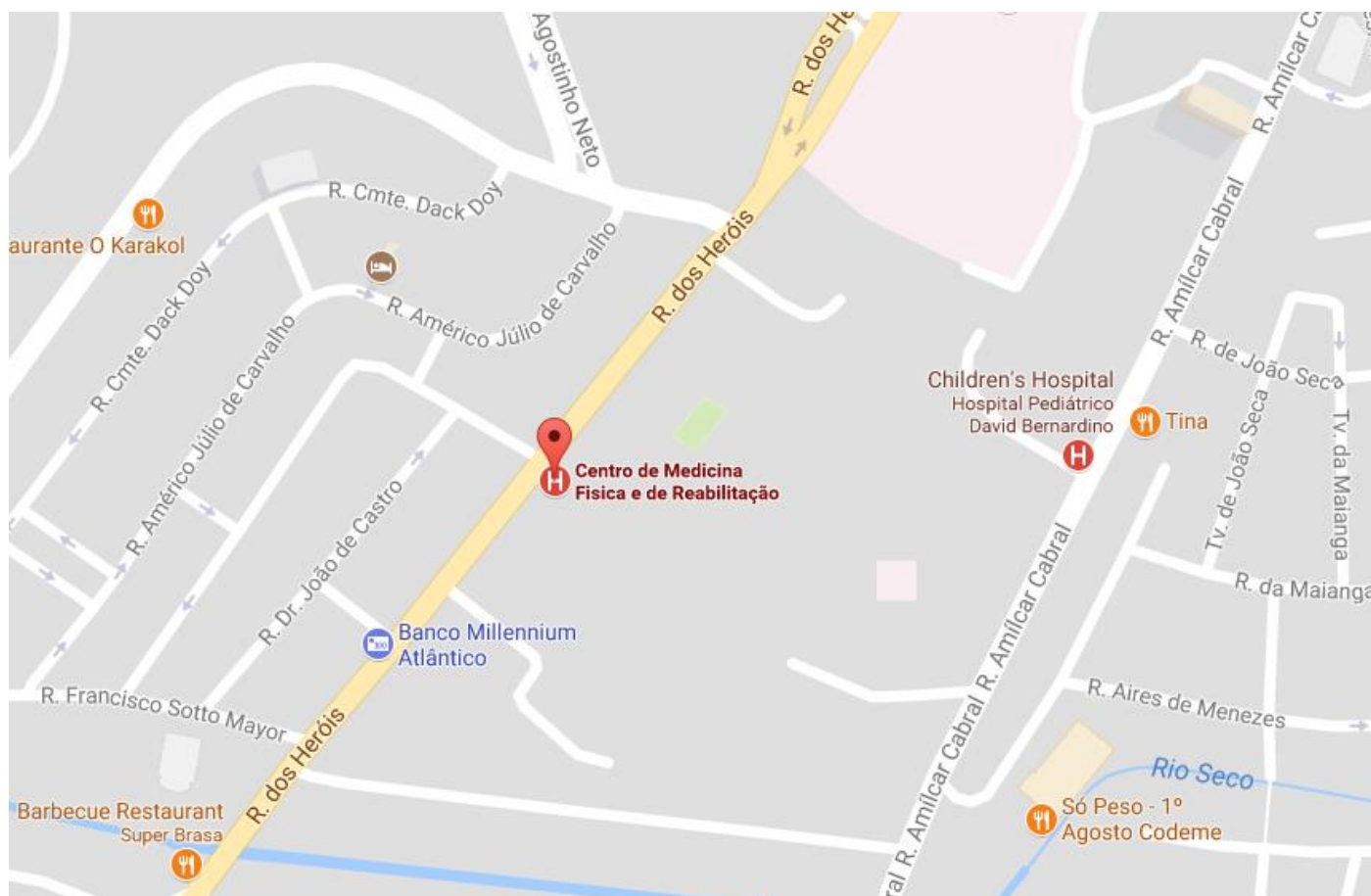


Figure 2. Map of Luanda indicating the region of study (Google, 2017).

1.3 Rationale for the study

The purpose of this dissertation was to analyse the possibility of recycling orthopaedic appliances waste at CMFR. Looking at the manufacture of orthopaedic and prosthetic appliances to meet the increasing demands by people with disability provided insights into the services offered and the barriers faced by many people with special conditions in accessing this equipment. CMFR sometimes experiences financial difficulties and cannot import sufficient orthopaedic and prosthetic materials to manufacture new orthopaedic and prosthetic appliances. Although the Centro is a public institution, it does not receive enough support from stakeholders in general, including the Angolan government, in implementing the recycling and reuse of orthopaedic and prosthetic appliances waste, considered as an alternative in addressing the high demand and limited access by people with disability that need these orthopaedic and prosthetic appliances to improve their daily activities and be mobile.

There are few published studies concerning the evaluation of the possibility of recycling orthopaedic appliances waste programmes in developing countries and in particular, concerning programmes with the potential of recycling orthopaedic and prosthetic appliances waste (Lundquist 2002). These programmes could provide social and economic benefits such as increasing the manufacture of new orthopaedic and

prosthetic appliances equipment by implementing a recycling system. This is not surprising, since evaluation is often not the priority for such programmes in most developing countries, especially those that have been faced with war for many years, such as Angola, and where the current priorities are more focussed on rebuilding the country.

Furthermore, the majority of research conducted in developing countries on orthopaedic and prosthetic equipment has tended to focus primarily on the orthopaedic technology of prosthetic limbs, rehabilitation and satisfaction (Peaco, Halsne & Hafner, 2011), (Jensen & Sexton, 2010), (Magnusson, Shangali, & Ahlström, 2016). It was my intention, in designing this study, to evaluate the possibility of recycling orthopaedic appliances waste at CMFR to be adopted as a future programme in Angola and to produce knowledge that would benefit people in places beyond the specific programme being assessed.

The orthopaedic and prosthetic appliances waste is moved and transported by hospital cleaners. Usually bags are available for the pre-collection and collection of orthopaedic and prosthetic appliances waste as well as boxes, which are emptied into containers, after the deposits of orthopaedic and prosthetic appliances waste have been washed or cleaned with wet cloths. These containers remain outdoors or even in waste bins in the areas of healthcare establishments. Because the waste has been emptied into the containers, it is not bagged and thus easily accessible to people and animals and exposed to climatic conditions. Given the high levels of poverty, it is common to find people seeking food and materials in these places.

This research explores the possibility of recycling orthopaedic and prosthetic appliances waste at CMFR as a study case. It is important to make an effort to understand how recycling orthopaedic and prosthetic appliances waste can provide benefits to any society, especially one that faced a civil war for many years. As a result of the civil war, the number of people with disability who need orthopaedic and prosthetic appliances equipment is extremely high and the access to such equipment is limited. The perception of orthopaedic and prosthetic appliances waste management is important for the successful implementation of a recycling system, since orthopaedic and prosthetic appliances waste is currently characterised by low levels of separation and storage and inappropriate disposal practices including indiscriminate dumping and open burning.

Orthopaedic and prosthetic appliances waste is also characterised by the involvement of various stakeholders, such as non-governmental organisations (NGOs), private and public sectors and the population in general, in various stages of orthopaedic and prosthetic appliances waste generation and recycling. The stakeholders who deal with this type of waste should be involved in different ways, and not only in the generation of the waste itself, but in the separation, storage, disposal as well as recovery, reuse and recycling

of orthopaedic and prosthetic appliances waste, as they are responsible for the waste that they generate at source during their activities.

It is evident that the involvement of politicians, hospital staff, NGOs and the population in general has to be hailed as a catalyst and contributing factor that has speeded up, and exerted tremendous pressure on, the recycling and management of orthopaedic and prosthetic appliances waste. This has been achieved through waste reduction, recovery, reuse, educational and awareness campaigns, and other areas of infrastructural development and maintenance of health care facilities that cope with orthopaedic and prosthetic appliances materials.

This section highlighted in great depth why the study needed to be done and why proper orthopaedic and prosthetic appliances waste management through a recycling system should be followed to the letter. It also revealed that currently orthopaedic and prosthetic appliances waste management at the Centro has proven to be a challenge. This chapter also looked at the research questions, aim, objectives and the problem under investigation and finally, the geographical position of CMFR.

The study shows that there is a lack of literature exploring the orthopaedic and prosthetic appliances waste management through adaptive recycling systems in the context of developing countries. This research also discusses the literature review of current waste management practices, including medical waste management with a particular focus on the management of orthopaedic and prosthetic appliances waste, by applying best practices through separation, storage, reuse, recovery and recycling systems in order to increase the manufacture of orthopaedic and prosthetic appliances equipment in the African context, including Angola. However, this research shows the high demand for and the scarcity of availability, and provision of such orthopaedic and prosthetic appliances equipment in the African context as well as the quality of healthcare services in eight provinces of Angola. I devote particular attention to the orthopaedic and prosthetic appliances waste management through a recycling system at CMFR due to the non-existent implementation of a recycling system at a national level.

Key general and medical waste indicators, and in particular the orthopaedic and prosthetic appliances waste management indicators, in Angola are still poor. In order to improve those indicators, more information is needed about the potential of recycling orthopaedic and prosthetic appliances waste through both economic and social aspects such as health service delivery, the availability of orthopaedic and prosthetic appliances materials and the reduced demand for the importation of orthopaedic and prosthetic appliances materials to make new orthopaedic and prosthetic appliances equipment. This dissertation aims to contribute to this pool of information. Policymakers could use this information to inform and improve healthcare policies. An important and unique feature of this data set is that I have collected data on both the supply side (healthcare

facilities and workers) and the demand side (the users) of the healthcare system. The aims of this dissertation are:

- a) To understand the context of orthopaedic and prosthetic waste management in Luanda at CMFR; and,
- b) Critically assess the potential of implementing such a programme in the future.

The aim of this research shows the current barriers exist of recycling orthopaedic and prosthetic appliances waste at CMFR. The awareness to manage and dispose of orthopaedic and prosthetic appliances waste properly remains very poor at institutional level. Consequently, it will increase the high demand for orthopaedic and prosthetic appliances by people with disabilities who need that basic equipment to improve their lifestyle and mobility. However, appropriate orthopaedic and prosthetic appliances waste management through a reuse and recycling system is a vital requirement as it would ensure that new orthopaedic and prosthetic appliances equipment can be manufactured by implementing such recycling mechanisms.

It is therefore important to understand that improper orthopaedic and prosthetic appliances waste management may cause adverse economic, social and environmental effects by increasing the huge amount of orthopaedic and prosthetic appliances waste generated at the source. The knock-on effects are decreasing the amount of space available to receive this huge quantity of orthopaedic and prosthetic appliances waste, increasing the importation of orthopaedic and prosthetic appliances materials to make new orthopaedic and prosthetic equipment, providing less access to such orthopaedic and prosthetic appliances by people with special needs (the disabled) and damaging the environment.

The aim of this research is to contribute to the stakeholders at CMFR in beginning to see the potential of recycling orthopaedic and prosthetic appliances waste in order to implement such a programme in the future. Therefore, the information contained in this research could help the Angolan government, particularly CMFR as a case study, to inform and improve orthopaedic and prosthetic appliances waste management through a recycling system in order to increase the manufacture of orthopaedic and prosthetic appliances. This would help to reduce the importation of orthopaedic and prosthetic appliances materials and alleviate the difficulties that many people with disabilities experience in accessing orthopaedic and prosthetic appliances which they need to improve their daily activities and mobility.

Another aim of this research is to explore the barriers that prevent the recycling of orthopaedic and prosthetic appliances, which would improve the socioeconomic conditions for many people with special conditions (the disabled) as they still face difficulties in accessing such equipment. Furthermore, I aim to focus on the lack of stakeholders' awareness of the importance of implementing best practices in

orthopaedic and prosthetic appliances waste management to promote a recycling system and to alleviate the demand for those orthopaedic and prosthetic appliances in Angola.

Having said this, the next chapter highlights the research design and methodology. Further details are described in the methodology section (chapter two). This chapter outlines in detail how the research was conducted and the methodology used in this research, which consisted of qualitative approaches, open-ended interviews, observations and analyses of documents accessed. This helped the researcher to conduct the research and gain an ample overview of the current situation at the Centro in order to evaluate the potential of recycling orthopaedic and prosthetic appliances waste at CMFR so as to increase the manufacture of orthopaedic and prosthetic appliances equipment. It also describes the research design, subjects, data collection process and instruments used. It also gives the data analysis and presentation plan. Furthermore, an ethical consideration is also outlined.

The qualitative approach consisted of interviewing those responsible for waste management in Angola at the Ministry of Environment, some municipalities, the official responsible for National Physical Rehabilitation at the Angolan Ministry of Health, the official responsible for Hospital Waste Management in Luanda from the company Recolix, the official responsible for Urban Waste Management at the company ELISAL in Luanda, the Head of the association that supports the integration of people living with disability (LARDEF), some workers and the Head at CMFR.

The respondents were interviewed in order to find out their views on orthopaedic and prosthetic appliances waste generation, its management practices of separation, storage, disposal, reuse, recovery and recycling, and the knowledge of orthopaedic and prosthetic appliances waste management. The use of a qualitative approach allowed the researcher to obtain a rich set of data.

The qualitative approach in this research also involved site visits or walks through the healthcare facilities to assess working conditions, and gather basic information about the institutions and issues relating to orthopaedic and prosthetic appliances waste management. A camera on a smart phone was used in the design to capture some scenes in the field of study. Photograph variables were used as evidence in the research. Dumping of orthopaedic and prosthetic appliances waste in open areas, orthopaedic appliances sector, prosthetic appliances sector, orthopaedic shoes sector and medical belts sector were observed and management of orthopaedic and prosthetic appliances waste through separation, storage, reuse, recovery and recycling were observed as well.

1.4 Outline of this research report

This present research gives a general overview of the current situation about the possibility of recycling orthopaedic appliances waste in Luanda based on a case study at CMFR. The possibility of recycling orthopaedic appliances waste could be defined as a manner of reusing orthopaedic appliances waste which is no longer needed to manufacture new orthopaedic appliances equipment.

This research is divided into 5 chapters, where in chapter 1 the research topic “possibility of recycling orthopaedic appliances waste in Luanda, case study CMFR” is introduced. It goes on to give an outline of the statement of the problem, research question, aim of the study, the objectives which are to be achieved in the study and it also gives a detailed account of the study area which the research is directed at and conducted from.

Chapter 2 reviews relevant literature which is important to providing the theoretical basis of the study, describing how prior studies, experience and theory have led to the focus of my research question. Chapter 3 presents the methodology and design processes used in the study which comprise the research site, the basis of the selection of participants, the data collection and analysis. The findings and a discussion thereof are presented in chapter 4, giving the survey analysis, case study interview and the direct observation analysis based on objective 1, which is the context of orthopaedic and prosthetic waste management in Luanda at CMFR. Then chapter 5 gives the survey analysis and case study interview analysis based on objective 2 which are the perceptions of recycling and waste management practices at CMFR among staff. Chapter 6 presents the survey analysis, case study interview analysis and the analysis of some documents accessed based on objective 3 which are the current barriers to recycling at CMFR. Lastly, the conclusions are outlined in chapter 7.

1.5 Conclusion

Chapter 1 introduced the research topic “Possibility of recycling orthopaedic appliances waste in Luanda; case study CMFR.” I went on to give an outline of the statement of the problem, research question, the aim of the study, the objectives which are to be achieved in the study, and also gave a detailed account of the study area which the research is directed at and conducted from, as well as the rationale for the study. From the above information it can be observed that the research seeks to ascertain the possibility of recycling orthopaedic appliances waste within the confines of CMFR. Although various studies and researches have been conducted in relation to medical waste management, they failed to take into consideration the recycling of orthopaedic appliances waste in particular. The researcher’s aim is to understand the barriers to the recycling of orthopaedic and prosthetic appliance waste management at CMFR that keep stakeholders from

participating and being involved in the orthopaedic appliances waste management, and to identify social, economic and environmental problems that arise from poor orthopaedic appliances waste management systems. The researcher is propelled to make a much more comprehensive study in order to proffer the best ways of managing orthopaedic appliances waste, and to evaluate the potential of recycling orthopaedic and prosthetic appliances waste in order to increase the manufacture of new orthopaedic appliances equipment within the CMFR.

In the following chapter, I will discuss the literature review that explores literature on orthopaedic appliances waste in Africa with a particular focus on the Angolan context. I will also look at disability, i.e. an overview of an estimate of people with disabilities and the demand for orthopaedic and prosthetic appliances materials in the Angolan context. And finally I will discuss the medical waste management challenges, focusing on the potential for an orthopaedic appliances waste recycling system in Africa with a particular focus on the Angolan context.

CHAPTER TWO

LITERATURE REVIEW

In this literature review I will cover three main sections of literature. In section 2.1 I will discuss the context of disability and orthopaedic demand in the African context. In section 2.2 I will discuss the specificity of the Angolan context, and especially the very particular context of post-war disability. In section 2.3 I will then discuss the possibility of orthopaedic and prosthetic appliances waste recycling, within the context of medical waste management in the African and specifically the Angolan context.

2.1 Disability in the Angolan context

Angola is one of the countries in Africa with a high rate of people with disability (LARDEF, 2014). The prevalence of disability is not well documented, and there are many people with disability as a result of violence during the colonial war between 1482 and 1975, after which Angola gained independence, and the civil war between 1975 and 2002 (Mazzaropi & Oiticica, 2008), both of which resulted in an increased number of amputees in need of orthopaedic and prosthetic appliances. In addition, low vaccination coverage led to polio outbreaks before and during the civil war, resulting in people in need of orthopaedic and prosthetic appliances equipment (CMFR, 2014).

It is assumed that the number of people with special needs at national level is 150,000 to 170, 000 but the total number of people with disabilities may be much greater than extrapolated, which is why international institutions suggest that the Angolan government should multiply those numbers by 10. This would bring the total to approximately one and a half million people with disabilities living in Angola (República de Angola, 2014). Monk and Wee (2008), the World Health Organization (2011) and the Department for International Development (2000) state that usually this vulnerable group of people live in developing countries, including Angola, under extreme poverty and face serious economic, psychological and social problems which include healthcare services, access to education and employment. One of the most essential elements is access to orthopaedic and prosthetic appliances, since these materials are vital for their mobility and daily activities, implying that the demand for this equipment is extremely high.

The number of people with disabilities in Angola is high as a result of war and other factors such as road traffic accidents, and different pathologies like poliomyelitis, meningitis and congenital deficiency. This number can be divided into different categories.

Table 1. Estimated percentage of people with disabilities

People with disability in Angola (total)	169,438
People with disability - victims of bombs	80,000
People with disability - victims of different pathologies	89,438
Men with disability	56%
Women with disability	44%

(República de Angola, 2014)

It is also noted in the information presented that an estimated 169,438 people with disability in Angola can be divided into different categories of which 80,000 are victims of bombs and 89,438 are victims of different pathologies such as poliomyelitis, meningitis and congenital diseases. This information also shows that 56% are men and 44% are women (República de Angola, 2014).

Ghobarah *et al.*, (2004) and Lusardi *et al.*, (2013) claim that armed conflict, motor vehicle accidents and endemic diseases like polio and meningitis have resulted in an increased number of people with disabilities in many developing countries, including Angola, and in increasing challenges experienced by persons affected by all these disasters.

2.2 Orthopaedic and prosthetic appliances in Angola

Ikeda *et al.*, (2014) claim that more than 5.8 % of people with special needs face immense difficulties in accessing orthopaedic and prosthetic appliances equipment in many developing countries. A lack of effective and efficient provision of these appliances and services, which includes manufacturing, service provision and application of new technology transference of orthopaedic and prosthetic appliances equipment, makes the whole process inefficient.

Chen *et al.*, (2014) recognised that the provision of orthopaedic and prosthetic appliances equipment for people with special conditions is considered important, based on healthcare field procedures. According to some investigations, they found that the provision of these basic needs for this particular group of vulnerable people includes assisting them by providing satisfactory services, functioning equipment, improvement in their quality of life and access to these appliances.

The World Health Organization (undated) asserts that 650 million people worldwide are persons with disabilities, which is approximately 10% of the world's population. Moreover, currently 80% of people with

special needs are living in developing countries and less than three percent of this particular community of people do not experience difficulties in receiving provision of services and accessing required orthopaedic and prosthetic appliances equipment and rehabilitation (World Health Organization, 2005).

Connell and Ingersoll (2012) and Kumar *et al.*, (2012) state that the demand for orthopaedic and prosthetic appliances equipment in developing countries including Angola is high and in itself will tend to increase in the coming years. However, some international organisations such as the World Health Organization and the International Society for Prosthetics and Orthotics estimate that only 0,5% of people with disabilities require this equipment in order to be mobile and improve their lifestyle in developing countries (Borg *et al.*, 2011).

In many developing countries, most of the people with special conditions are living in extreme poverty (Harkins *et al.*, 2012). However, various complex factors in many developing countries are linked to the poor provision of orthopaedic and prosthetic appliances equipment and healthcare services such as economic, cultural and social issues, where the healthcare services are low and rarely promised.

In the context of this analysis, social impacts are the perceptions expressed by citizens (Zengeni *et al.*, 2014) about their right to access orthopaedic and prosthetic appliance materials. These perceptions can be classified as follows:

- A general perception of a lack of interest by the government as their families do not face the same problems;
- disparity of equality at both social and economic levels;
- lack of effective legislation to provide a better quality life for the population, in particular disabled people;
- negligence by the government to implement strategies or programmes to overcome these issues;
- poor environmental quality;
- higher probability of accidents.

This influences the demand for orthopaedic and prosthetic appliances materials and significantly increases the need for this equipment (Borg *et al.*, 2012). Therefore, some developing countries have already started to improve on a variety of methods and strategies to provide efficient services, including more access to these appliances to the disabled population (Torrealba & Karger, 2011).

Cummings (1996) states that the demand for orthopaedic and prosthetic appliances equipment in developing countries is higher and will tend to increase significantly in the coming years because of a higher probability of car accidents and the prevalence of diseases such as malaria and diabetes, which is a current reality in these countries. Other reasons include limited resources of orthopaedic and prosthetic appliances, lack of

available advanced technology and lack of human resources, which can result in lower life expectancy for this particular community, that is, disabled people. This means that rapid intervention must be addressed by the stakeholders to ensure stability within this particular group of people with special conditions.

Meanley (1995) claims that various researches were conducted showing that the failure to assess individual needs, which include the need for orthopaedic and prosthetic appliances materials, leads to failure of services provision and any effective recycling system of these materials. It is also clear that disabilities have a major impact on the quality of life in many developing countries. It is recognised that disability is always linked to poverty and most of the time people with special needs are vulnerable because of poor health, high levels of unemployment, poor living and working conditions and poor nutritional standards. All of these affect their ability to prosper economically and to be integrated into society, forcing them to remain in extreme conditions (Iemmi *et al.*, undated).

Torrealba *et al.*, (2008) state that a prolonged armed conflict, road traffic accidents and some disasters that many developing countries, including Angola, faced for a long period of time, are the reasons for all the major physical destruction which are causing a breakdown in healthcare services, lack of treatment and control of diseases such as malaria, diabetes, cholera, typhoid fever and polio, alongside the inevitable increase in traumatic injuries. Consequently, this increased the massive demand for orthopaedic and prosthetic appliances equipment (African Union, undated). However, implementing the recycling and reuse of orthopaedic appliances waste system is one way to make new orthopaedic and prosthetic appliances equipment, allowing people with special conditions to have more access to these materials, helping to alleviate difficulties and improve their daily activities (Tudor, 2006; World Health Organization, 2010).

