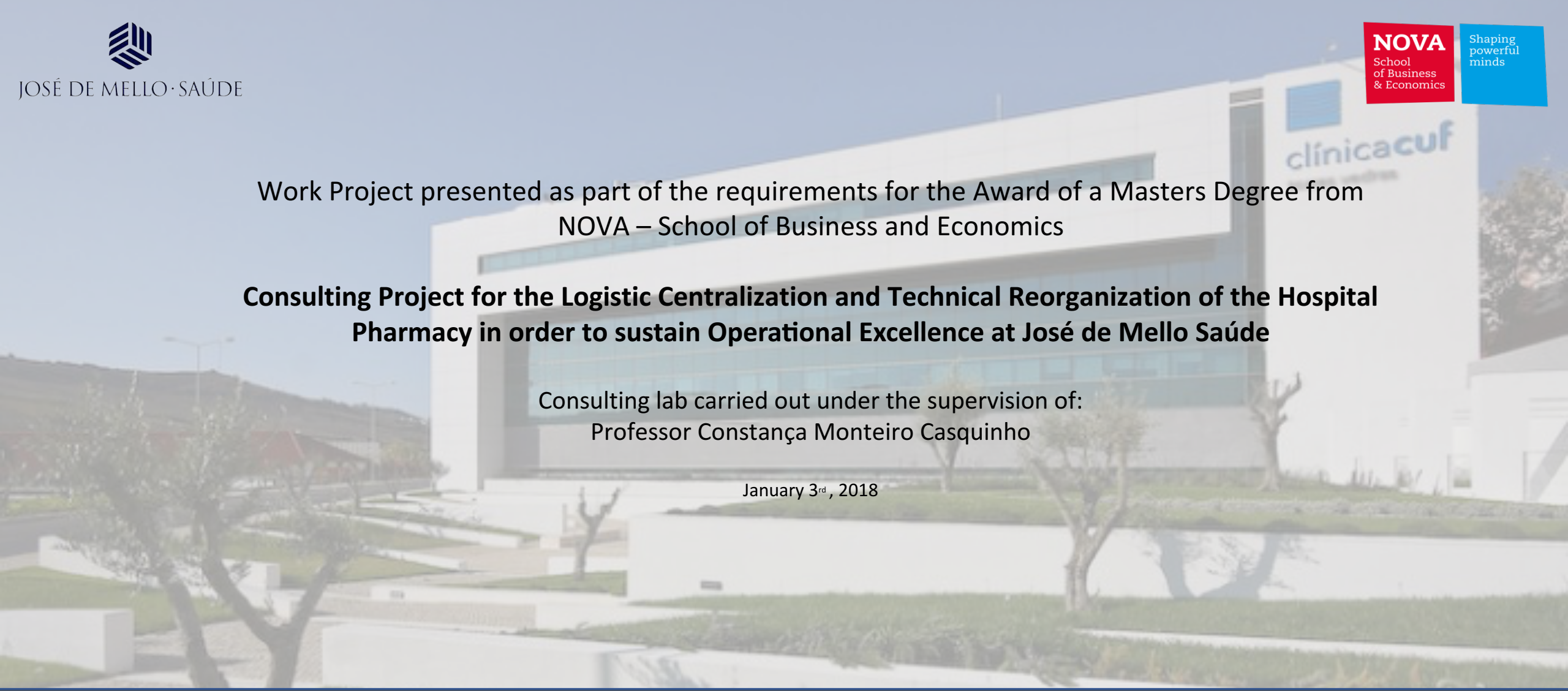

Work Project presented as part of the requirements for the Award of a Masters Degree from NOVA – School of Business and Economics

Consulting Project for the Logistic Centralization and Technical Reorganization of the Hospital Pharmacy in order to sustain Operational Excellence at José de Mello Saúde

Consulting lab carried out under the supervision of:
Professor Constança Monteiro Casquinho

January 3rd, 2018

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NOVA SCHOOL OF BUSINESS AND ECONOMICS

Acknowledgments

First of all, we would like to express our very great appreciation to our advisor **Prof. Constança Casquinho** for the continuous support in our project and related research, for her patience, motivation, and immense knowledge.

We are particularly grateful for the assistance given by **Dra. Rita Oliveira,** who enriched the project with her systematic useful comments, remarks, engagement and support and provided us with the opportunity to join her team during the time of the project. Only with her precious guidance was it possible to develop our work.

We would also like to offer our special thanks to **Dr. Rui Diniz, Dr. Rui Raposo** and **Dra. Maria Teresa Pereira** for their indescribable generosity of sharing knowledge and availability to be present at our Steering Meetings during the project.

Our special thanks are extended to **Dr. João Costa Macedo** and **Professor José Crespo de Carvalho** for sharing their deep knowledge on their areas of expertise and always being available to support us.

In addition, we would like to thank **Nova School of Business & Economics**, its university teachers, staff member and all of our colleagues. We are honored of belonging to such an institution that helped us grow and helped shaping us as professionals.

List of Abbreviations, Acronyms and Initials

AS IS - Current situation, one warehouse in each hospital unit

TO BE - Logistics centralization, creation of a central warehouse

CW - Central Warehouse

LD – Logistics Department

PDA – Personal Digital Assistant

UD – Unitary Doses

DCI – Denominação Comum Internacional

HU - Hospital Unit

HCD - Hospital CUF Descobertas

HCIS - Hospital CUF Infante Santo

HCC - Hospital CUF Cascais

HCTV - Hospital CUF Torres Vedras

HCSant - Hospital CUF Santarém

HCS - Hospital CUF Sintra

HCA - Hospital Cuf Almada

CCA - Clínica CUF Alvalade

HCT – Hospital Cuf Tejo

CCB - Clínica CUF Belém

CCM - Clínica CUF Miraflores

CSDR - Clínica CUF São Domingos de Rana

CMFR - Clínica CUF Mafra

CCS - Clínica CUF Sintra

PO - Purchase Order - *Notas de Encomenda*

Invoices – *Faturas*

Glossary

Galenic Formulations	Preparation of sterile (such as oncology, parenteral nutrition, ophthalmologic) and non-sterile medication.
Individualized Distribution	The galenic formulations, as well as some other medications, are directly prepared for a specific client. This type of distribution is called individualized distribution.
Picking	The picking consists of preparing the order for expedition. It includes tasks such as identifying the medication that was ordered and placing it in a box for expedition.
Point-Of-Care (POC)	Each hospital has several places where medication is stored and client's information is available for the nurses. The surgery room also includes a space for storing medication and for nurses to do administrative work. These locations are denominated POC.
Repackaging	Repackaging of unit doses, in case they were removed from the blister or if there is the need to add information such as batch, expiry date and DCI.

Glossary

Technical Pharmacy	Compounds the following activities: repackaging of medicines, unitary doses, individualized distribution, traditional distribution, galenic formulation and clinical pharmacy.
Unit Doses	One unit of medication (e.g. one tablet or one vial)
Unitary Doses	For admitted patients, medications are prescribed by a physician for a time span of 8, 12 or 24 hours. The prescribed medicines are placed into a drawer, allocated to that specific patient, which is afterwards transported to the POC. The combination of the medication placed into a patient's drawer is called Unitary Doses.
Unpicking	After reception of an order at the pharmacy, the paper boxes are opened, the medication removed and a record is created in the information system. This process is designated unpicking.

AGENDA

1. Executive Summary

Overview

The Consulting Labs at Nova Sbe provide students with the opportunity to experience a real-life consulting project. Accompanied by Professor Constança Casquinho, former consultant, our group elaborated a study on the centralization of the warehousing of medicines and the hospital pharmacy for the company José de Mello Saúde. The team was based at CUF Infante Santo, while staying in close contact with Carnaxide, the company's headquarters.

The ultimate aim of the consulting labs consists of solving a consulting challenge, while adapting to the client's corporate culture:

- Apply theoretical concepts acquired during the masters degree
- Development of soft skills, by working in a team
- Create value added for the company
- Development of analytical and structured thinking
- Get closer to the corporate world.

Partners & Advisors

Advisors:

- Dr. Rui Diniz - Vice-President
- Dr. Rui Raposo - Executive Commission
- Rita Oliveira – Head of Pharmacy
- Dr. João Costa Macedo - Manager of the Logistics Department
- Dra. Maria Teresa Pereira

Advisors:

- Constança Casquinho

Team

Duarte Almeida

Miguel Batalha

Jessica Müller

1. Executive Summary

José de Mello Saúde

José de Mello Saúde is inserted in the Portuguese corporate group Grupo José de Mello, which built its first hospital, CUF Infante Santo, in 1945. Owner of privately held hospitals and clinics that are part of the brand CUF, José de Mello Saúde's vision is being the leader in providing health care services, positioning itself in terms of quality and establishing a net of interrelated entities providing high performance not only in the private sector, but also in the public sector. The company's mission consists of promoting health care services based on skills such as knowledge, respect for human life and the environment, thereby developing intellectual capital and seeking to achieve the best possible result.

José de Mello Saúde nowadays owns 7 hospitals, 2 public-private partnerships, 8 clinics and 1 institute, most of them situated in the greater Lisbon area. Following the expansion of the health care market, JMS EBITDA increased by 7,72% in comparison to 2015, resulting in an operational result of €41,6 million in 2016 and an operational income of €586,3 million [1]. The number of medical appointments increased by 6,65%, reaching 2207 thousand appointments in 2016. JMS looks forward to expanding its footprint in Portugal with the creation of a new Hospital in Sintra and the new CUF Tejo. They furthermore inaugurated a new clinic, CUF São João da Madeira, in the beginning of 2017. [2]

The Project

This consulting project is divided into two related challenges, which can however be separately analyzed:

1. The first challenge consists of a financial analysis of a centralized warehouse for medications. The situation AS IS and TO BE will be compared with regards to their profitability. Since the previous consulting lab group at José de Mello developed a work on the centralization of consumables, this challenge will be based on their assumptions and conclusions, bearing in mind that we are analyzing another product category, which entails other legislative and regulatory issues.
2. The second part of the challenge is to find the best location for the hospital pharmacy. Different scenarios will be analyzed, in order to identify the most suitable and profitable one for José de Mello Saúde. A possibility of externally selling medications that had to undergo pharmaceutical processes is incorporated in this scenario.

Deliverables:

- Cost analysis comparing the situations AS IS and TO BE
- Overview of the newly structured pharmacy, explaining which processes are located at which locations: design the blueprint of the centralized logistics processes and central provisioning of medicines
- Identification of the implications of the new model: regulatory, financial and internal implications
- Short implementation overview, identifying the risks that could eventually [1]

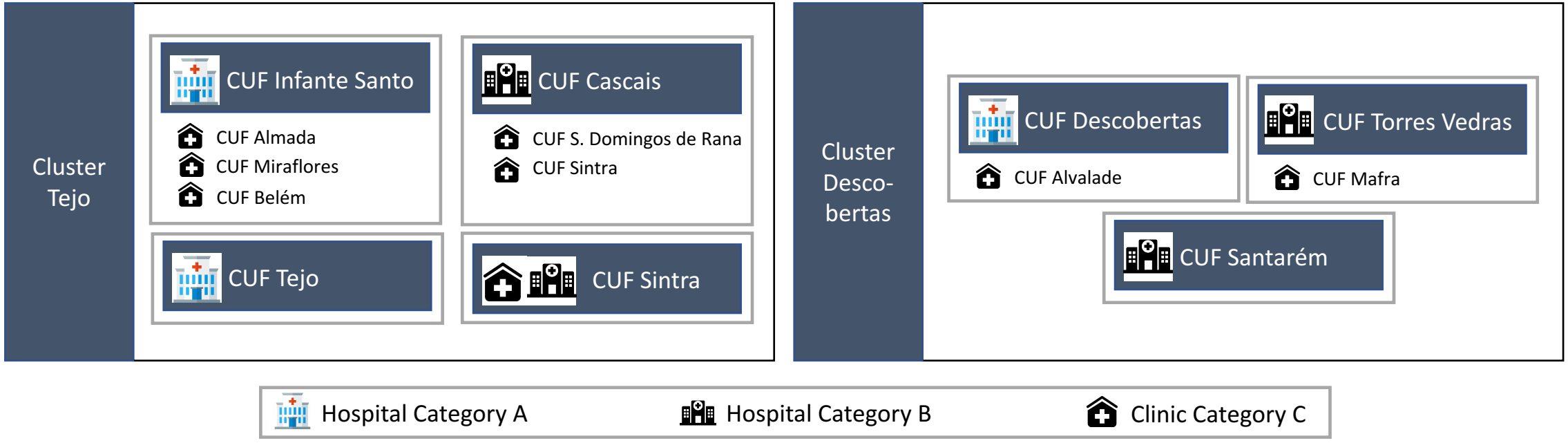
1. Executive Summary

The current distribution system of medications is divided into two clusters: Cluster Tejo and Cluster Descobertas. In each cluster, there are category A hospitals, the ones with the largest dimension, category B hospitals, smaller hospitals and category C clinics.

- As depicted below, in the Cluster Tejo CUF Infante Santo supplies CUF Almada, CUF Miraflores and CUF Belém, whereas CUF Cascais supplies CUF S. Domingos de Rana and CUF Sintra.
- On the other hand, in the Cluster Descobertas, CUF Descobertas supplies the Alvalade clinic and CUF Torres Vedras supplies CUF Mafra.

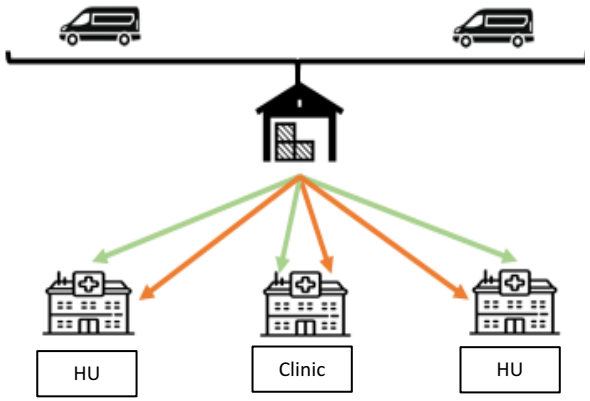
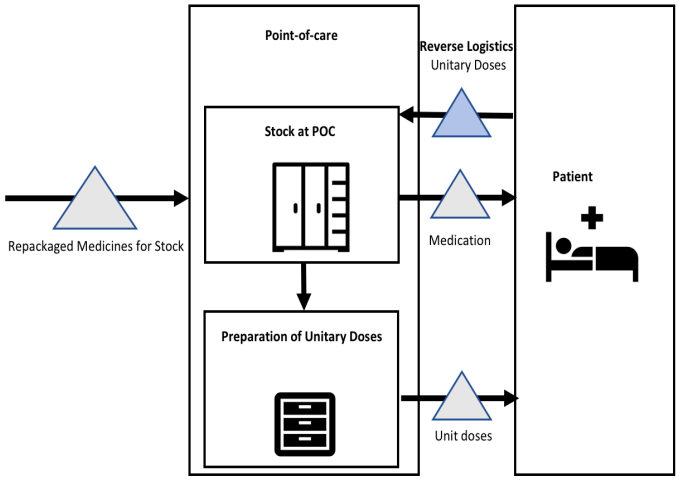
As this project is based on the former one, the warehouse, which was acquainted for consumables, will also be used as medications warehouse.

During the forecasting period some clinics will be expanded into hospitals and a few further hospitals will be built.



1. Executive Summary

The best case scenario is the one with the galenic formulations and medicines warehouse centralized at the CW, while the U.D. is created in a decentralized way at each Point-of-Care. This would entail **savings of 697 973 € between 2018 and 2022**

Central Warehouse and Galenic Formulation	Unitary Doses	Total Costs AS IS	Total Costs TO BE
		**Decentralized Storage**	**Central Warehouse**
		4 402 501€	**3 107 566€**
		+	**+**
		U.D.	**U.D. Point-of-Care**
		Accounted for in the warehouse scenario	**626 674€**
		+	**+**
		Galenic Formulation HCD	**Galenic Formulation CW**
		27 266€	**(2 446)€**
		=	**=**
		4 429 767€	**3 731 794 €**

Galenic Formulations

Medicines

The galenic formulation has to stay at the HCD until licencing request approval. In order to maximize the potential profits of this project we **studied a spin-off opportunity** consisting of **selling pharmaceutical services produced in the CW**.

1. Executive Summary

Analysis

Process

- Poorly automatized process results in:
  - Mistakes caused by human interactions
  - Assistants having to possess deep knowledge about the delivered medicines
  - Long repackaging process
  - Practical problems when using the Kanban method
- Decentralized purchasing leads to:
  - High minimum quantity requirements set by suppliers and subsequent excess of stock
  - High number of purchase orders
- A lack of resources in the purchasing department leads direct contact between the pharmacy and suppliers, in order to tackle out-of-stock situations
- Missing prescriptions when physicians only communicate decisions verbally

Total cost of each dimension

Cost of each dimension with decentralized (AS IS) and centralized warehouse (TO BE)

	AS IS	TO BE
Revenues	0€	(424 750)€
Stock	909 078€	294 076€
FTE	2 788 739€	2 728 381€
ESS	548 184€	331 359€
CAPEX	156 500€	178 500€
Total	4 402 501€	3 107 566€

Difference between scenarios

In comparison to the decentralized storage, the central warehouse would generate 5-year accumulated:

Revenues	**€425 k** profit due to vacant storage space
Stock	**€615 k** decrease in costs
FTE	**€60 k** lower costs
ESS	**€217 k** savings
CAPEX	**€22 k** decrease in costs
Total	**€1.294 million**

Conclusion

The scenario with a centralized warehouse has the best results, thereby being the optimal choice

1. Executive Summary

Analysis

Process

- Reverse logistics does not only entail a high risk of mistakes due to being highly human capital intensive, but it is also a protracted and time-consuming process
- Incongruences emerge with a record of consumption that is created when the unitary doses leave the pharmacy. (Automatically, the charges are transferred to the client's bill) However, if there are changes to the prescriptions, the medicine is not administered, which leads to temporary wrong records.
- The personal digital assistants (PDA) do not produce the desired efficiency

Total cost of each dimension

Cost of preparing the unitary doses in each Point of Care, (POC) or in the central warehouse (CW)

	POC	CW
Distribution	495 127€	973 618€
Stock	36 047€	0€
CAPEX	95 500€	39 000€
Total	626 674€	1 012 618€

Difference between scenarios

In comparison to the centralized production of unitary doses, the decentralized production would generate 5-year accumulated:

Distribution	**€478 k** savings
Stock	**€36 k** increase in costs
CAPEX	**€56.5 k** increase in costs
Total	**€385 944 k**
FTE	4h /FTE /day can be relocated to other tasks
Timely Invoices	€20 k / month will be available immediately

Conclusion

The scenario in which the Unitary Doses are prepared in each POC has the best results, thereby being the optimal choice

1. Executive Summary

Analysis

Process

- There are limited resources for centralized galenic formulation in terms of human capital and available space
- The process of galenic formulation cannot contain any mistake, which requires concentration and dedication

Total cost of each dimension

The cost of having galenic formulation in the HCD is lower than preparing them in the HCT. The preparation in the warehouse (CW) requires a special license.

	HCD	HCT	C.W.
Revenue	(96 948)€	(107 476)€	(204 424)€
Rent	48 214€	35 292€	25 978€
CAPEX	76 000€	176 000€	176 000€
Total	27 266€	103 816€	(2 446) €

Legal

For the central warehouse scenario, an additional license is needed. The other scenarios do not require any further authorizations proceed immediately.

Conclusion

The scenario in which the galenic formulation is prepared at the HCD presents the best results. It does not require any additional permits/licenses, which is why it is a temporary top choice.

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2. Action Plan

Diagnosis

- What is the current logistical process and organization of the technical pharmacy at José de Mello Saúde?
- Which model assesses the identified inefficiencies?
- What is the model's financial impact?

Cost Analysis & Recommendations

Warehouse

- Identify and determine all costs in the AS IS and TO BE scenarios
- Compare the computed costs
- Proceed to a recommendation

Unitary doses

- Identify and determine all costs associated with the hypothetical scenario
- Identify other non-financial advantages
- Proceed to a recommendation

Galenic Formulations

- Calculate costs associated to the location of the centralized galenic formulations process
- Proceed to a recommendation

Conclusion

- Create a holistic scenario with all the aforementioned recommendations
- Set up an implementation strategy
- Assessment of risks and possible mitigation
- Identify a further opportunity of growth for JMS

2. Methodology

Process

Objective: The main goal of our analysis was to identify gaps and inefficiencies that emerge with the process as it is nowadays. With opportunities for improvement we were then able to create a holistic recommendation, which addresses the identified problems.

Method: As a first step, we proceeded with a literature review about the processes in a hospital pharmacy, in order to understand each step and gather a few points of view. The papers already exposed some information about which pharmacy models are more efficient, comparing centralized and decentralized ones. Furthermore, they describe and define key words, crucial to understand the dynamics of the hospital pharmacies.

The process was sketched after careful on-site observation. The observation took place at the HCIS pharmacy, lead by Dra. Rita Oliveira, as well as at the HCD Pharmacy, led by Dra. Ana Margarida. The activities were divided into different stages (Reception, Preparation of medication for storage in their unit doses forms, Order Reception: replacement order, unitary doses prescription, individualized distribution, Distribution) and within each stage every scenario was taken into consideration. We therefore accompanied every step from the reception of the medicine until the replacement of stock in various sections, including surgery and admitted patients. The opportunities for improvement were partly identified independently, but we also took into consideration some opinions we were able to extract from personal interviews. These interviews were conducted with Dra. Ana Margarida (Head of Pharmacy HCD), Dra. Rita Oliveira (Head of Pharmacy HCIS), Dra. Carla (assistant HCIS) and Dra. Ana (assistant HCD). [3, 4, 5, 6, 7, 8, 9]

2. Methodology

Areas

Objective: Forecast the total area needed for both central warehouse and galenic formulations.

Method: To forecast the total area needed for this project, we firstly studied the "Manual da Farmácia" from Infarmed. This manual explains which specific areas are theoretically needed in the warehouse and for galenic formulations, and how much square meters each specific area occupies. The manual presents a study for a pharmacy serving a total of 500 beds so, to forecast the areas we would need, we divided the total areas in the Manual for the 500 beds in order to obtain square meters needed/ bed. After that we forecasted the total number of beds JMS might be serving in 2022 and multiplied that total by the square meters/ bed computed before. Through this method we were able to forecast a total area of 320 m^2 for the CW and 88 m^2 for galenic formulations. [10]

Revenues

Objective: Estimate the total revenues generated by setting free areas inside each hospital due to the centralization of the medicines warehouse and galenic formulations.

Method: To forecast the total revenues generated we asked the Production Department of JMS for information about the size of a doctor's office; duration, price and margin of contribution of each appointment. Then, dividing the area set free in each hospital by the size of an office we obtained the approximate number of offices available in each hospital. Furthermore, we calculated the number of appointments per office per year, using the duration of each appointment. Finally we computed the accumulated potential profit between 2018 and 2022 by multiplying the number of appointments per year by price of each appointment, times the margin of contribution.

2. Methodology

Stocks

Objective: Calculate the costs related with stocks, in both scenarios AS IS and TO BE, to compare both situations, as well as find out the optimal model that minimizes the holding, ordering and invoice costs, in a period of 5 years.