Harhay *et al.*, (2009) argue that it is crucial that the African governments, especially the Angolan government, create effective programmes where local issues must be discussed with the stakeholders that are in charge of orthopaedic and prosthetic appliances materials, in collaboration with people with special conditions, in order to improve and maximise the methods of services provision of orthopaedic and prosthetic appliances equipment in order to decrease the huge demand for these materials. Although it is obvious that the requirement for these services is still exorbitant, it should be noted that these strategies can alleviate current issues.

The reality is much worse in the Angolan context because the demand for orthopaedic and prosthetic appliances equipment by people with disability that need these materials is even higher, since a number of reasons are linked to a higher rate of people with disability such as civil war, endemic diseases like polio and meningitis, road traffic accidents, non-communicable diseases etc. Currently there is only one hospital that receives orders to make orthopaedic and prosthetic appliances, which has made it difficult for CMFR to

meet all the requests due to high demand. However, Calazans (2015) claims that in the Angolan case the situation is more concerning and severe since the statistics for people with disabilities are not well established.

At the end of the civil war, the number of people in need of orthopaedic and prosthetic appliances equipment was extremely high but it has not been well established exactly how many people have physical disabilities and how many people with special conditions use such orthopaedic and prosthetic equipment (Andrysek, 2010; República de Angola, undated). Approximately half of the orthopaedic and prosthetic appliances reviewed were not functioning well and people had difficulties in affording either repairs or new orthopaedic and prosthetic appliances equipment (República de Angola, 2014).

Campbell *et al.*, (2012), Resnik *et al.*, (2012) and Cornielje and Zulu (undated) state that various factors are linked to this failed process, such as lack of provision of health services, access and availability of orthopaedic and prosthetic appliances materials and human resources. These are considered to be the basic needs for this specific, vulnerable group of people. For example, the disabled people particularly in the rural areas where the needs are much higher, have difficulties accessing these services as they do not reach those who need orthopaedic and prosthetic appliances materials. Although an effort seems to have been made by the Angolan government by passing a law for people with disability Act No 21 of 2012 (República de Angola, 2012), more supportive interventions are needed to meet the high demand for orthopaedic and prosthetic appliances equipment.

Another important factor influencing this research is the demand for orthopaedic and prosthetic appliances (CMFR, 2014). It is estimated that the number of people with disabilities in developing countries is exorbitant, especially in those countries that experienced civil war for many years, such as Angola. Angola obtained independence in 1957, which did not last, and then suffered 27 years of civil war which ended in 2002 after the death of Jonas Savimbi, the leader of the Unita party (Djimeu, 2014). Furthermore, the rate of road traffic accidents in Angola over the past years has increased significantly and contributed to the number of people with disability, according to the National Directorate of Roads and Transit, Angola, although it is not well documented how many people have become disabled as a result of road traffic accidents (República de Angola, 2014).

This means that the demand for orthopaedic and prosthetic appliances countrywide is enormous. In most cases people are forced to travel to Luanda, the capital of Angola, to acquire orthopaedic and prosthetic appliances because of limited access to such orthopaedic and prosthetic equipment. These significant numbers of people come from other provinces, the majority from poor villages, towns, municipalities and

rural areas, where there is a higher concentration of uneducated and unemployed people who were victims of war (LARDEF, 2014; República de Angola, 2016).

This means that in both private and public health care facilities in the provinces, excluding Luanda, orthopaedic and prosthetic equipment supplies and the infrastructure of health care facilities are poor. Some of those places do not have enough or any orthopaedic and prosthetic materials to supply to the public while the demand remains high. Those who have the financial means usually travel abroad to purchase orthopaedic and prosthetic appliances. It is a current challenge that Angola needs to deal with.

2.3 Medical waste management and the potential for recycling in Angola

Akter (2000), Bartl (2014) and Hossain *et al.*, (2010) claim that hospital waste is waste generated inside healthcare facilities during their activities from different departments in the diagnosis, treatment or immunisation of human beings or animals, laboratories and orthopaedic and prosthetic sectors. Healthcare waste management is a significant problem in most developing countries, mainly because it is related to lack of appropriate legislation for effective control, and lack of skilled labour in charge of managing this type of waste from its generation at the source to separation, collection, transportation, storage and final disposal. Medical waste in developing countries is normally dumped and mixed with municipal urban waste, chemical waste and heavy metal waste (Coker *et al.*, 2008; International Committee of the Red Cross, 2011; Silva *et al.*, 2005; Wilson, 2007).

Diaz *et al.*, (2007) and Manyele and Lyasenga (2010) state that it is of prime importance to understand and distinguish orthopaedic and prosthetic appliances waste into its various types so as to understand the rationale behind stakeholder involvement. Patil and Shekdar (2001) suggest that orthopaedic and prosthetic appliances waste has to be managed properly in terms of its separation and storage in order to be reused and recycled, and the manner in which orthopaedic and prosthetic appliances waste is handled should differ from other types of waste such as household waste and contagious medical waste. Although a variety of waste is generated at healthcare facilities, each type of waste should be treated differently, since each one presents different characteristics (Rogers & Brent, 2005).

The lack of awareness about the hazards of medical waste at healthcare facilities, the level and promotion of public awareness related to proper waste management to promote best practices in order to safeguard public health and the environment, as well as minimal financial support from the government are the deficiencies, inconsistencies and improper applications of an integrated healthcare waste management system in most developing countries (Babanyara *et al.*, 2013; Demirbas, 2010).

Mosquera *et al.*, (2014), Nwachukwu *et al.*, (2013) and Patil and Shekdar (2001) claim that health care facilities can be inspired by quite simple and low-cost approaches to improving healthcare waste management, starting from awareness raising, education, and involvement. A systemic approach is always suggested, aiming at the integration of different tools and actions, such as the development of policy or procedures, the supply of material specifically dedicated to medical waste management e.g. with colour coding, posters and informative material, and training programmes in order to prevent poor medical waste management posing a severe risk to public health and the environment (Insa *et al.*, 2010; Marinković *et al.*, 2007).

Management of healthcare waste has received attention in many developing countries, and studies have been conducted on various issues of healthcare waste management in countries such as Nigeria (Abah & Ohimain, 2011), Tanzania (Manyele & Lyasenga, 2010), Libya (Sawalem *et al.*, 2008), Botswana (Mbongwe *et al.*, 2008) and Cameroon (Manga *et al.*, 2011). However, the recycling of orthopaedic and prosthetic appliances waste has not yet received much attention in the African context; in Angola in particular, systematic and comprehensive studies on orthopaedic and prosthetic appliance waste management in order to promote reuse and recycling system have not yet been conducted (República de Angola, 2011). Most of the research reported findings on medical waste management with a focus on disposal, contamination and reduction for various reasons such as economic and cultural. This means the prevalence of this issue related to the demand of orthopaedic and prosthetic appliances might increase in the coming years due to the persistence of many diseases and road traffic accidents (Idowu *et al.*, 2013).

Most of the barriers that continue to exist regarding the poor practices of healthcare waste management in various countries, including Angola, are associated with social and economic disparities in the society, which have been affected by the changes in the behaviour of the population. To overcome this problem, Aghapour *et al.*, (2013) suggest that the government needs to create effective programmes to make people understand that this problem cannot be seen as an individual but as a collective concern, and to motivate and also give opportunities to people to participate actively in the decisions made regarding social projects. A change in people's behaviour can have an effective impact on the healthcare waste management system.

Aghapour *et al.*, (2013), Birpinar *et al.*, (2009), Emmanuel (2007) and Taru and Kuvarega (2005) state that the current problems related to the generation of medical waste in general can be considered the greatest challenges in healthcare facilities in many developing countries, including Angola. Birpinar *et al.*, (2009) affirm that the amount of waste generated in many developing countries, especially those that have faced war for many years such as Angola, is increasing significantly, which poses a risk to public health and destroys the environment, as those societies are not prepared to deal with the huge quantity of waste generated by them. However, Blenkharn (2005); Khalid (2013); Mbongwe *et al.*, (2008) and Shivalli and

Sanklapur (2014) claim that it is necessary to minimise the production of medical waste by requiring effective separation, collection, transportation and treatment methods in order to decrease the volume of medical waste sent to the incinerator, thus protecting public health and the environment. As a result, the management of medical waste has become an indispensable condition to achieving sustainable development, but to achieve this goal it is essential that the plans address the principles of precaution, prevention and “polluter pays” and adopt the concepts of 3Rs are reuse, recycling and recovery as sustainable standards (Nassel, undated; Nwachukwu *et al.*, 2013).

A review by Castelão *et al.*, (2012) indicated poor orthopaedic and prosthetic appliances waste management practices prevailing in the country. Therefore, this study was specifically conducted to evaluate the present orthopaedic and prosthetic appliances waste management practices in selected healthcare facilities in Luanda, to determine the daily quantity of orthopaedic and prosthetic appliances waste generated and to put forward an appropriate orthopaedic and prosthetic appliances waste management system that promotes reuse and recycling in order to increase the manufacture of orthopaedic and prosthetic appliances equipment at local and national level.

The possibility of recycling orthopaedic appliances in Angola

In developed countries the reality is completely different compared to these developing countries when comes recycling and manufactured of orthopaedic and prosthetic appliances waste due to there is a strong involvement by stakeholders including the government, effectiveness polices, enough and advanced technologies (Cave, 2017).

However, High knowledge, advance technologies are available and strong policies are well documented, however, in these developed nations the healthcare facilities are encouraged to evaluate new technologies that contribute to reduce amount of waste generated through separation, collection, labeling, recycling and reuse to avoid negative impacts on the environmental and public health. Therefore, this process is equipped with automated process controls, monitoring and recording help to have a full picture of the medical waste management (Hughes and Jacobs 1996).

In industrialized countries context, for example in Australia each medical establishment is responsible for the waste generated at the source, and theses healthcare establishment are well auditable management structured in order to procedure correctly with medical waste management including orthopaedic and prosthetic appliances waste as a part of waste generated in healthcare facilities from separation, collection, storage, recycling and disposal, Also the regulations on medical waste management are well documented at all level (Hansen, Mikloweit , Ross and Popp, 2014); (Robertson, 2016).

Therefore, in developed nations the regulations and policies are well documented due to each healthcare facilities are responsible to ensure that all employees are provided with adequate education and training associated with medical waste management (Department of Tourism, Arts and the Environment, 2007); (Janagi *et al*, 2015). However, education and training programs focus on an understanding of approved work practices, and procedures for use the appropriate technology and equipment from separation, collection, labelling, reduction, recycling, transport and disposal (Agarwal *et at*, 2014); (Biohazard Waste Industry a Division of the Waste Management Association of Australia, 2010).

In many developing countries there is not a great deal of media attention surrounding technological advances in the field of recycling orthopaedic and prosthetic appliances waste (Diaz *et al.*, 2005; Taghipoura and Mosaferi, 2008). It will be particularly challenging in these developing countries to address the current issue, which requires aid-giving countries to assist in the implementation of a recycling orthopaedic and prosthetic waste system to promote manufacture of new orthopaedic and prosthetic equipment (Hossain *et al.*, 2010; Rushton, 2003).

Longe and Williams (2006) and Wiman *et al.*, (2002) claim that very little media coverage occurs. However, there is a need for planning and research that will create sustainable services to meet the needs of the majority of people with special conditions. This can lead to services becoming focused on new technology by manufacturing orthopaedic and prosthetic appliances equipment using the reuse and recycling process of this type of waste generated at the source rather than creating only an effective service (Yong *et al.*, 2008).

Olukanni *et al.*, (2014) state that there are lists of factors that can be considered and affected when it comes to implementing a recycling system of orthopaedic and prosthetic appliances waste to create an effective system of manufacturing these appliances, which can be adapted for use in most developing countries. Such factors include historical, social, economic, cultural, religious, political, psychological and climatic factors; available technology, materials and resources, and time and distance constraints.

There is a need for orthopaedic and prosthetic appliances that are vital to a significant number of people with disabilities worldwide, especially in developing countries such as Angola, in creating higher life expectancy (Howard *et al.*, 1995).

Abah and Ohimain (2011) claim that in general, little research related to recycling of orthopaedic and prosthetic appliances waste is available in most developing countries, including Angola. In the research that does exist, most of the focus has been directed towards evaluation of orthopaedic and prosthetic appliances materials, for example durability, satisfaction, provision etc. Lee *et al.*, (2003) and Omar *et al.*, (2012) state that the recycling of orthopaedic and prosthetic appliances waste needs to be available and affordable in

developing countries, particularly in Angola, in order to reuse locally available resources to increase the manufacture of new orthopaedic and prosthetic appliances equipment allowing people with disability to gain more access to these type of materials, which will help people with special conditions to improve their mobility and lifestyle in accordance with the Convention of Rights for Persons with Disabilities (Borg *et al.*, 2011).

Shinee *et al.*, (2006) state that it is important that African governments in these developing countries, including the Angolan government, recognise that a national strategy for effective orthopaedic and prosthetic appliance waste management to promote a reuse and recycling system with locally available resources in order to produce orthopaedic and prosthetic appliances equipment, education and training in the rehabilitation and healthcare sectors, is needed.

In the Angolan context there is a problem of recycling orthopaedic and prosthetic appliances waste, which is why the Angolan government needs to start seeing the potential of recycling orthopaedic and prosthetic appliances waste. The development of effective mechanisms at CMFR has been slow (ELISAL, 2011).

Presently, institutional recycling of orthopaedic and prosthetic appliances waste is an area in which our ignorance still exceeds our knowledge. The general picture is that significant quantities of orthopaedic and prosthetic appliances waste are generated in the institutional sector but there are no sound practices in place for recycling the orthopaedic and prosthetic appliances waste (Centro de Medicina Física e Reabilitação de Luanda, 2014).

The aim of this research was to understand the barriers in the recycling of orthopaedic and prosthetic appliance waste management at CMFR and to assess critically the potential of implementing such a programme in the future. Further objectives were to understand the context of orthopaedic and prosthetic waste management; analyse the extent, perception of practice and barriers to recycling orthopaedic and prosthetic appliance waste and evaluate the potential of implementing an efficient recycling project at CMFR.

There is a gap in the research on the implementation of reuse and recycling systems of orthopaedic and prosthetic appliances waste as one way of improving the manufacture of new orthopaedic and prosthetic appliances equipment and increasing access to, while significantly decreasing the demand for, these materials (Mbongwe *et al.*, 2008; Nemathaga *et al.*, 2007; Peaco *et al.*, 2011; Wyss *et al.*, 2013).

Furthermore, Udofia *et al.*, (2015) claim that a more substantial body of research on the reuse and recycling of orthopaedic and prosthetic appliances waste in many developing countries, including Angola, are

necessary to create the effective provision of services in order to manufacture new orthopaedic and prosthetic appliances equipment. These services have the potential to reach impoverished and disabled persons and may provide an opportunity to break the cycle of poverty and disability.

Legislators demonstrate their concern about environmental protection and establish legal responsibilities for each citizen and for institutions in the private or public sectors that may cause degradation of the environment. Any offenders who engage in and conduct activities detrimental to the environment should receive criminal and administrative sanctions in order to take responsibility for their acts against the environment (Castelão *et al.*, 2012).

Fisher and McLellan (1989) state that several studies have examined the satisfaction with, access to, cost, services delivery, rehabilitation and manufacture of orthopaedic and prosthetic appliances materials for people with special conditions. There is, however, scant research on the recycling of this type of waste and the purpose of this study was to investigate the possibility of recycling orthopaedic and prosthetic appliances waste at CMFR (República de Angola, 2014). The orthopaedic and prosthetic appliances waste included lower and upper limbs, orthopaedic and prosthetic, spinal and foot braces and orthopaedic shoes (Jensen and Raab, 2004).

This equipment is part of auxiliary appliances that are funded through government welfare allowance and they are prescribed commonly for people with disabilities including children that have paralytic poliomyelitis. However, poor healthcare conditions in various developing countries are related to armed conflict as well as economic, social and political reasons, which have failed to eradicate endemic diseases such as polio and malaria which still affect many African societies. (Ogwumike *et al.*, 2012; Olunsanya, 2008).

Ndidi *et al.*, (2009); Ikeda *et al.*, (2014) suggest that the implementation of recycling orthopaedic and prosthetic appliances waste in developing countries is an important factor in increasing the manufacture of new orthopaedic and prosthetic appliances and effective service provision.

Wiman *et al.*, (2002) claim that to achieve these goals the stakeholders and the population in general must be aware of the potential, that this network of processes can provide economic and social benefits by improving the quality of life for people with disabilities who have physical barriers to participating in society without these appliances.

The governments in these developing countries must provide a law to implement this recycling system and regulations to guarantee that disabled persons can be rehabilitated and become independent members of

society by having more access to orthopaedic and prosthetic equipment (Sakai *et al.*, 2011). Consequently, this would reduce the demand on government funding, contribute to the economy as well as help people with disabilities improve their lifestyle (Samuelsson & Wressle, 2008).

In this research, I focus on the possibility of recycling orthopaedic appliances primarily because it lends itself to increasing the manufacture of new orthopaedic and prosthetic appliances equipment. It is very important to recycle orthopaedic and prosthetic appliance waste, since the demand for these materials has increased significantly, particularly by people with special conditions, for example the disabled people who need these orthopaedic and prosthetic appliances for their mobility and their daily activities. Bassey *et al.*, (2006); Oweis *et al.*, (2005); Salam (2009) state that recycling also allows the application of the proceeds from selling materials into social benefits and improvement of infrastructure in the communities that participate in this programme. It can also create jobs and integrate previously marginalised workers into the formal economy.

Idowu *et al.*, (2013) state that it is important to note that the purpose of separating orthopaedic and prosthetic appliances waste generated at source is to reduce the volume of such waste by reusing and recycling orthopaedic and prosthetic waste to make new orthopaedic and prosthetic appliances. Manga *et al.*, (2011); Coker *et al.*, (2008) affirm that the reuse and recycling system has diverse advantages such as preserving natural resources, saving energy, creating jobs, raising stakeholders' and the public's awareness of issues related to the environment and helping disabled people who need those materials to improve their lifestyle.

2.4 The possibility of recycling orthopaedic and prosthetic appliance waste in the Angolan context

Adekunle *et al.*, (2012), Bendjoudi *et al.*, 2008), Chima *et al.*, (2014), Ibraim *et al.*, (2011), International Committee of the Red Cross (2007), Peizer (1977), Silva *et al.*, (2005) and Uwa (2013) comment that these days it is very important to recycle orthopaedic and prosthetic appliances waste to make new orthopaedic and prosthetic equipment, since the demand for these materials has increased significantly in many developing countries, including Angola, and a huge number of people with special conditions need these type of devices to improve their lifestyle.

In the case of Angola it is crucial that all stakeholders, and their contributions and involvement, and the reasons behind their involvement and the impact and extent of their involvement in reducing, reusing and recycling of orthopaedic and prosthetic appliances waste, are identified (Recolix, 2015). It is important for the Angolan government to begin to identify the social, health and economic problems arising from poor recycling of orthopaedic and prosthetic appliances waste systems and ways of improving the management of orthopaedic and prosthetic appliances waste to promote a recycling and reuse system at CMFR (ELISAL,

2011). Lastly, this chapter will outline the possible partnerships that may emerge from stakeholder involvement and associated benefits to the local authorities and communities. Delivery of services will also be highlighted. This section also covers the definitions of orthopaedic and prosthetic appliances waste which according to Abor and Bouwer (2008), Pongrácz and Pohjola (2004) and Prüss *et al.*, (1999) is defined as material that has been generated in a hospital during their activities and is deemed unwanted but which can be reused and recycled if it is well managed.

According to Lee *et al.*, (2002), Narayana (2008) and Pinho *et al.*, (2012), orthopaedic and prosthetic waste can include materials such as polypropylene plastics, rubber, leather and aluminium. Orthopaedic and prosthetic appliances waste is any solid material generated in hospitals. Orthopaedic and prosthetic appliances waste is categorised as non- hazard waste (Ndidi *et al.*, 2009).

Cheng *et al.*, (2008) and the International Committee of the Red Cross (2006) claim that leather waste is another type of orthopaedic waste that can also be recycled for other purposes such as making any orthopaedic and prosthetic appliances. Rubber waste is waste that protects the skin from direct contact with the polypropylene plastics of orthopaedic and prosthetic equipment to avoid any possible skin irritation. Aluminium waste is waste produced by industries and is an essential orthopaedic and prosthetic appliances material in the manufacture of new orthopaedic and prosthetic equipment and which provides support to the body. There is a need to separate these types of orthopaedic waste from other medical waste in order to promote a recycling system (Abdulla *et al.*, 2007; Mato & Kaseva, 1998; Mato & Kassenga, 1997; Sawalem *et al.*, 2008).

Therefore, lack of human resources, advanced technologies, finances and infrastructure have affected the proper recovery of orthopaedic and prosthetic appliances waste in order to promote a recycling system, which has been the slowest to develop effective mechanisms at CMFR (ELISAL, 2011). Presently, CMFR recycling of orthopaedic and prosthetic appliances waste is an area in which our ignorance still exceeds our knowledge. The general picture is that significant quantities of orthopaedic and prosthetic appliances waste are generated in the CMFR but there are no sound practices in place for recycling the orthopaedic and prosthetic appliances waste (Centro de Medicina Física e Reabilitação de Luanda, 2014).

2.5 Conclusion

In this chapter I have explored the literature review on orthopaedic and prosthetic appliances waste management systems and the demand for orthopaedic and prosthetic appliances equipment in Africa with particular focus on the Angolan context. In the first section, I discussed the issues that many developing countries are faced with in applying a proper mechanism in order to improve orthopaedic and prosthetic

appliances waste management systems, then I discussed the issues associated with the high rate of people with disability that are currently facing severe difficulties in their daily life to access the equipment for their basic needs. Then finally I discussed the potential of recycling orthopaedic and prosthetic appliances waste and the social, economic and environment benefits this could bring to the Angolan society if an effectiveness mechanism be implemented at national level.

What I have attempted to do is to show that although there is a great need for orthopaedic appliances, and that recycling offers great potential, there are in fact many barriers, connected mainly to the weak regimes of waste management - and especially medical waste management - in the Angolan context. In the following chapter, I will discuss the methodology of the study that I undertook in order to answer the question that emerges: what are these barriers that exist in medical waste management in Angola, and what potential is there to establish a recycling program in prosthetic and orthopaedic appliances waste?

CHAPTER THREE

METHODOLOGY

3.1 Introduction

The study employed case study action research techniques to collect data on the numerous stakeholders of the research instruments from an array of methodologies such as interviews, observations and access to some documents so as to achieve the objectives of the study. The current context of recycling orthopaedic and prosthetic appliances waste, and the perceptions of the stakeholders on the improvement of orthopaedic and prosthetic appliances waste through a recycling system in CMFR were captured this way.

Langen (2009) believed that a research design is a deliberately planned arrangement of conditions for analysis and collection of data in a manner which aims to provide relevance to the research purpose. The research is a case study of CMFR in relation to stakeholder involvement in orthopaedic and prosthetic appliances waste management in order to promote reuse and recycling. A case study was used in this case as a way to help me understand and to go deeper into a discussion on the barriers to recycling orthopaedic and prosthetic appliances waste that CMFR is faced with currently, and which delay the process of manufacturing new orthopaedic appliances equipment, which is a basic need for many people with disability, at national level (CMFR, 2014; Johansson, 2003). The adoption of a case study enabled me to relate what was studied at a micro-level scale to what could be in reality happening at macro-level.

The research is mainly descriptive (qualitative) in nature and the study employed the descriptive-survey method (Berg, 2001). This method incorporated the description, recording, analysis and interpretation of orthopaedic and prosthetic appliances waste management in order to promote the recycling system as a challenge at CMFR. It included the assessment and analysis of the data pertaining to the management of orthopaedic and prosthetic appliances waste at CMFR and the extent to which it presents a challenge.

This research used a qualitative approach, because I wanted to find out from key stakeholders what they perceived to be the barriers to recycling - in other words, I was more interested in the opinions of key people than in quantitative data about the issue of recycling. The reason for this is that I wanted to understand the institutional blockages and barriers, and to get their perceptions - as senior managers in the institution - about how to resolve these current issues related to recycling orthopaedic and prosthetic appliances waste system at CMFR.

The approach is further suitable for this study as it is used to carry out an investigation where other methods such as experiments are not practical (Thomas, 2006). Qualitative Research Design involves documenting real events and recording what people say about the challenges involved in the management of orthopaedic and prosthetic appliances waste while promoting the reuse and recycling system in order to increase the manufacture of orthopaedic and prosthetic appliances which would help to alleviate the difficulties that a significant number of people with disability face in affording this equipment which is a basic need for their mobility.

Qualitative research design further involves written documents, examining some visual images portraying orthopaedic and prosthetic appliances waste generations and the types and methods of reusing and recycling orthopaedic and prosthetic appliances waste.

3.2 Approach and methods

An interpretive philosophy was adopted for this study to explore the possibility of recycling orthopaedic appliances waste in Luanda at CMFR. A qualitative research approach was used in this study, as it was the best research methodology suitable for this research. Furthermore, the qualitative research helped me to understand how the participants feel and think about the issue under study. Proposal interview questions were adopted as the main technique for data collection. A judgmental procedure sample (from non-probability sampling) was selected for the study as quality experts were needed for this study (Baxter & Jack, 2008; Marshall, 1996).

The sample procedure was from a population made up of all individuals who occupy orthopaedic appliances waste management positions: about 15 participants at CMFR, one in the Department at the Ministry of Environment, Angola, one at the association that supports the integration of people living with disability (LARDEF). Four institutions were chosen to be part of the sample. Three respondents were part of the hospital waste collection company Recolix, three more were part of the urban waste collection company Elisal, one person was part of the department of National Physical Rehabilitation at the Ministry of Health, Angola, and four more respondents came from the residential area around CMFR.

A sample procedure of 20 proposal interview questions was subsequently chosen. The total was made up of 20 interview questions to be discussed with different responsible managers in different sectors such as the orthopaedic sector, prosthetic sector, orthopaedic shoes sector, belt medical sector and cleaning sector as well as the main administrator at CMFR where the study was carried out. Data for the research was collected from the 21st of October to the 19th of December 2015 in Luanda at the five institutions. Thematic or

deductive data analysis was chosen for this study as the researcher had to group various responses according to their meaning to come up with themes. Data was presented in the form of tables and graphs.

Table 2. Methods of data collection

Objective 1	Data needed	Tools
To understand the context of orthopaedic and prosthetic waste management in Luanda at CMFR	-The data needed here was regarding the observations made related to orthopaedic appliances waste: how it was disposed of outside, the storage thereof, and the separation practices of stakeholders in CMFR. -The data needed here helped comprehension of the current orthopaedic and prosthetic appliances waste management knowledge by the stakeholders, as well as help making an assessment pertaining to separation and the final disposition of the waste at the source.	- Observations - Interviews
Objective 2	Data needed	Tools
To analyse the perceptions of recycling and waste management practices at CMFR among staff	-The data needed here helped understand the stakeholders' perception by seeking their opinion about orthopaedic appliances waste management and their feelings regarding the need for training, information, and investment in order to incentivise the recycling system in CMFR.	- Interviews
Objective 3	Data needed	Tools
-To analyse the barriers to recycling	-The data needed here helped understanding the barriers to recycling, such as social and economic barriers, and disempowerment of doctors, which CMFR is faced with in overcoming the current issue in order to implement a recycling system. -The data needed here was collected by accessing some reports which helped to gain an overview of some gaps existent in	- Interviews - Access to documents

3.3 The use of interviews as data collection instruments

Interviews were used as research instruments to gather relevant data for the research and those formed the basis from which all important information for the study emerged. An interview is a conversation between the interviewer and the interviewee face-to-face. The first interview conducted was with the head at CMFR in the orthopaedic sector on the issues of work-related learning and management of orthopaedic and prosthetic appliances waste in order to promote the reuse and recycling system, which discussion was critically evaluated by me.

Other interviews were then conducted with other stakeholders such as a worker at LARDEF, the association that supports the integration of people living with disability, the head of Department of Waste Management at the Ministry of Environment, Angola, the leader of National Physical Rehabilitation at the Ministry of Health, Angola, some workers from the medical waste collection company Recolix and some municipalities in Luanda.

During the interviewing process, both the interviewer and the interviewee could clarify certain issues that seem complex and ambiguous on paper, for example, financial statements connected to orthopaedic and prosthetic appliances waste management are best understood by a person with accounting experience but could be understood by non-professionals if such statements are explained to them face-to-face during an interview.

The unstructured interview method allowed the interviewer to use discretion to depart from questions in relation to the order of their presentation as the situation demanded. The interviewer was in control and asked only the questions she wanted to. This aided the interviewer in analysing, appreciating and understanding the aspect under discussion.

Interviews went beyond obvious generalisations by exposing hidden information, which is the reason they could be viewed as highly informative in terms of gathering information on the subject under study. However, this method suffered from interviewee bias. The interviewees gave information that suppressed and concealed certain maladministration practices which the interviewer was seeking to expose in the study. Most interviewees gave a good impression of their organisations, which was actually the opposite of how those organisations operated on the ground.

I had difficulty in securing dates for interviews as most people to be interviewed were preoccupied with job commitments and had little or no time for me to carry out the interviews. There was also the issue of fear on the part of the interviewer of asking sensitive questions which might affect the confidentiality of the organization, and as a result of which otherwise important information which would have been very useful to the study may have been omitted.

The researcher conducted interviews with the head of medical waste management, including orthopaedic and prosthetic appliances waste, at CMFR which provided another opportunity to observe how orthopaedic and prosthetic appliances waste was currently managed. The researcher also observed a huge quantity of orthopaedic and prosthetic appliances waste, that could be reused and recycled, mixed with urban waste. The researcher further observed a large amount of orthopaedic and prosthetic appliances waste that could be reused and recycled on a large scale, such as leather, aluminium and polypropylene plastic, as well as the absence of biosafety practices by workers during their activities. In addition the researcher observed a dump in an open area during my fieldwork.

Interview questions were drawn from a document which contained a list of open-ended questions which the researcher asked respondents, based on the data obtained from the personnel department at CMFR, in relation to the topic under study. However, the interviews administered by me consisted of open-ended questions based on the respondents' knowledge and practice of orthopaedic and prosthetic appliances waste management, waste handling and separation, specific colour-coded bins, reuse and recycling of orthopaedic and prosthetic appliances, and implementation of waste management policies.

For a thorough assessment of orthopaedic and prosthetic appliances waste management at CMFR, the key stakeholders I was able to interview were the main administrator of CMFR, the head of the Department of Waste Management at the Ministry of Environment, Angola, and a worker at LARDEF, the association that supports the integration of people living with disability, both in person and by telephone, to obtain accurate information on the management of orthopaedic and prosthetic appliances waste that promotes a recycling system in order to increase the manufacture of orthopaedic and prosthetic appliances by helping people with special needs to gain more access to these materials in order to improve their mobility and lifestyle.

Participants felt more relaxed to attend the open-ended interviews on their own. More information was collected in a narrow space of time during the discussion between the researcher and the participants as compared to structured interviews during which participants simply answered the questions they had been given.

Participants were strictly limited to open-ended questions during interviews which allowed room for additional and constructive information that was useful for the study. The open-ended interview method was not a problem for some participants. Some of the participants were interested in attending the interviews and the researcher ended up receiving information from all those who participated in this study.

Various participants directly involved in the orthopaedic and prosthetic appliances waste management in order to promote the reuse and recycling system to increase the manufacture of new orthopaedic and prosthetic appliances equipment were surveyed using structured, open-ended interviews. Critical issues addressed by the interviews included the respondents' socio-economic characteristics and roles in the process of reusing and recycling orthopaedic and prosthetic appliances waste, the demand for orthopaedic and prosthetic appliances by people with disability, the provision of orthopaedic and prosthetic appliances materials to a significant number of people with special conditions, the implementation and effectiveness of policies and regulations, and the guidance and efforts of existing policies and regulations, among others.

The orthopaedic and prosthetic appliances waste rate was generally high, at 46%, which could be attributed to the growing community of people with disability who need orthopaedic and prosthetic appliances for several reasons such as endemic diseases polio and meningitis, and the high rate of road traffic accidents.

3.4 The use of observations as data collection instruments

Ritchie and Lewis (2003) suggest that observation is the method in which the researcher seeks to observe, identify, understand and obtain first-hand information on particular elements of the daily lives of people, situations, environment or problem under study. Observation was used to study social groupings or situations from an onlooker's perspective. I observed certain events related to the study. It served as a primary instrument of enquiry.

I conducted observations guided by the guidelines listed below, studying and trying to get a clearer understanding of the management of orthopaedic and prosthetic appliances waste in order to promote the reuse and recycling system at CMFR, the various stakeholders involved and their contributions, and the existence of mismanagement of orthopaedic and prosthetic appliances waste that affects an improvement in the efficiency of reuse, recycling and reduction of orthopaedic and prosthetic appliances waste in order to manufacture new orthopaedic and prosthetic appliances equipment at CMFR.

In this study, observations were made on the type of orthopaedic and prosthetic appliances waste generated, the modes of separation used for the reuse and recycling of orthopaedic and prosthetic waste, disposal sites and some illegal dumping sites. In the study, structured and participatory observations were used to

investigate the challenges faced in the management of orthopaedic and prosthetic appliances waste at CMFR.

The primary purpose of participatory observation research was to describe, in fundamental terms, the various events, situations and actions that occur in a particular setting. It was not a single method: it incorporated a wide range of characteristics blended together and combined methods and techniques that were employed in studying certain types of subject matter. I was privy to first-hand information, evidence, data and practices for this study. It helped the researcher to have an ample overview of the current reality.

Subjects tended to change their behaviour and perform better than usual in front of an audience, hence the observer ended up getting the wrong impression and information gathered was not accurate. It was too demanding in terms of time and required the day-to-day documenting of events so as to fully capture the essence, activities and operations of each participant under observation.

Using participant observation, this study builds on earlier work. The study adopted an ethnographic approach that involved three months of critical participant observation of the management of medical waste. Orthopaedic and prosthetic appliances waste management has not yet received enough attention in order to promote the reuse and recycling system, which cannot be simply ignored. This subject could be an objective for future study, thus giving better insight into the diverse ways of organising the orthopaedic and prosthetic appliances waste activities.

The fieldwork incorporated other instruments of data collection such as in-depth interviews. The purposefully random technique was employed in order to obtain maximum information about the economic and social aspects of orthopaedic and prosthetic appliance waste management. This technique helped in identifying the chain of activities associated with orthopaedic and prosthetic appliance waste separation, collection, reuse, recycling and the manufacture of new orthopaedic and prosthetic appliances equipment.

3.5 Study site

The study was carried out within the Centro Medicina Física e Reabilitação de Luanda (CMFR), which is a medical institution that specialises in the field of physical medicine and rehabilitation. This institution is a public health care institution. The political and military situation prevailing at that time as a result of the armed fight for the freedom and independence of Angola, encouraged the colonialists to build a hospital which was able to take care of and ensure the medical treatment of the multitude of colonial soldiers who were victims of the war. On the 5th of October 1970 the centre was inaugurated by Minister Joaquim

Modeira da Silva Cunha, who was the governor and general in Angola at that time (Centro Medicina Física e Reabilitação de Luanda, 2008).

The directorate of the medical staff was composed predominantly of Portuguese military doctors. After the independence in November 1975 many of these Portuguese doctors left the country, leaving many problems in CMFR. In 1990 it was found that the hospital was in a derelict state. With a dynamic new administration, the physical rehabilitation of the property began and was later furnished with new equipment. The centre was inaugurated by the current president of Angola, Engineer Jose Eduardo dos Santos.

During the colonial period when the Portuguese were in command of the power in Angola, the Portuguese state decided to open an orthopaedic centre in Luanda, the capital of Angola, based on the physical structures of a similar centre in Portugal, due to the higher number of disabled people as a result of the war that took place for many years until the independence in 1975. The centre also attended to people with physical injury from such causes as poliomyelitis, trombone, congenital diseases and meningitis, at national level.

CMFR also provides diverse health care services such as general practice, ophthalmology, paediatrics and gynaecology. Nowadays CMFR treats people from all over the country and at the present moment, even though there are 10 other orthopaedic centres at national level, CMFR is the biggest and the only one that is operating and providing orthopaedic medical services to the population that need it the most. However, currently it is a challenge for CMFR to fulfil all requests on time, due to the high demand for orthopaedic appliances equipment requested by people with special conditions that need these orthopaedic appliances equipment to improve their lifestyle, as CMFR is facing severe financial problems.

The research involved interviews with hospital staff and management who work in CMFR. Although the topic of the research speaks to the realities of disability among many of the Angolan people, this research did not involve interviews or any research with patients at the hospital. This is because the research question is concerned with hospital management strategy around orthopaedic appliance waste recycling, and not patient experience. As such, the sample group consisted of hospital employees.

The sampling procedure allowed for representatives of the main administrator of CMFR, the Ministry of the Environment, the Ministry of Health, the head of National Physical Rehabilitation at the Ministry of Health, Angola, the hospital waste collection company Recolix, the urban waste collection company Elisal, and of some municipalities in Luanda to be surveyed. A systematic random sampling was used. The interviews of some employees included the head at CMFR and the head of the Department of Waste Management at the Ministry of Environment, Angola. However, interviews with the director of the medical waste collection

company Recolix and the director of the urban waste collection company ELISAL were not conducted, but I was able to talk to a number of workers at both these companies, as well as a worker at LARDEF, the association that supports the integration of people living with disability.

Systematic random sampling was employed in an effort to interview more participants and give allowance for those absent. The intention of the researcher was to interview more people but some were absent, some were simply not interested and unwelcoming while others gave irrelevant information that was not useful for the study. On other hand, some of the participants were genuinely interested in taking part in the study.

Table 3. Systematic Random Sampling Technique used by the researcher

The Institutions where the data was collected	Number of Proposal Interview Questions	Systematic Sampling
Centro de Medicina Fisica e Reabilitacao de Luanda(CMFR)	20	15 Participants were interviewed
Some municipalities	2	6 Participants were interviewed
Urban waste collection company Elisal	3	3 Participants were interviewed
Hospital waste collection company Recolix	3	3 Participants were interviewed
The Department of Waste Management at the Ministry of Environment, Angola	6	1 Participant was interviewed
The National Physical Rehabilitation at the Ministry of Health, Angola	4	1 Participant was interviewed
The association that supports the integration of people living with disability (LARDEF)	5	1 Participant was interviewed

In the case of CMFR, the highest number of 15 participants were interviewed. In some municipalities six participants were interviewed, three participants were interviewed in both the urban waste collection company Elisal and the hospital waste collection company Recolix, and one participant was interviewed in the Department of Waste Management at the Ministry of Environment, Angola, at LARDEF, the association that supports the integration of people living with disability, and in the National Physical Rehabilitation at the Ministry of Health, Angola respectively. These were the lowest number of participants interviewed. Where it was not possible to interview the participants that had been randomly picked, for example the directors of Elisal and Recolix, then the workers in those two companies were considered suitable for the sample.

3.6 Data analysis

This area deals with data analysis. Analysis started as soon as data was collected, so one had to make sure that it had generated the themes for an accurate analysis. Bradley *et al.*, (2007) said that analysis holds the key to understanding the issues under investigation.

This section was performed with a view to analyse the possibility of recycling orthopaedic appliances waste in Luanda, specifically in the CMFR context, on the basis of their specific social, economic, environmental benefits and practical considerations. Furthermore, it was analysed which recycling steps could be carried out locally within CMFR and which steps CMFR had to take to make an improvement in recycling the huge quantity of orthopaedic appliances waste generated at CMFR in order to increase significantly the manufacture of new orthopaedic appliances equipment so as to reduce the high demand of those orthopaedic appliances equipment by people with special needs, who need those orthopaedic appliances materials to improve their lifestyle. Also, using local resources would decrease the importation of a huge quantity of orthopaedic appliances materials to manufacture new orthopaedic appliances materials.

This mechanism can be considered on the basis of the best way in order to improve recycling of orthopaedic appliances waste at CMFR. Technologies, economic, environmental and social improvement potential were analysed and quantified as far as possible. With regards to social improvement potential, special emphasis is placed on health and a better standard of life for people with disability issues, since the CMFR at the moment is the only medical centre nationwide responsible for the manufacture of orthopaedic appliances equipment for all people with special conditions that use those orthopaedic appliances equipment in order to be mobile.

Drawing from this analysis, a possible mechanism was sketched that could help to tap the described improvement potential for recycling orthopaedic appliances waste at CMFR. Thereby, special emphasis is on the possible role of the recycling system sector and on defining strategies to include the possibility of recycling orthopaedic appliances waste in future instead of importing huge amounts of orthopaedic appliances materials to manufacture new orthopaedic appliances equipment. Sometimes CMFR is not able to meet all requests in time due to financial problems, as the CMFR depends on the annual budget from the Angolan government. The analysis was conducted in three key areas, namely orthopaedic appliances waste, recycling and manufacture. The selection of these elements is based on the following criteria:

- The orthopaedic appliances waste constitutes an important share of the total medical waste volume in Luanda;

- The absence of an orthopaedic appliances waste recycling system is a particular social and economic concern; and
- The improvement of orthopaedic appliances waste management can serve as a model to implement a recycling system in order to increase the manufacture of new orthopaedic appliances equipment.

The results of the analysis of these criteria was presented at the beginning of each element analysis in the section relevant to the CMFR.

3.7 Challenges faced by the researcher during data collection

When I arrived in Angola, the first step was to send the letter from the University of the Witwatersrand to all the institutions where the data was gathered, such as CMFR, the urban waste collection company Elisal, the urban waste collection company Recolix, the head of the Department of Waste Management at the Ministry of Environment, and LARDEF, the association that supports the integration of people living with disability, which took one to two days.

While I was waiting for the responses from the institutions mentioned above to start arranging the appointments, which most of the time were delayed, I put all effort into contacting those people I needed to speak to and collect sufficient information, even though I did not have the authorization to do so, since the time I had to carry out the study was limited. Also, my competence to keep information gathered from participants confidential did not depend on the authorization given by those institutions to start with arranging the appointments. This stage took three to four weeks.

Although I believed that some participants would not agree to give some or even all information that I needed, I tried hard to convince participants to spare me some time. Some of the participants were often more preoccupied with their own business, sometimes they were too busy and they suggested a time convenient to them.

After I received the responses from those institutions to start with the visits, I just completed the data that I had already collected for a further two to three weeks. I showed the consent and information form to the participants to gain their confidence, but during the interviews the participants tended to give information that suppressed and concealed certain improper practices which the researcher was seeking to expose in the study. Some of the participants also tended to give a good impression of their institution, particularly CMFR as the case study which is actually the opposite of what the CMFR looks and operates like on the ground. I also had difficulty in obtaining some important information data which could have been useful for this

paper, since during the interview some participants were preoccupied with job commitments and hence had little or no time for me to conduct interviews.

There was also the issue of fear discussing some questions during the interview, as participants were concerned about maintaining the confidentiality of the CMFR in particular, but I made a significant effort to make the participants feel comfortable by ensuring them that everything they said would be totally confidential. I persevered in trying to obtain all the information I could get to enrich the data collection.

3.8 Study limitations

The findings in this study were subject to certain limitations. Some of the major limitations were:

- The study site covered only one specific place, which was CMFR.
- The study did not start on time, as a result of the delay from the institutions in responding to the letters I had sent to enable me to start with the data collection.
- The study was unable to adequately assess all documents needed to enrich this paper on orthopaedic and prosthetic appliances waste generation because of the uncooperative attitude from some administrators. It seems that in spite of the assurance of confidentiality; there was a hidden fear that the findings might be reported to higher authorities for action.

3.9 Ethics of the research

Research ethics concern the extent to which the researcher is ethically responsible to his or her participants, sponsors, the general public and the researcher's own beliefs. Ethical norms also serve the aims or goals of research and apply to those who conduct research as scholarly or creative activities (Orb *et al.*, 2000).

In this study, an ethics certificate was obtained from the relevant, approved, University ethics committee with (protocol number H15/09/20) at University of Witwatersrand, Johannesburg. I assured the participants that the information they gave would be treated with the strictest confidentiality and no divulgence of the information took place. Furthermore, no participant wrote their name or provided information that could lead to their identity becoming known during the interviews. There was also no personalisation of responses in the interviews which was explained before the commencement of the interviews. There was a need to strive for honesty for both parties in this study (Robley, 1995).

On my part, report data was gathered in an honest manner. During the study, no fabrication, falsification or misinterpretation of data was practiced. Participants were urged to provide true and accurate information pertaining to the management of orthopaedic and prosthetic appliances waste to promote a recycling system

in order to manufacture orthopaedic and prosthetic appliances equipment appliances at CMFR. In short, there was no bias or self-deception.

I accepted the research outcomes. Human rights were respected in this research, for example the right to worship. Participants were not forced to do activities such as being interviewed on the days they consider holy according to their denominations. For example, I did not schedule a Seventh Day Adventist follower for an interview on their Sabbath. Similarly, participants were not bribed, forced or begged to release data for this study, but had done so willingly. High integrity was one of the ethical priorities adhered to in this study.

I honoured the promises and agreements I had made. When I set a particular date and time for conducting an interview with a participant, for example, I arrived at the agreed venue well ahead of the scheduled time. Since my parents live far away from each of the places where I gathered all the data necessary for my study, I took possible traffic delays into account and ensured I arrived well ahead of time to fulfil my promise.

I strived for consistency of thought and action in this study. Participants in this study were too busy at times with their own commitments while at other times, they postponed their appointments to other days, which is why I was delayed in gathering all the data as quickly as I had expected. Nonetheless, I was able to overcome all the difficulties encountered during the data collection process and to gather all the data necessary to conclude my research. I was not authorised to work for a short time during the data collection process due to CMFR internal politics. Lastly, I ensured that politeness and respect was maintained throughout the research process.

3.10 Conclusion

This chapter identified the specific subjects that were analysed in the research as well as outlining the research instruments that were employed to collect primary data. In short this chapter embraces an approach of qualitative research instruments to analyse the current issues associated with the orthopaedic and prosthetic appliances waste management system in the Angolan context in order to evaluate the potential of recycling orthopaedic appliances waste with a particular focus on CMFR. Structured interviews and observations as secondary data sources as well as access to some documents (reports) were utilised. I also made use of photographs to illustrate the indiscriminate disposal of orthopaedic appliances waste in CMFR as among the instruments used to collect data for this study.

Having gone through the details on methodology, the next thing was to focus my attention on the research findings, which is the essence of the following chapter. The research findings on orthopaedic and prosthetic

appliances waste management at CMFR are presented with special attention to the current issues that CMFR faces in dealing with orthopaedic appliances waste through its generation, separation, storage and disposal of those orthopaedic and prosthetic appliances waste, in order to promote a recycling system at CMFR.