Method: Information from September 2016 to August 2017 regarding all HU of JMS was used, provided by the Pharmacy. This information included the average stock of March 2016, as well as the entries in all pharmacies during all 12 months. This represents the most recent information available, thereby being the most correct one to study the current situation of the firm, and correctly make predictions. We calculated the unitary price of each product (since the price is variable, an average of the price of each product bought was made), the value of annual and daily consumption, number of orders and average number of product in each order, and finally the number of invoices and the average number of invoices per order. All these dimensions were analyzed according to the category of each hospital and current number of beds in each category. With this information, by bed and type of hospital, we were able to make realistic predictions, since we knew how many new hospitals would open in the 5 year time frame, as well as the respective number of beds.
Some other relevant data was provided by JMS: Value of WACC (financial department), and cost with orders and invoices (Logistics Department).
In all models used, three major cost dimensions were compared: total cost of holding stock, total cost of invoices and total cost of orders.
The scenario AS IS was studied taking into consideration the average level of stock in March 2017, since that month represented an average of the level of stock during the year. The remaining variables relied on data from the entire period.
For the TO BE scenario, different models were used, based on information regarding the entries in the pharmacies. First, models which assumed linear consumption were computed, having fixed safety stock (SS 2, SS 4 and SS 10). These were used as a way to study the effects of changing certain variables (more SS will result in higher inventory levels, and lower number of orders). Besides, the Economic Order Quantity (EOQ) model was used, since it minimizes the sum of Ordering and Holding Costs, while having the capacity to be calculated with and without linear consumption. To study the variance in consumption, a Safety Stock was calculated, with a service level of 95% and 99%, representing the probability of avoiding stock outs. To do so, a daily variance for each product was calculated, and the values of the service level were taken from the "Z table". Finally, a last EOQ model was developed, (EOQ Safe) where it was assumed a SS of 10 and 7 days, in the first two years respectively, and from that point, a service level of 99%. This model was asked by the company, since it is more cautious due to the lack of efficiency in the first years of the transition to a central warehouse. [11, 12, 13]
For the unitary doses scenarios, since it requires some quantities of stocks in each Point-of-Care, a two day safety stock was added to avoid stock-outs.

2. Methodology

Human Resources

Objective: Estimate the 5 year cost of all employees with tasks associated to the pharmacy, in a centralized and non-centralized scenario. Furthermore, measure potential synergies with workers in other areas, mainly the ones in charge of clinical consumables.

Central Warehouse

Method:

Firstly, we acquired the average hourly cost with each worker, according to their function (Technical Director, Pharmacist, Pharmacy Technician and Medical Assistant). This value was provided by the Human Resources Department.

- AS IS scenario: We were given the number of workers in each HU, per year, by the pharmacy Administration. That information was used to calculate the current costs with FTE's associated to the pharmacy. The average of the number of workers per HU category was computed, to correctly predict the necessary increase in Human Resources during the 5 years.
- TO BE scenario: We divided the number of workers into two areas: The ones in the central warehouse, and the ones in each HU.
    1) To calculate the first dimension, the group measured samples of time for each activity (reception, repackaging, storage and picking), while taking notes of the number of medicines included in each task. Then, with the help of the information computed in "Stocks", such as number of receptions and orders, the total time for each task was calculated. To measure synergies in the warehouse, the group contacted the team working on the centralization of clinical consumables and asked for the number of HR included in their project and the percentage of time that could still be allocated to pharmacy activities, in each task. We were then able to identify and compute the synergies.
    2) 2) Regarding the workers in each HU, due to the huge logistical variations of each HU, instead of measuring times, a more general study was performed. Through dialogue with the Technical Directors of the pharmacies of the category A UH's, we calculated how many people would be needed in each HU, taking into consideration the efficiency gain and expunged duplicated activities. [14, 15, 16]

Unitary Doses

The difference between having centralized or non centralized Unitary Doses, in a Human Resources dimension, is expressed in the number of hours that would be spent doing inverse logistics. So, the daily amount of time spent performing this activity was computed in each hospital. That value is assumed to be saved in a decentralized Unitary Dose scenario.

2. Methodology

External Services and Supplies	
Objective: Estimate the Total Costs of ESS, which are the costs incurred by the warehouses, for the AS IS situation (one warehouse per hospital) and for the TO BE situation (only one warehouse for all hospitals). A comparison will then determine the savings or additional costs of having a central warehouse.	
Medicines Warehousing	In order to calculate the total ESS costs for the Central Warehouse we firstly asked João Costa Macedo for the ESS costs per hospital, who advised us to use the same costs as the Consumables Project. After gathering all information needed we computed the unitary cost by dividing the ESS costs of a hospital by its total area. To calculate the AS IS scenario we simply multiplied the unitary costs by the total area of the hospital, updating the unitary cost for each year using the forecasted inflation rate. To calculate the TO BE scenario, we decided to use as unitary cost per square meter, the average of ESS unitary costs of all hospitals. Then we followed the same process as in the AS IS scenario and we multiplied the unitary cost by the forecasted area for the Central Warehouse.
Galenic Formulation	The specific infrastructure, facilities and devices needed for this area have different consumptions of ESS from all other areas within the CW. Once there is no reliable measurement for the consumption of most of ESS in this area such as water and electricity, we decided to only include the rent of the required space.

2. Methodology

CAPEX	
Objective: Forecast the Capex for each scenario analyzed and compare the results.	
Method: For the forecast of the CAPEX we had to take into account two different types of CAPEX and apply a different methodology to each one of them.	
Infrastructures and Facilities	Within infrastructures and facilities we accounted for costs such as: building up and renovate infrastructures; installation of ventilation system, fire alarm and sprinklers and air-conditioning. To obtain these values we reached out to the Department of Infrastructures of JMS which provided us with a value of 300€/ m^2 for the CW and 2000€/ m^2 for galenic formulations.
Specific Devices	The specific devices which we accounted for were: PDAs and shelves for unitary doses and automated packaging machines. To better estimate the price and characteristics of each product we talked to various suppliers: BIQ (repackaging machine) [17], Mobit (shelves) [1], Blue Star (PDA's) and Iten (PDA's) [19]. [20]

2. Methodology

Distribution	
Objective: In sum, the aim was to compare four scenarios, which include the following variables: type of distribution (self-distribution or outsourcing) and optimal scenario (centralized unitary doses production or decentralized unitary doses production).	
Self-distribuition	**Method:** When calculating the self-distribution costs, we started by defining the most efficient routes, bearing in mind the distance between the hospitals and clinics and the frequency of delivery. Coming to the conclusion that a lower frequency would not significantly increase the cost of stock and CAPEX at each hospital, we decided to deliver to Category A hospitals two times a day, 6 days a week, Category B hospitals once a day, 5 days a week and deliver to the clinics only 3 times a week. After fixing the routes and their frequency, we calculated the total time for each route, having included 15 minutes at each stop (time to unload the truck). From there on, we set the number of trucks and drivers necessary to fulfil all necessary requirements. We assumed a renting contract for the truck with an associated cost of 1200€ per month, per truck (information provided by IVECO). We then proceeded by computing the gas cost per kilometre and the tolls associated with each route. With this method, we got to a final cost in terms of gas and tolls per route and the related costs of drivers and trucks.
Outsourcing	To estimate the cost of outsourcing the distribution, we made two requests for quotation. One was provided by Corrida do Tempo, the current distributor at JMS, and the other one by Torrestir. Since the quote provided by Torrestir was much higher than the one provided by Corrida do Tempo and the self-distribution costs, they were not included in this presentation.

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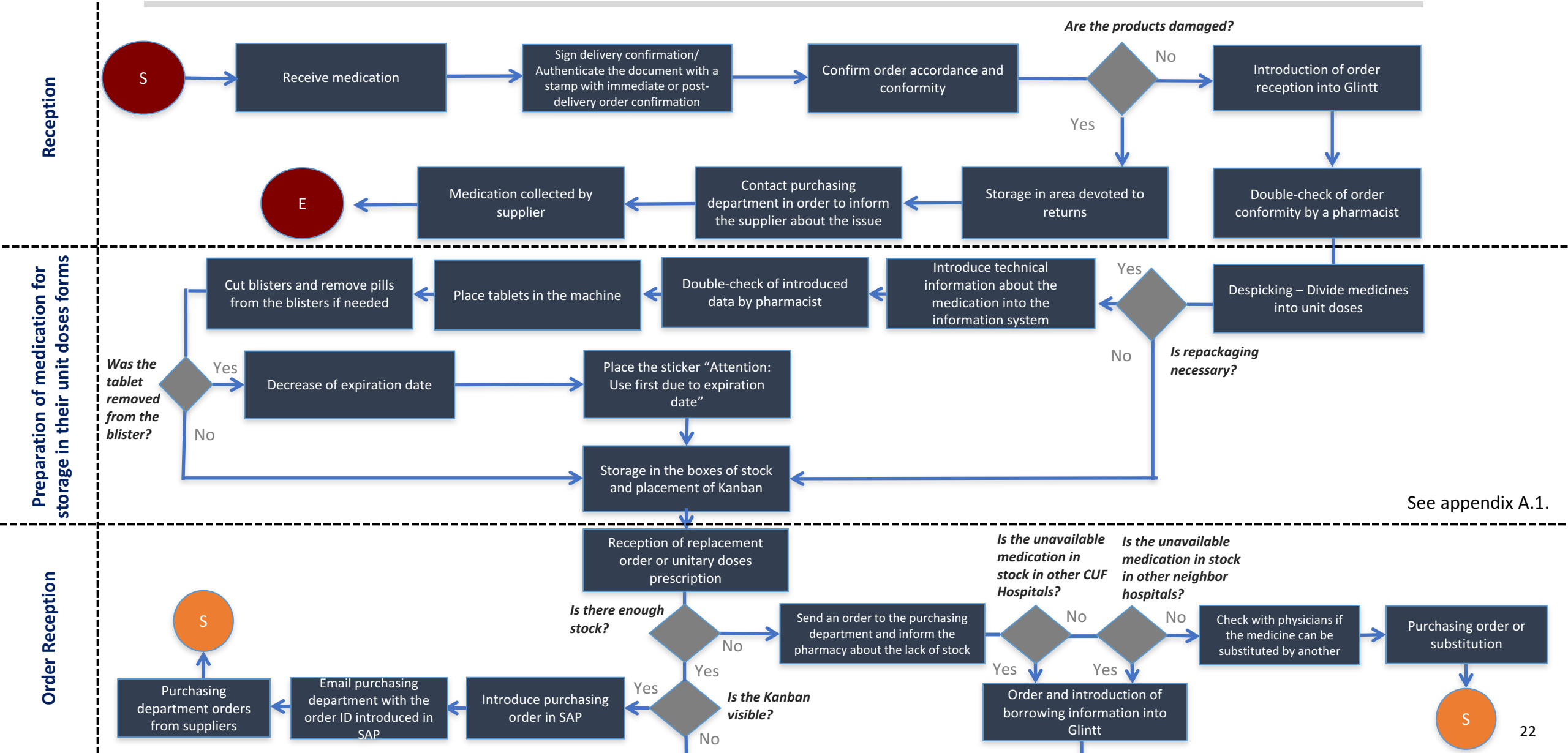
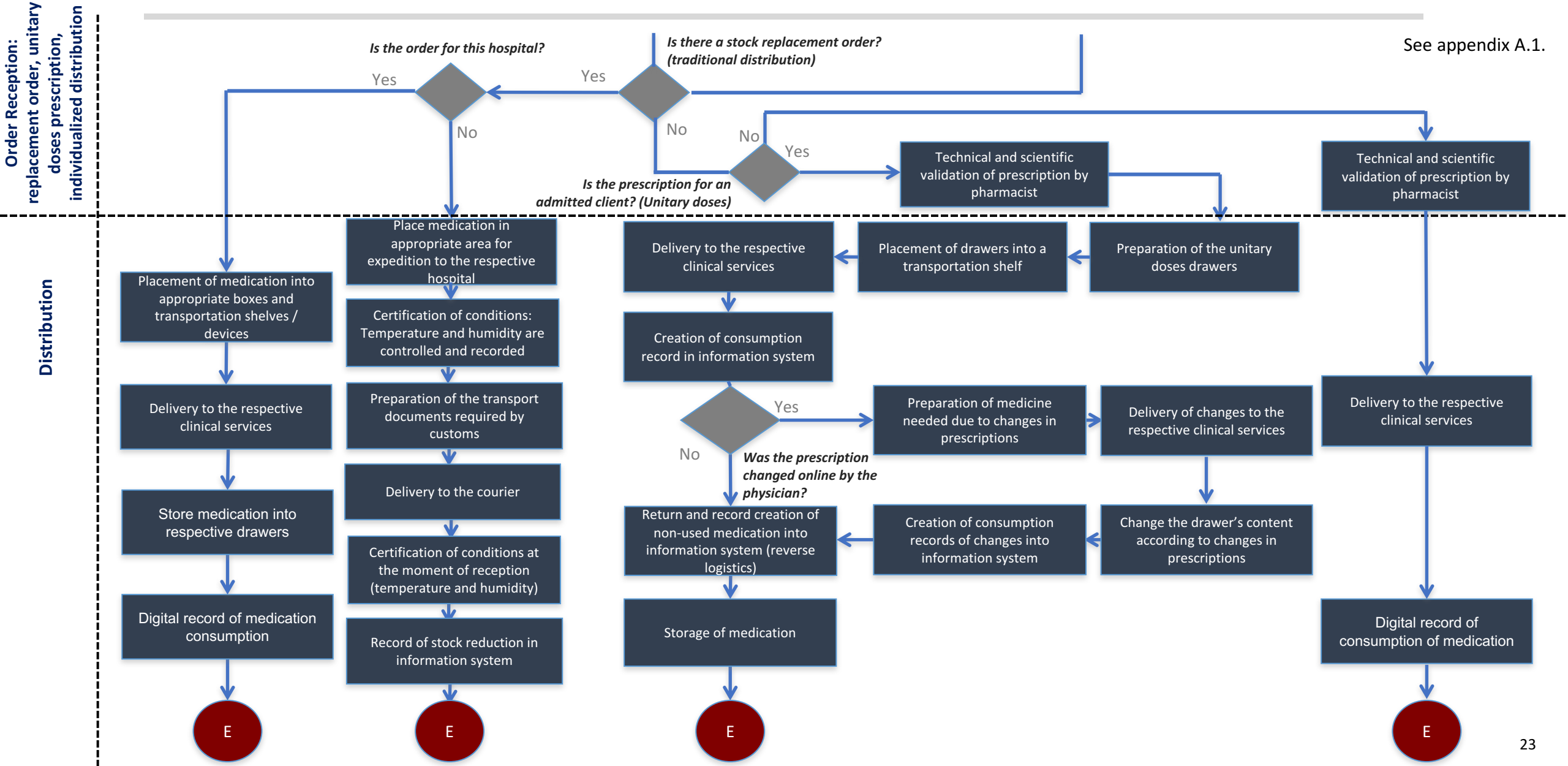
3.1 Process Flow diagram



See appendix A.1.

3.1 Process Flow diagram



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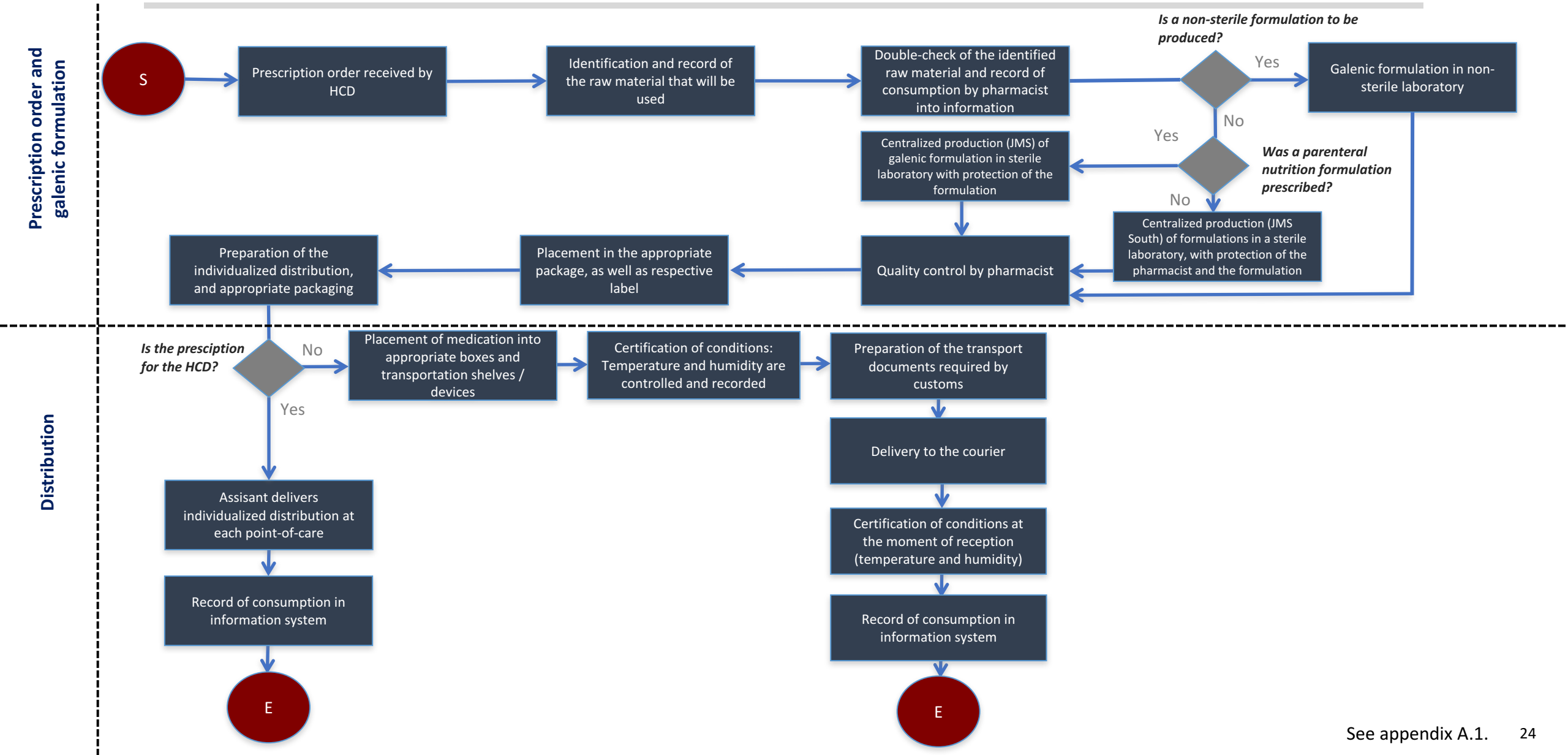
3.1 Process Flow diagram



See appendix A.1.

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3.2 Improvement Opportunities in the Process

Automatizing the process (using PDA's, an integrated software and information system, and QR codes on the products) mitigates the inefficiencies at the reception and storage. Negotiation with suppliers is vital for a better functioning process.

Reception	Mitigation
Due to the dynamics at the pharmacy, it is not always possible to double-check incoming orders	To maintain security, an integrated information system with usage of PDAs, which allows an easier and faster check and double-check, would make the process more efficient. The final aim is that the pharmacy assistants do not need to have specific knowledge of the incoming medicines to check and double-check the orders.
The assistant has to have deep knowledge of the ordered medicines, in order to check order conformity	Negotiate with the suppliers, in order for them to place a bar code on each unit doses (depends on the medicine and format needed) or give higher preference for the suppliers who already do so. Automatize the process.

Storage of unit doses	Mitigation
Limited storage space	This is due to: high lead times; limited space for the amount of activity, excessive stock due to minimum quantity requirements. A centralized purchasing system and warehouse, with possibility to improve the efficiency of the stock management, would mitigate this issue.
Unit doses do not come with the necessary information, which creates the need to repackage each one separately	Negotiation with suppliers and / or give higher preference for those who supply the medication in its optimal format
Manual repackaging process is protracted and prawn to mistakes	Analysis of the available machines in the market, and investment in a better option, which allow for process automatization – requires financial investment (Capital Expenditure)

3.2 Improvement Opportunities in the Process

The centralized and continuous provisioning and purchasing of medicines, the digitalization of the stock management and the use of clinical protocols are vital for a more efficient process.

Order entry	Mitigation
Minimum value of each order required by suppliers lead to excessive stocks and significant costs	Centralized provisioning and purchasing of medicines
Limited periods for complaints to the purchasing department (Fridays)	Centralized and continuous provisioning and purchasing of medicines
Practical problems with the usage of Kanbans	Digitalization and automation of stock management, by using PDA's. Nevertheless, the Kanbans system should remain in function, as a visual support
Missing prescriptions when physicians only communicate verbally	Introduction of clinical protocols into the information system; POC should be informed on a monthly basis about the difference between consumption and prescription, in order to minimize it; Raise awareness among physicians and nurses about the importance of creating all necessary records

3.2 Improvement Opportunities in the Process

By decentralizing the creation of the unitary doses, reverse logistics is eliminated and the invoices will be ready at any point in time. The existing resources for galenic formulations can be allocated more efficiently.

Distribution	Mitigation
Reverse logistics originated from the distribution of unitary doses is protracted and human capital intensive	Decentralization of the process of preparing the unitary doses (preparation in each POC for 8, 12 or 24h), simultaneous consumption/billing and administration record in the moment of the actual administration, will eliminate reverse logistics and allows for timely invoices.

Galenic formulation	Mitigation
Limited capacity for centralized process of galenic formulation (limited resources in terms of space and HR)	Optimization of working schedules and space
Mistakes in the can have severe and vital consequences. Concentration and dedication are required to avoid mistakes	Exclusive allocation of HR to the process of galenic formulation

JOSÉ DE MELLO · SAÚDE

AGENDA

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4.1 Recommendation

According to our forecasts, the CW will cost JMS less €~1 295 k between 2018 and 2022. This is possible mainly due to the reduction of stocks costs and potential revenues from the areas set free.

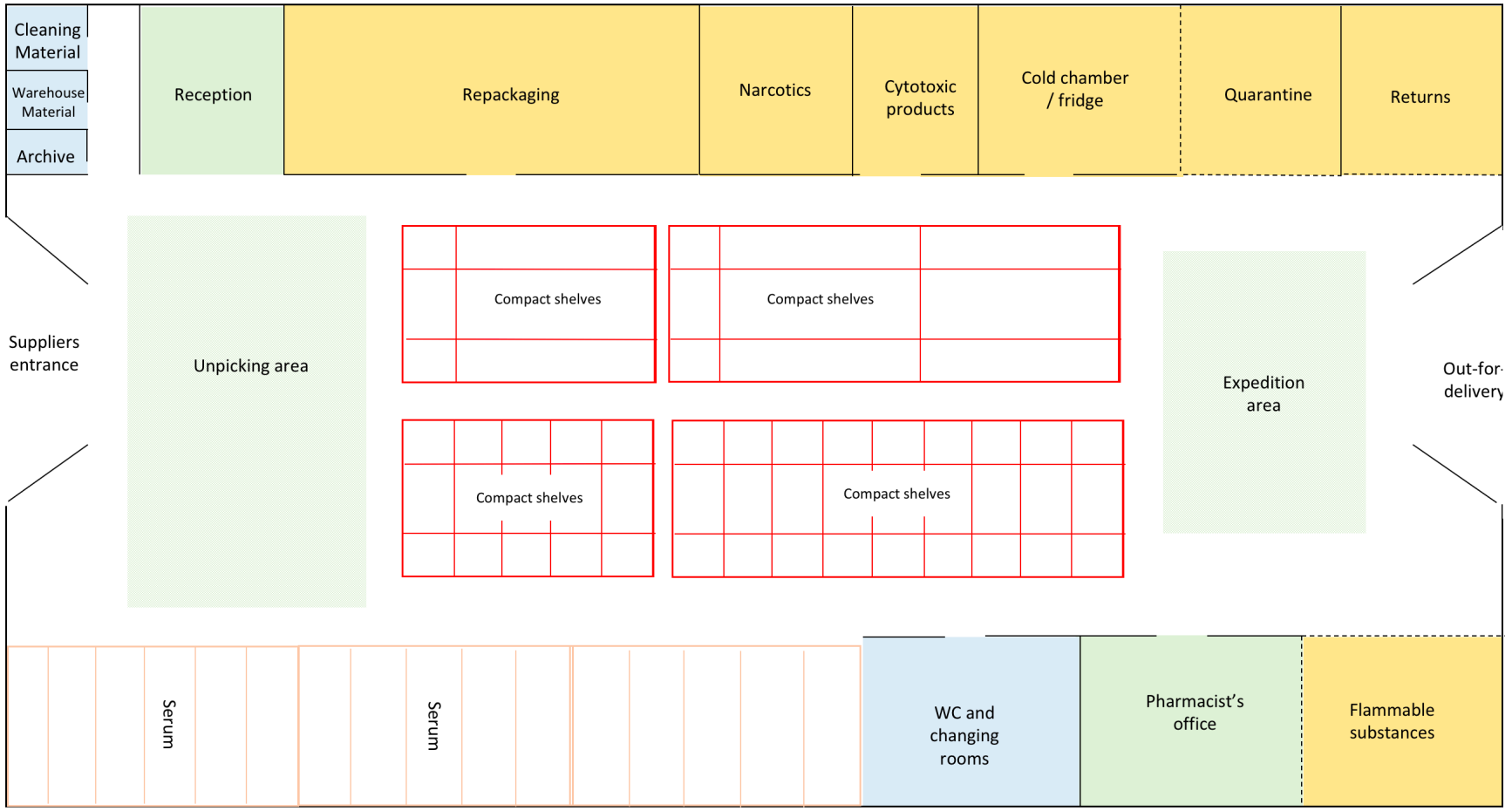
	AS IS	TO BE	Savings
Revenues	0 €	(424 750) €	424 750 €
Stocks	909 078€	294 076€	615 002€
FTE´s	2 788 739€	2 728 381€	60 358€
ESS	548 184 €	331 359 €	216 825 €
CAPEX	156 500 €	178 500 €	(22 000) €
Legal	Doesn't require licensing	Requires licensing from Infarmed[25,26]	
Total	**4 402 501€**	**3 107 566 €**	**1 294 935 €**

See appendix: A.2.1

AGENDA

4.2 Centralized Warehouse and Purchasing department

In the centralized scenario, the CW provides storage areas, an area for the reception and unpicking, one for the repackaging, an expedition area and common areas such as WC or offices.