CHAPTER FOUR

WASTE MANAGEMENT IN CMFR CONTEXT

In this chapter I will cover seven main sections of research findings. In section 4.1, I will discuss the context of orthopaedic and prosthetic appliances waste management in CMFR. Then in 4.2, I will discuss in a particular context the irresponsible behaviour on disposal of waste by residents, especially stakeholders at CMFR. In section 4.3 I will cover the orthopaedic appliances waste management in the context of CMFR, considering generation, type of orthopaedic waste, separation and storage of orthopaedic appliances waste.

The waste management system in CMFR is facing a wide range of problems like separation, and the shortage of orthopaedic appliances materials to make new orthopaedic appliances equipment. Inappropriate disposal practices is another issue that CMFR has to cope with due to lack of education and awareness, and the present lack of enforcement related to illegal dumping by stakeholders.

The findings revealed also that some respondents were not happy with the current waste management systems which compromise the implementation of recycling of orthopaedic appliances waste at CMFR. It also includes the indiscriminate dumping of orthopaedic appliances waste in open dumps, which is associated with the improper waste management due to the irresponsible behaviour of the stakeholders as a whole. The respondents affirmed also that those irresponsible behaviours can pose social, economic and environmental threats.

Some respondents affirmed that if the waste management is handled properly, it will assist in importing fewer orthopaedic and prosthetic materials and giving a better quality of life to the population, particularly the more vulnerable groups of people such as people with disability. Therefore, the consumption of locally available waste generated at the source should be encouraged with the purpose of diversifying and increasing the economy in different sectors.

In spite of the contradiction from the head of the Department of Waste Management at the Ministry of Environment, Angola, who affirmed that the government has done a lot in relation to waste management practices, including orthopaedic and prosthetic appliances waste management, such as providing education, workshops and seminars in order to encourage proper management of both urban and healthcare waste, problems in certain public healthcare establishments, including CMFR, are associated with not following the commitment or instruction received to implement best practices on orthopaedic and prosthetic appliances waste management.

4.1. The Context of Orthopaedic and Prosthetic Appliances Waste Management in CMFR

The research interview survey reveals that improper management of orthopaedic and prosthetic appliances waste can have a negative impact on the community, particularly on people with disability, as they need that equipment to improve their lifestyle and move freely. It also delays the implementation of a recycling system at CMFR, which will consequently affect the increase in manufacture of new orthopaedic and prosthetic appliances equipment that results in demand for those materials and it also damages the environment.

Therefore, the head of the Department of Waste Management at the Ministry of Environment, Angola, cited that the Angolan government has made some efforts by implementing regulations and guidelines on medical waste management but without taking into consideration the orthopaedic and prosthetic appliances waste management to promote a recycling system to overcome the current issue that CMFR is faced with. Lack of information about the social and economic benefits of managing orthopaedic and prosthetic appliances waste properly remains a great challenge.

A worker at LARDEF, the association that supports the integration of people living with disability, said that currently there is a need and an urgency to implement proper management of orthopaedic appliance waste at CMFR at national level in order to reduce environmental risks and to improve the quality of life for the population, particularly disabled people, and to achieve sustainable development. Currently orthopaedic waste is composed of a variety of recyclable materials. The leader of National Physical Rehabilitation at the Ministry of Health, Angola has affirmed that this process, apart from recovering those materials, can create jobs, reduce the extraction of natural resources and save energy which is beneficial for the hospital, citizens, particularly disabled people, and the government.

The findings of this study revealed that during the raw data collection 30 people in different institutions were interviewed and during the discussions I noted that there is little motivation for engaging in orthopaedic appliances waste recycling by some participants. The study showed the level of awareness of solid waste, particularly orthopaedic and prosthetic appliances waste, recycling problems is low as there is no evidence of training on orthopaedic and prosthetic appliances waste management in order to promote a recycling system at national level, in particular in CMFR. Also, the findings revealed that stakeholders generated huge amounts of orthopaedic and prosthetic appliances waste during their activities, which usually was disposed of in open dumps where people and animals have access to it, and where it poses a threat to public health and the environment.

Table 4. Number of respondents interviewed in different institutions to show orthopaedic appliances waste management as a cause for concern in CMFR

Institutions where interviews were done	Number of people interviewed
CMFR	15
The Head of Waste Management Department at the Ministry of Environment, Angola	1
Workers at Urban Waste Collection Company Elisal	3
Workers at Hospital Waste Collection Company Recolix	3
some Municipalities	6
A Worker at the Association that Supports the Integration of People Living with Disability, LARDEF	1
The Head of National Physical Rehabilitation at the Ministry of Health, Angola	1
Total	30

The information in Table 4 above demonstrates the two methods used; observations and interviews of thirty people respectively clearly show that there is a serious concern regarding the orthopaedic appliances waste management in CMFR, where some participants do not want to expose the situation on the ground. However, given the above premises, the researcher's opinions are based on the information provided by those who support the research under study. From the observations made by the researcher, there are some elements of truth on the ground that orthopaedic and prosthetic appliances waste management is an issue of serious concern which compromises the implementation of a recycling system at CMFR level. The presence of huge amounts of orthopaedic and prosthetic appliances waste in open dumps is a clear testimony that orthopaedic and prosthetic appliances waste management is a cause for concern in CMFR.

Therefore, a worker at LARDEF, an association that supports the integration of people living with disability, confirmed that it is crucial that stakeholders at the Centro have the right personnel to take care of the orthopaedic and prosthetic appliances waste which is generated during their activities as well as sufficient capacity and knowledge to undertake the support of orthopaedic and prosthetic appliances waste management through separation, according to its characteristics, allowing the recyclable to be distinguished from the non-recyclable, and storage, in order to implement a recycling system to increase the manufacture of orthopaedic and prosthetic appliances equipment not only at local but also at national level.

4.2 Impact of irresponsible disposal of waste by residents and hospital workers at CMFR

From what has been observed during research, and in photographs taken, a dark situation at Centro emerges which is a true reflection of the residents' as well as the hospital workers' irresponsibility of what is termed "negative stakeholder involvement" in mixing orthopaedic and prosthetic appliances waste with urban waste due to mismanagement. Although during the interviews some residents blamed negligence by the Angolan government and the waste collection company ELISAL, associated with the waste collection system, for performing poorly and failing to deliver as promised during presidential elections. Residents do not have any other option but to discard their own waste, rather than dumping it around storage bins when they are full, because they cannot keep it at home even though most of them are aware of possible health risks that they are exposed to because of this poor procedure.

It was also mentioned by other residents that CMFR cannot deposit the waste that they generated in the same place as them, as this type of waste is not common waste and it can pose threats to public health and the environment, especially during the rainy season. However, some workers at the Centro admitted that the waste generated at the Centro is also deposited in the same external storage bins as urban waste, and sometimes dumped around storage bins, because of the complete lack of management of orthopaedic and prosthetic appliances waste at the Centro.

According to the response from a worker at LARDEF, the association that supports the integration of people living with disability, the extent of the situation that Centro still faces is shameful as Angola is a rich country and the Angolan government should make a greater effort by increasing sensitivity in terms of professional development of personnel on orthopaedic and prosthetic appliances waste management. There is a need for urgent attention among governmental entities regarding the organisation and implementation of an orthopaedic and prosthetic appliances waste management system, including the proper disposal of the orthopaedic waste generated at the source in order to overcome this current issue that affects the most vulnerable people.



Figure 3. A dump of orthopaedic and prosthetic appliances waste mixed with urban waste in an open area.

Source: CMFR (Photograph captured on 15/12/2015 within the Centro at 10:57 AM)

From the research observation as captured by the photo above it was noted how the residents, hospital workers and patients ignore the possible severe health risks by dumping both urban and healthcare waste, including orthopaedic and prosthetic appliances waste, since we can see clearly that those people, including children, are exposed to such an unsafe environment as waste dumps. There is a concentration of many insects such as flies and mosquitoes, as well as rats, which become vectors of many diseases such as malaria, typhoid fever, diarrhoea, cholera, etc. The insects and other animals from the waste dumps normally also go inside the residences as well as the Centro, particularly flies and mosquitoes, and other kinds of insects run around such as cockroaches, all of which have an effect on public health.

The observation survey revealed the indiscriminate dumping performed by the stakeholders at the Centro. The information in Figure 3 reflects that open dumping is the most common method of orthopaedic and prosthetic appliances waste disposal practiced at CMFR. However, the presence of such dumpsites demonstrates that there is poor management of orthopaedic and prosthetic appliances waste practices within the Centro. This bad procedure is performed not only by the workers at the Centro but by the residents living in that area. Hence, as one moves to this site, some illegal and unofficial open dump sites can be seen on the sides of the road, which are definitely an eyesore as they affect the aesthetic value and scenic beauty of this environment.

Some of these materials are a danger to human health and the environment itself, since many of these materials (orthopaedic devices and prostheses) are made up of acrylic resins and polypropylene plastic. Polypropylene is a thermoplastic substance which is highly toxic when burned and can present severe injuries to the population if inhaled and to the environment because of the particles that are emitted into the

atmosphere. Acrylic resin is in a liquid state in containers, and presents a danger to the environment and to public health if it is disposed of in open dump and burn areas without any treatment. Therefore, it is important for the stakeholders at the Centro to start thinking about developing efficient processing and disposal facilities and to encourage proper separation in order to promote recycling of orthopaedic and prosthetic appliances waste at the source.

Some of the reasons cited by the residents and the head of National Physical Rehabilitation at the Ministry of Health, Angola is that there is a need for more support from the Angolan government, as well as the stakeholders at CMFR, considered as a large public centre that provides orthopaedic and prosthetic equipment to many people with disabilities, to implement effective mechanisms in order to separate urban waste from orthopaedic and prosthetic appliances waste as well as to create effective mechanisms to dispose of the huge amount of orthopaedic waste generated at the source, reducing it through a recycling system to increase the manufacture of new orthopaedic and prosthetic equipment.

It was also observed that residents and workers at Centro deposit their waste in open spaces near roads, leading to the formation of ugly landscapes and massively foul smells which become characteristic features of those residential areas as well. Such improper practices of open dumping are a source of greenhouse gases such as methane, which is highly flammable and can cause fires and contribute to global warming. Leachate, which is a liquid produced by the decomposing of this waste material, is also common at such sites and this can seep deep down into the soil thereby polluting underground water sources. These bad practices have been a common feature either close to residential areas or healthcare establishments, including CMFR as case study under this research, because of a currently non-existent orthopaedic and prosthetic appliances waste management system.

It was observed that the presence of illegal dumpsites is a clear testimony to the fact that orthopaedic and prosthetic appliances waste management needs to be taken more seriously than people think. In addition to that, poor handling, absence of orthopaedic and prosthetic appliances waste separation and storage, lack of regulations, lack of awareness and training on orthopaedic and prosthetic appliances waste management are clear indications of why orthopaedic and prosthetic appliances waste is a great challenge at CMFR. Not only that, but some of the orthopaedic and prosthetic appliances waste is being dumped haphazardly, which is clogging the city's drains and will eventually cause sewer pipes to burst, promoting the spread of diseases such as cholera, typhoid and dysentery.

Workers at the hospital waste company Recolix confirmed that illegal dumpsites are home to rodents and vectors which are a great threat to humans. The failure to sort and grade orthopaedic and prosthetic appliances waste reveals that proper waste management is not practiced at CMFR. The mixing of

orthopaedic and prosthetic appliances waste with urban waste poses a great threat to residents, patients, hospital workers, cleaning staff and the environment.

The findings from what has been discussed and observed revealed that the orthopaedic and prosthetic appliances waste in open dumps close to their establishment is the most common method used by CMFR to dispose of orthopaedic and prosthetic appliances waste, which normally is mixed with urban waste since CMFR is located in a residential area, and the residents in that area use the same method to dispose of the urban waste they generate.

Some respondents said that it is important that workers at CMFR are made aware of the fact that they also have an important role to play in the enforcement of government strategies to collect and properly treat orthopaedic and prosthetic appliances waste. Awareness campaigns and other best practices should be implemented at institutional level in order for people to understand that orthopaedic and prosthetic appliances waste issues are not only the responsibility of the CMFR but also the provincial government, policy makers, public and private institutions as well as the population in general. It is essential to have a new conscience and attitude toward this phenomenon.

4.3 Context of orthopaedic and prosthetic appliances waste management at CMFR and perceptions

The research survey revealed that the context of orthopaedic and prosthetic appliances waste management continues to be an issue, and how important it is for the stakeholders to understand how a proper orthopaedic and prosthetic appliances waste management system can bring social and economic benefits to CMFR. The findings revealed also that the huge amount of orthopaedic and prosthetic appliances waste generated at CMFR is influenced by the high levels of people with disability who were victims of the long civil war which ended in 2002, or of non-communicable diseases such as polio and meningitis, of physical deformities, of measles or malnutrition (vitamin A and iodine deficiency), of congenital or perinatal diseases and of a significant increase in the number of road traffic accidents. However, these are only some aspects of the huge amount of orthopaedic and prosthetic appliances waste generated at Centro because the demand for this equipment by people with disability in Angola is extremely high, and the quantity of orthopaedic and prosthetic appliances waste generated at the Centro is proportional to the number of people with disability treated at the Centro and who require orthopaedic and prosthetic appliances.

The improper orthopaedic and prosthetic appliances waste management system at CMFR is plagued by non-existent data on the quantities of orthopaedic and prosthetic appliances waste generated, poor planning and lack of adequate budget allocation, including the absence of color-coded storage containers for different categories of orthopaedic and prosthetic appliances waste.

The findings reveal that orthopaedic and prosthetic appliances waste has been growing at a faster pace than what nature is capable of absorbing. The response from workers at the Centro confirmed that in recent years the generation of this waste has increased significantly due to a higher number of people with disabilities requiring those orthopaedic and prosthetic materials in Angola where the civil war, an increase in the rate of road traffic accidents, lack of adequate medical services, and non-communicable diseases were all contributory factors. Consequently the poor handling of waste through separation, storage, and a reuse and recycling system creates difficulties in properly managing that waste, which compromises the increase in the manufacture orthopaedic and prosthetic appliances for people with special needs.

During the study visit at CMFR the analysis revealed that the workers had no concept at all of the amount of orthopaedic and prosthetic appliances waste generated. In fact, some directors and workers were surprised at the interest expressed in the quantity of orthopaedic and prosthetic appliances waste they generate because this type of waste generated at the source is deposited together with urban waste in open dumping areas which poses operational, social, economic, and environmental and maintenance problems and which delays the implementation of a recycling system at CMFR.

Therefore, the analysis revealed also that stakeholders' understanding of the proper orthopaedic and prosthetic appliances waste management would help the reduction of orthopaedic and prosthetic appliances waste generation and that it should be the responsibility of everyone, but the study survey revealed that there are no training plans in place regarding the orthopaedic and prosthetic appliances waste management to assist the stakeholders in overcoming this current problem at CMFR.

The improper orthopaedic and prosthetic appliances waste management, including its design, separation, collection, reuse and recycling, continue to be a major issue at CMFR that causes a negative impact on the society by affecting the manufacture of new orthopaedic and prosthetic appliances, which consequently increases the demand for these materials by people with special conditions since this equipment is a basic need for them and allows them to be mobile and improve their daily activities.

The creation of a national policy on orthopaedic and prosthetic appliances waste would be essential to discipline integrated management, contribute to the changing consumption and production patterns in Angola, improve environmental quality and the population's living conditions particularly those considered as more vulnerable people (the disabled) in the Angolan community, as well as allow for a more effective implementation of the National Environmental Policy and the National Health Policy, highlighting strong democratic, participatory and decentralising components.

Concern over environmental issues makes orthopaedic and prosthetic appliances waste management a process of paramount importance in the preservation of health and improvement in the quality of life in the disabled people's community. The implementation of a reuse and recycling system at the source would increase the manufacture of orthopaedic and prosthetic appliances to alleviate the difficulties that many disabled people in Angola face when trying to access these materials as well as improve the quality of the environment.

The findings revealed that orthopaedic and prosthetic appliances waste would be a valuable benefit to the institution under study if the CMFR reused the waste generated at the source during their activities to manufacture new orthopaedic and prosthetic appliances equipment and to avoid importing these materials for the benefit of the more vulnerable population with special conditions as well as to ensure a healthy environment. Some of these materials are highly reusable and recyclable like aluminium, polypropylene plastics, rubber and leather.

Orthopaedic and prosthetic appliances waste generation at CMFR

The findings revealed that there are some reasons why the stakeholders at the Centro are not aware of the amount of waste they generate at the source during their activities. Hence, this can cause negative social or economic issues affecting particularly a huge number of disabled people as a result of poor orthopaedic and prosthetic appliances waste management which exposes more and more people with disabilities to the problem of accessing orthopaedic and prosthetic appliances that could, and should, be avoided.

It is crucial that the stakeholders are aware of the amount of waste generated during their activities, since it helps to obtain estimated data on how much waste is generated at the source by separating it according to its characteristics, which will provide a clear understanding to the stakeholders of how orthopaedic and prosthetic appliances can be reused and recycled.

For example, the information in table 5 below shows that in January 2014 an estimated 6,234 tons of orthopaedic and prosthetic appliances waste generated about 6% of orthopaedic and prosthetic appliances waste that could have been recycled, in February 6,629 tons generated about 6%, in March 6,433 tons generated about 6%, in April 4,521 tons generated about 4%, in May 4,222 tons generated about 4%, in June 3,067 tons generated about 3%, in July 3,985 tons generated about 3%, in August 2,882 tons generated about 2%, in September 3,010 tons generated about 3%, in October 3,856 tons generated about 3%, in November 4,025 tons generated about 4% and in December 4,764 tons generated about 4% that could have been recycled at the source in order to manufacture new orthopaedic and prosthetic appliances.

Table 6 shows that in January 2015 an estimated 5,768 tons of orthopaedic and prosthetic appliances waste generated about 5% of orthopaedic and prosthetic waste that could have been recycled, in February 5,890 tons generated about 5%, in March 6,789 tons generated about 6%, in April 6,432 tons generated about 6%, in May 6,290 tons generated about 6%, in June 4,965 tons generated about 4%, in July 3,335 tons generated about 3%, in August 2,032 tons generated about 2%, in September 2,345 tons generated about 2%, in October 3,665 tons generated about 3%, in November 3,221 tons generated about 3% and in December 3,786 tons generated about 2% that could have been recycled at the source in order to manufacture new orthopaedic and prosthetic appliances.

Orthopaedic and prosthetic appliances waste generation is proportional to the number of people with special conditions who have been treated at healthcare facilities. Orthopaedic and prosthetic appliances waste generally includes bandages, plasters, polypropylene plastic, metal, aluminium, leather and rubber. Angola, just like many other African countries, has experienced war for many years, the outbreak of many diseases such as polio, meningitis and a number of non-communicable diseases as well as road traffic accidents that created a large population of people with disability (República de Angola, 2013). The increase in the number of people with special conditions (disabilities) will increase per capita production of orthopaedic and prosthetic appliances waste, and the non-availability of land conveniently suited for orthopaedic and prosthetic appliances waste disposal has already aggravated the acute problems of orthopaedic and prosthetic appliances waste collection and disposal systems (Elisal, 2014),

Research reveals that waste at CMFR is not being estimated since orthopaedic and prosthetic appliances waste is mixed with urban waste which is collected by ELISAL, a company responsible for collecting urban waste, which is estimated to be close to 1,283,906.56 tons–1,905,423.45 tons per year (ELISAL, 2014-2015). A respondent at the Centro agreed that the non-existence of orthopaedic and prosthetic appliances waste management, bad administration of funds, lack of interest from the administration in directing staff to handle orthopaedic and prosthetic appliances waste in order to separate this waste and lack of supervision in orthopaedic and prosthetic appliances waste management practices at the Centro are due to a lack of support and encouragement from the Angolan government.

It is estimated that 4 million people live in Luanda (vide, 2014). The city has grown since 1992 as a result of the war after the census done in 2014 it is estimated that 6, 5 million people currently live in Luanda (Governo de Angola, 2014). Therefore, these are some of the reasons for the current, improper practices related to dumping waste in an open area. Furthermore, according to the interviews conducted with a number of workers at the urban waste collection company ELISAL, 45% of urban waste was not collected in 2015 due to actual economic issues that the Angolan government is facing with paying this institution which is responsible for urban waste collection in the capital city (ELISAL, 2015). Orthopaedic and prosthetic

appliances waste generation is the sole responsibility of CMFR. From the interviews conducted with one of the companies responsible for hospital waste collection, Recolix, it was found that healthcare waste management, including orthopaedic and prosthetic appliances waste management, at national level seems to be a lesser priority compared with other sectors at national level.

Table 5. Estimated healthcare waste generated in Luanda hospitals in 2014

Month	Jan	Feb	March	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
Tons	6,234	6,629	6,433	4,521	4,222	3,067	3,985	2,882	3,010	3,856	4,025	4,764

Source: Recolix 2014 (monthly healthcare waste collection report)

Table 6. Estimated healthcare waste generated in Luanda hospitals in 2015

Month	Jan	Feb	March	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
Tons	5,768	5,890	6,789	6,432	6,290	4,965	3,335	2,032	2,345	3,666	3,221	3,786

Source: Recolix 2015 (monthly healthcare waste collection report)

The tables show the estimates per month of healthcare waste generated from 2014 to 2015 in Luanda hospitals. From the table above, the largest amount of healthcare waste in Luanda hospitals was produced in March 2015, which formed 6,789 tons of the total annual healthcare waste collected. This month was characterised by the presence of numerous patients looking for healthcare services. However, in August 2015 2,032 tons of healthcare waste were generated in Luanda hospitals, and compared with all other months this was low. The generation of healthcare waste in 2015 was higher compared to 2014 due to the increased demand for healthcare services.

In 2015 the waste collection either urban and medical waste including orthopaedic waste in Luanda were not been collected due to Angolan government was facing financial problems which force them to cancel various contract with many companies included with these waste collection company such as Elisal resulted tremendously amount of waste ended up in open dump areas causing severe public health problems, unaesthetic appearance, pollution of water bodies such as lake, river and groundwater sources (Elisal, 2014).

Type of orthopaedic and prosthetic appliances waste generated at CMFR

The research survey revealed that there is lack of proper orthopaedic and prosthetic appliances waste management regarding its separation in order to establish the type of orthopaedic and prosthetic appliances waste generated at the Centro, and to explain the reasons why the stakeholders are not aware of the quantity

of orthopaedic and prosthetic appliances waste they generate at CMFR. Although some stakeholders are aware of the type of orthopaedic and prosthetic appliances waste generated during their activities such as metal, leather, bandages, rubber and polypropylene plastic, they do not know the amount of orthopaedic and prosthetic appliances generated at source as normally this waste tends to have the same destination as the remaining waste, such as urban waste, in open dumping areas. This poses a risk to hospital workers, cleaning staff, patients as well as the environment. Therefore, this poor procedure by the stakeholders can delay the adoption of a recycling system at all levels.

The interviews with workers at the Centro confirmed that huge quantities of different orthopaedic and prosthetic appliances waste are generated during their activities from different sectors such as the orthopaedic sector, the prosthetic sector, medical belts sector and orthopaedic shoes sector. Most of the waste generated includes leather, rubber, polypropylene plastic and aluminium. Polypropylene plastic generated the most waste at the Centro due to the fact that the major parts of all orthopaedic and prosthetic appliances are made from this material which results in a significant amount of waste.

Research reveals that the orthopaedic and prosthetic appliances under area of study can be reused and recycled in order to manufacture new orthopaedic and prosthetic appliances for local benefits and to improve the lifestyle of many people with disabilities. However, it has been observed that lack of interest, lack of awareness, lack of human resources that could handle orthopaedic and prosthetic appliances waste management, low level of motivation of some the leaders, and lack of effort from those responsible for implementing a recycling system are some of the reasons behind CMFR's failure to provide effective services according to increased demand from those who really need these orthopaedic and prosthetic appliances.

Some of the workers at the Centro claim that sometimes there are no materials available to complete an order on time due to financial difficulties. However, by implementing an orthopaedic and prosthetic appliances waste management system to recycle this waste is one way to create new social and economic opportunities in order to increase the manufacture of orthopaedic and prosthetic appliances. Other workers at the Centro also confirmed that lack of cooperation between CMFR and other entities involved with waste management, as well as interests from the government, are some of the reasons that the Centro has not yet begun to manage orthopaedic and prosthetic appliances waste that is generated at the source. However, the Centro is forced to import enormous amounts of orthopaedic and prosthetic appliances materials, usually from China and Brazil, in order to manufacture new orthopaedic and prosthetic equipment which is why the Centro sometimes fails to supply all this equipment partly due to an increase in demand.

The interview with a worker at LARDEF, the association that supports the integration of people living with disability, confirmed that corruption is the reason why CMFR is still in the same condition as, or worse than, before. Due to a conflict of interest at CMFR, the Centro still continues to import huge quantities of orthopaedic and prosthetic equipment to make new orthopaedic and prosthetic appliances.

The head of CMFR said that associated financial problems, particularly now due to problems related to the drop in oil prices internationally which has affected the economy in Angola, are the reasons why the Centro has not yet implemented the orthopaedic and prosthetic appliances waste management system.

Separation and storage of orthopaedic and prosthetic appliances waste

The observation survey revealed that separation of orthopaedic and prosthetic appliances waste is a reason for concern at CMFR since this process is not done at the source where the waste is generated and to such materials as polypropylene, leather, bandages, rubber, plasters, aluminium and hard aluminium. Although plastic or metal bins are normally supplied by a waste company, namely ELISAL, to the CMFR, they do not have a specific colour code to separate the non-reusable and non-recyclable waste from reusable and recyclable orthopaedic and prosthetic appliances waste, which has made it difficult for the stakeholders to manage this waste adequately in order to adopt a reuse and recycling system.

During the interviews with workers at the Centro it was mentioned that the orthopaedic, prosthetic, medical belts and orthopaedic shoes sectors are provided the same bin for common waste to store waste temporarily, which has made it difficult to separate orthopaedic and prosthetic appliances waste according to its characteristics due to a variety of reasons such as financial problems and bad administration. Therefore, it forces them to mix non-reusable with reusable waste due to a lack of proper bins to separate orthopaedic and prosthetic appliances waste adequately and to promote a recycling and reuse system in order to manufacture new orthopaedic and prosthetic appliances.

Furthermore, the interview with cleaning staff at Centro confirmed that when the internal temporary bins are full of orthopaedic and prosthetic appliances waste they take them to the on-site storage bins where residents around the Centro also deposit their waste, which poses a risk to public health, hospital staff, patients and problems to the environment since these bins are inappropriate for storage of orthopaedic and prosthetic appliances waste. At the end of the day these external bins are full of different types of waste, which forces either the residents or the cleaners to dump urban waste, orthopaedic and prosthetic appliances waste around these bins instead of inside the bins. In response to this, the head of the Department of Waste Management at the Ministry of Environment, Angola said that CMFR receives an annual budget from the government and there is no reason for the mismanagement.

One of the workers from the healthcare waste collection company Recolix confirmed during the interview that the colour of waste bins is a very important element in the efficiency and effectiveness of orthopaedic and prosthetic appliances waste separation to promote a reuse and recycling system, as it determines the amount of orthopaedic and prosthetic appliances waste generated at the source and how much from this waste can be reused and recycled to manufacture orthopaedic and prosthetic appliances. A lack of sufficient orthopaedic and prosthetic appliances waste bins results in the mixing of reusable and recyclable waste with the non-reusable and non-recyclable orthopaedic and prosthetic appliances waste, which increases the overall amount of orthopaedic and prosthetic appliances waste because of improper separation methods that lead to serious economic, social and environmental issues as well as increase the costs of collection.

The figure below shows photographs of storage at CMFR related to the mismanagement of orthopaedic and prosthetic appliances waste separation systems, as mentioned above, by some of the workers.

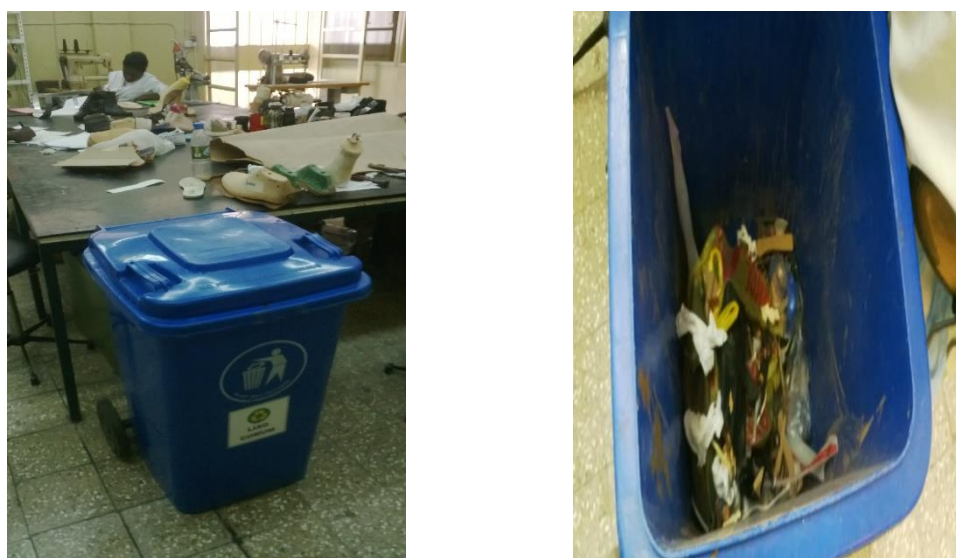


Figure 4. Internal containers of orthopaedic and prosthetic appliances waste used at CMFR

Source: CMFR (Photograph captured on 13/1/2016 within the Centro at 14:57 PM)

The research survey indicated that this inadequate procedure at CMFR is compounded by the shortage of orthopaedic and prosthetic appliances waste bins. The problem could be alleviated by adopting efficient separation at the source in order to promote a reuse and recycling system to increase the manufacture of orthopaedic and prosthetic appliances at CMFR.

The observation survey revealed also that the appropriate separation and storage of orthopaedic and prosthetic appliances waste are some of the mechanisms or components of orthopaedic and prosthetic appliances waste management that could be undertaken by the stakeholders at CMFR. As yet this has not received any attention from the stakeholders, policy makers and academics, other than the attention they

have paid to other social, economic and environmental issues, and this includes the huge quantity of waste generated, increased importation of orthopaedic and prosthetic appliances materials to make new orthopaedic and prosthetic appliances, the scarcity of landfill space to receive such a large quantity of this waste and high demand for orthopaedic and prosthetic appliances.

Separation and storage of orthopaedic and prosthetic appliances waste are linked to orthopaedic and prosthetic appliances waste management until they are placed in storage-distinguished containers in order to be separated according to their characteristics to manufacture new orthopaedic and prosthetic appliances equipment.

The responsible actors for the collection of waste in Luanda

In Angola waste management system are comprises both formal and informal system. The formal system consists of some actors: the municipal body that is responsible for waste collection, transportation and disposal namely Elisal that collect the general waste and send to the Mulenvos landfill that received all waste generated in Luanda city (Paula, Chaves, and Almeida, 2016); (Governo de Angola, 2009).

Medical waste collection company Recolix specialized in collecting and eliminating medical waste in the incinerator but many hospitals have not contracted them because of the expenses, except very few private hospitals at national level (República de Angola, 2011).

At the moment the waste generated in CMFR is not been collect by the medial waste collection company Recolix due to the expenses, and normally the orthopaedic waste generated in CMFR is mixed with other urban and afterword the urban waste collection company Elisal collect it and send those waste to the Mulenvos landfill (Recolix, 2009).

4.4 Conclusion

In this chapter the findings illustrated that the orthopaedic and prosthetic appliances waste management system continues to be a major concern at CMFR, since it was clear from evidence such as photographs that the stakeholders at CMFR are not aware that lack of proper orthopaedic appliances waste management can cause social, economic and environmental problems which could be avoided if an effective mechanism is implemented in order to reuse the locally available resources. The findings demonstrated different views of the participants, their suggestions, criticisms and answers regarding various aspects of the current orthopaedic and prosthetic appliances waste management system. The findings also confirmed that the local authorities and CMFR do acknowledge that they are facing challenges on orthopaedic appliances waste

management and therefore CMFR cannot provide an efficient and effective service to people with disability without stakeholder involvement.

The findings showed that it was clear that it is usually considered as a very difficult task to investigate the operational system at CMFR by any outside agent (the researcher) due to internal politics. This leads to a situation where lack of internal facts and basic information hampers the proper planning and assessment of the current situation. With the exception of very few workers interested in improving this sector at the Centro, lack of record keeping practices becomes a serious handicap, and the absence of implementation, limited administrative capacity and financial constraints are some of the reasons associated with this point.

In Angola, the inequality between people is growing. This reality is clearly seen in the lifestyle of many Angolans. As a result, access to quality health services, both increasingly privatised, is a privilege that only the better-off can afford. Therefore, it demonstrates that many Angolans are still suffering even after the civil war ended in 2002, and many Angolans continue to live in extreme conditions (Union Nation, undated); (Addison, 2003).

There was also evidence on the ground, such as the presence of orthopaedic and prosthetic appliances waste and urban waste being mixed in open dumps found close to CMFR. The findings in this study revealed that orthopaedic and prosthetic appliances waste ends up having the same destination as urban waste at the landfill. Therefore, this evidence shows that orthopaedic and prosthetic appliances waste continue to be a concern in CMFR.

In the following chapter I will highlight findings around the perceptions on issues of recycling orthopaedic appliances waste from the doctors, through the doctors' involvement in recycling orthopaedic appliances waste, and the perception and impact on the services of doctors regarding patients' satisfaction and dissatisfaction. The perception of stakeholders associated with the demand of orthopaedic appliances equipment will also be analysed and discussed, as well as the perception of doctors regarding waste management, within recycling of orthopaedic appliances waste and manufacturing of orthopaedic appliances.

CHAPTER FIVE

PERCEPTIONS REGARDING WASTE MANAGEMENT

In this chapter, I will look at various aspects of stakeholder involvement in refuse collection and disposal systems, which were the main concerns of the study since they were considered the most important components of any refuse management system. The different views of the respondents, their suggestions, criticisms and answers regarding various aspects of the current refuse collection and disposal system will be considered. The local authorities do acknowledge that they are facing challenges in refuse collection and disposal systems and cannot deliver an efficient and effective service without stakeholder involvement. In this chapter I cover six main sections of research findings. In section 5.1 I will discuss perceptions regarding waste management, within the context of orthopaedic and prosthetic appliances waste as a concern specifically for CMFR. In section 5.2 I will discuss the perceptions of recycling orthopaedic appliances waste in CMFR. Then in section 5.3 I will discuss the perceptions of doctors regarding recycling and manufacturing. In section 5.4 I will discuss the context of the demand for orthopaedic and prosthetic appliances. In section 5.5 I will discuss the perceptions of doctors regarding patient satisfaction. Lastly, in section 5.6 I will discuss the doctors' perceptions about the possibility of recycling.

The research survey revealed that orthopaedic and prosthetic appliances waste management at the Centro has not at all improved over the last ten years as it has not yet been seen as a priority by the officials responsible at the Centro. The low level of motivation of those responsible was mainly caused by financial difficulties, lack of support from the Angolan government and the non-existence of legislation on orthopaedic and prosthetic appliances waste which directly affects and delays the implementation of a recycling system at CMFR.

The response from workers at the Centro confirmed that orthopaedic and prosthetic appliances waste has not received adequate attention despite the fact that the waste is generated at the Centro during their activities. The huge amount of orthopaedic and prosthetic appliances waste is linked to the high number of people with disabilities with different pathologies such as polio, diabetes, meningitis, road traffic accidents, war and landmine incidents, congenital defects and psychiatric disorders, which are increasing significantly and which has become a complex and challenging matter for CMFR.

The head of waste management at the Ministry of Environment, Angola cited that it is also necessary for workers at CMFR to take into account practices such as dumping in open areas and mixing with urban waste as poor procedures or processes which pose a risk to public health such as skin infections, respiratory

problems and stomach-aches. It is important that the stakeholders understand that applying best orthopaedic and prosthetic appliances waste management practices will prevent public health issues as well as reduce the amount of orthopaedic and prosthetic appliances waste in order to encourage the adoption of a recycling system at institutional level and to alleviate difficulties that many disabled people in Angola are faced with nowadays.



Figure 5. Temporary storage of orthopaedic and prosthetic appliances to be disposed of.

The official responsible for the orthopaedic appliances sector confirmed that the orthopaedic and prosthetic appliances temporarily stored in the cupboard pictured above are not recycled and will be deposited into waste bins.

It has been observed that most of the barriers that continue to exist regarding the recycling of orthopaedic and prosthetic appliances waste at CMFR are associated with lack of interest by the government, disparity of equality either at a social or economic level, lack of effective legislation to provide a better quality of life for people, in particular disabled people, negligence by the government to implement strategies or programmes to overcome this issue and lack of regulations to promote a recycling system at the Centro.

A worker at LARDEF, the association that supports the integration of people living with disability, stated that to overcome this issue it is important the CMFR, in collaboration with the Angolan government, creates effective programmes and regulations to make the workers at CMFR understand how crucial the recycling of orthopaedic and prosthetic appliances waste is and that the recycling of this waste could significantly reduce the importation of orthopaedic and prosthetic materials which are needed to increase the manufacture of new orthopaedic and prosthetic appliances and to reduce the high demand for this equipment by people with special conditions who need them for their daily activities.

Some workers at the Centro complained during interviews that the current problem of handling orthopaedic and prosthetic appliances waste management at the Centro to promote a recycling system cannot be seen as an individual but as a collective concern, and motivation and opportunities should be given to workers at the Centro to participate actively in decision-making regarding social projects since they cited that restrictions impede their full involvement such as motivation and disempowerment of the workers. The research observation survey revealed that a change in CMFR workers' behaviour can have an effective impact on the project of recycling orthopaedic and prosthetic appliances waste system.

5.1 Orthopaedic appliances waste management is a cause for concern in CMFR

The findings demonstrated that orthopaedic and prosthetic appliances waste management is one of the issues of serious concern in CMFR. The findings also revealed that several factors are the reasons for the unsustainable operation of orthopaedic and prosthetic appliances waste to promote a recycling system in CMFR, such as small financial allocations to the various departments, which result in minimal and inadequate orthopaedic and prosthetic appliances waste management. More investment in human resources is needed, such as the employment of orthopaedic and prosthetic appliances waste handlers, the organization of training workshops and seminars, and the promotion of an awareness programme. Also, the abovementioned problem could be attributed to the employment of inadequately trained stakeholders to manage the orthopaedic and prosthetic appliances waste management.

The findings in this study demonstrated consistently that the stakeholders in general view the orthopaedic and prosthetic appliances waste management task as just a matter of management, without understanding the social and economic problems associated with improper orthopaedic and prosthetic appliances waste which could be caused not only in CMFR but at national level. The continuation of this current trend of low performance in CMFR cannot move the system towards sustainability in order to reduce the high demand of orthopaedic and prosthetic appliances equipment by people with special needs, who need those orthopaedic and prosthetic appliances materials to be mobile.

Therefore, with the continuous increase in the number of people with disability for several reasons such as congenital diseases, traffic road accidents, poliomyelitis and meningitis, which increase is proportionate with people looking for healthcare facilities, there will definitely be a greater generation of orthopaedic and prosthetic appliances waste, which will increase significantly the demand for orthopaedic and prosthetic appliances equipment by those who need the most. It is therefore pertinent that the Angolan government and all stakeholders involved in this process should pay more attention to the awareness of orthopaedic and prosthetic appliances waste problems.

Some participants from different institutions stated that CMFR still faces many problems not only at financial level but also with personal interest benefits. After the civil war ended in 2002 some countries decided to help Angola to overcome the difficult situation at that time with the destabilization caused by the rebellion from the Unita party, which carried out attacks killing civilians which also resulted in a number of people with disability at national level.

According to some participants, one of these countries was Germany, who cooperated with the Angolan government. Germany decided to provide orthopaedic and prosthetic appliances materials to Angola in order to manufacture new orthopaedic appliances equipment since at that time Angola was facing problems, including financial issues. Therefore, in order to reduce this problem associated with the high number of people with disability that were in need of those orthopaedic and prosthetic appliances equipment for them to improve their lifestyle, Germany started donating huge amounts of orthopaedic appliances equipment to assist Angola in increasing the manufacture of orthopaedic appliances equipment to reduce the high demand for those orthopaedic appliances materials by people with special needs.

However, some people from the Angolan government started to keep those orthopaedic and prosthetic appliances equipment for their own benefit, and when Germany realized that all the orthopaedic and prosthetic appliances materials that they were providing were not being supplied according to the cooperation agreement between Angola and Germany, Germany immediately withdrew their cooperation, which significantly increased the difficulties that many people with disability currently face in their daily lives.

Other participants also stated that the time Germany cancelled the cooperation with Angola was when Angola started to import orthopaedic and prosthetic appliances materials in order to manufacture orthopaedic and prosthetic appliances equipment. Although Angola is a rich country with a number of resources like oil, wood, diamonds and coffee, CMFR depends on the government's annual budget which usually is not sufficient to import large amounts of orthopaedic and prosthetic appliances materials to make new orthopaedic appliances equipment due to the high demand for those orthopaedic and prosthetic appliances by a number of people with disability. It has therefore become difficult for the CMFR to fill all requests on time, and thus it takes months and sometimes a year to fill the orders made.

5.2 How stakeholders understand the demand for orthopaedic and prosthetic appliances at CMFR

It is also noted in the information presented that an estimated 200,000 people with disability in Angola can be divided into different categories of which 80,000 are victims of bombs, 37,000 are children, younger people and adults with educational needs and 89,438 are citizens with disabilities from different pathologies.

This information also shows that 61,9% are people with physical disability, 28,3% are people with sensory disability and 9,8% are people with mental illness, and of which 56% are men and 44% are women (República de Angola, 2014).

The interview with the head of National Physical Rehabilitation at the Ministry of Health, Angola revealed that the number of people who do not have access to these appliances has not been well estimated in Angola up until now. This is due to the fact that the Ministry of Social Integration is still registering the number of people with disability who need these appliances, as well as other assistance. The real percentage of people living with disability in Angola remains uncertain even though the Angolan household and population census was done in 2014 and it was estimated 2, 5% which correspond 656.258 people with disability in Angola (República de Angola, 2016)

A worker at LARDEF, the association that supports the integration of people living with disability, cited that this means that the demand for orthopaedic appliances is huge countrywide. Most of the time people are forced to travel to Luanda, the capital of Angola, to look for orthopaedic appliances because of the otherwise limited access to orthopaedic equipment. This significant number of people come from other provinces, and the majority are from poor villages, towns, municipalities and rural areas, where there is a high concentration of uneducated and unemployed people who were victims of war.

Some municipalities complain that the infrastructure of private and public healthcare facilities, and orthopaedic equipment supplier facilities, in provinces other than Luanda, which is the capital city of Angola, are poor because some of those places do not have enough, or any, orthopaedic appliances to supply to people while the demand remains high, and the Angolan government is not doing anything to address this issue.

It is a current challenge that Angola is dealing with. In addition, the interview with workers at the Centro confirmed that the non-existence of orthopaedic appliance waste management will compromise the implementation of a recycling system, which will result in extensive importation of orthopaedic equipment to make orthopaedic appliances at CMFR. This is due to lack of financial support from the government to invest in orthopaedic and prosthetic appliances waste management, lack of specific regulations on orthopaedic and prosthetic appliances waste, lack of human resources and lack of adequate structures, which means that the demand for this equipment by people with disability will increase significantly and affect the most vulnerable in people in our society.

Currently the demand for orthopaedic and prosthetic appliances tends to increase significantly for several reasons such as increases in road traffic accidents and diseases such as polio and meningitis, and it has

become difficult for the Centro to fill all the orders to make this equipment since sometimes they experience financial problems in importing orthopaedic and prosthetic materials to make new orthopaedic and prosthetic appliances

Most people are forced to travel to Luanda, especially these who live in rural areas, looking for this equipment which is a basic item for those who really need it to be mobile and to improve their lifestyle, as there are no opportunities in those areas to obtain those orthopaedic and prosthetic appliances. However, it is interesting to note that the implementation of regulations, legislation and guidelines on a recycling system at the Centro would bring benefits not only to the economy and the environment but to the population as well, and in particular the disabled people. A conclusion was reached during the study that most of the influential and decision making stakeholders are at CMFR.

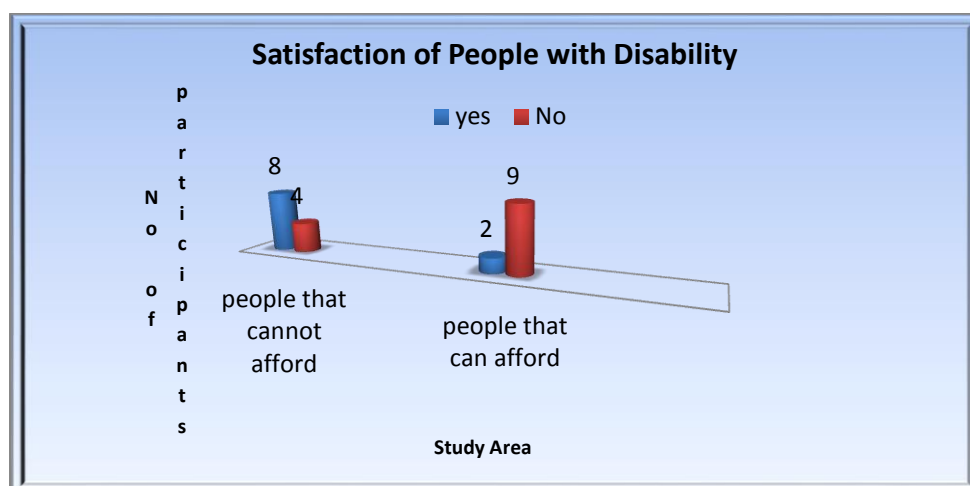
The stakeholders at the Centro have been working without having received training in the fundamental aspects of orthopaedic and prosthetic appliances waste management to promote best practices in the implementation of a recycling system at CMFR. The practices have been found to be grossly inefficient. Lack of concern about using proper orthopaedic and prosthetic appliances waste management through separation, storage, reuse and recycling, and lack of colour-coded bins to separate this type of waste are some of the key issues that require attention.

5.3 Perceptions of doctors regarding patient satisfaction

This section talks about the perceptions of doctors regarding patients' satisfaction in CMFR. The main question that remains is whether the patients are satisfied with the current orthopaedic and prosthetic provision services in CMFR.