*Medical gases will still be stored at the HU, because of the already existing structures. The gas suppliers are independent from the other products' suppliers. [27]

4.2 Centralized Warehouse and Purchasing department

After the centralized purchase of medicines, these are delivered, received, registered and immediately repackaged. Afterwards, they are stored.

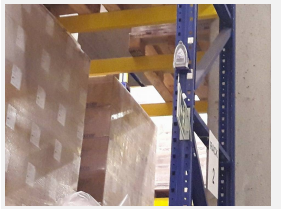
1 Centralized Purchasing

- Centralized provisioning and purchasing allows for JMS to meet the minimum quantity requirements set by suppliers, thereby reducing excessive stock.
- Negotiations with the suppliers, due to less complex and frequent distribution routes, could result in lower costs.
- Possible synergies between medicines and consumables could arise with joint distribution.

2 Warehouse Reception

- Orders are received and registered by PDA scanning (prevents manual order conformity check)
- After scanning, the stock immediately enters the information system
- A double-check is required (after the PDA scan, a double-check precedes the storage)
- There is no need to have deep knowledge about the products in order to develop the tasks at the reception.

3 Repackaging and Storage



- After the repackaging, the medicines are stored by batch in separated shelves. Each medicine has a respective destination.
- Serums can be stored in palettes, due to their large dimensions and high consumption quantities.
- The whole warehouse has a cooling system with temperature and humidity control.

4.2 Centralized Warehouse and Purchasing department

Certain types of products have to be stored in a specific area of the warehouse. The consumed quantity in the HU is replenished after each order is prepared in the area of expedition.

5 Special areas

- Special storage areas [28] :
  - Returns
  - Quarantine
  - Flammable substances
  - Cytotoxic products
  - Narcotics
  - Cold chamber / Fridge

6 Expedition

- This zone is intended for the preparation of orders, which will be delivered to each hospital and clinic.
- When an order is prepared, a consumption record is created by scanning the bar code with the PDA. A sign is placed on the order, signaling the orders that are ready for expedition.

AGENDA

Assumptions

Assumptions
Opening of CUF Sintra Hospital: September, 2018
Opening of CUF Almada Hospital: January 2020
Opening of CUF Leiria Hospital: March 2019
Opening of CUF Tejo Hospital: June 2019
WACC of 6,74%
Central warehouse located in Matinha

Inflation

Price (variation) – Consumer Price Index

	2017	2018	2019	2020	2021	2022*
Inflation %	1,6%	1,7%	1,7%	1,8%	1,8%	1,8%

Source: Programa de Estabilidade 2017-2021 - Ministry of Finance[29]

*It was assumed that the inflation rate for the last year would be the same as the two previous years.

AGENDA

4

Medicines Warehouse: Centralized vs Decentralized

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iii. Costs Analysis

- **i. Stocks**
- ii. FTE's
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4.3.1 Stocks

To study the stocks, data from September 2016 until August 2017 was used, mainly the information regarding average inventory levels and entries during that period. Different models were used to predict the optimal cost.

Fixed Components

Holding Cost Rate (H) = Tied Capital Rate (i) * Unitary Cost of Acquisition (c)
Tied Capital Rate (i) = 6,74%. This is the WACC of JMS, which was given by the company.
Unitary Cost of Acquisition (c): The price for each product is variable, so a unitary price was achieved by doing an average of each unitary liquid value in the period mentioned before.
Aggregate annual consumption (D): Sum of the annual consumptions per product in all HU's.
Aggregate daily consumption (d): Sum of daily consumption per product in all HU's.
Lead Time (l): Average time, per reference, between the order and the entry of the product in warehouse.
Unitary cost per Purchase Orders (S): $\frac{Co}{No} + \frac{Ni*Ci}{No}$
Unitary Cost per Order (Co)= 2,61€. Costs with employees involved in processing purchase orders + administrative costs + ESS costs associated with the employee.
Average Number of products per Order (No): The amount of products in each order is variable. We were provided with the number of products ordered, in the period mentioned before, and divided it by the number of orders, in the same period, for each HU.
Unitary Cost per Invoice (Ci) = 0,4€. Cost per invoice, given by financial department.
Average number of invoices per order (Ni): Division between total number of invoices by total number of orders.
Service Level (z): Percentage of probability of avoiding stock out. This value comes from the z table. (In this work, the value 1,28 and 1,65 were used, for 90% and 95% respectively).
Daily standard deviation (σ): Measure that is used to quantify the amount of variation of a set of values.

Variable Components

Average inventory (AI): Average amount of units that exist stored in the warehouses, at any point in time. Each reference has a different number.

Safety Stock (SS): Extra quantity of stock used to prevent variances in consumption, and avoid stock outs.

Optimal Order Quantity (Q): Value to order, from each product, in each order made.

Annual number of product request(r)= D/Q: This number represents how many replenishment each product has to have per year.

Total Purchase Ordering Costs: Total costs with ordering products.

Total Holding Costs: Opportunity cost of holding the cost in inventory.

All data provided by pharmacy administration

4.3.1 Stocks

Some dimensions were computed differently between models, since some assume linear consumption: Fixed Safety Stocks (SS2; SS4; SS10), and Linear Economic Order Quantity, while others assume non-linear consumption: EOQ (90%; 95%; Safe)

AS IS

Average Inventory (AI): assumed to be always the same as March 2017, since it represents the average of the inventory for all months. Due to this, **Optimal Order Quantity** was irrelevant to calculate.

Safety Stock: Not computed, because it was impossible to differentiate which units, from the average inventory, belonged to this category.

Total Ordering Costs: Since we had real values for the period mentioned, those were used to directly calculate this cost. (Total Number of Orders * 2,61 + Total Number of invoices * 0,4)

Total Holding Costs: AI * H

SS 2; SS 4; SS 10

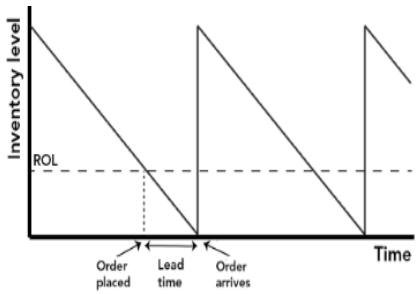
Optimal Order Quantity (Q): I*d+SS

Average inventory: $\frac{Q}{2}$

Safety Stock: d* days of SS

Total Ordering Costs: S * $\frac{D}{Q}$

Total Holding Costs: $\frac{Q}{2}$*H



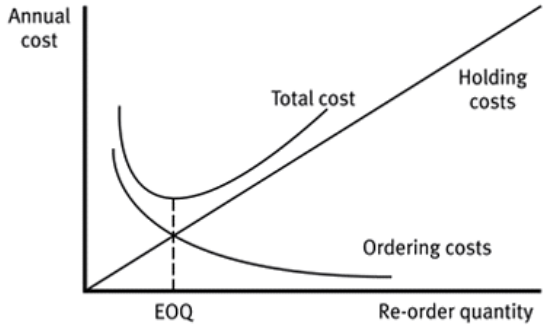
EOQ Linear and Non Linear (90%; 95%; Safe)

The Economic Order Quantity is a formula to achieve the optimal order quantity (Q) that minimizes costs (Holding and Ordering). The derivative of both curves gives Q.

Total Ordering Costs: S * $\frac{D}{Q}$

Total Holding Costs: $\frac{Q}{2}$*H

Optimal Order Quantity: $Q = \sqrt{\frac{2 \times S \times D}{H}}$



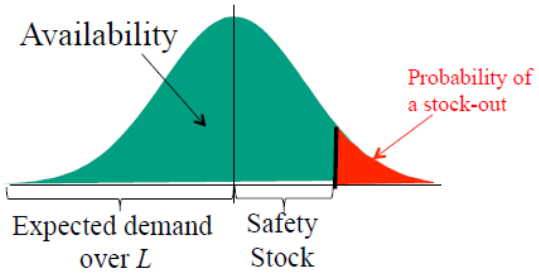
Average inventory: $\frac{Q}{2}$+ SS

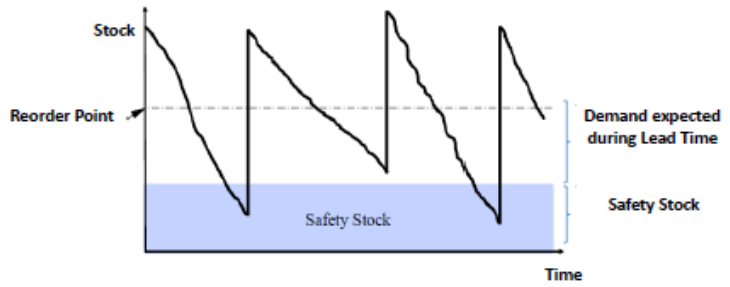
For EOQ Linear, no SS was calculated. For Non linear:

Safety Stock: $z\sqrt{L\sigma^2}$ (This value depends on the service level required. In this model, 90% and 95% were used, in order to compare the results of both options. From the benchmark realized, the majority of the warehouses operate with 90% service level. Since we are dealing with medicines, which can be vital for the survival of patients, 95% was used, to minimize the stock out probability)

This SS calculation assumes demand, and demand over lead time, to be normally distributed in each period.

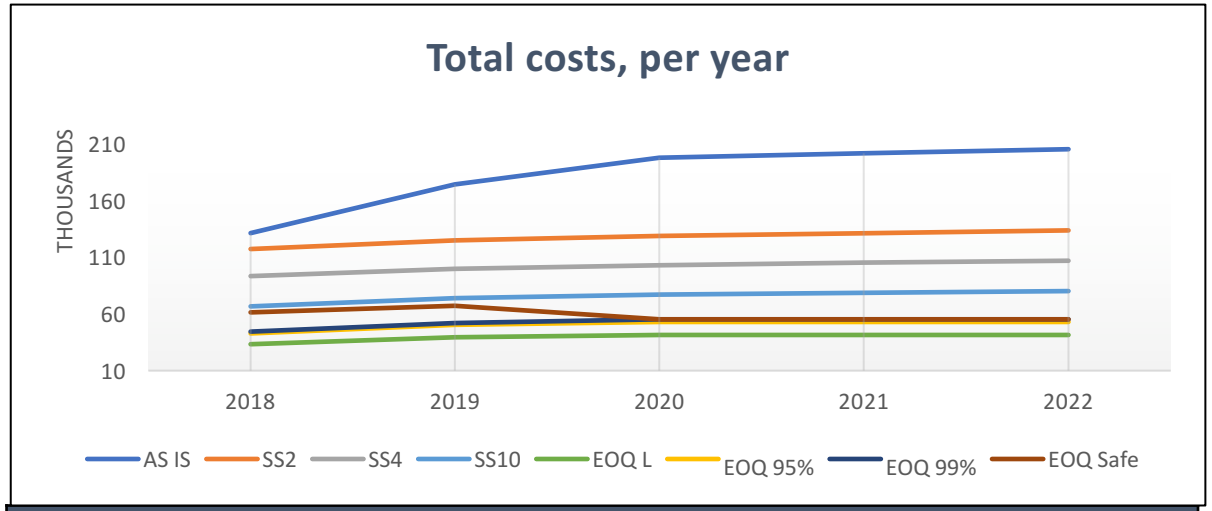
In EOQ Safe, the first two years have fixes SS (10 and 7 days, respectively), and the following ones respect this formula.

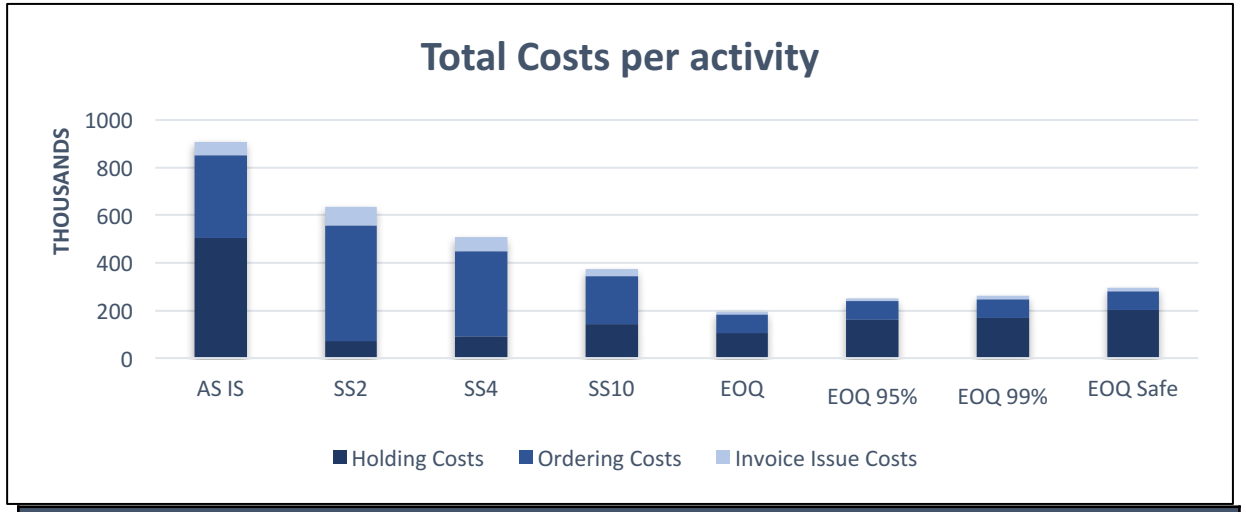




4.3.1 Stocks: AS IS vs TO BE

EOQ 99% Model allows for savings of €647 K in comparison to the AS IS model. However, EOQ Safe allows the minimization of the risk, due to the reduced efficiency in the first two years, being the chosen one, with a saving of €615 K





Increase in costs in the period of analysis, 2018-2022 (%)							
AS IS	**SS2**	**SS4**	**SS10**	**L EOQ**	**EOQ 90%**	**EOQ 95%**	**EOQ Safe**
56%	14%	15%	21%	25%	24%	24%	-10%

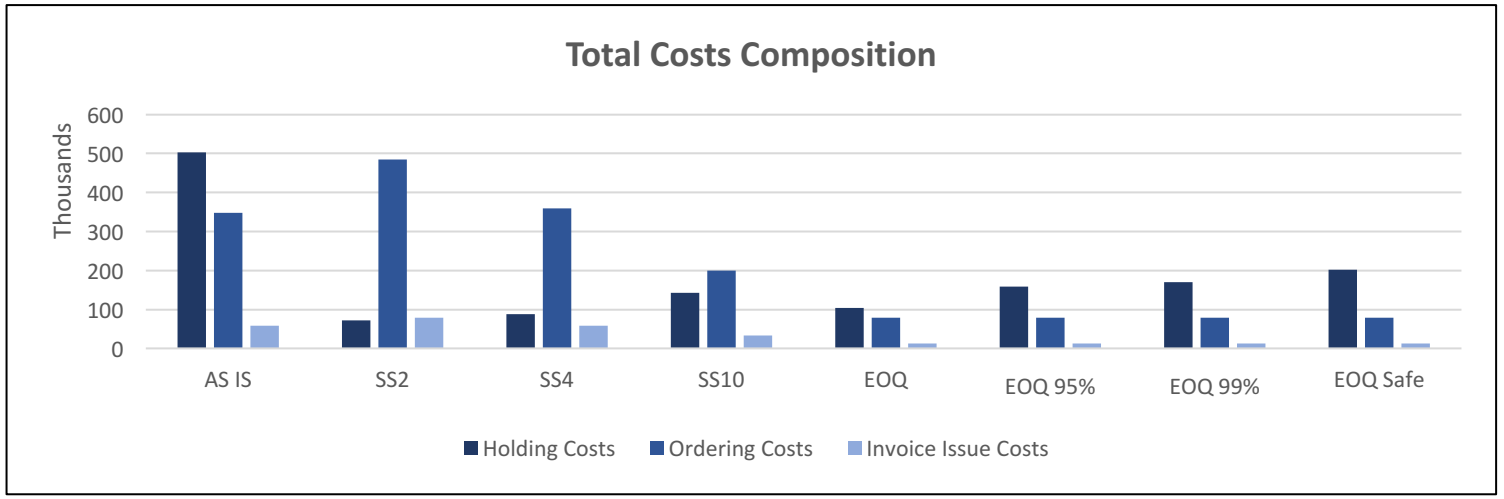
Total Costs (€)							
AS IS	**SS2**	**SS4**	**SS10**	**EOQ L**	**EOQ 95%**	**EOQ 99%**	**EOQ Safe**
909 078€	634 926€	507 327€	375 749€	196 498€	251 268€	261 705€	294 076€

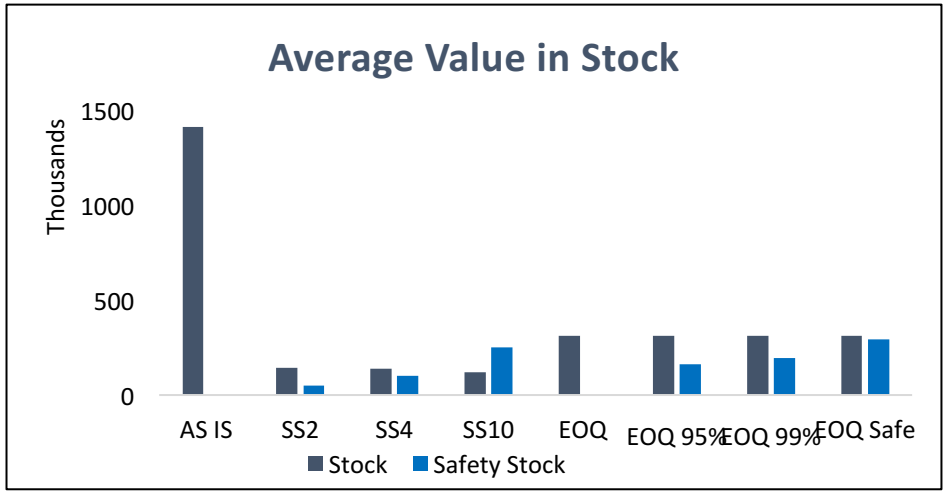
- The AS IS scenario has the highest costs, and shows the highest increase through the years (56% from 2018 and 2022, in contrast with only 24% increase in EOQ 95% model). The EOQ Safe model has higher costs in the first year than the last, due to the increase in SS to avoid stock outs in the first years. These high values can be justified by the decentralization of orders made, increasing the number of orders, as well as the existence of minimums (some suppliers require a minimum amount of spending in each purchase, obligating pharmacies to purchase medicines they don't need at that point in time)
- Linear EOQ shows the best results, due to the lack of SS. Nevertheless, it is followed closely by the remaining EOQ models.
- Significant advantage with the reduction of Purchase Orders, and consequent increase in quantity in each one, shown by the low costs of EOQ models.

See appendix A.2.2.1

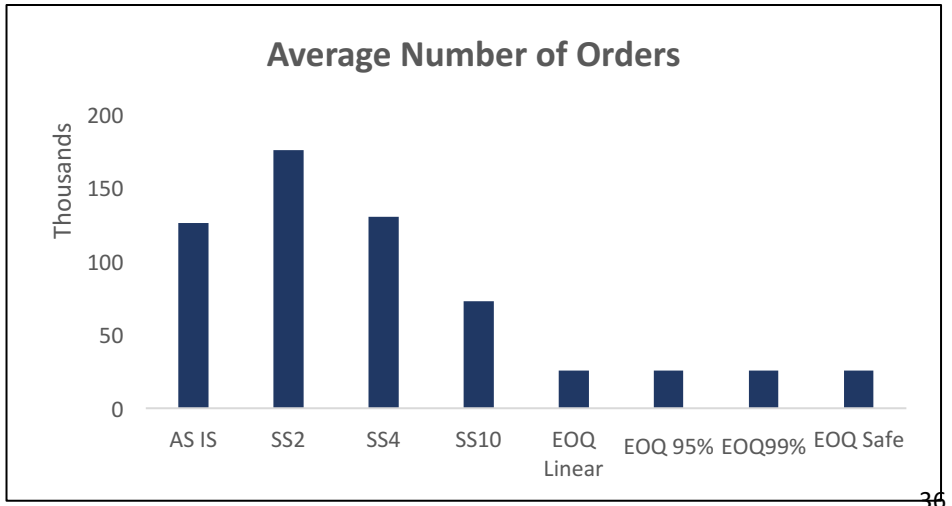
4.3.1 Stocks: AS IS vs TO BE

EOQ Model outperforms the remaining ones because, while the number and total cost of orders decrease a lot, the cost of holding stock increases marginally. EOQ Safe has the highest safety stock, to avoid stock outs.





- EOQ has best results, but EOQ Safe was the chosen one due to the existence of a reasonable SS.
- Fewer costs with EOQ Model due to a higher quantity of average stock than other models, since the cost of holding stock is inferior to the cost of Purchase Orders.
- EOQ Safe allows for a reduction of 80% of orders, in comparison to AS IS, and 58% less average stock value.
- In EOQ Safe, inventory costs represent 65% of total costs.
- Average value in stock, in EOQ Safe, is €600 k. 50% of this value is Safety Stock.



See appendix A.2.2.1

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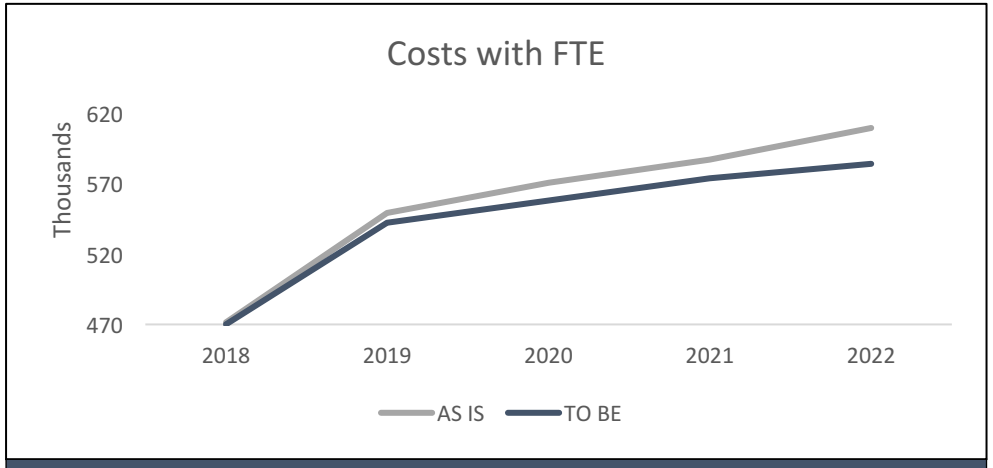
4.3.2 FTE's: AS IS vs TO BE

In the TO BE scenario, with synergies, the costs with FTE's will decrease by €60 thousand, in comparison to the AS IS. These savings are mainly due to the reduction in Medical Assistants, as well as incorporation of the value of synergies.