The satisfaction or dissatisfaction of patients with the orthopaedic and prosthetic appliances provision services offered by CMFR was also observed during research, as shown in Figure 6. It shows that people with disability, especially from rural areas, who cannot afford this equipment were somewhat content with the services provided, and the people who can afford these materials were totally disgruntled.

Figure 6. The satisfaction and dissatisfaction of people with disability with services provided at CMFR according to the workers at the Centro.



The results obtained from the interviews conducted with workers at the Centro showed that close to 84% of people with disability who cannot afford the services were however fully satisfied with the provision of orthopaedic and prosthetic appliances services offered by CMFR. This large proportion of people are people from other provinces and rural areas because that is where the demand and limited access to orthopaedic and prosthetic appliances materials is still high and their response tends to be more consistent because they belong to a low social stratum in society which is why they are satisfied since CMFR is still the only, and the biggest centre, currently operating which provides this equipment at national level, and it is the Centro's responsibility to provide such services to them. There are, however, two other centres at capital level, namely Centro Ortopedico de Viana and Centro Ortopedico Neves Bendinha.

A smaller proportion of people with disability, that is 29%, were not satisfied with the provision of orthopaedic and prosthetic appliances services offered by CMFR since this particular number of people are those who often can afford to travel to other countries to acquire such appliances, and for them this means that the provision of orthopaedic and prosthetic appliances is neither efficient nor effective since they complain about limited access, poor provision and quality of services offered by CMFR. From the observation research it was noted that the manufacture and provision of orthopaedic and prosthetic appliances by CMFR was to the satisfaction of people with disability at national level.

Workers at the Centro confirmed that the limited access to these appliances in Angola tends to increase for several reasons such as increases in road traffic accidents, non-communicable diseases, post-polio syndrome cases, meningitis and the number of armed conflict victims. These are some of the factors that influence the current high demand for these orthopaedic and prosthetic appliances by a large number of people with special conditions. According to a document accessed in the research survey it was noted that in 2015

CMFR manufactured about 6,638 orthopaedic appliances, 1,584 prosthetic appliances, 3,135 medical belts and 3,593 orthopaedic shoes as compared to about 62 orthopaedic appliances, 182 prosthetic appliances, 130 medical belts and 90 orthopaedic shoes manufactured from 2008 to 2010.

A worker at LARDEF, the association that supports the integration of people living with disability, said that it is the CMFR's institutional responsibility as a public healthcare establishment to ensure that more orthopaedic and prosthetic appliances are made to meet the increased demand for these appliances, to implement effective strategies and to adopt a reuse and recycling system with the available resources at institutional level, as alternative ways of overcoming the current issues that CMFR is faced with.

The leader of National Physical Rehabilitation at the Ministry of Health, Angola claims that currently CMFR is still importing materials to make new orthopaedic and prosthetic appliances. As CMFR sometimes experiences financial problems, it becomes difficult for the Centro to manufacture the required number of orthopaedic and prosthetic appliances to meet the huge demand, which makes the life of persons with disability practically impossible and affects their rehabilitation process.

Table 7. Number of appliances manufactured at CMFR 2008 - 2010.

Months	Jan.	Feb.	Mar	Apr	May	June	July	Aug.	Sept.	Oct	Nov	Dec.	total
Prosthesis	00	01	02	03	17	07	9	4	6	3	8	2	62
Orthotics	10	05	11	14	32	21	15	24	20	11	9	9	181
Medicinal belts	10	05	11	14	32	22	06	06	03	9	4	8	130
Orthopaedic shoes	12	04	01	09	28	09	0	6	6	9	4	2	90
Nº patients	24	10	25	26	78	58	10	20	22	23	24	15	335

Source: Centro de Medicina Física e Reabilitação de Luanda (2008-2010).

Table 8. Number of appliances manufactured at CMFR in 2015.

Months	Jan.	Feb	Mar	Apr	May	June	July	Aug.	Sept.	Oct	Nov	Dec.	total
Prosthesis	21	56	70	87	109	129	150	174	189	211	139	249	1584
Orthotics	80	262	253	343	450	520	594	659	765	858	914	940	6638
Medicinal belts	80	26	25	34	50	52	54	65	65	85	91	40	667
Orthopaedic shoes	46	83	127	191	233	279	326	372	432	478	509	517	3593
Nº patients	227	663	703	964	1242	1448	1664	1864	2151	2405	2476	2646	12482

Source: Centro de Medicina Física e Reabilitação de Luanda 2015.

From the documents accessed the table above shows the amounts of orthopaedic and prosthetic appliances, medicinal belts and orthopaedic shoes manufactured monthly and the number of patients that required these appliances at CMFR from January to December 2015. It was observed that the most produced equipment is orthopaedic with about 6,638 pieces. According to the data obtained it was found that there was an increase in the manufacture of orthopaedic and prosthetic appliances and other equipment in 2015 compared to previous years from 2008 to 2010.

The head of National Physical Rehabilitation at the Ministry of Health, Angola did not agree that CMFR is the only centre that provides orthopaedic services at national level. Although she agreed that CMFR is still the biggest centre at national level, it is not the only one operating at the moment, since there are eight other orthopaedic centres distributed in other provinces: Centro Ortopedico da Huila, Centro Ortopedico do Kuando Kubango, Centro Ortopedico do Huambo, Centro Ortopedico do Bie, Centro Ortopedico de Benguela, Centro Ortopedico do Kwanza Sul, Centro Ortopedico do Moxico and Centro Ortopedico do Uige.

It was identified during interviews with some workers at CMFR that the above mentioned orthopaedic centres are not operating at all because most of the patients come from exactly these places due to lack of provision of these services in their own provinces.



Figure 7. Prosthetic appliance lower limb.



Figure 8. Orthopaedic appliance lower limb.

As captured by the photos above, some of the orthopaedic and prosthetic appliances manufactured at the Centro were observed. According to the workers at the Centro, different orthopaedic and prosthetic appliances are manufactured and provided at the Centro such as the femoral lower limb prosthetic appliances, trans-femoral lower limb prosthetic and higher limb prosthetic and orthopaedic appliances.

The interviews with the workers at the Centro affirmed that most of the people with special conditions are happy with the appliances provided by CMFR. Some participants from the municipalities said that the provision of this equipment is still too low due to the high demand, which is why it is important for the Angolan government to start investing in recycling orthopaedic and prosthetic appliances at the Centro to increase the manufacture of these appliances.

5.4 Perception of practice of recycling orthopaedic and prosthetic appliances waste at CMFR

The research survey demonstrated the extent of lack of perception from the stakeholders on the potential of recycling orthopaedic and prosthetic appliances waste generated at CMFR. The argument that I am going to make is that there are various barriers that impede or compromise the implementation of a recycling system of orthopaedic and prosthetic appliances waste at institutional level in order to increase the manufacture of new orthopaedic and prosthetic appliances, which could meet the increased demand by many Angolans with special conditions (the disabled) to access these orthopaedic and prosthetic appliances to improve their lifestyle.

The participants were also asked to proffer suggestions on how to improve the orthopaedic and prosthetic appliances waste separation and collection systems in order to encourage the reuse and recycling of orthopaedic and prosthetic appliances waste at CMFR. Figure 9 below is an orthopaedic and prosthetic appliances waste hierarchy showing the various strategies that could be adopted by CMFR to improve their reuse and recycling of orthopaedic and prosthetic appliances waste.

The strategies have been arranged in a sequence starting with the strategy that has been most favoured and supported by the various participants who were interviewed. At the bottom of the hierarchy are the least favoured options that participants proffered could be employed by CMFR in order to improve the orthopaedic and prosthetic appliances waste management to encourage a reuse and recycling system at CMFR.

From the pyramid below it is evident that stakeholder involvement and privatisation of the reuse and recycling of orthopaedic and prosthetic appliances waste systems have been selected as the most appropriate strategies that could be employed in order to increase the manufacture of orthopaedic and prosthetic appliances at the Centro and which would provide an effective and efficient service due to their extensive contributions towards healthcare service delivery. However, this is not to say that other strategies are not appropriate but stakeholder involvement and privatisation are most appropriate in order to implement a recycling system at institutional level to increase the manufacture of orthopaedic and prosthetic appliances

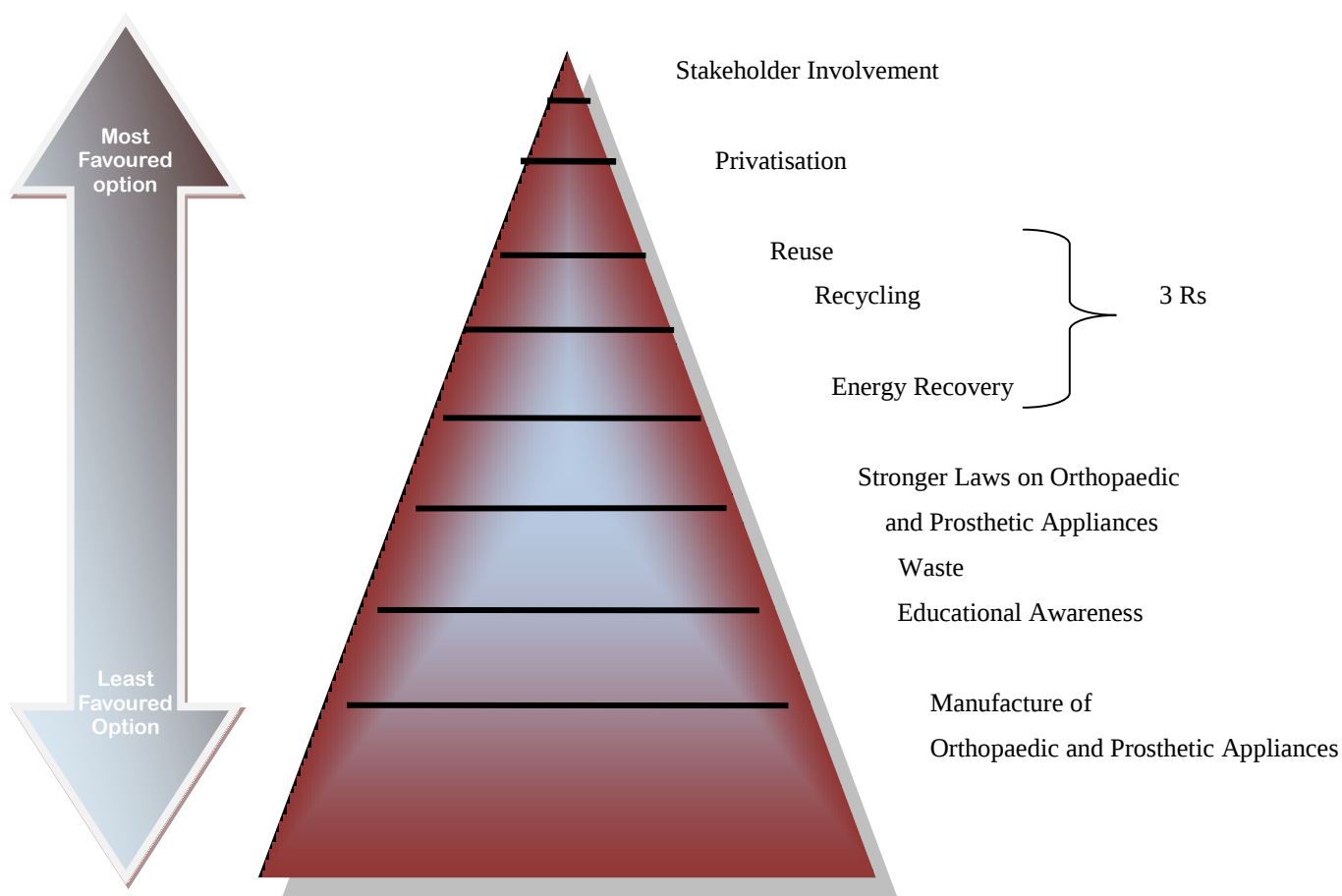
and to reduce the high demand for this equipment by many people with disability and with the purpose of minimising the difficulties of those who depend on such appliances for their daily activities.

The head of National Physical Rehabilitation at the Ministry of Health, Angola has stated that no healthcare services could be provided more efficiently without truly involving other stakeholders from different sectors. A worker at LARDEF, the association that supports the integration of people living with disability, believed that a privatised view of orthopaedic and prosthetic appliances waste management in order to implement a recycling system at the Centro would be better because of issues such as corruption, lack of awareness of the national healthcare waste management policy at institutional level, the non-existence of orthopaedic and prosthetic appliances waste management plans at institutional level and the lack of interest from the government to invest in this sector.

The head of the Department of Waste Management at the Ministry of Environment, Angola disagreed by citing that the Angolan government has put a lot of effort into healthcare waste management at national level. As a result of all this effort, on 18 June 2014 the Angolan government established the presidential decree 160 on hospital waste management and healthcare services with the purpose of solving all these issues related to healthcare waste management that many healthcare establishments, including CMFR, have failed to respond to with the waste generated at the source (Diário da República, 2012). However, she agreed that there are a few gaps in the social and economic aspects and the Angolan government is currently putting in a lot of effort to overcome those issues.

The research interview survey revealed that although Angola had faced civil war for many years and which lasted until 2002, some municipalities complain that the Angolan government has not done much to provide the population with the most basic needs such as electricity, water and sanitation and they do not believe that the government currently in power is able to solve the waste issue, and in particular implement a recycling system.

Figure 9. Participants' suggestions on how to improve orthopaedic and prosthetic appliances waste management to encourage a reuse and recycling system.



Source: Raw Data.

The pyramid shows that the participants are in favour of the management of orthopaedic and prosthetic appliances waste in order to encourage a reuse and recycling system which would result in the manufacture of new orthopaedic and prosthetic appliances equipment at CMFR.

Some workers at the Centro said that it is also a great strategy in the orthopaedic and prosthetic appliances waste management designed to promote the integration of proper management to use locally available resources with waste generated at the source to help to decrease the limited access to these appliances by persons with disability.

Others, such as workers at the healthcare waste collection company Recolix, stated that CMFR would increase the manufacture of this equipment, it would import less orthopaedic and prosthetic appliances to make new orthopaedic and prosthetic appliances equipment and decrease the amount of this type of waste generated at the source during their activities.

The 3 Rs (reuse, recycle and recover) were also suggested, as these are the most economical ways of making good use of unwanted material and benefitting from it by reusing, recycling and recovering it. This, however, was a strategy suggested by some of the participants such as workers at the healthcare waste collection company Recolix, a worker at LARDEF, the association that supports the integration of people living with disability, some workers at the Centro, the head of National Physical Rehabilitation at the Ministry of Health, Angola and the head of the Department of Waste Management at the Ministry of Environment, Angola, who were more aware of the benefits such a strategy could provide, especially for the community of people with disability, and they confirmed that it is cheaper and easier to use some of this orthopaedic and prosthetic appliances waste to manufacture new appliances. Polypropylene plastic, leather, rubber and aluminium are all materials which can be easily reused and turned into useful material, which is environmentally friendly and it would be very useful to manufacture new orthopaedic and prosthetic appliances to help many people with special conditions particularly the more vulnerable ones who cannot afford to go overseas to acquire those appliances which are a basic need for them.

A worker at LARDEF, the association that supports the integration of people living with disability, also voiced the need for stronger partnerships, arguing instead for capacity building at the council in charge of waste management in Angola, whose change of attitude is needed, as well as a reduction in public dependency on publicly-provided services. Some workers at the Centro said that there is a need to create more appropriate institutional and legislative orthopaedic and prosthetic appliances waste management in order to facilitate a vibrant and flexible platform which stakeholders from different sector can freely be part of and assist in the decision making and provision of services which includes the manufacture of new orthopaedic and prosthetic appliances and more access to this equipment by people with special conditions.

It was observed that at CMFR the topic of recycling orthopaedic and prosthetic appliances waste is seen to be an unusual topic for discussion due to limited information, unskilled workers, the non-existent legislation on orthopaedic and prosthetic appliances recycling and waste management due to the absence of support from the government to implement such legislation. Since the government is the only state organ capable of making those laws, there is no other way to make the Centro follow regulations or legislation and to punish rule breakers if they do not obey the rules to be implemented by them, which makes it more difficult to overcome this problem affecting disabled people's lives who need orthopaedic and prosthetic appliances to move freely.

Some of the workers at CMFR do not seem to be interested in recycling those materials, which affects their contribution to the proper separation of waste that they generated at the source. It is noticed that there are no colour-coded bins to identify which orthopaedic appliances waste has to be recycled, and that which does not, according to their characteristics, and which makes it difficult to use a recycling system and decrease the

amount of orthopaedic appliance waste materials. This fact shows lack of preoccupation by the stakeholders related to the destination or the life cycle of the waste generated.

The research interview survey revealed that there does not seem to be even a small amount of information available about the recycling of orthopaedic and prosthetic appliances waste at national level. With research that could be done in this area about recycling orthopaedic and prosthetic appliances waste by the stakeholders, enough information would be provided to public organs which would be useful in elaborating strategies, allowing developing research, and aiding application to achieve the recycling system.

It has been demonstrated that there is a need for investigation related to the recycling of orthopaedic and prosthetic appliances waste and also local developments in the transfer of knowledge from the Centro, which is a more experienced hospital, to those who can contribute to the management and recycling of orthopaedic appliance waste in order to create new negotiations opportunities.

It was observed that some of the stakeholders do not know that they should separate orthopaedic and prosthetic appliances waste at the source as the waste that is generated can be recycled. The knowledge given to them about the destination and evaluation of that waste by hospitals with more experience could be really useful in promoting a recycling system. Unfortunately there are no initiatives that indicate good prospects or practices in the orthopaedic and prosthetic appliances waste recycling sector.

5.5 Doctors' perceptions regarding possibility of recycling and manufacturing

In this section the discussion is focussed on the efficient and effective implementation of a recycling system at CMFR. The argument that I am going to make is that a possible implementation of such a project at the Centro could bring about social, economic and environmental benefits which would help to increase the manufacture of orthopaedic and prosthetic appliances and more consumption of those orthopaedic and prosthetic appliances by disabled people in Angolan communities which in turn would help to decrease the huge amount of orthopaedic and prosthetic appliances waste generated at source.

The findings reveal that recycling of orthopaedic and prosthetic appliances waste is a current issue at CMFR and there is a need to study the ideologies, activities, awareness of the need to change and the predisposition of heads and directors in order to create, and to participate in, teams that can assure an integrated orthopaedic and prosthetic appliances waste management system at CMFR and possible partnerships between politicians, NGOs, private and public sectors. We need to start to consider the recycling of orthopaedic and prosthetic appliances waste as a network of processes since failure of proper orthopaedic and prosthetic appliances waste management can compromise and delay the implementation of a recycling

of orthopaedic and prosthetic appliances waste system that affects the quality of life of many Angolan people with disability, who are the most vulnerable people in the Angolan community and who need orthopaedic and prosthetic appliances to improve their lifestyle.

A worker at LARDEF, the association that supports the integration of people living with disability, said that workers at CMFR should also be instructed to carry out a review of existing orthopaedic and prosthetic appliances waste management practices in their area of responsibility. The existence of such practices can help to evaluate the potential implementation of an efficient recycling project in light of provisions made in the regulations and an appropriate system can be developed as well in order to increase the manufacture of orthopaedic and prosthetic appliances equipment.

The same worker at LARDEF confirmed that in order to promote a recycling system we need to begin studying the permanent frameworks issues, such as gaps in medical waste management in Angola, which result in gaps in, or the non-existence of, orthopaedic and prosthetic appliances waste management. Some workers from the medical waste collection company Recolix and some workers from the urban waste collection company ELISAL stated that the stakeholders need to begin to see this not only as a local (CMFR) but as a national issue. Since we cannot look at local issues in isolation, as everything is interconnected, the stakeholders need to make an effort to participate more as well as change their attitudes, which can create new, national and stable political, social, economic and environment realities for future generations.

There is a need for the Angolan government to begin seeing a recycling system of this type of waste as a new opportunity to increase the manufacture of orthopaedic and prosthetic appliances, which would also diversify the Angolan economy, reduce importation of orthopaedic and prosthetic materials, and most importantly improve the lifestyle of people with special conditions and allow them to have more access to this equipment.

The findings demonstrate how crucial the implementation of an effective, strategic plan for orthopaedic and prosthetic appliances waste management through a recycling system at CMFR could be in ensuring sustainability and securing long-term funding or support to people with disability. A substantial orthopaedic and prosthetic appliances waste handling system at the Centro needs to be developed in order to improve the efficacy of orthopaedic and prosthetic appliances waste management methods by applying separation, storage, recovery and reuse to maximize an effective and sustainable recycling system.

Another argument that some workers made is about the improvement of orthopaedic and prosthetic appliances waste management as these procedures currently reveal deficiencies at CMFR that delay the

implementation of the recycling system. However, efforts need to be made to provide appropriate technologies that have so far been limited. The healthcare waste management and services regulations need to be publicized as widely as possible so that junior workers at CMFR may become fully aware of them.

The findings reveal that in order to develop any effective plan for recycling at the source, it is necessary that the Angolan government, in collaboration with stakeholders at the Centro, take into consideration that recycling of orthopaedic and prosthetic appliances will bring social and economic benefits which will help to reduce the high demand for orthopaedic and prosthetic equipment by many people living with disability. CMFR must have a budget to ensure that the performance of orthopaedic and prosthetic appliances waste management activities can help to implement an effective recycling system project in order to increase the manufacture of orthopaedic and prosthetic appliances which will, as a result, decrease the high demand for these materials.

Figure 10. Level of Satisfaction of workers at CMFR with the reuse and recycling system.



Source: Research Findings

From the graph above it is evident that the level of satisfaction also varies according to sectors at CMFR. In the orthopaedic sector area 0% of the workers believe that the system of waste management is excellent and 45% have identified the system as poor and 100% of the stakeholders have blamed the orthopaedic and prosthetic appliances waste management system for being very poor and failing to deliver enough orthopaedic and prosthetic appliances as promised. The reasons for the poor orthopaedic and prosthetic appliances waste management in order to promote a reuse and recycling system at institutional level might be as a result of a shortage of resources, lack of finances, lack of human resources in charge of orthopaedic and prosthetic appliances waste management and lack of polices and regulations.

It is also observed in the information presented by the table that 0% of stakeholders were satisfied with the orthopaedic and prosthetic appliances waste management system which they neither described as excellent nor poor but as satisfactory.

The argument that I will make about the satisfaction of workers at the Centro is that those that are more aware of the significance associated with proper orthopaedic and prosthetic appliances waste management methods of separation, storage, disposal, reuse, recovery and recycling are not at all happy with current practices within the Centro.

From the information obtained on the ground it seems that the few workers who are more aware are worried about the current situation but they are uncomfortable, or there are restrictions impeding them, to be fully involved. However, most of the workers agreed that the orthopaedic and prosthetic appliances waste management system is poor at institutional level and there is a need for an urgent intervention and more attention from the Angolan government, as well as leaders and directors, in relation to current issues since improper procedures can compromise and fail to deliver enough orthopaedic and prosthetic appliances equipment as promised. There are, however, some workers who are not really interested in the entire current situation as a result of reduced motivation, awareness etc.

Some workers expressed their dissatisfaction on the need for additional provisions in the regulations, since a critical review of the legislation and regulations indicates that the following issues need to be addressed for an effective implementation of a recycling system: the responsibility of the Centro to manage waste that they generate, local authority to provide the equipment necessary to separate orthopaedic and prosthetic appliances waste, provisions for training orthopaedic and prosthetic appliances waste handlers, provisions against indiscriminate dumping of orthopaedic and prosthetic appliances waste in open areas, awareness program for the generators of orthopaedic and prosthetic appliances waste and provisions of a budget allocation to CMFR for orthopaedic and prosthetic appliances waste management.

From my discussion regarding the manufacture and provision of orthopaedic and prosthetic appliances at CMFR it is clear that it is still not enough to meet the high demand for these materials due to various aspects linked to this problem such as increase in road traffic accidents, cases of polio, meningitis and physical congenital illnesses, and a high number of victims of the civil war, although according to the data collected it was evident that the Centro has significantly increased its provision of appliances. In 2015 an estimated 6,638 orthopaedic appliances and 1,584 prosthetic appliances were manufactured and provided to the huge number of people who need this equipment to be mobile and improve their daily activities, compared to an estimated 62 orthopaedic appliances and 182 prosthetic appliances manufactured from 2008 to 2010.

It was also clear from the interviews with workers at the Centro that despite the difficulties that the Centro still experiences in meeting all the requests made due to higher demand, 84% of people with special conditions (the disabled) are satisfied with the provision of orthopaedic and prosthetic appliances by CMFR.

The findings reveal that to improve the current service provision, the implementation of a recycling system at the Centro would be one way of increasing the manufacture of new orthopaedic and prosthetic appliances, but to reach this goal there is a need to increase knowledge of current orthopaedic and prosthetic appliances waste management systems to improve the provision of this equipment. However, there must be a reviewed and concerted effort to ensure that legislation or regulations that are implemented are being followed correctly. It is also important that politicians, workers at the Centro, public institutions, NGOs and the general population recognise that the economic and social benefits from recycling orthopaedic and prosthetic appliances waste can significantly improve the provision of orthopaedic and prosthetic appliances for many disabled people.

Some workers confirmed that to create a sustainable recycling system with the purpose of increasing the manufacture of orthopaedic and prosthetic appliances, a well-trained workforce must be employed at the Centro as well, although there already is some interest from a few workers who are more aware of the need to create an effective project of orthopaedic and prosthetic appliances waste management in order to implement a recycling system at CMFR. This project has the potential to reach impoverished, disabled people and may provide an opportunity to break the cycle of poverty and improve the lifestyle of people with disability in Angola.

5.6 Conclusion

As we have seen in this chapter, doctors at CMFR are very aware of the problems that exist. In fact, some of them had very strong opinions / feelings about recycling. However, it was also very clear that doctors mostly feel unable to enact such systems themselves, and feel disempowered within the system. More than that, doctors also were more interested in the urgency of treatment, and felt that it was up to hospital management to worry about orthopaedic and prosthetic appliances waste management issues.

It can be concluded from the study that, although there is a desire on the part of some stakeholders that orthopaedic and prosthetic appliances waste management is implemented in the form of separation, collection and storage in order to encourage and incentivise the implementation of a recycling system at CMFR, their involvement is not recognised by any form of legislative and regulatory systems which can specify what they are to perform, provide, expect and not to do.

In the following chapter, when I consider the main barriers to recycling, I will mention the doctors' own sense of disempowerment as one of the barriers.

CHAPTER SIX

BARRIERS TO RECYCLING

In this chapter I will cover five main sections of research findings. In section 6.1 I will discuss the current barriers to recycling orthopaedic appliances waste in CMFR. In section 6.2 I will discuss the critical involvement by the stakeholders in orthopaedic and prosthetic appliances waste management. In section 6.3 I will discuss the impact of stakeholders' involvement on the process of orthopaedic appliances waste system, while in section 6.4 I will discuss the current social and economic barriers to recycling orthopaedic appliances waste. Lastly, in section 6.5 I will discuss the policies on rights for people with disability, with a particular focus on the legal framework for medical waste management in the Angolan context.

This chapter will show that social, economic, cultural and political aspects in Angola remain some of the barriers that impede the implementation of a recycling system at CMFR at present. As the Centro is still the only establishment that is operating and providing orthopaedic and prosthetic services to the population at national level, it continuously delays and promises to increase the manufacture, as well as the importation, of orthopaedic and prosthetic materials to make new orthopaedic and prosthetic appliances in order to help many people with special conditions who need those appliances to improve their daily activities.

The policy and legislation in Angola is still surprisingly weak and little research has been conducted into issues related to general waste management, particularly on orthopaedic and prosthetic appliances waste separation, storage, recycling and final destination. As an initial starting point it will be crucial to document and critically assess the non-existence of legislation, regulations and guidelines at provincial, local or national levels of waste management that have affected the orthopaedic and prosthetic appliances waste management.

The research interview survey reveals that there is no policy or plan in place for orthopaedic and prosthetic appliances waste management at CMFR. There is no definite policy or plan for purchasing the necessary equipment and for providing facilities for the correct orthopaedic and prosthetic appliances waste management at institutional level. The Centro has not had orthopaedic and prosthetic appliances waste management guidelines prepared by someone appointed to control how this type of waste is managed.

It was observed that none of the areas of medical waste management at the Centro are properly managed. For instance, there is no separation of orthopaedic and prosthetic appliances waste. CMFR does not have a

regular report on how orthopaedic and prosthetic appliances waste management is practiced and the process of performing respective studies is also not reported.

The interview with some workers at CMFR also revealed that the Centro has not carried out an orthopaedic and prosthetic appliances waste management audit and there are no policies and guidelines regarding the recycling of orthopaedic and prosthetic appliances waste products.

6.1. Current barriers to recycling orthopaedic appliances waste in CMFR

The aim of this chapter is to demonstrate the present significant issues and shortcomings in implementing orthopaedic and prosthetic appliances waste management practices through a reuse and recycling process at CMFR which originated from direct observations, key informant interviews with hospital staff at the Centro, and with different stakeholders such as administrators, cleaning staff and orthopaedic and prosthetic technicians, in order to convince them that current poor practices of orthopaedic and prosthetic appliances waste management at institutional level will only change if all stakeholders, particularly those that are directly involved in this process, change their behaviour and begin to implement best practices in the management of orthopaedic and prosthetic appliances waste, including separation, storage, disposal, reuse, recovery and recycling.

Another important reason behind the poor orthopaedic and prosthetic appliances waste management as reported by some stakeholders, and also considered as a barrier, is the poor remuneration paid to workers at the Centro per month a worker of first class earn about 123. 600 thousand kwanzas equivalent to 9.563,24 Rands, a worker of second class earn about 82.000 thousand kwanzas equivalent 6.344,54 thousand Rands and a worker of third class earn about 57, 600 thousand kwanzas equivalent about 4.456,66 thousand Rands. Therefore, the workers are not keen on applying the standards of orthopaedic and prosthetic appliances waste to implement recycling and in order to increase the manufacture of orthopaedic and prosthetic appliances and reduce the huge amount of waste generated at the source during activities in their respective departments.

The majority of the workers did not consider proper and responsible waste handling as one of their important duties in the Centro. For instance, some stakeholders believed that this is an extra burden on them as they only consider patient related work as their responsibility. However, the head of National Physical Rehabilitation at the Ministry of Health, Angola confirmed that the leaders are the ones that need to point people to handling waste especially for this purpose. Some workers at the Centro claim that because of the conflict of interest from Angolan authorities, no recycling mechanism has been implemented at CMFR.

The Angolan government should be focussed on reviewing present processes and policies through those policies that have already been developed and which can provide insight into how those can be changed by creating strong policies, regulations and guidelines. On the other hand, the provincial and local policies should be explored further as these could also assist in exploring available options in waste management and recycling in general, including that of orthopaedic and prosthetic appliances, in order to promote changes even in the current legislative regime.

Despite all the above mentioned implemented legislation, no specific mention is made of orthopaedic and prosthetic appliances waste management. Orthopaedic and prosthetic appliances waste management is not well legislated and thus proper attention has not been given to it by the Environmental and Health Care regulators. This issue needs to be treated as urgent and very critical by the Angolan Government and immediate interventions are also required. All hands, including the National Orientation sector such as the Ministry of Environment, the Ministry of Health and the communities must be on deck to overcome this challenge since not only CMFR, but Angola as a country, stands to benefit from recycling orthopaedic and prosthetic appliances waste.

It was also observed in the information presented that to overcome the current barriers to recycling orthopaedic and prosthetic appliances waste, modification of the regulations and guidelines on the concepts and definitions of medical waste management and services and proper separation of recyclable and non-recyclable orthopaedic and prosthetic appliances waste generated at the source are required, as well as the development of a recycling infrastructure, awareness and education of workers and leaders, and combined efforts of the entire hospital staff to increase the recycling of orthopaedic and prosthetic appliances waste should be pursued at institutional level.

6.2 Critical involvement of the workers at CMFR, and population in general, in the orthopaedic and prosthetic appliances waste management

The observation survey reveals that poor involvement by the different stakeholders is the result of a lack of incentives for the separation, storage and disposal practices in order to encourage a recycling system at the Centro, since all orthopaedic and prosthetic appliances waste generated at the source is mixed with general urban waste and disposed of in municipal waste bins. In both cases it represents a serious hazard to workers and to public health in general. The lack of alternatives at Centro for the proper disposal of orthopaedic and prosthetic appliances waste leads to stockpiling them inside the premises, creating another potential threat.

Recyclable orthopaedic and prosthetic appliances waste is not separated at the Centro. Despite the huge amount of orthopaedic and prosthetic appliances waste generated during their activities, there is currently no

operational programme in place to recycle this orthopaedic and prosthetic appliances waste which is leather, aluminium, polypropylene, metal etc. Most of the orthopaedic and prosthetic appliances waste is collected together with urban waste and disposed of in dumpsites.

The legislators have demonstrated their concern for environmental protection by establishing legal responsibilities for each citizen and for private and public sector institutions to prevent the degradation of the environment. The Angolan government needs to put more effort into those activities and preventing detrimental conduct against the environment, and must ensure that offending citizens receive criminal and administrative punishments in order to take responsibility for their actions against the environment.

What was also observed is that there is no support and encouragement from different stakeholders at the Centro, which delays the implementation of separation of waste according to respective colour-coded bins and its disposal away from the population in general. It was also clear from the observation survey that there were no effective training programmes and educational plans in place related to orthopaedic and prosthetic appliances waste management at CMFR.

Currently the involvement of the stakeholders such as workers at the Centro, the public (the Ministry of Environment and the Ministry of Health in particular) and the private sectors, NGOs, academic bodies and the population in general is extremely low in relation to best practices in orthopaedic and prosthetic appliances waste management to increase the manufacture of orthopaedic and prosthetic appliances equipment in order to decentralise the provision of orthopaedic and prosthetic appliances equipment at national level and reduce the high demand by many people with disability who need those appliances to improve their lifestyle. The Angolan government needs to commit to providing an effective and economical means for orthopaedic and prosthetic appliances waste to give a better quality of life to the Angolan community, particularly to those who need it the most.

Regular training programmes are required at the Centro, since proper training will ensure that the workers develop awareness of orthopaedic and prosthetic appliances issues. The stakeholders who are involved in the handling of orthopaedic and prosthetic appliances waste should be provided with training in the handling, separation, storage and disposal procedures. This group of people should also receive certificates of achievement upon successful completion of appropriate training in order to incentivize them to be fully involved in this process.

Disposal of general waste, including orthopaedic and prosthetic appliances waste, in open dumps in many areas in Luanda is a current reality due to the mismanagement of waste by the stakeholders and the population in general. It was noted that in some areas a huge amount of waste is disposed of by the

communities on the ground near roads, schools, hospitals and sometimes near churches, due to the stakeholders' delay in collecting the waste, as well as the stakeholders at the Centro disposing of orthopaedic and prosthetic appliances waste in open dumpsites while they should be responsible for all orthopaedic and prosthetic appliances waste generated by them by giving it adequate treatment such as recycling it.

Waste collection companies sometimes have difficulties in accessing certain areas because of damaged and deteriorating roads, and houses that are built too close to one another, which impedes access to those residential areas, forcing the communities to dump and burn waste thereby disturbing other people, causing air pollution and consequently posing a risk to public health.

It is also observed in the information presented that orthopaedic and prosthetic appliances waste management in Angola has not received sufficient attention and this is because healthcare issues at national level very often compete for very limited resources. That is why it is common to see orthopaedic and prosthetic appliances waste still being handled and disposed of together with urban waste thus creating a risk to public health, degrading the environment and stripping it of its beauty. .

Therefore, the response from workers at the medical waste collection company Recolix confirmed that there is a need for public awareness and community participation in general, and in particular the involvement of stakeholders who are directly dealing with orthopaedic and prosthetic appliances waste. They would be assisted by obtaining guidance on carrying out strategic planning of orthopaedic and prosthetic appliances waste management, enhancing appropriate levels of Angolan community participation and establishing a two-way communication in planning and implementing an integrated orthopaedic and prosthetic appliances waste management in order to help CMFR provide better health services, which includes orthopaedic and prosthetic appliances equipment provision to the people, particularly to the more vulnerable community of people with disability.

It was observed that in order for all stakeholders, including the population in general, to be fully involved in this process there is a need to set up a proper orthopaedic and prosthetic appliances waste management system, taking into consideration various factors such as public health, economic status, social aspects, regulations and hospital management particularly at CMFR. All these aspects need to be incorporated into the system and it is essential to determine all the interactions among those factors in order to develop a sustainable approach for orthopaedic and prosthetic appliances waste management and to integrate the strategies in pursuit of a sustainable society.

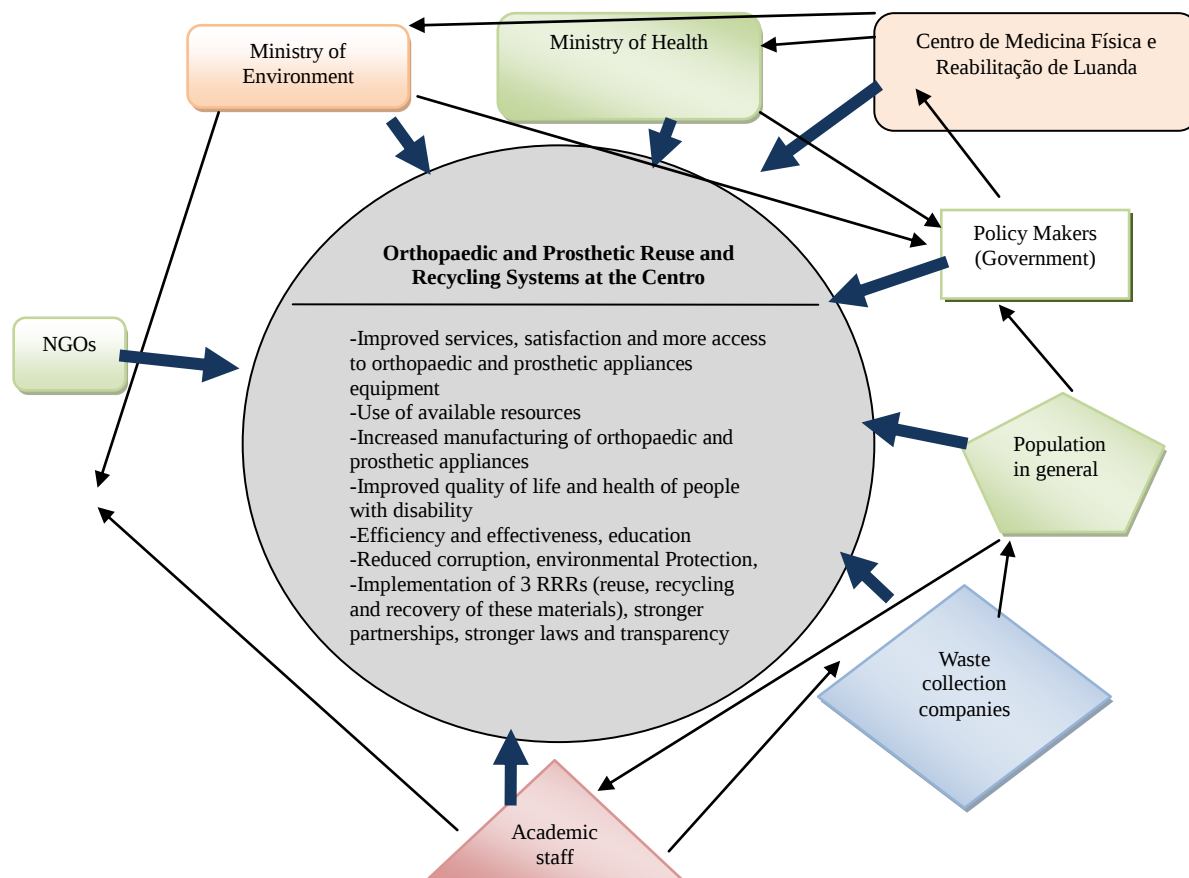
6.3 Impact of stakeholder involvement in orthopaedic and prosthetic appliances waste management systems

Figure 11 below diagrammatically explains what was revealed in the survey: the diagram shows a lack of contributions by the stakeholders towards orthopaedic and prosthetic appliances waste management to promote a reuse and recycling system, and it also shows the non-existent networks of partnerships and possible partnerships that could be formed amongst the stakeholders involved. From the diagram it can be observed that the larger oval part shows how crucial stakeholder involvement is in the orthopaedic and prosthetic appliances waste management systems at CMFR and that it can bring economic and social benefits at national level.

A worker at LARDEF, the association that supports the integration of people living with disability, confirmed that there is no doubt that a lack of stakeholder involvement in orthopaedic and prosthetic appliances waste management can have a negative impact on promoting a reuse and recycling system at CMFR which emerges with the need to improve on the manufacture of new orthopaedic and prosthetic appliances in order to increase the provision and delivery of basic services to more than 50% of people with disability who need these appliances to move freely and for their daily activities.

The research observation survey reveals that the diagram below as shown by the alliances, partnerships, teamwork and stakeholder involvement which have posed as instruments of governance, does not offer 100% great scope of high resource mobilisation, skilled workers, capacity building and securing sustainability of orthopaedic and prosthetic appliances waste management systems. However, there is a need for strong rules and establishment of strong partnerships and opportunities in order to implement a reuse and recycling system at CMFR.

Figure 11. The networks between, and impact of, stakeholders in the orthopaedic and prosthetic appliances waste management.



Source: Raw Data

Key	
	Involvement and contributions of stakeholders
	Partnership or possible partnership

Some workers at CMFR who are more aware of the current situation said that stakeholder involvement is based on the following perceptions: active participation, collaborative and collective deliberate action by different actors in decision-making as well as shared responsibilities and goals regardless of differences in interests and powers seeking to solve and improve a common problem affecting everyone and for the benefit of all, which currently does not happen at Centro due to lack of motivation and interest of some stakeholders including the Angolan government.

A worker at LARDEF, the association that supports the integration of people living with disability, stated that there are a multiplicity of problems and socialisms involved such as lack of public accountability, chronic shortage of resources, corruption and mismanagement, lack of autonomy on the part of the local authority, weak waste management laws and regulation enforcements and general lack of specific laws or

regulations on orthopaedic and prosthetic appliances waste management. The capacity of the public entity to cope with increasing demands for social service provision, particularly in orthopaedic and prosthetic appliances, and by implementing a reuse and recycling system is one alternative to be adopted to increase the manufacture of new orthopaedic and prosthetic appliances, helping a huge number of people with disability to access these appliances that are a basic need to improve their lifestyle.

The head of the Department of Waste Management at the Ministry of Environment, Angola stated that the end result of this is that the academic staff, NGOs, waste collection companies, private and public sectors and other local authorities, the civil society in general and policy makers are all involved as major stakeholders in order to improve the quality of service being offered so as to ensure a healthy life for all through shared responsibilities and increased manufacture of orthopaedic and prosthetic appliances by implementing a reuse and recycling system.

The head of National Physical Rehabilitation at the Ministry of Health, Angola confirmed that stakeholder involvement also provides greater opportunities, such as social, political, economic, institutional and administrative, to orthopaedic and prosthetic appliances waste and environmental management including the injection of new systems and the use of available resources into local areas which is an effective way to overcome current barriers at Centro de Medicina Física e Reabilitação de Luanda.

6.4 Social and economic barriers to recycling orthopaedic appliances waste

Some of the possible barriers that prevent orthopaedic appliance recycling from improving the socioeconomic conditions include lack of human resources to deal with orthopaedic appliance waste management in hospitals, unmotivated workers, lack of information about orthopaedic waste, limited financial resources and social aspects. Education levels of hospital staff, as well as their previous job experience of doing the same thing without any training to improve their skills, a lack of information for the hospital staff that would allow them to segregate and recycle the waste generated since it is still a huge problem at national level, are also some of the barriers found.

The observation survey revealed that the perception of orthopaedic and prosthetic appliances waste management at CMFR was also one of the barriers since it was seen to be an unusual topic for discussion due to limited information, unskilled workers, the non-existent legislation on orthopaedic appliance recycling and waste management due to absence of support from the government to implement such legislation. Since the government is the only state organ capable of making those laws, there is no other way to make these hospitals follow regulations or legislation and to punish rule breakers if they do not obey the

rules to be implemented by them, which makes it more difficult to overcome this problem affecting disabled people's lives who need orthopaedic and prosthetic appliances to improve their lifestyle.

These are all barriers that influence the recycling of orthopaedic appliances waste by being so poorly managed at national level. However, the stakeholders' perception of this topic is essential in understanding how important their integration is in the recycling of orthopaedic waste to overcome the current issues that Angola is facing and that have been affecting a number of disabled people's lives because of insufficient materials available to make new orthopaedic appliances. On the other hand, the country, and in particular CMFR, would benefit more from importing less orthopaedic equipment and providing an opportunity to improve socioeconomic conditions of many disabled people by preventing them from being part of the largest community with health, economic and social disparities by opting for recycling as a viable alternative.

There is no proper management and recycling of orthopaedic equipment at CMFR so there is no opportunity for the stakeholders to make new ones. That is why a lot of disabled people can be seen crawling on the streets of Luanda because they do not have those appliances to help them walk. Although the Angolan government is forced to collaborate with partners such as China and Brazil in order to import orthopaedic appliances equipment in order to manufacture new orthopaedic appliances, the private sector, NGOs like Lardef as well as citizens, there are still no large incentives in the recycling sector, particularly in orthopaedic and prosthetic appliance waste.

Most of the workers at CMFR do not seem to be interested in recycling those materials, which affects their contribution to the proper segregation of waste that they generated at the source. It has been noticed that there are no colour-coded bins to identify which orthopaedic appliances waste has to be recycled, and that which does not, according to their characteristics, and which makes it difficult to use a recycling system and decrease the amount of orthopaedic appliance waste materials. This fact shows a lack of attention by the stakeholders related to the destination or the life cycle of the waste generated.

Table 9. The barriers to changing current practices in orthopaedic and prosthetic appliances waste management.

Social barriers	Economic barriers
A perception that orthopaedic and prosthetic appliances waste at CMFR, cannot be recycled and reused.	Lack of encouraging and effective practices to promote recycling at CMFR.
Changes in stakeholders' habits and acceptance of orthopaedic and prosthetic appliances waste issues.	Some of the orthopaedic and prosthetic appliances materials which could potentially be recycled, or reused, are mixed with urban waste.
Some hospital staff perceive orthopaedic and prosthetic appliances waste management as someone else's problem due to lack of participation towards seeking solutions. Lack of skilled workers to manage orthopaedic and prosthetic appliances waste.	Lack of a long-term investment in the orthopaedic and prosthetic appliances waste management issues, absence of training for the workers in the orthopaedic and prosthetics sectors at CMFR.