Annual Savings (€)					
2018	2019	2020	2021	2022	Total
1434	7132	13037	13272	25483	60358

Number of workers with synergies, AS IS

	2018	2019	2020	2021	2022
Technical Director	2	2	2	2	2
Pharmacists	18	21	21	21	21
Pharmacy Technician	1	1	1	1	1
Medical Assistant	19	22	24	25	27
Total	**40**	**46**	**48**	**49**	**51**

Number of workers with synergies, TO BE

		2018	2019	2020	2021	2022
Technical Director	HU	2	2	2	2	2
	Warehouse	1	1	1	1	1
Pharmacists	HU	18	21	21	21	21
	Warehouse	0	0	0	0	0
Pharmacy Technician	HU	0	0	0	0	0
	Warehouse	1	1	1	1	1
Medical Assistant	HU	10	11	12	12	12
	Warehouse	5	6	6	7	7
	Total	**37**	**42**	**43**	**44**	**44**

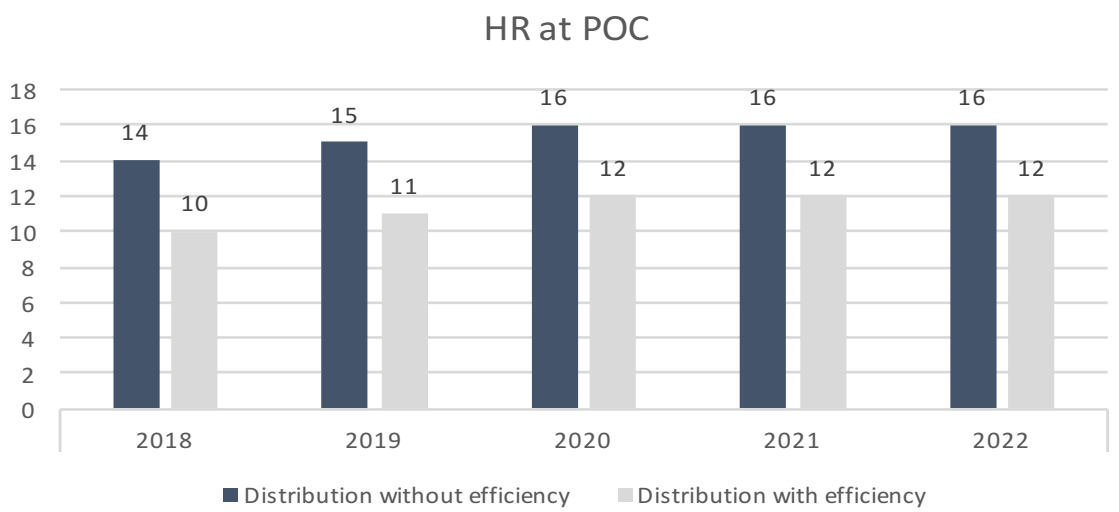
- Central warehouse allows for earnings with efficiency and quality, basic components of the strategy of JMS: Elimination of duplication of some tasks, such as reception and storage. Furthermore, the centralization of orders saves time, and finally, there are also earning in terms of automatization of processes.
- Significant reduction in costs with cut of medical assistants (4 in 2018, 8 in 2022), amounting to a total of €168 thousands (only in 2022, the savings are €48 thousands), but introduction of a Technical Director in central warehouse counterbalances this.
- The number of Pharmacists doesn't suffer any change because there are no gains or losses in efficiency in their job.
- Synergies equivalent to 12 hours of Medical Assistant work time, in the warehouse. There are synergies in terms of the Technical Director, not accounted for in this project.

See appendix A.2.2.2

4.3.2 FTE's

In the warehouse, 5 workers will be required in 2018 and 7 in 2022 to perform the pharmacy related tasks, in addition to the synergies. Outside the warehouse, four assistants will be reduced, compared with the AS IS scenario

		2018	2019	2020	2021	2022
Time (h)	Reception	2,66	3,15	3,33	3,33	3,33
	Repackaging	6,87	7,09	10,05	11,35	11,35
	Storage	3,17	3,75	3,96	3,96	3,96
	Picking	39,49	41,65	43,80	43,80	43,80
	Total	**52,18**	**55,63**	**61,14**	**62,44**	**62,44**
Without synergy	# of workers	6,52	6,95	7,64	7,81	7,81
	Rounded #	7	7	8	8	8
With synergy	# of workers	5,02	5,45	6,14	6,31	6,31
	Rounded #	5	6	6	7	7



- To study warehouse activities, measurements of times were done according to each activity
- Picking is the activity that takes more time, but will save time in each Point of Care, since the exact number of medicines needed in each service will be separately delivered.
- Time for repackaging is high, but includes repackaging with addition of QR code (75% of the medicines will need to be repackaged). If only the bar code is necessary, this percentage decreases to 50%, allowing the saving of an average of 3 hours.

- Impossibility to calculate with measurement of times, due to the huge differences between each HU.
- Data was provided by technical directors of HCIS and HCD pharmacies.
- Savings, every year, of 4 medical assistants, compared to the initial number of employees if they were to be divided between warehouse and HU
- Savings are due to earnings in efficiency, such as central management of expiration date, which frees a week of 1 FTE in category A HU, each month.

See appendix A.2.2.2

4.3.2 FTE's: Synergies with the Project of Clinical Consumables

The existing synergies were only accounted for when related to central warehouse. In total, 12 hours of medical assistants are saved, apart from a Technical Director, with a value of €40 251.

Clinical Consumables Warehouse			
	Number of workers	% for synergy	Hours of synergy
Technical Director	1	100%	8
Reception	2	0%	0
Storage	3	20%	4,8
Picking	6	15%	7,2

Savings with HR, with synergies					
	2018	2019	2020	2021	2022
Number	2	1	2	1	1
Savings	11 158€	5 674€	11 552€	5 880€	5 986€

- Out-of-the-warehouse synergies weren't accounted for due to the huge difference between each HU, in terms of logistics, work to be done, type of services, number of employees, among others.
- The synergies are translated into the savings of one or two medical assistants, in the period of 5 years (€ 40 251 in the 5 years)
- Technical Director wasn't accounted for in this project, but will be in a synergy in the project of clinical consumables (€ 108 156 in 5 years). This happens due to the fact that the technical director related to the pharmacy needs to be a pharmacist. In this case, the pharmacy will need to hire one pharmacist to perform this job, who will be able to perform the job of a technical director in the consumables project as well.

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4.3.3 Areas: AS IS vs TO BE

In the AS IS scenario the area increases with the opening of new hospitals. For the TO BE scenario we forecasted the area needed for each year and assumed as constant the area obtained in 2022 which differs in 161 m^2 from the AS IS scenario.

AS IS Areas (m^2)

	2017	2018	2019	2020	2021	2022
AS IS	310.04	346.52	460.17	481.67	481.67	481.67

In the AS IS scenario each hospital has its own medicines warehouse. Thus the total warehousing area increases with the opening of new hospitals (HCT, HCSintra, HCAlmada and HCLeiria). In 2022 we expect JMS to use about 482 m^2 for medicine warehousing alone. See appendix A.2.2.3.

TO BE Areas (m^2)

	2017	2018	2019	2020	2021	2022
TO BE	212.9	231.14	308.53	320.06	320.06	320.06

To compute the required area in the TO BE scenario, we used the "Manual da Farmácia" from Infarmed. This manual explains which areas are required in a warehouse. It also explains the space needed in each specific area. Since it would be difficult for JMS to increase the area in the Central Warehouse we assumed as constant the area forecasted for 2022, when all predicted and existing hospitals will be open and operating. See Appendix A.2.2.3.

4.3.3 Revenues

To forecast potential revenues we precautiously applied the released area to the less profitable activity which is general appointments performed in an office with 20 m^2. Thus, with centralization, JMS can built a total of 21 new offices.

Average Price per Appointment (€)

	2017	2018	2019	2020	2021	2022
HCD	39.89	40.56	41.25	41.27	41.29	41.31
HCIS/ HCT	35.98	36.59	37.21	37.23	37.25	37.26
HCC	33.34	33.91	34.49	34.50	34.52	34.54
HCTV	32.36	32.91	33.47	33.49	33.51	33.53
HCSant	31.50	32.03	32.58	32.60	32.62	32.63
HCSint	-	32.95	32.97	32.99	33.01	33.02
HCLeiria	-	-	33.51	33.53	33.55	33.57
HCA	-	-	-	33.53	33.55	33.57

* 2017 prices discounted at the predicted inflation rates
** Prices for HCSintra, HCLeiria and HCAlmada were computed as the average of prices of other category B hosiptals, which existed in 2017

Nº of Doctor's offices (20 m^2)

	2018	2019	2020	2021	2022
HCD	4	4	4	4	4
HCIS/ HCT	5	9	9	9	9
HCC	1	1	1	1	1
HCTV	2	2	2	2	2
HCSant	2	2	2	2	2
HCSint	1	1	1	1	1
HCLeiria	-	1	1	1	1
HCA	-	-	1	1	1
Total	15	20	21	21	21

* Data from Strategic Planning of JMS

4.3.3 Revenues

Through the areas released by centralizing the warehouse and using the aforementioned data, we were able to forecast a potential profit of ~€ 425 k for the period 2018-2022.

Potential Profits of released areas

	2018	2019	2020	2021	2022	Total
HCD	€ 19,269	€ 19,596	€ 19,605	€ 19,613	€ 19,622	€ 97,705
HCIS/ HCT	€ 21,725	€ 39,771	€ 39,790	€ 39,809	€ 39,828	€ 180,923
HCC	€ 4,027	€ 4,095	€ 4,097	€ 4,100	€ 4,102	€ 20,421
HCTV	€ 7,817	€ 7,950	€ 7,954	€ 7,959	€ 7,963	€ 39,643
HCSant	€ 7,609	€ 7,738	€ 7,742	€ 7,747	€ 7,751	€ 38,586
HCSint	€ 3,913	€ 3,915	€ 3,917	€ 3,920	€ 3,922	€ 19,587
HCLeiria	-	€ 3,980	€ 3,982	€ 3,984	€ 3,986	€ 15,932
HCA	-	-	€ 3,982	€ 3,984	€ 3,986	€ 11,952
Total	**€ 64,360**	**€ 87,045**	**€ 91,070**	**€ 91,115**	**€ 91,160**	**€ 424,750**

Average appointments/ office/day	13	**Average appointments/ office/year**	3393	**Contribution Margin**	3.5%

* Data from Production Department of JMS

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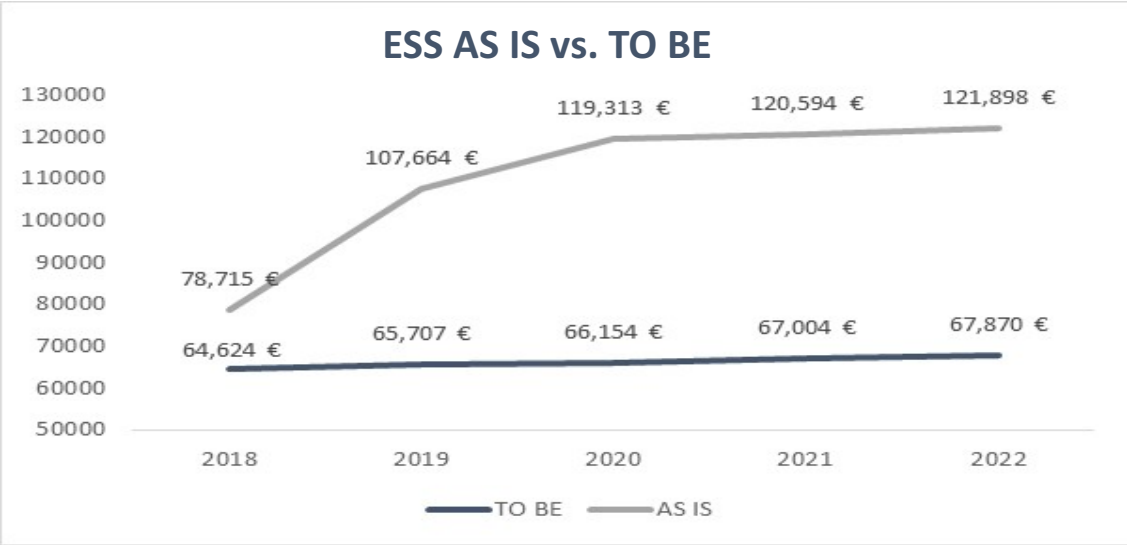
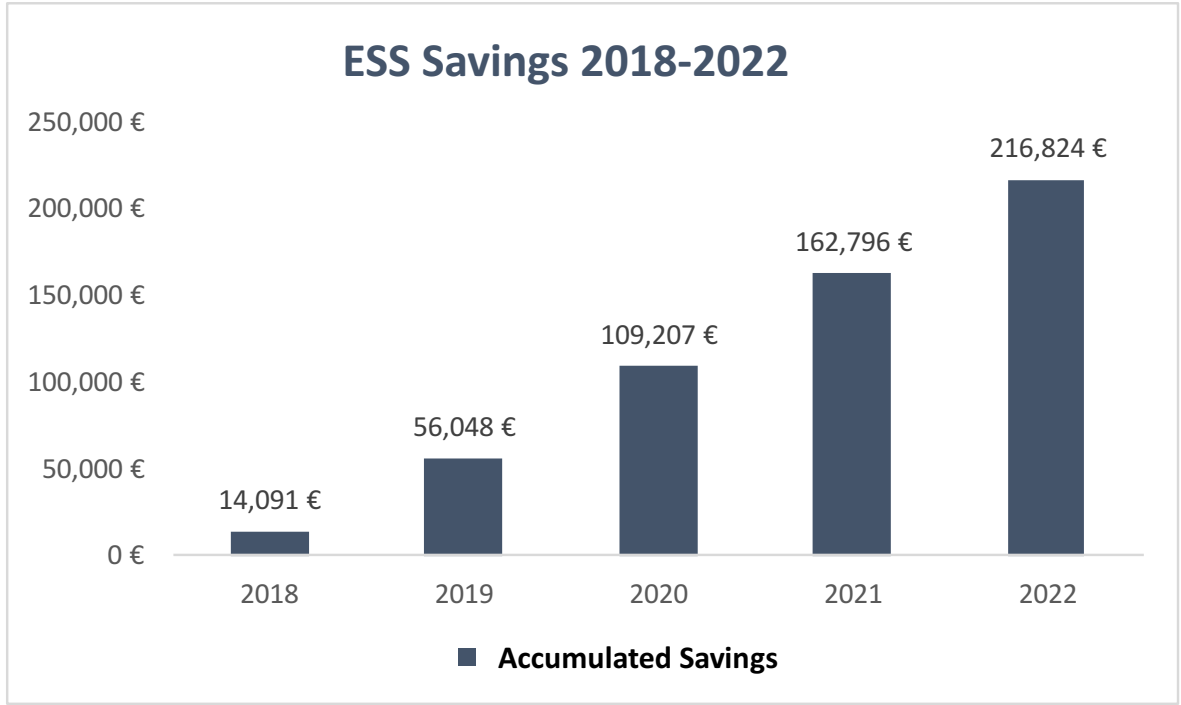
    v. CAPEX

4.3.4 ESS: AS IS vs TO BE

The TO BE scenario will allow JMS to save € 217 k between 2018-2022. The main reason for this saving is the much lower rent of the CW compared to the rents of any of JMS HU and the space required, which is less than in the AS IS scenario.



	TO BE	AS IS
TOTAL	331,360 €	548,183 €



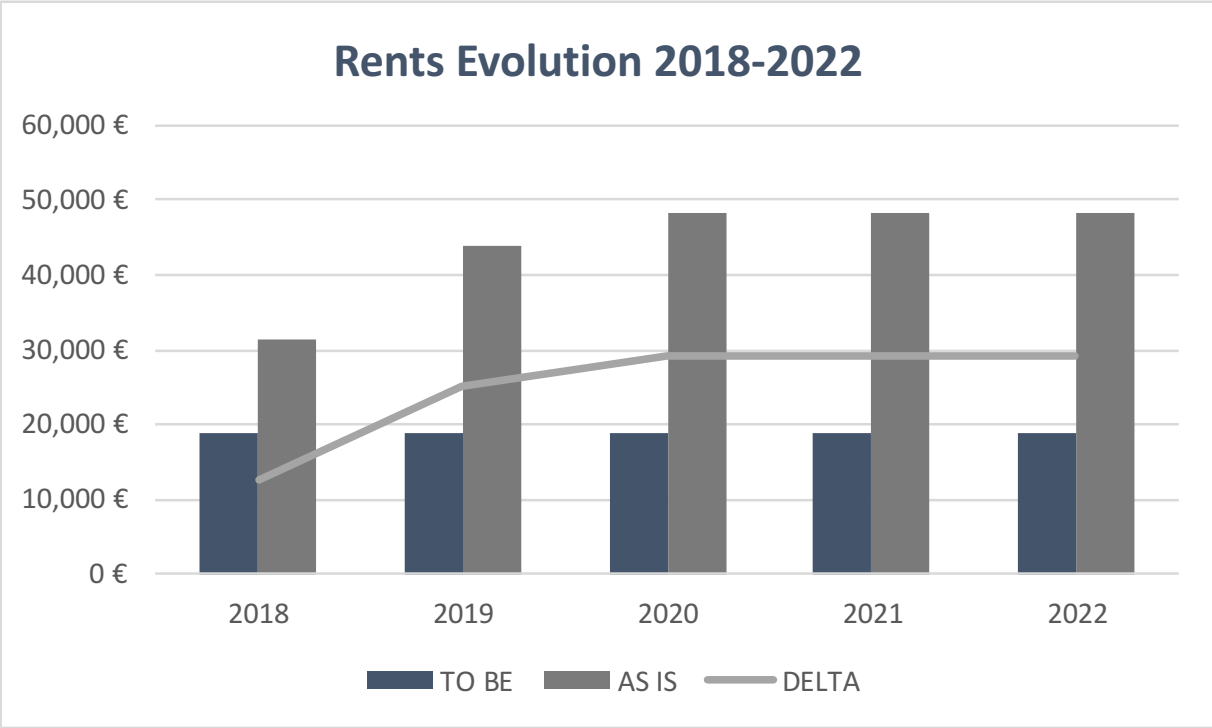
In the AS IS scenario ESS increase by ~€ 41 k between 2018 and 2020 due to the opening of new hospitals such as HCT and HCSintra.

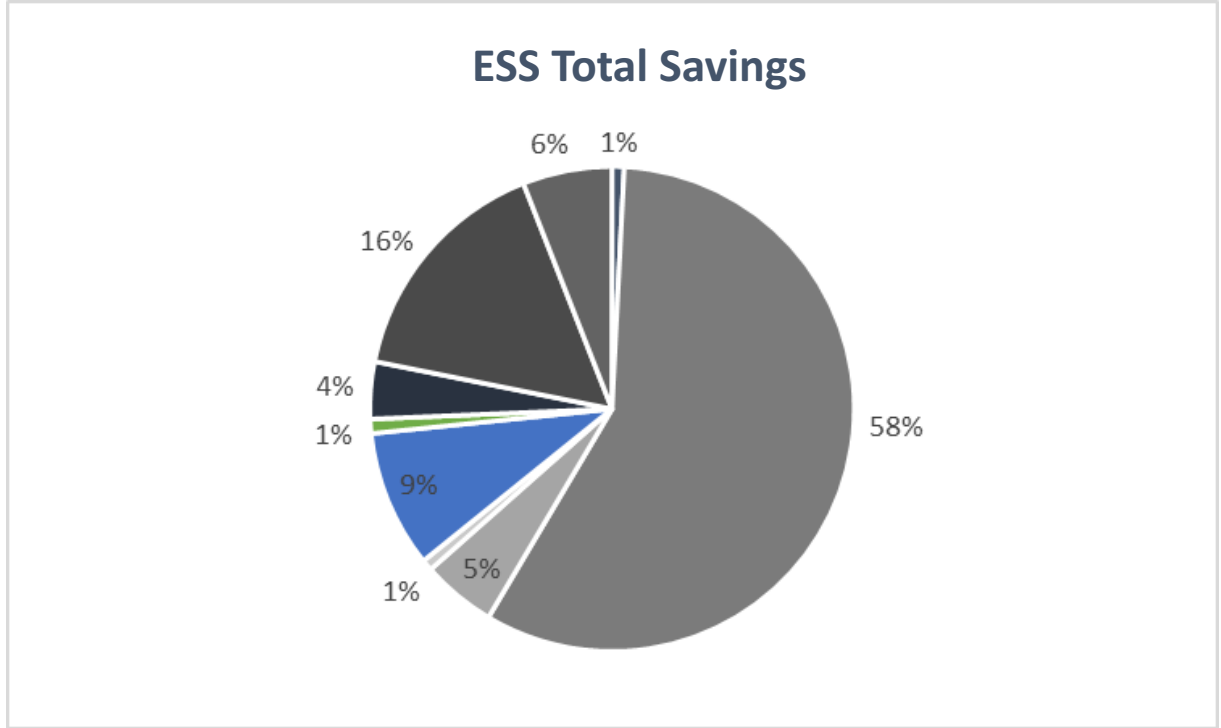
There might be synergies with the clinical consumables, which will be placed in the same warehouse as the medication. By using the same space it will be possible to save in some services such as security.

See Appendix: A.2.2.4

4.3.4 ESS: Rents

In the TO BE scenario JMS will save between 2018 and 2022 ~€125 k just in rents. Rents alone represent 58% of total ESS savings in the forecast period.





	2018	2019	2020	2021	2022	TOTAL
TO BE	18,896 €	18,896 €	18,896 €	18,896 €	18,896 €	94,482 €
AS IS	31,316 €	43,901 €	48,145 €	48,145 €	48,145 €	219,653 €
DELTA	12,420 €	25,005 €	29,249 €	29,249 €	29,249 €	125,171 €

Others 1% Rent 58% Electricity 5%
Water 1% Cleaning 9% Trash 1%
Security 4% Various common center cost 16% Costs with purchase department 6%

See Appendix: A.2.2.4

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4

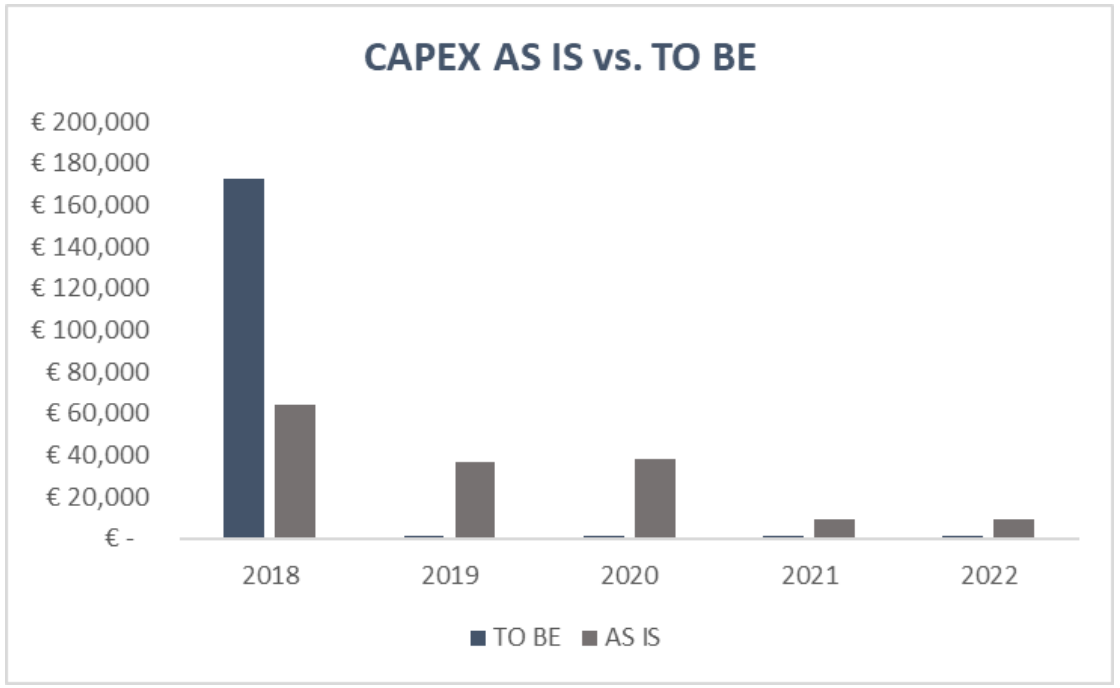
Medicines Warehouse: Centralized vs Decentralized

i. Recommendation
ii. Centralized Warehouse and Purchasing Department
iii. Costs Analysis

- i. Stocks
- ii. FTE’s
- iii. Areas & Revenues
- iv. ESS
- **v. CAPEX**

4.3.5 CAPEX

In order to build and equip the CW JMS will have to spend around € 179 k in CAPEX. This CAPEX includes a new repackaging machine* and the cost of building and renovating the infrastructures required in the CW (see appendix areas CW).