A number of barriers to recycling or reusing orthopaedic and prosthetic appliances waste have been identified. The most common barriers to improving current practices of orthopaedic and prosthetic appliances waste management are social and economic as in Table 9.

It seems that there is very little information about recycling orthopaedic and prosthetic appliances waste available at national level. With research that could be done in the area of recycling of orthopaedic and prosthetic appliances waste by the stakeholders, enough information would be provided to public organs which would be useful in elaborating strategies and encouraging the implementation of a recycling system at national level.

Currently in Angola there are various reasons for the failure of orthopaedic and prosthetic appliances waste management such as lack of awareness about best practices of these types of waste management systems and the possible social, economic and environmental benefits related to the orthopaedic and prosthetic appliances waste management, the non-existent training of handlers in proper orthopaedic and prosthetic appliances waste management, lack of human resources and the low priority given to this issue.

It was observed during the research survey that there is a lack of specific regulations on orthopaedic and prosthetic appliances waste and limited access by the stakeholders to actual medical waste management and services regulations, which compromises the stakeholders' interest in enforcing them and delays the CMFR from achieving safe and sustainable management of orthopaedic and prosthetic appliances waste.

6.5 Current policy barriers to implementing a recycling system at CMFR

An appraisal of the current situation regarding orthopaedic and prosthetic appliance waste management in many developing countries including Angola is essential (Diaz *et al.*, 2005). Sogge (2006) avers that the policy and legislation in Angola is surprisingly weak and little research has been conducted on issues related to general waste management practices such as proper separation, storage, collection, reuse, recycling and final destination. However, the research interview survey reveals that between the previous decade and the present situation, the legislative and regulatory framework in Angola has improved slightly.

Currently there is presidential decree No 190/12 of 24 August 2012 of urban waste management in Angola. This legal instrument used to covers both municipal and medical waste management, and quality of life of the population, but it does not include specific mandates regarding the management of orthopaedic and prosthetic appliances waste in order to promote a recycling and reuse system. In fact, there are no clearly defined regulations about the proper management of hospital waste in Angola where orthopaedic and prosthetic appliances waste is included (Ministério do Ambiente, 2012).

Magnusson *et al.*, (2013) claim that in many developing countries, the gap between commendable principles and laws supporting persons with disabilities is theoretically not so great, and aligned with the convention on the Rights of Persons with Disabilities, but in practice the opposite is true. According to INEE (2006) and Zingale and McColl (2006), in many African societies the rate of discrimination against people with disabilities continues to be extremely high.

There is the law No 21/12 of 30 July 2012 whereby persons with disabilities have the right to access health services, including orthopaedic and prosthetic appliances which constitute the basic needs for this particular community (República de Angola, 2012). However, the law is currently still rare in practice. During the study it was also discovered that no studies have investigated the estimated demand for, and access to, orthopaedic and prosthetic appliances in Angola by persons with disability, and the access to this equipment is still a dream for many Angolans with special conditions.

The situation has been worsened by the lack of adequate technical, technological and human resources to deal with the problem. The data collected revealed that despite concerted efforts by the Angolan government towards medical waste management, yet without taking into consideration the orthopaedic and prosthetic appliances waste management, cases of orthopaedic and prosthetic appliances waste left uncontrolled for a long period of time are still quite prevalent at national level.

This study, however, focuses specially on presidential decree No. 160/14 of 18 June 2014, the presidential decree of hospital waste management and healthcare services in Angola which establishes regulations on

separation, collection, transportation and final disposal for medical waste management, which as yet does not take into consideration orthopaedic appliances waste management (Diário da República, 2012).

6.6 Conclusion

In this chapter it can be concluded that there is no doubt that several factors such as financial, human resources, cultural, lack of investment, non-existent enforcement of regulatory mechanisms and social aspects still make it difficult for CMFR to see orthopaedic and prosthetic appliances waste as goods that could bring social, economic and environment benefits for the country as whole. Another barrier is the disempowerment of the doctors, and their lack of involvement is one of the reasons which continues to cause a negative impact on current orthopaedic and prosthetic appliances waste management in order to promote a recycling system in CMFR, since the involvement of doctors is crucial in this process. The rendering of services and patient satisfaction will be improved by the recycling of the locally available resources, which will increase the manufacture of new orthopaedic appliances and thereby improve the quality of life and health of many people with disability in Angola.

Other barriers are related to the lack of awareness by the stakeholders, since some of them do not know that they should separate orthopaedic and prosthetic appliances waste at source during their activities. The knowledge given to them about the correct treatment and evaluation of that waste could be really useful in increasing recycling. Unfortunately, there are no initiatives that signal good perspectives or practices for the orthopaedic and prosthetic appliances waste recycling sector. The findings verified that in spite of the implementation by the Angolan government of regulations on medical waste management, there are still gaps in these regulations since they do not take into consideration the recycling of orthopaedic and prosthetic appliances waste at national level.

The following chapter deals lastly with conclusions proffered to CMFR so as to improve orthopaedic and prosthetic appliances waste management by recycling the local available resources in order to increase the manufacture of new orthopaedic appliances equipment. The lack of an orthopaedic appliances waste recycling system is viewed as one of the greatest issues in Angola, with a particular focus on CMFR, which continues to cause negative effects on people with disability who could be helped to overcome these obstacles in their daily routine.

CHAPTER SEVEN

CONCLUSION

In chapter one the statement of the problem, research questions, aims and objectives, case study site and rationale for the study were presented. It also provided an outline of this research report.

In chapter two I explored the literature on people with disability in the Angolan context, and it includes an overview of the rate of people with disability in different categories. The demand for orthopaedic and prosthetic appliances by many people with disability, who are struggling in their daily life because of the scarcity of access to such orthopaedic and prosthetic appliances equipment to improve their lifestyle in Africa with a particular focus on the Angolan context, was analysed. The potential of recycling orthopaedic appliances waste within medical waste management was also looked at, which revealed that there are several potential social, economic and social benefits to the society if a proper mechanism is applied to orthopaedic and prosthetic appliances waste in Africa, with a special focus on the Angolan context.

In chapter three I summarized the study approach and design, the methods used and the research ethics. The study adopted a qualitative study approach with an interpretive perspective given the nature of the research questions. The research study was set in CMFR as a pilot project. There were 30 participants from different institutions and the data collection methods used were interviews, observation and access to some documents on orthopaedic appliances waste practice. This research also made use of pamphlets, journals and media reports. The data gathered was useful to understand the real picture of the current situation in CMFR and to enrich this paper. This chapter also described the challenges that I faced during the data collection and it ended with a description of how research ethics were treated.

In chapter four it was concluded that orthopaedic and prosthetic appliances waste management at CMFR is still a big challenge at institutional level, causing impediments as well as opportunities to be covered by respective stakeholders at the Centro. Orthopaedic and prosthetic appliances waste management through proper generation, separation, storage as well as proper disposal is not practised by the stakeholders concerned, especially the unskilled workers at CMFR. It is for this reason that they indulge in highly incorrect practices of orthopaedic and prosthetic appliances waste management, as orthopaedic and prosthetic appliances waste is not yet considered as a priority sufficient to extend awareness to concerned stakeholders about important aspects such as economic and social benefits by applying best practices in orthopaedic and prosthetic appliances waste management.

In chapter five it can be concluded from the study that it is important to note that the perception by the stakeholders on a recycling system of orthopaedic and prosthetic appliance waste is crucial in order to

increase the manufacture of those appliances which have a significant impact on improving the quality of life of people with special needs who use orthopaedic and prosthetic appliances. This is not surprising and it is also reflected in the fact that the benchmark for the use of orthopaedic and prosthetic appliances is greater at national level. However, this does indicate that more needs to be done to improve the provision of orthopaedic and prosthetic appliances.

In chapter five it was further concluded that the perception of the stakeholders at CMFR on the general status of their performance in orthopaedic and prosthetic appliances waste management is extremely poor. For this reason, they do not find it pressing to adopt any mechanism procedures for self-improvement. As for some stakeholders involved in this process, this subject seems to be a new task, whereas others are more aware of the current issues associated with the poor orthopaedic and prosthetic appliances waste management. They believe there are a number of strategies that CMFR can adopt in order to implement an effective orthopaedic and prosthetic appliances waste recycling system, such as engaging stakeholders and establishing institutional and legal arrangements, and creating awareness and education on orthopaedic and prosthetic appliances waste management. Other strategies are providing information which will promote proper separation, storage and collection practices among stakeholders to promote a recycling system in order to increase the manufacture of new orthopaedic and prosthetic appliances and reduce the demand for this equipment by people with special conditions who need those appliances to improve their daily activities.

In chapter six it can be concluded that social and economic aspects, and lack of empowerment and full involvement of the stakeholders, as well as budgetary constraints are some of the barriers which still pose a serious problem in applying the routine procedure of orthopaedic and prosthetic appliances waste management at CMFR. For instance, it was observed that the CMFR did not have orthopaedic and prosthetic appliances waste bins that are colour-coded for separation, collection and disposal of different categories of orthopaedic and prosthetic appliances waste. Due to the unavailability of appropriate funds, all the orthopaedic and prosthetic appliances waste was collected in one type of polythene bins.

It was also concluded that gaps in policies and regulations on medical waste management, which still do not take orthopaedic and prosthetic appliances waste management into consideration, are another barrier at the core of the shortcomings in best practices of the orthopaedic and prosthetic appliances waste management, which lacks implementation in practically all respects. Furthermore, the generally weak Angolan legislation and regulations on medical waste management is one of the aspects that impede the implementation of an orthopaedic and prosthetic appliances waste recycling system at CMFR.

OVERALL SUMMARY OF THE STUDY

The question that I began with was what the current barriers are to, and future possibilities for, recycling orthopaedic and prosthetic appliance waste at Centro de Medicina Física e Reabilitação de Luanda. In order to answer this question I conducted the study and found the barriers to be:

- 1- Lack of skilled workers due to the lack of training of workers at the Centro. Training is essential and is needed on the various stages of orthopaedic and prosthetic appliances waste management. Training has been neglected due to a lack of funds as well as maladministration. CMFR has not been able to devise an effective monitoring system to create proper checks and balances in the separation, storage and internal disposal procedures of orthopaedic and prosthetic appliances waste in order to implement best practices in orthopaedic and prosthetic appliances waste management
- 2- Non-existence of specific regulations on orthopaedic appliances waste within the current medical waste regulations are an aspect that still impedes the implementation of proper orthopaedic appliances waste practices.
- 3- Absence of funds also impede the implementation of proper orthopaedic appliances waste management in order to increase the manufacture of this equipment by adopting a reuse and recycling system rather than importing a huge quantity of orthopaedic and prosthetic materials to make new orthopaedic and prosthetic appliances at CMFR.
- 4- Lack of empowerment of the stakeholders restricts them from being fully involved in the whole process of orthopaedic appliances waste management and encourages them to stay exclusively focussed on their own activities.
- 5- Absence of education and awareness on proper orthopaedic waste management, and above all weak enforcement related to illegal dumping of medical waste in open sites by both residents and workers are some of the barriers encountered at CMFR.

In chapter six we were reminded of some of the barriers mentioned above that are encountered at CMFR. These barriers still impede the implementation of a proper orthopaedic and prosthetic appliances waste management system to reduce the huge amount of orthopaedic waste generated at the source by recycling it in order to increase the manufacture of new orthopaedic and prosthetic appliances and decrease the demand of such orthopaedic equipment for people who need it the most.

Another question I posed at the beginning of my research was what the future possibilities are for recycling orthopaedic and prosthetic appliance waste at Centro de Medicina Física e Reabilitação de Luanda. Again, to answer this question through this thesis, I may say that the potential of recycling orthopaedic appliances can bring social and economic benefits to the Angolan society, but it will only become a reality if the

Angolan government starts thinking seriously about this task. At present, it seems that this topic is not recognized by a number of stakeholders in CMFR, including the Angolan government, as chapter four reminded us. However, the findings showed that there are some doctors who have their own viewpoints and a different perspective related to the potential of recycling orthopaedic appliances waste. They acknowledge that recycling can provide multiple social and economic benefits. Another aspect is that the implementation of a recycling system in CMFR will reduce the large amount of orthopaedic appliances waste generated as well as help decrease the high demand for orthopaedic appliances equipment by people with disability, who need such orthopaedic appliances to improve their daily activities, as chapter five reminded us.

I hope that this study will create awareness regarding the problem of orthopaedic appliances waste management in CMFR and will create interest for systematic control of orthopaedic appliances waste management to make it more effective and to promote a recycling system.

From the findings of this thesis it would be helpful to consider the following directions for future research on orthopaedic appliances waste management practices:

- It is important that the stakeholders that deal with orthopaedic waste know the amount of orthopaedic waste generated in the Centro on a periodic basis.
- There is a need for the stakeholders to separate orthopaedic waste according to their characteristics, and for plastic bags and strong plastic containers to be provided for infectious waste. Those containers should be marked with a symbol to help differentiate each type of waste. Using a code or colour containers for proper separation will help manage the waste in an easy, safe and cost-effective way.
- CMFR should institute an efficient waste management system, which should include a contract with the company that is in charge of collecting waste to avoid the waste generated in the source being mixed with other waste such as urban waste.
- There is a need for training for the workers that are dealing with orthopaedic appliances waste in order to increase the efficiency of orthopaedic appliances waste management.
- CMFR should implement regular training and education of all workers, from the stakeholders who are dealing with orthopaedic waste to the cleaning staff, as proper training is necessary to develop awareness of health, safety and environmental issues. It is important that the workers in CMFR know and understand the potential benefits of orthopaedic appliances waste if it is properly managed.
- CMFR should develop clear plans and policies for proper orthopaedic appliances waste management and for the promotion of a recycling system, since it is important that the CMFR formulates an orthopaedic appliances waste management policy separately from other medical waste management systems.

- CMFR should create a committee to be in charge of orthopaedic appliances waste management, with a sub-committee that will be in charge of regularly reviewing and solving orthopaedic waste management issues within CMFR. This committee should also monitor the activities of the company that is in charge of collecting orthopaedic appliances waste to ensure that they perform their job according to what is expected from them.

The Centro de Medicina Fisica e Reabilitacao de Luanda needs to improve orthopaedic appliance waste management. The above findings could enhance the operating efficiency in the Centro de Medicina Fisica e Reabilitacao de Luanda with regards to orthopaedic appliance waste management.

In order to promote ongoing improvement in the proper management of orthopaedic and prosthetic appliances waste, the following suggestion must be taken into consideration:

In the light of the above conclusions, this thesis suggests that more research in this area is needed in order to overcome the current issues that CMFR is faced with and to achieve sustainable development by seeing the potential of recycling orthopaedic appliances waste to help many people with disability who need such orthopaedic and prosthetic appliances equipment to improve their life style at national level.

APPENDIX A: PHOTOS



Photo 1. Moulding process with plaster made from acrylic resin.



Photo 2. Internal storage container with mixed orthopaedic and urban waste.



Photo 3. Orthopaedic and prosthetic shoes sector.





Photo 4. Lower limb orthopaedic appliances.



Photo 5. Orthopaedic appliances sector.



Photo 6. External storage container of urban as well as orthopaedic appliances waste close to the Centro.



Photo 7. Incinerator (Recolix).



Photo 8. Medical waste containers taken from the truck at Recolix.



Photo 9. Workers manually cleaning medical waste containers.



Photo 10. Feeding the incinerator stove with medical waste.



Photo 11. Collection of medical waste within the incinerator.



Photo 12. Waste on the ground next to a park station and maternity hospital at Samba municipality.



Photo 13. People selling food near the waste.



Photo 14. Dumping and burning of waste in an open area.

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APPENDIX 1: COVER LETTER

UNIVERSITY OF WITWATERSRAND, JOHANNESBURG

CENTRO DE MEDICINA FÍSICA E REABILITAÇÃO DE LUANDA

Date:.....

Dear Sir/Madam

RE: REQUEST FOR PERMISSION TO CARRY OUT EDUCATIONAL RESEARCH AT YOUR ORGANISATIONAL PREMISES

I am a student at the University of Witwatersrand, Johannesburg in the School of Geography, Archaeology and Environmental Studies. I am asking for your kind permission to carry out research on ***Possibility of Recycling Orthopaedic Appliances Waste. The case for CMFR*** as part of my fulfilment of the requirements of the Masters of Geography Degree in the School of Geography, Archaeology and Environmental Studies. I would like to ask for your permission to take some pictures, do some observations, and conduct some interviews with the staff at **CMFR**. I would also like to inform you that the reason for this project is that the implementation of a recycling system will help to increase the manufacturing of orthopaedic and prosthetic appliances and provide easier access to these orthopaedic and prosthetic appliances for disabled people in Angola, as well as help to decrease the huge amount of orthopaedic and prosthetic appliance waste generated at source. However, I am not planning to interview this vulnerable group of people, i.e. disabled people.

Please feel free to assist in this academic pursuit, and I assure you that the information you provide will be used strictly for the sole purpose of this research.

Your participation in this regard will be greatly appreciated and feel free not to answer a question should you feel uncomfortable doing so. The information you provide will be used strictly for the purpose of this research and will be treated with the highest level of confidentiality and no names, contact details and age will be requested during the interview. If granted permission, the research will be conducted in strict adherence to your organizational rules and codes of conduct. Please see below my personal details as well as those of my supervisor:

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Yours faithfully

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APPENDIX 2: INSTRUMENTS TO BE USED IN THE COLLECTION OF DATA DURING THE STUDY

In this study, *A Medical Challenge: A case study of CMFR*, individual interview and observation guides will be used as instruments for collecting data on a recycling system that is associated with the process of orthopaedic and prosthetic appliance waste management. The reason for this focus is that the implementation of a recycling system will help to increase the manufacturing of orthopaedic and prosthetic appliances in Angola. A qualitative approach will be used to enhance the investigation under study.

Interviews with the undermentioned people will be used to determine their points of view on orthopaedic and prosthetic waste management, the promotion of a recycling system, medical waste, the right to access orthopaedic appliance equipment and their beliefs regarding actual practice. This will give me an opportunity to be close to the participants and to discuss the key information questions during an open-ended interview face-to-face, rather than just asking (interviewer) and responding (interviewee).

The interviews will be arranged according to the times determined by the participants at their convenience and will be transcribed directly during the interview. Each interview will last between 25 minutes to one hour in different institutions over two to three months. The research questionnaires will be used to develop the interview procedure and the participants will be made aware of the aim of the study and the methodology that the researcher will use in order to ensure that they feel comfortable to ask questions about the study and to give honest and open responses.

APPENDIX 3: PROPOSAL INTERVIEW QUESTIONS FOR HOSPITAL STAFF AT CENTRO DE MEDICINA FÍSICA E REABILITAÇÃO DE LUANDA

1. Tell me more about the type of orthopaedic and prosthetic appliances waste usually generated at CMFR.
2. Does the hospital recycle, and what is your feeling about this.
3. Help me to understand what you think the key is to the implementation of a proper orthopaedic and prosthetic appliances waste management system at institutional level.
4. Is orthopaedic and prosthetic appliances waste treated differently from other type of waste at the Centro? How? If not, do you know why not?
5. Explain to me how orthopaedic and prosthetic appliances waste is finally disposed of at the source.
6. In your opinion, how has the orthopaedic and prosthetic appliance waste management improved over the last ten years?
7. In your opinion, how has the healthcare waste management improved over the past ten years at the CMFR?
8. What do you see as the major challenges being faced by CMFR regarding the promotion of an orthopaedic and prosthetic appliance waste recycling system?
9. What measures do you think can be taken to reduce or mitigate the abovementioned challenges?
10. Help me to understand why the Centro still imports a huge quantity of orthopaedic and prosthetic appliances materials to make new orthopaedic and prosthetic appliances equipment. Can you think of another way to circumvent this current issue?
11. Tell me how orthopaedic and prosthetic appliances waste is separated from other types of waste generated during your activities.
12. Who has the authority to be in charge of orthopaedic appliance waste management at CMFR?
13. Do you believe that the recycling of orthopaedic and prosthetic appliance waste is a viable option at CMFR?
14. Why has no recycling system been implemented at CMFR, in your opinion?
15. Are the stakeholders that handle orthopaedic and prosthetic appliances waste aware of the national waste management policy at institutional level?
16. To what extent have you thought about the possibility of recycling orthopaedic and prosthetic waste at CMFR?
17. Help me to understand how orthopaedic and prosthetic appliances waste is managed during your activities.
18. As stakeholders, involved in orthopaedic and prosthetic appliances waste management at CMFR, are there any uncomfortable or harsh regulations or restrictions impeding you from full involvement?

19. What do you think is the status of orthopaedic and prosthetic appliances equipment provision at CMFR?
20. From your point of view, how can the provision of orthopaedic and prosthetic appliances equipment at the CMFR be improved or made more successful?

Thank you for your co-operation. I greatly appreciate it.

APPENDIX 4: PROPOSAL INTERVIEW QUESTIONS FOR A WORKER AT THE ASSOCIATION THAT SUPPORTS THE INTEGRATION OF PEOPLE LIVING WITH DISABILITY LARDEF

- Help me to understand exactly what the association has already done to help almost 50 % of people with disabilities that find it difficult to have access to orthopaedic and prosthetic appliance equipment.
- How has the association been taking these concerns to the government?
- What do you think are the reasons for the limited access to orthopaedic and prosthetic equipment in Angola?
- How do you feel about this current issue, which affects a very vulnerable group of people in Angola, and what do you think should be done to overcome this problem?
- What do you think are the reasons that the CMFR is still the only hospital that receives orders to make orthopaedic and prosthetic appliances equipment, although Angola is a rich country and almost 50% of its people have special needs?

Thank you very much for taking part in this interview. I highly appreciate it.

APPENDIX 5: PROPOSAL INTERVIEW QUESTIONS FOR THE LEADER OF WASTE MANAGEMENT AT THE MINISTRY OF ENVIRONMENT, ANGOLA.

1. How long have you been working as the official responsible for waste management in the Ministry of the Environment?
2. What do you think are the reasons for the waste management of both urban and medical, including orthopaedic and prosthetic, waste still being critical in Angola, since there are policies in the Angolan constitution that provide the basic needs or instruments to establish proper waste management?
3. What measures are being taken to address the abovementioned challenges?
4. In your opinion, what are the challenges being faced in the promotion of an effective, efficient and regular orthopaedic and prosthetic appliances waste recycling system?
5. What do you think of laws against improper waste management practices, including orthopaedic and prosthetic appliances waste, which are causing a negative impact on economic, environmental and social aspects: are these laws weak, do they exist or are they a myth?
6. What do you suggest as possible methods, solutions and strategies to improve the situation by reducing, reusing and recycling orthopaedic and prosthetic appliances waste?

Thank you for your co-operation, it is highly appreciated.

APPENDIX 6: OBSERVATION CHECKLIST

In conducting an observation the researcher seeks to observe, understand and get first-hand information on the following issues in relation to stakeholder involvement in orthopaedic and prosthetic waste management in order to promote a recycling system in the CMFR:

1. I will be observing the hospital staff that are dealing with orthopaedic and prosthetic appliances equipment during the Manufacturing of these materials.
2. I will be observing how is the final destination of orthopaedic and prosthetic appliances waste at CMFR.
3. I will be observing how is done the process of orthopaedic and prosthetic appliances waste management at the CMFR.
4. I will be observing how the stakeholders at Centro separate, collect, reuse and recycling orthopaedic and prosthetic appliances waste that their generated in the source according with their characteristic by taking pictures.
5. I will be observing how waste in general particularly orthopaedic and prosthetic appliances waste is disposed outside at CMFR, I will be taking some pictures.