	2018	2019	2020	2021	2022	2018 - 2022
TO BE	€ 172,500	€ 1,500	€ 1,500	€ 1,500	€ 1,500	€ 178,500
AS IS	€ 64,000	€ 36,500	€ 38,000	€ 9,000	€ 9,000	€ 156,500
Delta	€ 108,500	-€ 35,000	-€ 36,500	-€ 7,500	-€ 7,500	€ 22,000

- 2018 is the only year in which the CAPEX is higher in the TO BE scenario. As stated before, this is due to the constructions needed in the CW.
- In the following years the costs invert: while in the TO BE scenario the total investment is made in 2018, in the AS IS scenario the investment is made throughout the years according to openings of new hospitals.
- CAPEX in the TO BE scenario is **€ 22 k higher** than in the AS IS Scenario

See appendix A.2.2.5

4.3.5 CAPEX

CAPEX in the AS IS scenario only includes repackaging machines and the maintenance cost of those machines.

TO BE Scenario

Since medicines repackaging is done for all hospitals at the Central Warehouse, there is no reason to keep the existing repackaging machines in the hospitals (HCD & HCIS). Thus, these machines will be transferred to the CW to increase repackaging capacity together with the new machine. See Appendix A.2.2.5.

AS IS Scenario

- In the AS IS scenario repackaging will be performed in each hospital individually. For that reason each existing hospital and the ones yet to come will need their own repackaging machines.
- These repackaging machines are cheaper than the one chosen for the CW because they has lower capacity which is well justified by the lower medicine consumption in an individual hospital. See Appendix A.2.2.5.

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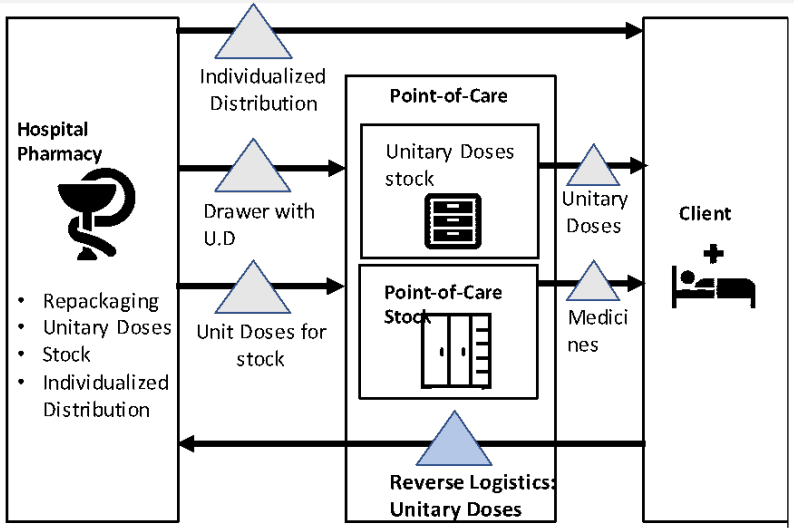
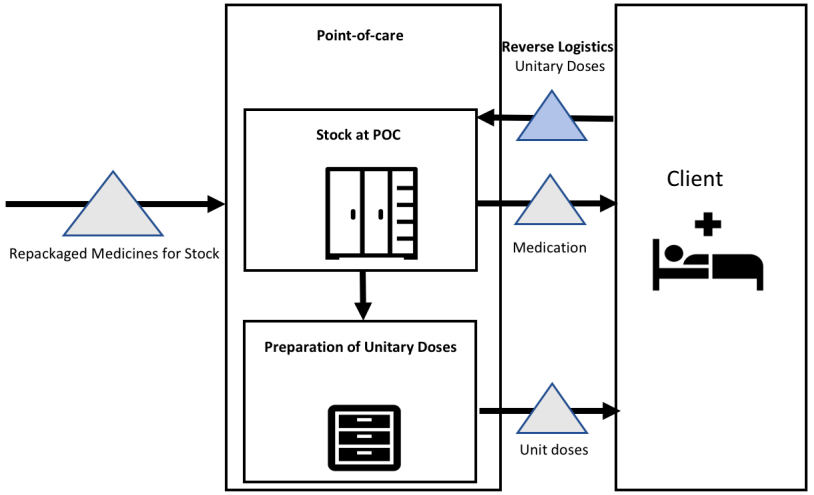
5. Unitary Doses: Centralized vs Point-of-Care

Unitary doses prepared at the Points-of-Care completely eliminates the reverse logistics process. This is the major advantage compared to producing it in the CW.



Unitary Doses Centralized at CW

- ✗ Lower flexibility to react to prescription changes – expensive and long lasting process.
- ✗ Reverse logistics implies duplication of records: New entry and consumption record when returned from the hospitals, in case there were changes.
- ✗ Reverse Logistics requires at least one more truck and longer routes.
- ✗ Delay of invoices issuance.
- ✓ Reduced stock at Points-of-Care.



Unitary Doses at Point-of-Care

- ✓ Timely response to prescription changes.
- ✓ Allows for timely invoice issuance.
- ✓ Consumption record is only created at the moment of administrations (and not when the medication leaves the pharmacy)
- ✓ Does not need licensing.
- ✓ Obliteration of reverse logistics.
- ✗ Requires stock in each point-of-care. To be determined according to the type of hospital and Point-of-Care.

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5.1 U.D. Recommendation

The preparation of the Unitary Doses at the Point-of-Care will cost ~ € 404 k less than centralizing the process in the Central Warehouse.

	Point-of-Care	Centralized at CW	Δ Point-of-Care vs Centralized
Distribution	495 127 €	973 618 €	478 491 €
Stocks	36 047 €	0 €	(36 047) €
FTE's	Release of 4 hours of FTE'S	0 €	Release of 4 hours of FTE'S
CAPEX	95 500 €	39 000 €	(56 500) €
Total	**626 674 €**	**1 012 618 €**	**385 944 €**
Timely Invoices	Allows for immediately available cash in the amount of € 20 K per month.		

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Unitary Doses: Centralized vs. Point-of-Care

i. Recommendation

ii. **Costs Analysis**

   i. **Distribution**

   ii. Stocks

   iii. FTE’s

   iv. CAPEX

   v. Timely Invoices

5.2.1 Distribution

The optimal alternative consists of decentralizing the unitary doses, since its centralization would result in the duplication of delivery frequency and costs. Not only is outsourcing less costly, but it also entails fewer risks.

Self-distribution

Routes and frequency:

- Tejo (Hospitals category A): Twice a day, 6 times a week
- Norte (Hospitals Category B): Once a day, 5 times a week
- Clinics: Once a day, 3 times a week

The costs of self-distribution include the costs with the necessary quantity of drivers and the required number of trucks. We assumed a monthly renting contract of 1200€, which includes the cooling system required for transport of medication. (See appendix A.3.1.)

Outsourcing

We sent out two requests for quotation, one to Corrida do Tempo and the other one to Torrestir. Since Corrida do Tempo made a more competitive offer, we only included their quote in this comparison.

Risk mitigation through outsourcing distribution:

- No responsibility for risks related to the maintenance of transport vehicles
- Vacation planning for FTE
- Risks and inefficiencies related to the optimal delivery routes

	Decentralized U.D.	Centralized U.D.
Self-distribution	€ 496 880	€ 943 521
Outsourcing	**€ 495 127**	€ 973 618

1. Outsourcing is less costly than self-distributing and it eliminates the risks associated with the latter.

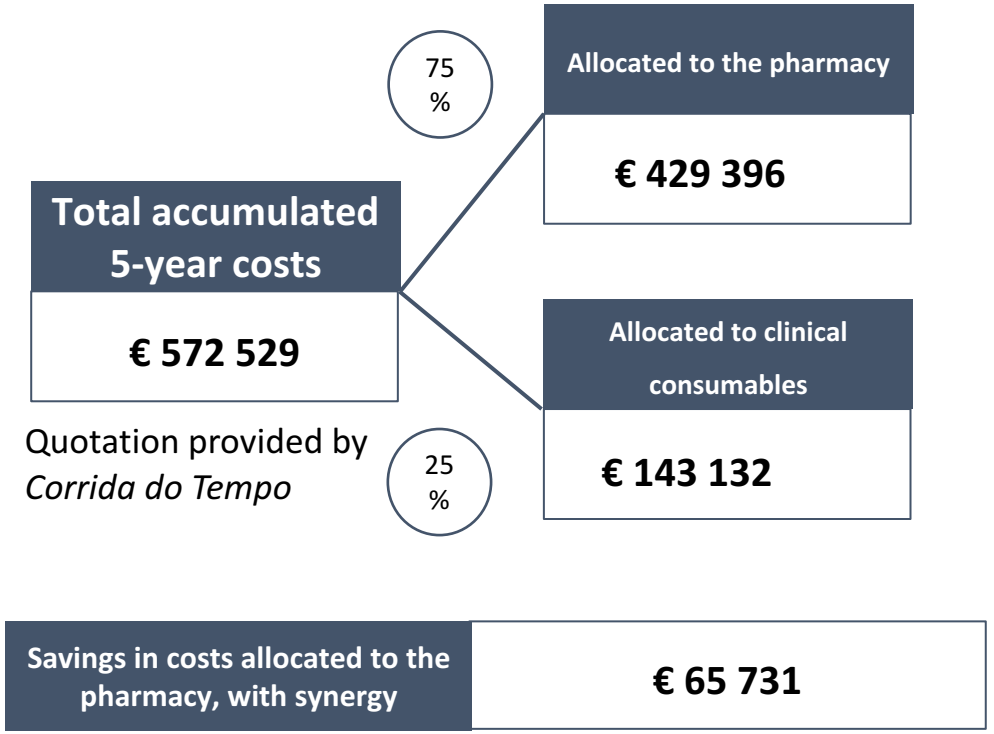
2. Centralizing the production of the unitary doses would double distribution costs. In order to eliminate inverse logistics, it is best to decentralize the preparation of the unitary doses and thereby incur less costs.

5.2.1 Distribution: Synergies with clinical consumables

The synergy with the distribution of clinical consumables reduces the costs allocated to the pharmacy (about 75% of distribution costs), bringing about savings of approixmately €65 k, compared to the initial quotation provided.

Required conditions for the transport of medicines and clinical consumables:

- Vehicles: FIAT DUCATO XL 17m^3, 1250kg
- Vehicles include temperature control and cooling systems
- Allocation of necessary number of drivers
- Medicines transporte authorization / license



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Unitary Doses: Centralized vs. Point-of-Care

i. Recommendation

ii. **Costs Analysis**

   i. Distribution

   ii. **Stocks**

   iii. FTE's

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5.2.2 Stocks

Addition of two days of safety stock to the total stock, which will be stored in each HU. Total cost of holding stock will increase by €36 K during 5 years. This addition had the goal of compensating the deviations in consumption in each POC.

Holding cost for each SS day						
	2018	2019	2020	2021	2022	**Total**
SS1	2 407 €	3 462 €	3980 €	4 051 €	4 124 €	**18 024 €**
SS2	4 815 €	6 923 €	7959 €	8 102 €	8 248 €	**36 047 €**

- The value of Stocks will not suffer big changes, since, instead of increasing the stocks due to the advanced warehouses, there will be a reallocation of the stock. It is expected that, in the chosen scenario, the central warehouse will have less average stock than in the scenario with centralized unitary doses.

- There will be an addition of two days of Safety Stock, which will be spread through the POCs, according to the respective consumption. This will compensate the deviations in consumption, without influencing the efficiency and operation level of the central warehouse.

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5

Unitary Doses: Centralized vs. Point-of-Care

i. Recommendation

ii. **Costs Analysis**

   i. Distribution

   ii. Stocks

   iii. **FTE's**

   iv. CAPEX

   v. Timely Invoices

5.2.3 FTE's

The predicted spending will be the same in both scenarios. Nevertheless, in the scenario with decentralized unitary doses, 4 hours will be saved, in the different Points-of-Care, due to the reduction in reverse logistic.

Savings with Reverse Logistics					
Year	2018	2019	2020	2021	2022
Nr of HR	0,5	0,5	0,5	0,5	0,5
Value of Synergy	€ 2790	€2837	€2888	€2940	€2993

- On average, 4 daily hours of FTE will be saved, from medical assistants, due to the simplification of the inverse logistics. These workers can use those hours in different activities, resulting in synergies for other projects of 14.5€ thousand in 5 years.

- The assistants allocated to the HU will be responsible for pharmacy tasks (preparation of Unitary doses, storage, management of expiry date, among others) in the different Points-of-Care and advanced warehouses.

- The pharmacists will remain in their teams, with doctors, nurses and other professionals, and will have tasks related to clinical pharmacy and distribution (support and follow-up)

AGENDA

5

Unitary Doses: Centralized vs. Point-of-Care

i. Recommendation

ii. **Costs Analysis**

   i. Distribution

   ii. Stocks

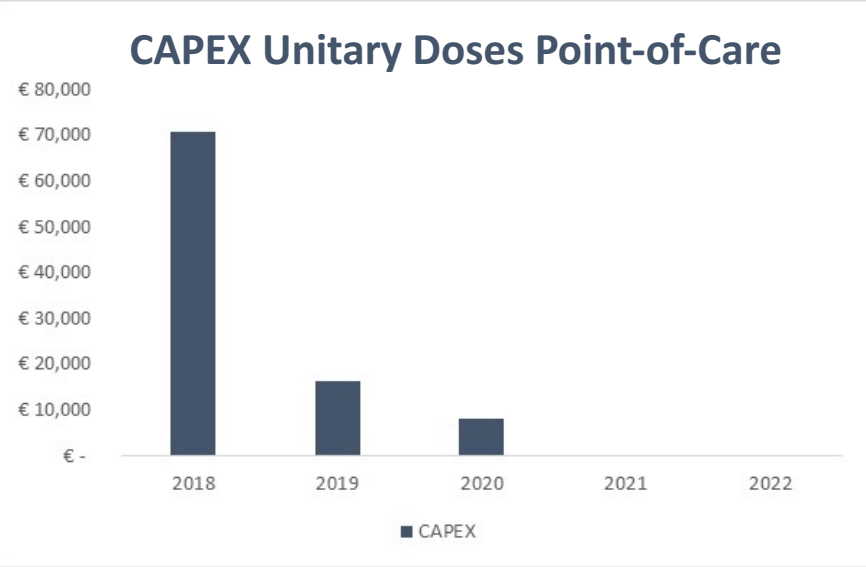
   iii. FTE's

   iv. **CAPEX**

   v. Timely Invoices

5.2.4 CAPEX

Unitary Doses produced at the Points-of-Care requires an investment of € 95.5 k in CAPEX. This CAPEX includes cabinets for each Point-of-Care to increase stock capacity and PDAs to improve the tracking of medicines.



	nº PDA	Price/PDA	Total
TOTAL	65	€ 600	€ 39,000

- To determine how many PDAs were needed, we analysed together with RO the needs of each Point-of-Care in each different HU. See appendix A.3.2.
- Thus we concluded that for Category A Hospitals JMS would need 12 PDAs (HCD + HCT = 24), and, for Category B, would be needed 6 PDAs per hospital (36 for all category B Hospitals). Furthermore despite their small size, each clinic should have one PDA as well (5 in total).
- Moreover, there might be savings from a synergy with another project currently in progress at JMS “Projecto Mobilidade” which already includes one PDA for each Point-of-care.

Cabinets

	Double	Price	Single	Price	TOTAL
TOTAL	20	€ 2,300	7	€ 1,500	**€ 56,500**

- Cabinets will be used to increase stock capacity in each Point-of-Care. See appendix A.3.2.
- Due to last year’s renovation, HCD doesn’t need to increase its stock capacity at the Points-of-Care.

Centralized Unitary Doses preparation at the CW doesn’t require stocks at the Points-of-Care. Thus, this scenario’s CAPEX only includes PDA’s expenses, which are approximately € 39 k.

AGENDA

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Unitary Doses: Centralized vs. Point-of-Care

i. Recommendation

ii. **Costs Analysis**

   i. Distribution

   ii. Stocks

   iii. FTE's

   iv. CAPEX

   v. **Timely Invoices**

5.2.5 Timely invoices

The preparation of decentralized unitary doses and billing in the moment of administration allow for immediately available cash in the amount of €20 k / month. This value comes from the invoices which are “stuck”, since the beginning of 2017

AS IS

Billed medicine when leaving the pharmacy

Results in errors in invoices
Due to the reverse logistics and wrong record of the quantity actually consumed by patients

Accumulated value of stuck invoices, in the studied HU from January to October = €329 k.

60% of this value = approximately €200 k (accumulated value) for issues such as reverse logistic and wrong registration in quantity actually consumed by patients

TO BE

Billed medicine, when administrated to the client

Timely invoices

The elimination of reverse logistics and billing of the medicine only when it is administrated to the clients allows for up-to-date invoices, and elimination of the error coming from wrong records of consumption

Data provided by Financial Department

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- i. Recommendation
- ii. Costs Analysis

7 Best Case Scenario

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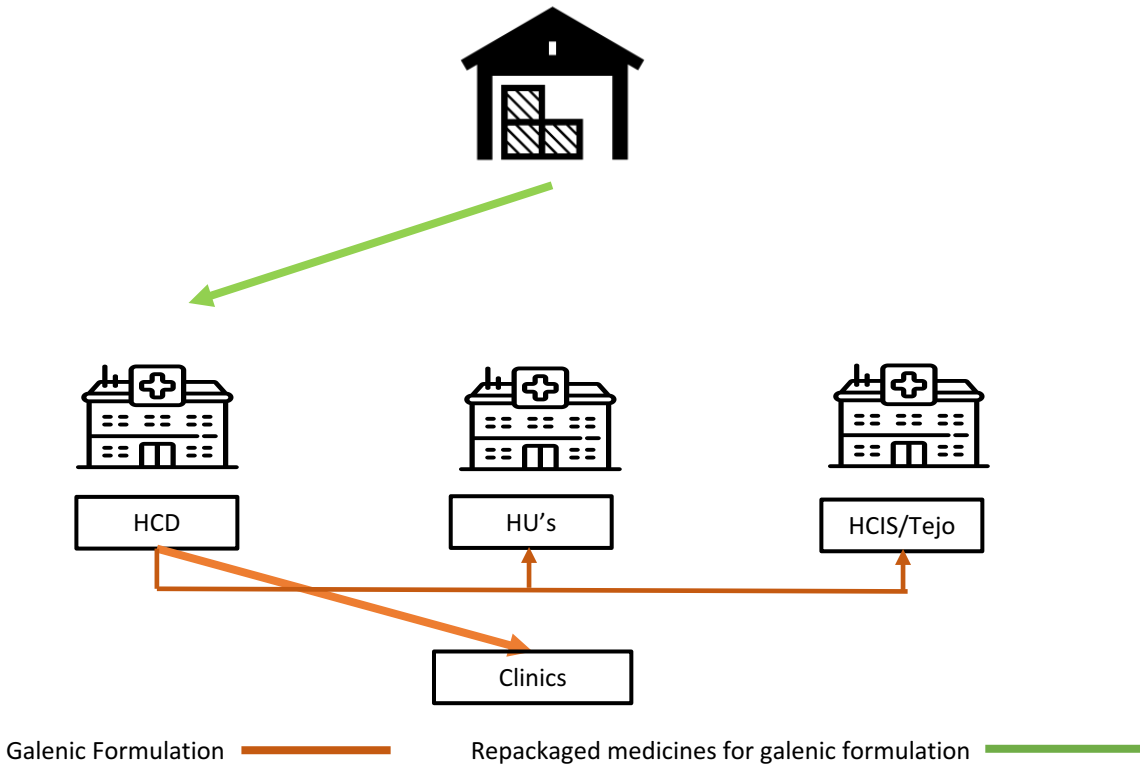
6. Galenic formulations in HCD

The centralized galenic formulation at the HCD, will mainly bring logistical advantages for the pharmacy.



Unitary doses produced at each point-of-care

Advantages

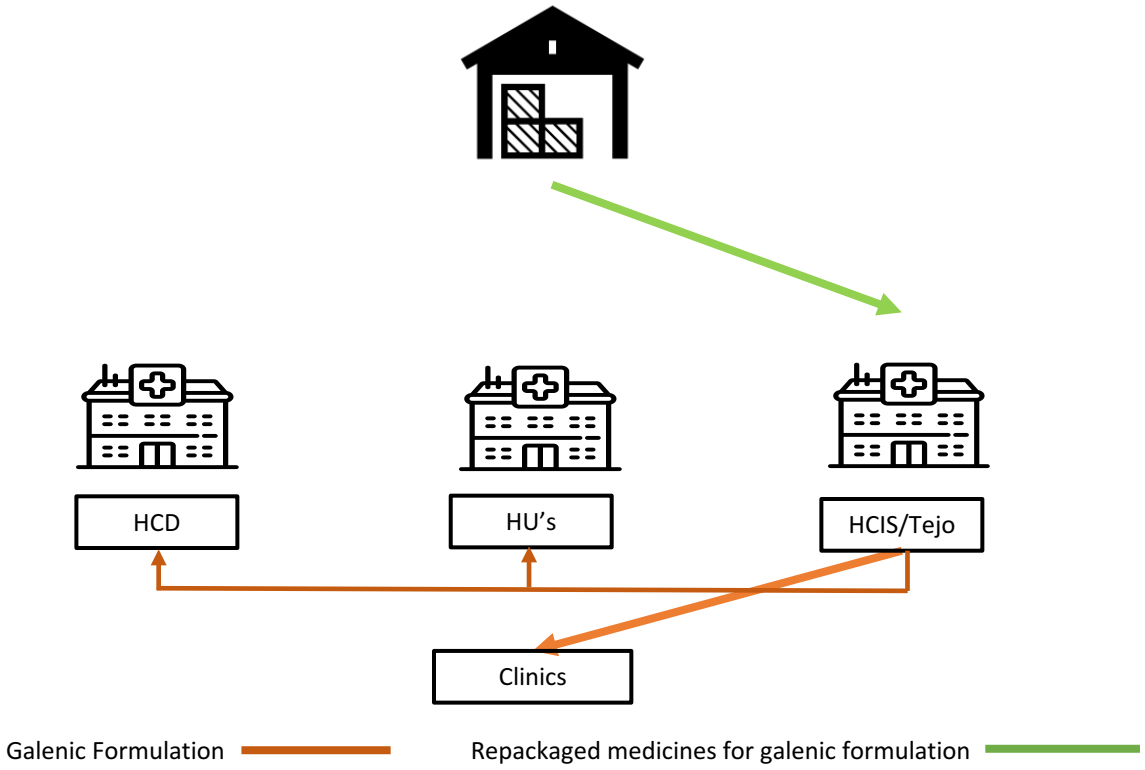
- Already existing infrastructures
- Release of the area of the pharmacy predicted for HCT
- Does not require licensing

Disadvantages

- Challenge due to limited space. Nevertheless, due to the implementation of the central warehouse, more space will be released, which can be used in this task.

6. Galenic formulations in HCT

It won't be beneficial to make the galenic formulation at the HCT, since the area of the pharmacy in this HU can be used for other tasks and activities that generate profit.



Unitary doses produced at each point-of-care

Advantages

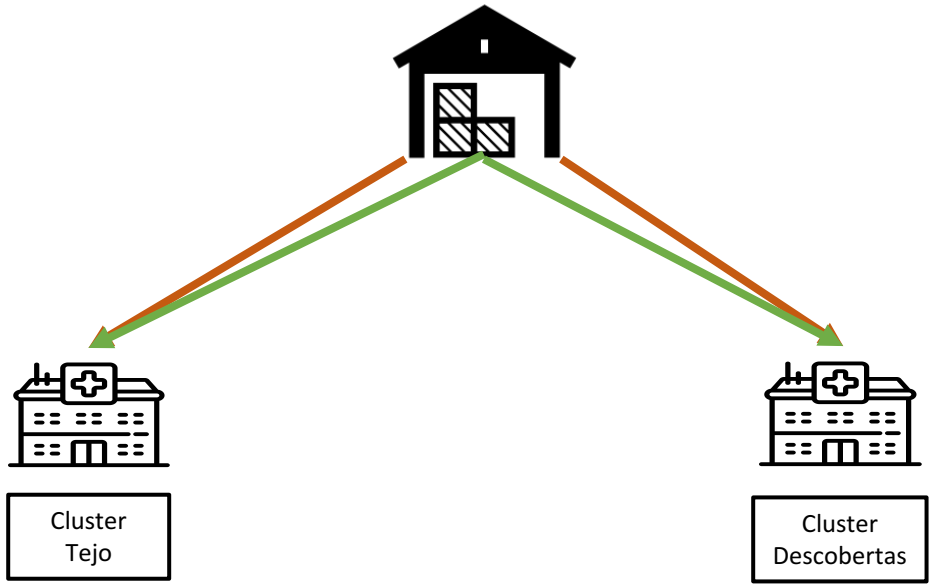
- New and optimized space
- Release of the total area of the HCD pharmacy
- Doesn't need additional licensing

Disadvantagens

- Utilization of the area of the pharmacy, which could be used for profitable activities.

6. Galenic formulations centralized in central warehouse

The scenario that would optimize the logistics, the case in which the galenic formulation would be made in the central warehouse, needs additional licensing.



Galenic Formulation

Repackaged medicines for galenic formulation

Unitary doses produced at each point-of-care

Advantages

- Optimized logistics, since it doesn't require the distribution to pass by the HCD or HCT in the beginning of the route.
- Release of all the space allocated to the pharmacy in all HU.

Disadvantages

- Needs additional licensing.

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5 Unitary Doses: Centralized vs Point-of-Care
- i. Recommendation
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6 **Galenic Formulation**
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- ii. Costs Analysis

7 Best Case Scenario

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6.1 Recommendation

Galenic Formulation at CW is of all three scenarios the best option, because it is the only one which can be sustainable by itself. However, due to licensing requirements, Galenic Formulation must stay at HCD where it already is until further approval from Infarmed.

	HCD	HCT	Armazém Central
Revenues	(96 948) €	(107 476) €	(204 424) €
Rent	48 214 €	35 292 €	25 978 €
CAPEX	76 000 €	176 000 €	176 000 €
Legal	Doesn't require licensing	Doesn't require licensing	Requires licensing from Infarmed [31]
Total	**27 266 €**	**103 816€**	**(2 446) €**

[30] Boletim do CIM

See Appendix: A.4.1

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Galenic Formulation

i. Recommendation

ii. **Costs Analysis**

   i. **Areas, Revenues & Rents**

   ii. Distribution

   iii. FTE’s

   iv. CAPEX

6.2.1 Areas & Revenues

Galenic Formulation at CW is the scenario with the largest revenues ~€ 204 k because it sets space free, which can be used for other operations: the area forecasted for galenic formulation in both HCD and HCT.

Potential Annual Profits/ Scenario

	2018	2019	2020	2021	2022	TOTAL
HCT	€ 21,196	€ 21,556	€ 21,565	€ 21,575	€ 21,584	**€ 107,476**
HCD	€ 19,118	€ 19,443	€ 19,453	€ 19,462	€ 19,472	**€ 96,948**
CW	€ 40,314	€ 40,999	€ 41,018	€ 41,037	€ 41,056	**€ 204,424**

- "Manual da Farmácia" from Infarmed suggests an area of 88 m^2 for galenic formulation.
- According to data provided by the Production Department of JMS, each doctor's office must have an are of 20 m^2.
- Thus it is possible for JMS to build 4 offices in that area if not used for galenic formulation.

Average Price per appointment per Hospital

	2017	2018	2019	2020	2021	2022
HCD	€ 39.89	€ 40.56	€ 41.25	€ 41.27	€ 41.29	€ 41.31
HCIS/ HCT	€ 35.98	€ 36.59	€ 37.21	€ 37.23	€ 37.25	€ 37.26

Nº of Doctor's Offices per Hospital

	2018	2019	2020	2021	2022
HCD	4	4	4	4	4
HCIS/ HCT	4	4	4	4	4

Appointments/ Office/Day	13
Appointments/ Office/Year	3393
Contribution Margin	3.5%

* Data from Production Department of JMS.

See Appendix A.4.2

6.2.1 Rents

Due to a substantially lower rent per m^2 the CW scenario is the one with lowest spending on rent ~ € 26 k. In fact, in terms of rent, doing the galenic formulation in the CW will cost JMS almost half than what it is costing at HCD.

Rents Galenic Formulation

	2018	2019	2020	2021	2022	TOTAL
HCT	€ 7,058	€ 7,058	€ 7,058	€ 7,058	€ 7,058	**€ 35,292**
HCD	€ 9,643	€ 9,643	€ 9,643	€ 9,643	€ 9,643	**€ 48,214**
CW	€ 5,196	€ 5,196	€ 5,196	€ 5,196	€ 5,196	**€ 25,978**

HCD (€)	109.58		HCT (€)	80.21		CW (€)	59.04

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Galenic Formulation

i. Recommendation

ii. **Costs Analysis**

   i. Areas, Revenues & Rents

   ii. **Distribution**

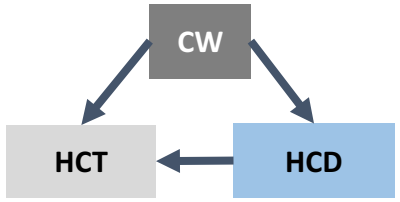
   iii. FTE's

   iv. CAPEX

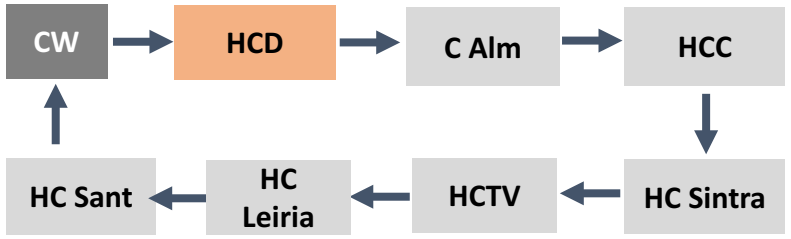
6.2.2 Distribution

The aforementioned quotations include a compulsory initial stop at the HCD, since the production of galenic formulation is already centralized at this hospital. The costs thereby remain the same.

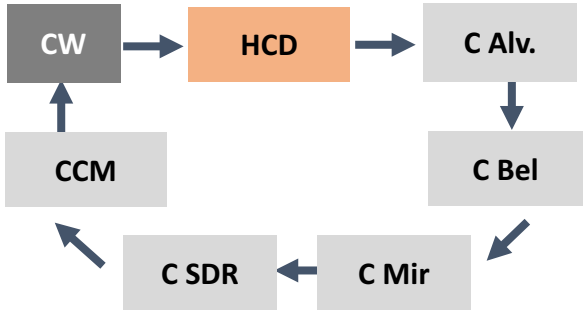
Route Tejo



Route Norte



Route Clinics



The self-distribution costs, as well as the outsourcing quotations, both include a compulsory first stop at the HCD, in order to pick up galenic formulations.

If the process of galenic formulation is transferred to the warehouse, the costs of distribution would only marginally be reduced, since only the Norte route and Clinics route would undergo minor changes. Due to the short distance between the warehouse and the HCD, these changes would not have a significant impact on distribution costs.

These costs can therefore be transferred to the optimal scenario and to the case in which galenic formulation is centralized at the HCD.

Costs allocated to the pharmacy (with synergy)
€ 429 396

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Galenic Formulation

i. Recommendation

ii. **Costs Analysis**

   i. Areas, Revenues & Rents

   ii. Distribution

   iii. **FTE's**

   iv. CAPEX

6.2.3 FTE's

There are no changes in the cost of HR in each location of the galenic formulation. This happens since there is only a physical reallocation of the pharmacists responsible for this manipulation.

5 pharmacists in total for the galenic formulation, responsible for:

- Activities of production of formulations
- Validation of medical prescriptions, and double-check.
- Pharmacists will operate at 100%, so there is no possibility for synergies.

3 Pharmacists for oncology

2 Pharmacists for other sterile and non-sterile formulations

AGENDA

6

Galenic Formulation

i. Recommendation

ii. **Costs Analysis**

i. Areas, Revenues & Rents

ii. Distribution

iii. FTE’s

iv. **CAPEX**

6.2.4 CAPEX

CAPEX is lower for the HCD scenario because the HCD already has an installed capacity of 50 m^2. At the CW or the HCT, infrastructures would have to be built from scratch increasing CAPEX.

Type of CAPEX	Unitary Cost	Total Cost
Build up labs and other infrastructures	2 000 €/ m^2 *	**HCD:** 2 000 € x 38 m^2 **HCT & CW:** 2 000 € x 88 m^2
Galenic Formulation Chambers and other specific devices	Already existing at the HCD, might be transferred to other HU.	0 €
	CAPEX	**HCD:** 76 000 € **HCT & CW:** 176 000 €

* Department of Infrastructures JMS

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AGENDA

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1 Executive Summary

2 Methodology

3 Diagnosis
- i. Flow Diagram and description of the current process
- ii. Process improvement opportunities

4 Medicines Warehouse: Centralized vs Decentralized
- i. Recommendation
- ii. Centralized warehouse and purchasing department
- iii. Costs Analysis

5 Unitary Doses: Centralized vs Point-of-Care
- i. Recommendation
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6 Galenic Formulation
- i. Recommendation
- ii. Costs Analysis

7 Best Case Scenario

8 Implementation, Risks & Mitigations

9 Spin-off

10 Personal Reflections

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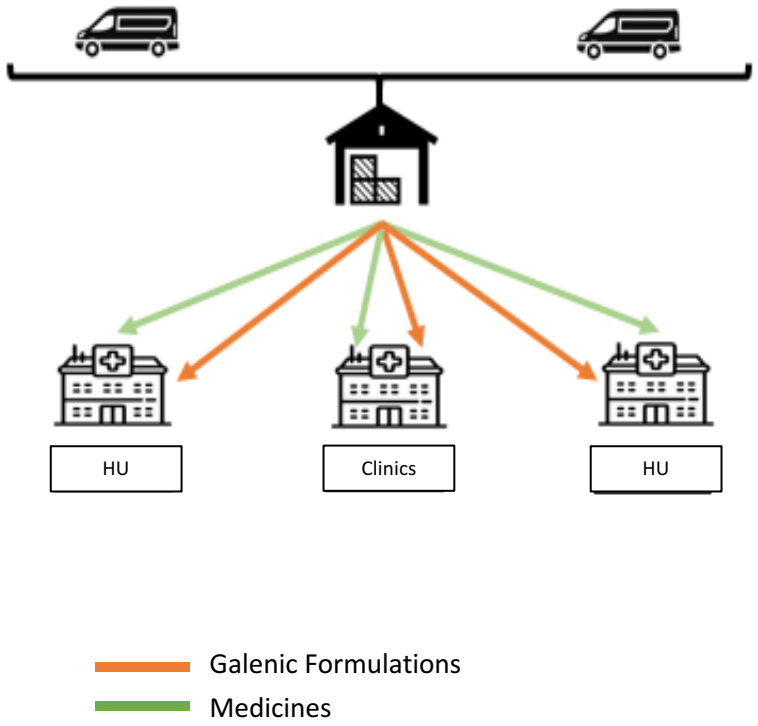
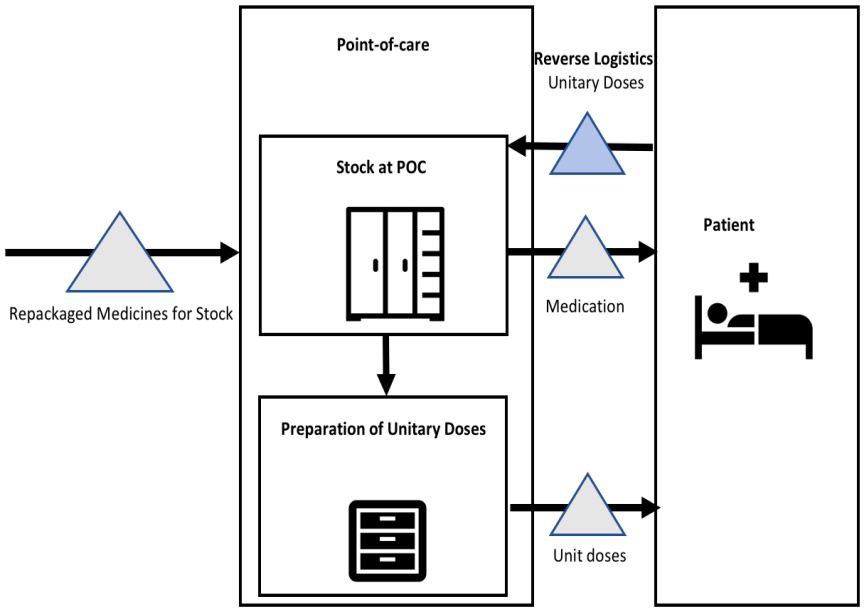
7. Best Case Scenario

The best case scenario is the one with the galenic formulations and medicines warehouse centralized at the CW, while the U.D. is created in a decentralized way at each Point-of-Care. This would entail **costs of € 3 731 k between 2018 and 2022**.

Central Warehouse and Galenic Formulation



Unitary Doses



Total Cost 2018 - 2022

Central Warehouse

3 107 566€

+

U.D. Point-of-Care

626 674€

+

Galenic Formulation CW

(2 446)€

=

3 731 794 €

The galenic formulation has to stay at the HCD until licencing request approval. In order to maximize the potential profits of this project we **studied a spin-off opportunity** consisting of **selling pharmaceutical services produced in the CW**.

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8 **Implementation, Risks & Mitigations**

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8. Implementation Plan

A high level road map was asked for, to merge this project with the clinical consumables centralization. Thus, the implementation will last for 12 months and will start in June/ July when the implementation of the consumables is finished.

See appendix A.5.

	# months	1 month	3 months	6 months	9 months	12 months
Preparing the Warehouse						
Choosing the warehouse	1					
Getting the required license	4					
Preparing the infrastructure and information systems	2					
Internal Organization						
Communicating with suppliers	2					
Communicating internally and reallocation of HR	2					
Communicating with distributors	2					
Transferring Activities						
Pilot with Category B hospital (e.g. HCC)	1.5					
Category B hospitals and clinics	3					
HCD + HCT	3					

8. Implementation Plan

A few points were discussed, when communicating with the team responsible for centralizing the clinical consumables.

Choosing the warehouse

- 500 m2 predicted for the pharmacy in the central warehouse by the infrastructure department
- Various alternatives of warehouses, in Lisbon:
  - ❖ Forte da Casa 1500 m2, constructions necessary, activity can start in March 2018
  - ❖ Other warehouses in Lisbon

Information system

- Design and prepare the information systems for the warehouse and the POCs (most probably SAP)
- Investment in more advanced technologies will only be analysed after stabilizing the activity in the warehouse

Preparing the infrastructures

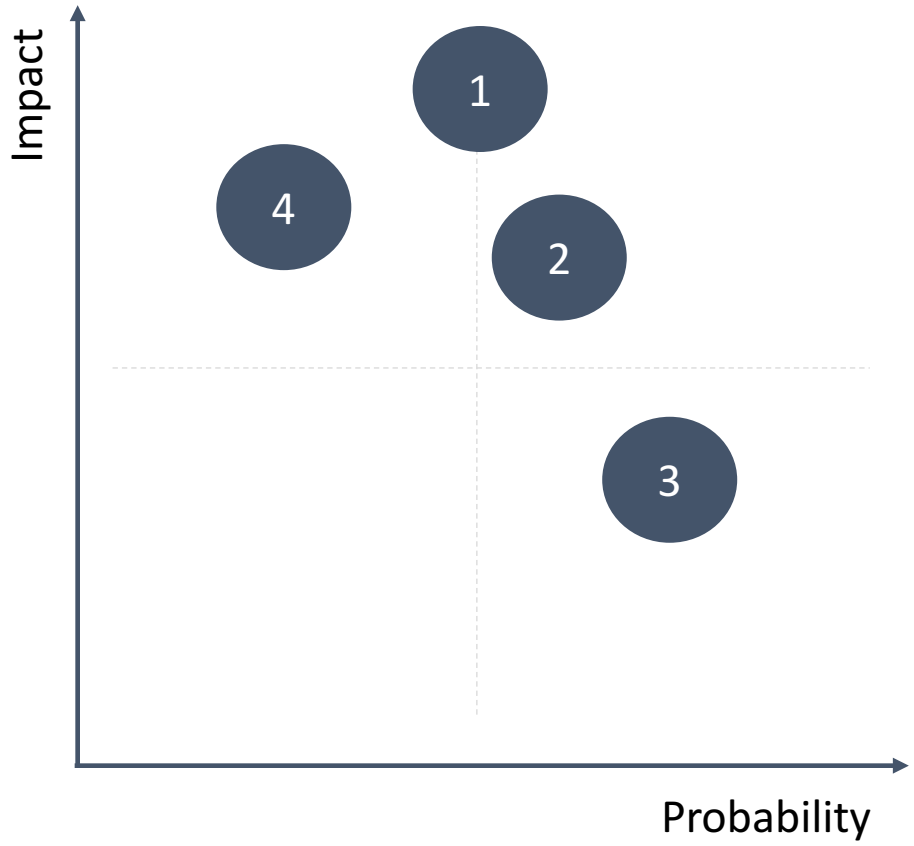
- Segregate or join consumable's and medication's spaces and areas (e.g. a cooling area for medicines and consumables)
- Preparation of each POC (infrastructure and information system) takes on average 5 working days for each POC

Synergies with distribution

- Clinical consumables routes will adapt to medication routes (consumables only need to be delivered once a day)

8. Risks

Four major risks were identified, which could significantly impact the development and quality of the project's implementation.



1

Licenses

The Infarmed might not concede the necessary licenses, or only part of them.

2

Information systems

The information system used at the central warehouse has to be compatible with the one used at the Hospital Units. If the information flow between both parties stops or includes mistakes, the service quality might decrease drastically.

3

Change Management

Risks emerge with the re-allocation of human resources, adaptation to new systems and processes.

4

Implementation of Clinical Consumables Project

Timing and logistical issues of this project have to be combined with the implementation of the clinical consumables project, which will precede the implementation of the centralization of the pharmacy.

8. Mitigation

There are ways and precautions that can be taken in order to mitigate the aforementioned risks.

Licenses	The optimal scenario requires two licenses: gross distributor license and production license. If the production license is not conceded, the centralized galenic formulation will stay at the HCD, while the repackaging can be centralized at one of the hospital pharmacies. If the distributor license is not conceded, all activity, including storage and repackaging can be centralized into one single hospital pharmacy. This option would negatively influence the revenues that emerge from freed space with the central warehouse.
Information Systems	A deep analysis on the risks of combining the system in the warehouse and the system in the HU has to be developed, in order to prevent malfunctioning. Emergency plans have to be created in case of system failure, which would entail a break in information flow from the warehouse to the pharmacies.
Change Management	A change management plan can mitigate the associated risks. The plan should include information about re-allocation of HR and HR training (new processes and systems). For the new structure to be clear, a precise division of tasks/functions should be developed and communicated.
Implementation Clinical Consumables	Some issues have to be analyzed in depth: 1. The centralization of the clinical consumables precedes the implementation phase of the centralization of clinical consumables. 2. The space allocated to pharmaceutical products in the warehouse might or might not be solely prepared for this purpose. (The same space might be prepared for both, medicines and consumables.) 3. The distribution of both kinds of products may be done jointly.

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9. José de Mello Pharma - Services

The outcome of the infrastructure and know-how invested in can be maximized with offering services of storage, repackaging, galenic formulation and unitary doses for other institutions.

9. José de Mello Pharma - Target

The service represents added value to its targets: hospitals and clinics, care/nursing homes, home support, nurseries and ONGs.

Target

1	**Hospitals and Clinics**	Benefits with released spaces, previously allocated to the hospital pharmacy. Allows for attention to the core activities.
2	**Care / nursing homes**	Release of FTE working hours allocated to activities such as preparation of unitary doses or repackaging.
3	**Home support**	Adds value to the value proposition, which does not include provision of medicines yet.
4	**Nurseries**	Release of working hours allocated to the maintenance of nurseries
5	**ONGs**	Supply of “ready-to-use medicine” (e.g. IMVF)

9. José de Mello Pharma - Benchmark

In addition to the value proposition offered by the already existing logistics companies, JM Pharma would specialize in hospital pharmacy logistics, offering various services: repackaging, creating unitary doses and galenic formulations.

Servicio Móvil

Main activities:

- Management of documents
- Logistics: technology, automated management of reception, order preparation and delivery of products
- Business process optimization

Provisions all medication for all hospitals in Galicia

logaritme serveis logístics aie

Main activities:

Develops auxiliary and complementary activities to their partners

- Logistics management
- Storage
- Distribution of all types of products

mestre serveis logístics

Main activities:

- Transport
- Logistics Services (reception, storage, stock management, picking, expedition)
- Other services (import, export, customs)

The value proposition of JM Pharma would be specialized in hospital pharmacy activities. In addition to the reception, storage and delivery, repackaging, unitary doses and galenic formulation would also be offered.

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Belbin Analysis – Jessica Müller

The Belbin analysis surprisingly showed me a side of me I was not initially aware of. I completely changed my role with this group and focused on being a harmonic team worker, in deterioration of being the strategist or finisher.

TOP 3

Team Worker	Considering myself a very stable, enthusiastic, supporting and communicative person, I always aimed for unity and harmony within the group. Creating a good environment is key for satisfaction and work quality.
Prospector	I consider myself a very open and communicative person. Thereby, I naturally played a role of PR, taking the initiatives to call or contact people external to the project and ask for their contribution. Maintaining those contacts was also in our interest.
Monitor	Although each one of us had from the beginning on really high performance standards set for themselves, I strongly believe I supported the group with some perfectionist final aspects, which equalized performance within the group.

BOTTOM 3

Finisher	I feel like pressure and stress influence creativity and work quality. Even though I always worked towards meeting deadlines, what wasn't perfectly done in time did not correspond to our quality standards, thus was only decently presented afterwards.
Strategist	It took me a significant amount of time to understand the processes at the pharmacy, which is why, throughout the project, it was important to get some guidance and strategic support from my teammates.
Intellectual	I believe that within our group, all of us contributed equally with new and creative ideas, thereby no one occupying this role independently. Each one contributed with creative ideas about the fields we specialized on.

Miguel about Jessica

"Jessica is a dynamic person, full of energy, who played a key role in the group. She was always really communicative, helping maintaining a positive environment in the group, and with other stakeholders. Her attention to detail and hard work ethics helped pushing the project forward. I am sure she will have success in her next projects"

Duarte about Jessica

"Jessica is a very communicative and open person, who always tries to create a very good working environment. She kept in contact with external contributors, thereby getting constant feedback for our project. Her detail-oriented attitude added a lot of value to our project. "

Belbin Analysis – Duarte Castro e Almeida

Whereas I usually see myself especially as strategist and operational, this team really made it easy to highlight my skills as team worker, since this function was transversal to all of us and we were able to create a very good working environment.

TOP 3

Team Worker	I am a very stable and communicative person, who is always ready and eager to help out my teammates. It was of utmost importance to me to create a nice working environment, so that everyone could work as efficiently as possible, while enjoying the project and the work.
Strategist	I believe I was able to from early on assimilate a large amount of information, in short time. Understanding the processes was key to developing a strategy for our project and setting the main milestones.
Operational	After setting major guidelines, I believe I am a very practical person, who likes to set theory into practice. This project confirmed this hypothesis, since it required a large amount of practical work, which I enjoyed every day.

BOTTOM 3

Monitor	As I am a very practical person and enjoy working myself, my attention was not on monitoring my teammate's work. Furthermore, they made it pretty simple to trust them completely.
Finisher	Since I consider myself a very calm person, I never feel an extreme sense of urgency. I am responsible, which is why I organize myself the right way, to avoid last-minute pressures.
Intellectual	It was hard to be very creative in a topic that was so new to us at the beginning. Furthermore, the project itself did not give a lot of space for creativity and new ideas.

Jessica about Duarte

"Duarte filled without doubt the role as strategist in our team. From early on, he was able to process and connect all information given and see the big picture. He provided the guidance to the project, especially in the beginning, when all ideas were still vague, while always being an exceptional team worker. "

Miguel about Duarte

" Duarte brought his experience and fast and clever thinking to the group, which helped the other members feel more at ease, and more confident. His skills to guide and plan our work were key, and brought our work to another level. He is an excellent team player and I would be happy to work with him in the future."

Belbin Analysis – Miguel Batalha

The Belbin analysis confirmed the idea of which roles I filled in this project. I extremely enjoyed getting things done ad the more practical side to our work.

TOP 3

Operational	As a very stable and balanced personality, I strongly believe I work methodically and efficiently, in order to create an optimal organizational frame. I really appreciated putting our projects and goals into practice.
Monitor	Before making any decision, I like to consider all possible options, and analyze them critically, so that the optimal solution is achieved. Besides, I am a stable person, who doesn't let emotions interfere with my judgments, which I consider key to success in a work environment.
Team Worker	I know how to listen and communicate with others, encouraging them to express themselves freely. I like to be supportive, and build on each group member ideas. I feel that each member of our group fits in this category, which makes it increasingly easier to have success.

BOTTOM 3

Intellectual	I tend to discard some secondary tasks, such as deadlines or some planning activities, and focus too much on what needs to be done. The role of my colleagues was key to help me stay more organized.
Strategist	I am not the most extroverted person, and sometimes I lack some energy to do certain tasks, mainly related with communicating with third parties. A good allocations of tasks was key for me to surpass this problems.
Finisher	I am not too perfectionist in some things I find secondary for the goal of the project. I noticed that in the later stages of our project, mainly in the elaboration of the final thesis. I think this is a subject I can improve on, since small changes can have huge impacts in the end.

Jessica about Miguel

"I would describe Miguel as the operational side of our team, with major soft skills on how to manage a harmonic team work. His intellectual capacities accelerated and contributed significantly to our project. We really owe him a major part of the theoretical content of our work."

Duarte about Miguel

"Miguel is the most focused member of our team. With his enormous analytical capacities and his extraordinary resilience he is not only a very good teammate, but also a dear friend. He is a very stable and calm person, always happy to help."

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Thank You

Q & A

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Logistic Centralization and Technical Reorganization of the Hospital Pharmacy in order to sustain Operational Excellence at José de Mello Saúde

Appendix

AGENDA

A.1 **Diagnosis**

A.2 Medicines Warehouse: Centralized vs Decentralized
- i. Recommendation
- ii. Costs Analysis

A.3 Unitary Doses: Centralized vs Point-of-Care
- i. Distribution
- ii. CAPEX

A.4 Galenic Formulation
- i. Recommendation
- ii. Areas

A.5 Implementation, Risks & Mitigations

A.1. Description of the technical process

1

Reception

- The order is delivered by the supplier and received by a pharmacy assistant, who signs the reception documents
- Manual check of order accordance, conformity and quantity
- The document is authenticated with a stamp, signalizing immediate or post-delivery order confirmation, in case there is no one available to check the order at the time of reception.
- The assistant types an order reception record into the information system
- Double-check of order by another assistant or pharmacist

2

Preparation of medication for storage in their unit doses forms

- Unpicking of medicines
- If the batch and expiry date are written on each unit dose of the medicine, in case of the oral tablets, the blister is cut manually. Afterwards, these unit doses are stored.
- If the batch and expiry date are not written on each unit dose of the medicine, the medicine is repackaged and a sticker is glued to the package with the missing information
- If the oral medicines have to be removed from their blisters, they are separately placed in a machine, which will repackage them, one by one. The expiration date is 6 months and a red sticker is glued to the package to drive the attention of the workers to the short expiration date.
- If the medicines do not have to be removed from the blisters, after cutting the blisters, they're also inserted in the machine, which will repackage them.
- In all repackaging cases, the batch, DCI, expiry date, bar code and dose have to be entered into the information system manually
- Double-check of repackaging by pharmacist
- Medicines are stored as unit doses

A.1. Description of the technical process

3

Order Reception: replacement order, unitary doses prescription, individualized distribution

- Confirmation if there is stock when a prescription order enters the pharmacy .
- If there is no stock, an order is sent to the purchasing department and the pharmacy is informed about the lack of stock.
- It has to be confirmed if the unavailable medication is in stock in either other CUF hospitals or in nearby neighbor hospitals. If possible, borrow the medicine if there is no substitute in stock.
- If there is stock and the Kanban is visible, an order has to be issued to the purchasing department, and the Kanban should be collected.
- If there is stock and the Kanban is not visible, the medication is distributed (either traditional distribution, individualized or by unitary doses.
- If there is a unitary doses prescription, it has to be validated by a pharmacist.

4

Distribution

- Medication for stock replenishment of POC for the hospital in question: an assistant identifies the consumption in each POC, verifying the quantity of consumed medication and comparing it to the consumption recorded digitally. Then, a box is prepared with the necessary medication for stock replenishment.
- The medication is transported to each POC, bearing in mind a weekly schedule for different hospital services.
- If the stock is not for the hospital in question: medication is placed in a box, ready for expedition to another hospital or clinic.
- Before delivery, a record of temperature, humidity, storage and transport conditions is created, so that the process is protocolled.
- Medication for unitary doses (division of medication by client): A drawer in which the prescribed unit doses are inserted for a time span of 8, 12 or 24h, which serves one specific client. The prescription has to be double-checked by a pharmacist.
- These drawers are prepared at the unitary doses area of the pharmacy, afterwards transported to the services/POC, at around 18h (unitary doses are prepared for the whole next day)
- Continuous analysis of the prescriptions to identify potential changes made to them by physicians.
- If there are changes: prepare the requires medication in the pharmacy and transport it to the POC, changing the content of the drawer in question.
- For any type of distribution, there is always a digital record of consumption in the information system.

A.1. Description of the technical process

5

Prescription order and galenic formulation

- After the prescription order enters the pharmacy, the raw materials that will be used to create the galenic formulation have to be recorded on paper.
- A pharmacist validates the latter step and registers the consumption of the raw materials in the information system.
- There are two types of galenic formulations: sterile and non-sterile.
- The sterile formulations include oncology and parenteral nutrition, which are produced in a centralized way for all CUF hospitals.
- The quality of the formulation has to be controlled by a pharmacist.
- A label is placed on the formulation with the following information: batch, expiry date, expiry date of raw material, composition, quantity, conservation guidelines, dosage, and vacant spaces to add the name of the client, the physician and the pharmacist.
- The individualized distribution is prepared and appropriately stores/transported.

6

Distribution

- If the medication was not prescribed for consumption in the hospital in question: medication is placed in an area for expedition.
- A record of temperature, humidity, conditions of storage and transport conditions has to be created and the delivery documents prepared.
- After delivery, a double-check of the temperature, humidity and transport conditions is made, in order to protocol the whole process.
- If the medication was prescribed for consumption in the hospital in question: assistant takes the formulation to the services / POC, where it is administered to the client.
- A consumption record is created in the information system.
- Because of the particular specificities of each galenic formulation, since it is prepared for an individual client, there is no reverse logistics process.

AGENDA

A.1 Diagnosis

A.2 **Medicines Warehouse: Centralized vs Decentralized**
- i. **Recommendation**
- ii. Costs Analysis

A.3 Unitary Doses: Centralized vs Point-of-Care
- i. Distribution
- ii. CAPEX

A.4 Galenic Formulation
- i. Recommendation
- ii. Areas

A.5 Implementation, Risks & Mitigations

A.2.1 Legal Analysis

The central warehouse requires a licence as gross distributor of human medication, in the terms of the current legislation.

ENQUADRAMENTO LEGAL DO ARMAZÉM CENTRAL DA FARMÁCIA

REGIME JURÍDICO DOS MEDICAMENTOS DE USO HUMANO (Lei n.º 51/2014, de 25 de Agosto)
DL n.º 176/2006, de 30 de Agosto (versão actualizada)

Artigo 3.º
Definições
m) «Distribuição por grosso», atividade de abastecimento, posse, armazenagem ou fornecimento de medicamentos destinados à transformação, revenda ou utilização em serviços médicos, unidades de saúde e farmácias, excluindo o fornecimento ao público;

Artigo 79.º
Aquisição direta de medicamentos
1 - Os fabricantes, importadores ou distribuidores por grosso só podem:
a) Vender medicamentos diretamente a farmácias;
b) Vender medicamentos não sujeitos a receita médica a pessoas singulares ou coletivas autorizadas, por força da lei, a vender medicamentos ao público;
c) Transacionar medicamentos livremente entre si;
d) Vender medicamentos a estabelecimentos e serviços de saúde, públicos ou privados, e a instituições de solidariedade social sem fins lucrativos, que disponham de serviço médico e farmacêutico, bem como de regime de internamento, desde que os medicamentos adquiridos se destinem ao seu próprio consumo e estes estabelecimentos, serviços e instituições se encontrem devidamente autorizados para o efeito pelo INFARMED, I.P.;
e) Vender determinado medicamento a entidades públicas ou privadas a quem o INFARMED, I.P., haja concedido, por razões fundamentadas de saúde pública ou para permitir o normal exercício da sua atividade, uma autorização de aquisição direta do medicamento em questão, desde que seja assegurado o acompanhamento individualizado dos lotes e adotadas as medidas cautelares adequadas.

A.2.1 Legal Analysis

Currently, a special authorization has to be conceded in order to proceed with the repackaging outside of the hospital pharmacy, in the central warehouse.

REEMBALAGEM NO ARMAZÉM CENTRAL FARMÁCIA

REGIME JURÍDICO DOS MEDICAMENTOS DE USO HUMANO (Lei n.º 51/2014, de 25 de Agosto)

DL n.º 176/2006, de 30 de Agosto (versão actualizada)
CAPÍTULO III
Fabrico, importação e exportação
SECÇÃO I
Fabrico
Artigo 55.º

Âmbito de aplicação
1 - O fabrico, total ou parcial, de medicamentos no território nacional está sujeito a autorização do INFARMED, I.P.
2 - A autorização de fabrico é igualmente exigida para as operações de divisão, acondicionamento, primário ou secundário, ou apresentação.....
4 - Excetuam-se do disposto nos números anteriores:
a) As operações de preparação, divisão, alteração de acondicionamento ou apresentação efetuadas em farmácias por farmacêuticos ou outras pessoas legalmente habilitadas, com vista à dispensa de medicamentos;

A.2.1 Legal Analysis

Currently, a special authorization has to be conceded in order to proceed with the repackaging outside of the hospital pharmacy, in the central warehouse.

Artigo 56.º
Requisitos
1 - A autorização de fabrico é requerida pela pessoa singular ou coletiva que fabrique ou pretenda fabricar medicamentos no território nacional.
2 - Sob pena de indeferimento, o requerimento:
a) Especifica os medicamentos a fabricar e as respetivas formas farmacêuticas;
b) Indica o local de fabrico ou de controlo;
c) Assegura o cumprimento das exigências técnicas e legais em matéria de direção técnica, instalações, equipamentos e possibilidades de controlo;
d) Identifica o diretor técnico.
3 - A autorização só é concedida se o requerente dispuser de instalações devidamente licenciadas e de equipamentos adequados, com as características estabelecidas na legislação aplicável, cumprindo as boas práticas de fabrico previstas na lei.
4 - Os requisitos previstos nos números anteriores devem estar preenchidos na data da apresentação do requerimento, cabendo ao requerente comprovar os elementos e dados
constantes do requerimento.
5 - O cumprimento dos requisitos referidos no n.º 3 é confirmado pelos serviços competentes do INFARMED, I.P., designadamente por via de inspeção ou inquérito, antes da decisão de concessão ou recusa da autorização

Artigo 60.º
Diretor técnico
1 - O titular de autorização de fabrico fica obrigado a dispor, de forma permanente e efetiva, de um diretor técnico, que assume as obrigações previstas no artigo seguinte.
2 - O titular da autorização pode assumir a função de diretor técnico, desde que reúna as condições definidas no presente decreto-lei.
3 - As funções de diretor técnico são assumidas por farmacêutico especialista em indústria farmacêutica, inscrito na Ordem dos Farmacêuticos e sujeito aos deveres resultantes do
Decreto-Lei n.º 288/2001, de 10 de novembro
Decreto-Lei n.º 134/2005, de 16 de agosto.

AGENDA

A.1 Diagnosis

A.2 **Medicines Warehouse: Centralized vs Decentralized**
- i. Recommendation
- ii. **Costs Analysis**

A.3 Unitary Doses: Centralized vs Point-of-Care
- i. Distribution
- ii. CAPEX

A.4 Galenic Formulation
- i. Recommendation
- ii. Areas

A.5 Implementation, Risks & Mitigations

AGENDA

A.2

Medicines Warehouse: Centralized vs Decentralized

i. Recommendation

ii. **Costs Analysis**

   i. **Stocks**

   ii. FTE's

   iii. Areas & Revenues

   iv. ESS

   v. CAPEX

A.2.2.1 Stocks: Total Costs of Each Model

AS IS

	2018	2019	2020	2021	2022	Total
Average Inventory	1058369	1383981	1542371	1542371	1542371	7069464
Holding Costs	72547	96479	109456	111426	113432	503339
Ordering Costs	50220	66787	75770	77134	78522	348432
Invoice Issue Costs	8260	10984	12462	12686	12915	57307
Total	131026	174250	197687	201246	204868	909078

SS 4

	2018	2019	2020	2021	2022	Total
Average Inventory	185707	246121	272192	272192	272192	1248403
Holding Costs	12729	17157	19316	19664	20018	88885
Ordering Costs	69075	70796	71830	73123	74439	359264
Invoice Issue Costs	11376	11662	11833	12046	12262	59179
Total	93181	99615	102979	104833	106720	507328

SS 2

	2018	2019	2020	2021	2022	Total
Average Inventory	150613	198896	217322	217322	217322	1001474
Holding Costs	10324	13865	15422	15700	15983	71294
Ordering Costs	91609	95148	97298	99050	100833	483938
Invoice Issue Costs	15084	15669	16024	16312	16606	79694
Total	117017	124682	128744	131062	133421	634926

SS10

	2018	2019	2020	2021	2022	Total
Average Inventory	287765	392518	437144	437144	437144	1991714
Holding Costs	19725	27363	31022	31581	32149	141840
Ordering Costs	40187	39548	39640	40354	41080	200810
Invoice Issue Costs	6620	6518	6535	6653	6772	33098
Total	66532	73429	77198	78587	80002	375749

A.2.2.1 Stocks: Total Costs of Each Model

EOQ Linear

	2018	2019	2020	2021	2022	Total
Average Inventory	266734	309820	326270	326270	326270	1555364
Holding Costs	17978	20882	21991	21991	21991	104832
Ordering Costs	13108	15647	16652	16652	16652	78711
Invoice Issue Costs	2158	2575	2741	2741	2741	12956
Total	33244	39104	41383	41383	41383	196498

EOQ non Linear 95%

	2018	2019	2020	2021	2022	Total
Average Inventory	408552	473112	497570	497570	497570	2374374
Holding Costs	27482	31818	33459	33459	33459	159675
Ordering Costs	13098	15634	16638	16638	16638	78647
Invoice Issue Costs	2156	2573	2739	2739	2739	12946
Total	42736	50025	52836	52836	52836	251268

EOQ non Linear 99%

	2018	2019	2020	2021	2022	Total
Average Inventory	432320	501158	532525	532525	532525	2531054
Holding Costs	29067	33685	35787	35787	35787	170112
Ordering Costs	13098	15634	16638	16638	16638	78647
Invoice Issue Costs	2156	2573	2739	2739	2739	12946
Total	44321	51892	55164	55164	55164	261706

EOQ Safe

	2018	2019	2020	2021	2022	Total
Average Inventory	690652	730296	532525	532525	532525	3018523
Holding Costs	46274	48849	35787	35787	35787	202483
Ordering Costs	13098	15634	16638	16638	16638	78647
Invoice Issue Costs	2156	2573	2739	2739	2739	12946
Total	61528	67057	55164	55164	55164	294077

A.2.2.1 Stocks: Total Costs of Each Model

Total Costs of Stock

	2018	2019	2020	2021	2022	Total
AS IS	131026	174250	197687	201246	204868	909078
SS2	117017	124682	128744	131062	133421	634926
SS4	93181	99615	102979	104833	106720	507328
SS10	66532	73429	77198	78587	80002	375749
EOQ L	33244	39104	41383	41383	41383	196498
EOQ 95%	42736	50025	52836	52836	52836	251268
EOQ 99%	44321	51892	55164	55164	55164	261706
EOQ Safe	61528	67057	55164	55164	55164	294077

Increase in total costs, from 2018 to 2022 (%)

AS IS	56%
SS2	14%
SS4	15%
SS10	20%
EOQ	24%
EOQ 95%	24%
EOQ 99%	24%
EOQ Safe	-10%

Total costs segmented per activity (€)

	AS IS	SS2	SS4	SS10	EOQ	EOQ 95%	EOQ 99%	EOQ Safe
Holding Costs	503339	71294	88885	141840	104832	159675	170112	202483
Ordering Costs	348432	483938	359264	200810	78711	78647	78647	78647
Invoice Issue Costs	57307	79694	59179	33098	12956	12946	12946	12946
Total	909078	634926	507328	375749	196498	251268	261706	294077

A.2.2.1 Stocks: Average Value in Stock and Number of Orders

Average value in stock (€)

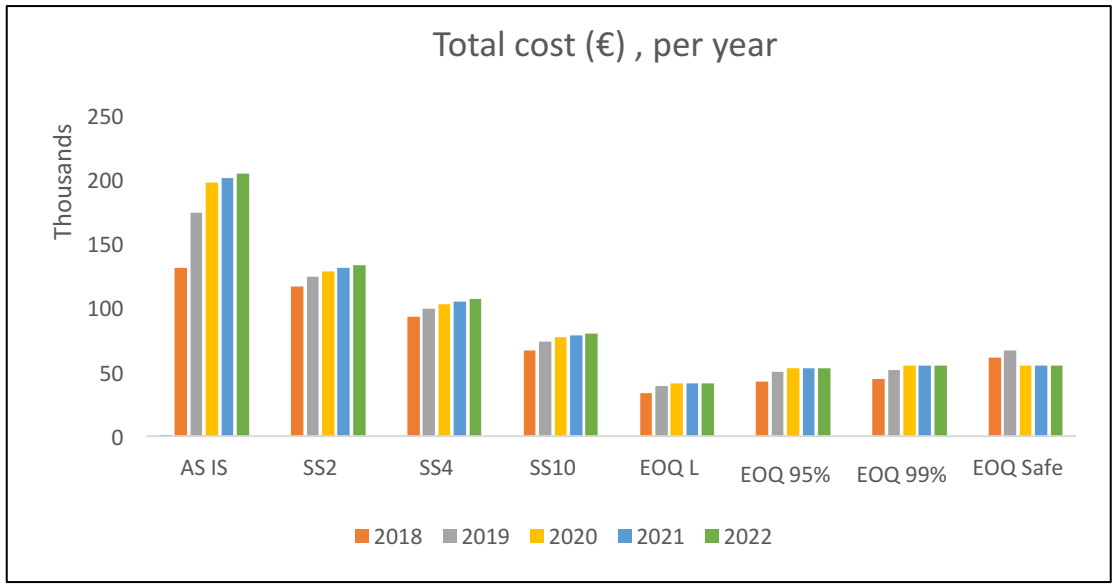
	2018	2019	2020	2021	2022	Total
AS IS	1058369	1383981	1542371	1542371	1542371	1413893
SS2	150613	198896	217322	217322	217322	200295
SS4	185707	246121	272192	272192	272192	249681
SS10	287765	392518	437144	437144	437144	398343
EOQ Linear	266734	309820	326270	326270	326270	311073
EOQ 95%	408552	473112	497570	497570	497570	474875
EOQ 99%	432320	501158	532525	532525	532525	506211
EOQ S	690652	730296	532525	532525	532525	603705

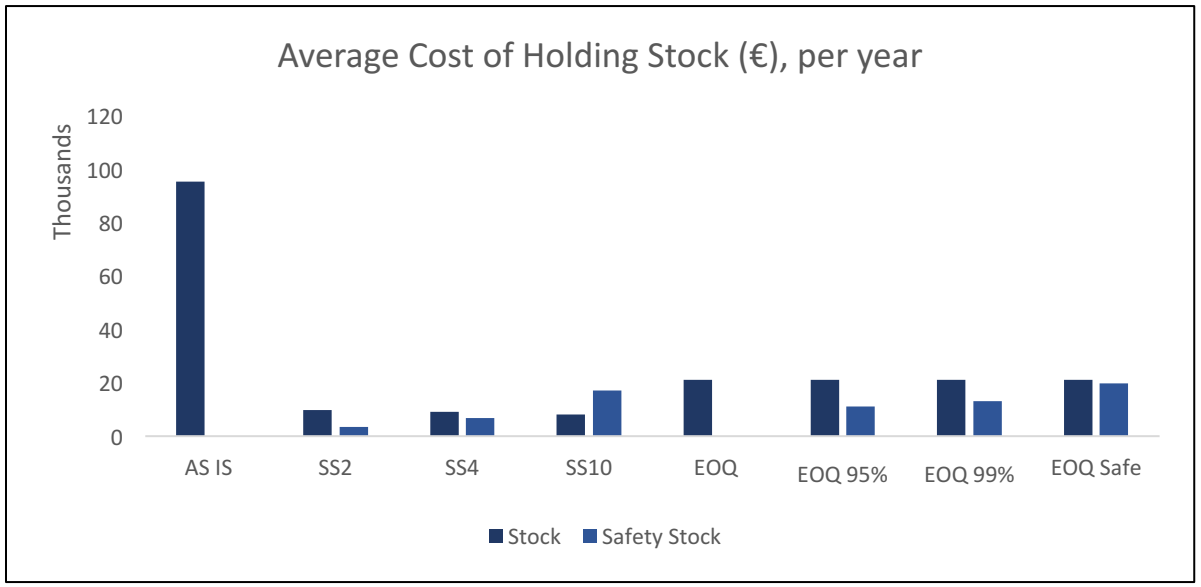
	Average value in stock in each year (€)		Average holding cost in each year (€)	
	Stock	Safety Stock	Stock	Safety Stock
AS IS	1413893	0	95296	0
SS2	143394	51352	9665	3461
SS4	137524	101205	9269	6821
SS10	117951	253013	7950	17053
EOQ	311073	0	20966	0
EOQ 95%	311073	163802	20966	11040
EOQ 99%	311073	195138	20966	13152
EOQ Safe	311073	292632	20966	19723

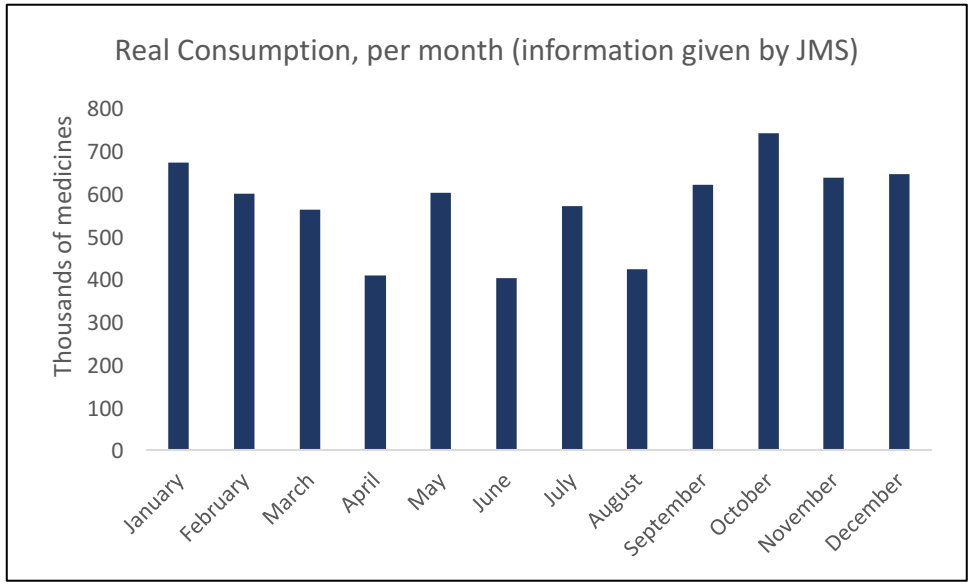
Number of orders

	2018	2019	2020	2021	2022	Total
AS IS	18920	24740	27572	27572	27572	126376
SS2	34513	35247	35406	35406	35406	175977
SS4	26023	26226	26138	26138	26138	130664
SS10	15140	14650	14425	14425	14425	73064
EOQ Linear	4257	5077	5395	5395	5395	25518
EOQ 95%	4257	5077	5395	5395	5395	25518
EOQ 99%	4257	5077	5395	5395	5395	25518
EOQ Safe	4257	5077	5395	5395	5395	25518

A.2.2.1 Stocks: Total Costs of Each Model







AGENDA

A.2

Medicines Warehouse: Centralized vs Decentralized

i. Recommendation

ii. **Costs Analysis**

- i. Stocks
- ii. **FTE's**
- iii. Areas & Revenues
- iv. ESS
- v. CAPEX

A.2.2.2 FTE's: Wages and Total costs

Annual cost with each type of worker (€)

	2018	2019	2020	2021	2022	Total
Technical Director	20883	21238	21620	22009	22405	108156
Pharmacist	17364,8	17660	17977	18301	18630	89935
Pharmacy Technician	11158,48	11348	11552	11760	11972	57791
Medical Assistant	5579,24	5674	5776	5880	5986	28895

Provided by Financial Department of JMS

Total costs and savings (€)

	2018	2019	2020	2021	2022	Total
AS IS	471 496	549 514	570958	587115	609 655	2 788 739
TO BE without synergy	481 221	548 055	569473	579724	590 159	2 768 633
TO BE with synergy	470 062	542 381	557921	573844	584 173	2 728 381
Savings	**1 434**	**7 132**	**13 037**	**13 272**	**25 483**	**60 358**

A.2.2.2 FTE's: Total Costs

Costs RH, AS IS

	2018	2019	2020	2021	2022
Technical Director	41766	42476	43241	44019	44811
Pharmaceutical	312566	370860	377536	384331	391249
Pharmacy Technician	11158	11348	11552	11760	11972
Medical Assistant	106006	124830	138629	147005	161623
Total	**471496**	**549514**	**570958**	**587115**	**609655**

Costs with RH TO BE, with synergies

		2018	2019	2020	2021	2022
Technical Director	HU	41766	42476	43241	44019	44811
	Warehouse	21238	21620	21620	22009	22406
Pharmaceutical	HU	312566	370860	377536	384331	391249
	Warehouse	0	0	0	0	0
Pharmacy Technician	HU	0	0	0	0	0
	Warehouse	11158	11348	11552	11760	11972
Medical Assistant	HU	55792	62415	69315	70562	71832
	Warehouse	27896	34045	34657	41161	41902
	Total	**470417**	**542764**	**557921**	**573844**	**584173**

Costs with RH TO BE, with no synergies

		2018	2019	2020	2021	2022
Technical Director	HU	41766	42476	43241	44019	44811
	Warehouse	20883	21238	21620	22009	22406
Pharmaceutical	HU	312566	370860	377536	384331	391249
	Warehouse	0	0	0	0	0
Pharmacy Technician	HU	0	0	0	0	0
	Warehouse	11158	11348	11552	11760	11972
Medical Assistant	HU	55792	62415	69315	70562	71832
	Warehouse	39055	39719	46210	47042	47888
	Total	**481221**	**548056**	**569473**	**579724**	**590159**

A.2.2.2 FTE's: Times Measured per Activity

Times Measured for each activity

	Seconds
Reception of 1 order (manually measured)	372
Repackaging of 1 unit (manually measured, and incorporating capacity of the new machine)	0,417
Storage of 1 order (manually measured)	443
Picking of 1 unit (calculated according to current times of "picking" for each service)	10,1

Repackaging time (units per hour)

New machine	1000
Current machines (measured)	500
Total	1500

Number of orders and medicines consumed (Values acquired from "Stocks" information)

	2018	2019	2020	2021	2022
Orders per year	8049	9528	10077	10077	10077
Orders per day (6 days per week)	26	30	32	32	32
Daily consumption	11779	12147	17224	19455	19455
Repackaging per day (6 days per week)	13743	14171	20095	22697	22697

A.2.2.2 FTE's: Times Measured per Activity and Total Time

Current times of picking for each service

	Time	Frequency	Number of services								
Activity	Minutes	Times per day	HCIS	HCD	HCC	HCTV	HCSant	Clinics	HCSint	HCL	HCA
UCIP	60	1	1	1	0,5	0,5	0,5	0	0,5	0,5	0,5
Internment	45	1	8	8	0,5	0,5	0,5	0	0,5	0,5	0,5
Operating room	60	1	2	2	0,5	0,5	0,5	0	0,5	0,5	0,5
Emergency	25	1	1	1	0,5	0,5	0,5	0	0,5	0,5	0,5
Others	25	0,5	27	27	6,5	2	3,5	0	2,75	2,75	2,75
Clinics	25	0,5	0	0	0	0	0	6	0	0	0
Total Time per hospital			902,5	902,5	176,3	120	138,8	75	129,4	129,4	129,4

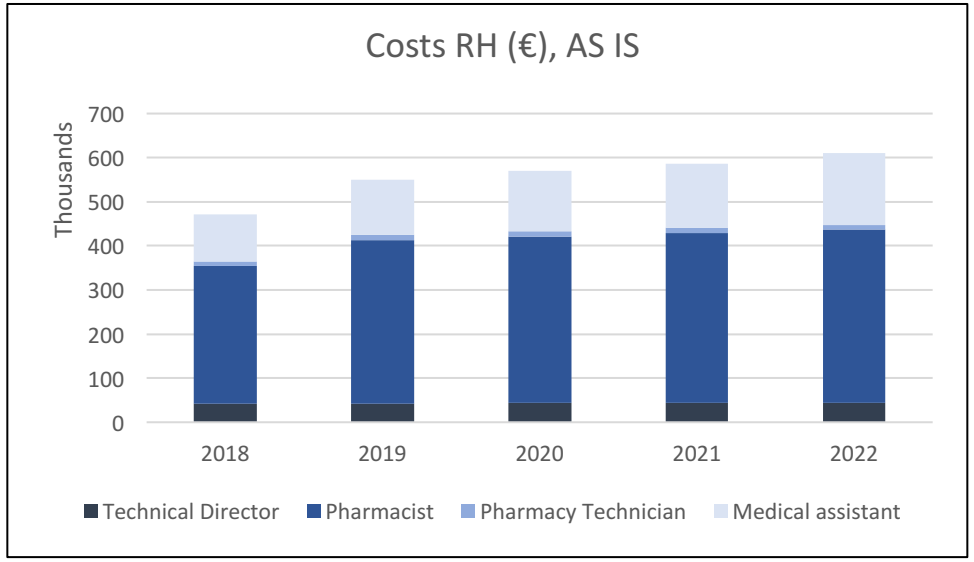
Total Picking time required per day (Minutes)

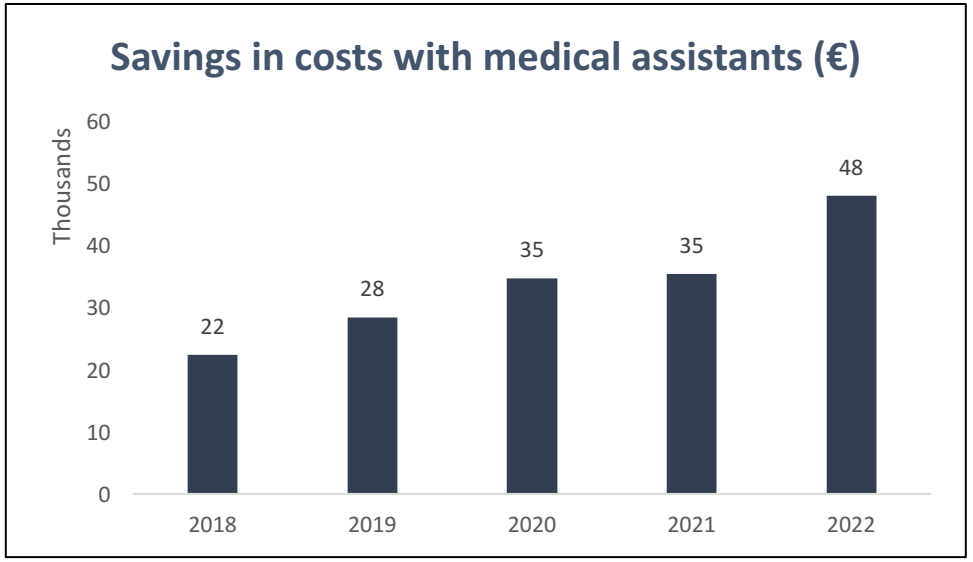
	2018	2019	2020	2021	2022
UCIP	240,0	270,0	300,0	300,0	300,0
Internment	810,0	832,5	855,0	855,0	855,0
Operating room	360,0	390,0	420,0	420,0	420,0
Emergency	100,0	112,5	125,0	125,0	125,0
Others	859,4	893,8	928,1	928,1	928,1
Clinics	75,0	62,5	62,5	62,5	62,5
Total in Minutes	2444,4	2498,8	2628,1	2628,1	2628,1
Total in Hours	40,7	41,6	43,8	43,8	43,8
Nr of assistants	5,1	5,2	5,5	5,5	5,5

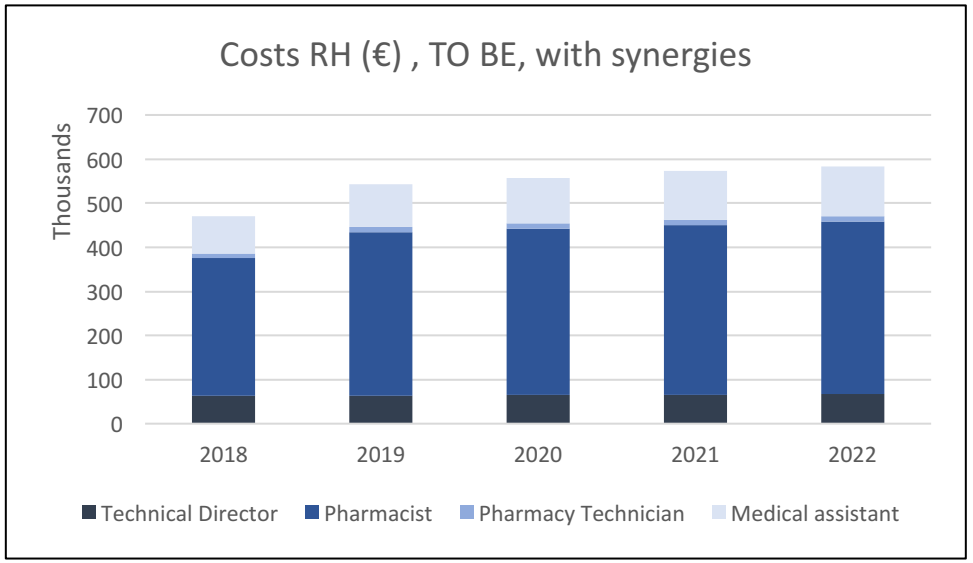
Daily total time per activity (Seconds)

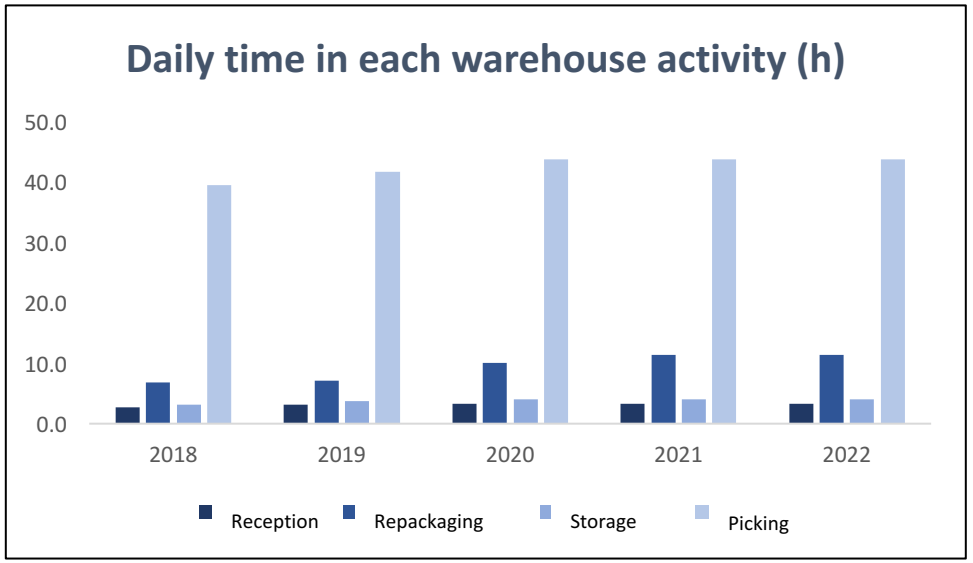
	2018	2019	2020	2021	2022
Reception	9570	11330	11982	11982	11982
Repackaging	24737	25508	36171	40854	40854
Storage	11397	13492	14268	14268	14268
Picking	146663	149925	157688	157688	157688

A.2.2.2 FTE's: Total Costs and Times per activity









A.2.2.2 FTE's: Recommended Ratio Pharmacist/ Patient

The Infarmed, Portuguese Society of Hospital Pharmacists and The American Society of Health-System Pharmacists recommend a specific number of pharmacists to perform certain functions.

INFARMED – Ratio Pharmacist / Patient

1. The recommended ratio to a decentralized pharmacy (pharmacist in the HU) is one pharmacist per clinical service, or 60 beds of ambulatory or low complexity care (counting hospitalization, intensive and intermediate care units, oncology, urgency and SO)
2. There should be one pharmacist allocated to the operating room.
3. For sterile formulations, there should be 3 oncology pharmacists and 2 for other sterile and non-sterile manipulations (validation of medical prescription, manipulation, double-check).
4. There should be a pharmacist (technical director) and a pharmacy technician to provide support in the warehouse (responsible for the warehouse)

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A.2

Medicines Warehouse: Centralized vs Decentralized

i. Recommendation

ii. **Costs Analysis**

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   ii. FTE's

   iii. **Areas & Revenues**

   iv. ESS

   v. CAPEX

A.2.2.3 Areas – AS IS

Medicines Warehouse area per Hospital Unit (AS IS)

	Hospital pharmacy	% Warehouse	Warehouse 2017	Warehouse 2018	Warehouse 2019	Warehouse 2020	Warehouse 2021	Warehouse 2022
HCIS	148.31	70%	103.82	103.82	-	-	-	-
HCD	162.61	60%	97.57	97.57	97.57	97.57	97.57	97.57
HCT	301.65	60%	-	-	180.99	180.99	180.99	180.99
HCA	38.5	75%	-	-	-	22	22	22
HCC	26.38	75%	19.79	19.79	19.79	19.79	19.79	19.79
HCSant	65.25	70%	45.68	45.68	45.68	45.68	45.68	45.68
HCTV	57.6	75%	43.2	43.2	43.20	43.20	43.20	43.20
HCSint	49.74	73%	-	36.48	36.48	36.48	36.48	36.48
HCLeiria	49.74	73%	-	-	36.48	36.48	36.48	36.48
Total			**310.04**	**346.52**	**460.17**	**481.67**	**481.67**	**481.67**

A.2.2.3 Areas required by Infarmed

	Compartment Name	Compartment Function	Usable/net area (m^2)	Net area (m2) by bed
Reception	Parking	Parking for transportation vehicles	15	Not applicable
	Order reception	Receive and process orders, with space dedicated to trucks and/or a treadmill	20	Not applicable
	Unpicking area	Check of order documents and conformity and information input into the information system	20	Not applicable
	Trash	Placement of empty boxes	4	Not applicable
		Total	**59**	
Storage	General medication	Storage of general medication and health products, with a table area for work and a lavatory	160	0.32
	Flmmable substances	Storage of flammable substances, which require a seperated storage space from the general medication in fire proof shelves	20	0.04
	Cooling space	Storage of medication which need to be stored in a cooled area, such as a fridge	6	0.012
	Narcotics	Storge of narcotics in a safe	4	0.008
		Total	**190**	**0.38**

A.2.2.3 Areas TO BE

	2017		2018		2019		2020		2021	
	Nº Beds	Total m^2	Nº Beds	Total m^2	Nº Beds	Total m^2	Nº Beds	Total m^2	Nº Beds	Total m^2
HCD	188	71.44	188	71.44	214	81.32	214	81.32	214	81.32
HCIS	145	55.1	145	55.1	-	-	-	-	-	-
HCT	-	-	-	-	266	101.08	266	101.08	266	101.08
HCC	30	11.4	30	11.4	30	11.4	30	11.4	30	11.4
HCTV	16	6.08	16	6.08	35	13.3	35	13.3	35	13.3
HCSant	26	9.88	32	12.16	36	13.68	36	13.68	36	13.68
HCA	-	-	-	-	-	-	30	11.4	30	11.4
HCSintra	-	-	42	15.96	42	15.96	42	15.96	42	15.96
HCLeiria	-	-	-	-	34	12.79	34	12.92	34	12.92
Total Warehouse	**405**	**153.9**	**453**	**172.14**	**657**	**249.53**	**687**	**261.06**	**687**	**261.06**
Total CW = Warehouse + Reception		**212.9**		**231.14**		**308.53**		**320.06**		**320.06**

- For these calculations we used the ratio recommended by Infarmed.

** Nº of beds used in these calculations include: hospital admission, intensive and intermediate care, observation services and day hospital.
Data given by the Production Department of JMS.

*** Area required is equal for 2020, 2021 and 2022 because for those years we don't forecast opening of new hospitals

AGENDA

A.2

Medicines Warehouse: Centralized vs Decentralized

i. Recommendation

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A.2.2.4 ESS Costs AS IS 2017

2017		HCD	HCIS	HCC	HCTV	HCSant	Total
ESS - Warehouse Costs							
Direct Costs:	Others	1,013.45 €	473.79 €	457.39 €	601.00 €	0.00 €	2,545.62 €
Indirect Costs:	Rent	10,691.04 €	5,278.22 €	3,015.98 €	5,662.66 €	5,069.20 €	29,717.10 €
	Electricity	2,113.84 €	2,399.18 €	548.87 €	1,107.44 €	1,120.78 €	7,290.11 €
	Water	408.38 €	455.47 €	145.26 €	233.69 €	243.49 €	1,486.29 €
	Cleaning	2,891.20 €	3,694.87 €	465.45 €	1,032.46 €	1,286.31 €	9,370.29 €
	Trash	632.75 €	368.21 €	194.46 €	233.80 €	288.58 €	1,717.79 €
	Security	1,277.47 €	1,269.39 €	184.28 €	276.46 €	468.56 €	3,476.16 €
	Various common center cost	5,852.85 €	4,459.23 €	821.78 €	1,944.84 €	814.22 €	13,892.92 €
ESS - Costs with Purchasing Department		2,197.75 €	1,674.45 €	308.58 €	730.29 €	305.74 €	5,216.82 €
Warehouse Area		98	104	20	43	46	**310**
Total costs		27,078.72 €	20,072.82 €	6,142.05 €	11,822.64 €	9,596.88 €	**74,713.11 €**

2017		HCD	HCIS	HCC	HCTV	HCSant	Average
ESS - Warehouse annual costs per m^2							
Direct Costs:	Others	10.39 €	4.56 €	23.12 €	13.91 €	0.00 €	10.40 €
Indirect Costs:	Rent	109.58 €	50.84 €	152.44 €	131.08 €	110.98 €	110.98 €
	Electricity	21.67 €	23.11 €	27.74 €	25.64 €	24.54 €	24.54 €
	Water	4.19 €	4.39 €	7.34 €	5.41 €	5.33 €	5.33 €
	Cleaning	29.63 €	35.59 €	23.53 €	23.90 €	28.16 €	28.16 €
	Trash	6.49 €	3.55 €	9.83 €	5.41 €	6.32 €	6.32 €
	Security	13.09 €	12.23 €	9.31 €	6.40 €	10.26 €	10.26 €
	Various common center cost	59.99 €	42.95 €	41.54 €	45.02 €	17.83 €	41.46 €
ESS - Costs with Purchasing Department		22.53 €	16.13 €	15.60 €	16.90 €	6.69 €	15.57 €
Total costs per m^2		277.54 €	193.35 €	310.44 €	273.67 €	210.11 €	**253.02 €**

A.2.2.4 ESS Costs AS IS 2018

2018		HCD	HCIS	HCC	HCTV	HCSant	HCSintra	Total
ESS - Warehouse Costs								
Direct Costs:	Others	1,030.68 €	481.84 €	465.16 €	611.22 €	0.00 €	152.64 €	2,741.54 €
Indirect Costs:	Rent	10,691.04 €	5,278.22 €	3,015.98 €	5,662.66 €	5,069.20 €	1,598.98 €	31,316.08 €
	Electricity	2,149.77 €	2,439.97 €	558.20 €	1,126.27 €	1,139.83 €	321.17 €	7,735.22 €
	Water	415.32 €	463.21 €	147.72 €	237.66 €	247.63 €	74.54 €	1,586.09 €
	Cleaning	2,940.35 €	3,757.68 €	465.45 €	1,050.01 €	1,308.17 €	309.95 €	9,831.63 €
	Trash	643.50 €	374.47 €	197.76 €	237.77 €	293.49 €	88.87 €	1,835.86 €
	Security	1,299.19 €	1,290.97 €	187.41 €	281.16 €	476.53 €	107.06 €	3,642.32 €
	Various common center cost	5,952.35 €	4,535.04 €	835.75 €	1,977.90 €	828.06 €	430.27 €	14,559.37 €
ESS - Costs with Purchasing Department		2,235.12 €	1,702.92 €	313.83 €	742.71 €	310.94 €	161.57 €	5,467.07 €
Warehouse Area		98	104	20	43	46	36	**347**
Total costs		27,357.31 €	20,324.33 €	6,187.28 €	11,927.36 €	9,673.85 €	3,245.04 €	**78,715.17 €**

2018		HCD	HCIS	HCC	HCTV	HCSant	HCSintra	Average
ESS - Warehouse annual costs per m^2								
Direct Costs:	Others	10.56 €	4.64 €	23.51 €	14.15 €	0.00 €	12.55 €	10.90 €
Indirect Costs:	Rent	109.58 €	50.84 €	152.44 €	131.08 €	110.98 €	131.50 €	114.40 €
	Electricity	22.03 €	23.50 €	28.21 €	26.07 €	24.96 €	26.41 €	25.20 €
	Water	4.26 €	4.46 €	7.47 €	5.50 €	5.42 €	6.13 €	5.54 €
	Cleaning	30.14 €	36.20 €	23.53 €	24.31 €	28.64 €	25.49 €	28.05 €
	Trash	6.60 €	3.61 €	10.00 €	5.50 €	6.43 €	7.31 €	6.57 €
	Security	13.32 €	12.44 €	9.47 €	6.51 €	10.43 €	8.80 €	10.16 €
	Various common center cost	61.01 €	43.68 €	42.24 €	45.78 €	18.13 €	35.39 €	41.04 €
ESS - Costs with Purchasing Department		22.91 €	16.40 €	15.86 €	17.19 €	6.81 €	13.29 €	15.41 €
Total costs per m^2		280.40 €	195.77 €	312.73 €	276.10 €	211.80 €	266.87 €	**257.28 €**

We used the average values as the unitary cost for the Central Warehouse.

A.2.2.4 ESS Costs TO BE 2018

2018		Central Warehouse
ESS - Warehouse Costs		
Direct Costs:	Others	3,489.60 €
Indirect Costs:	Rent	18,896.34 €
	Electricity	8,064.96 €
	Water	1,773.03 €
	Cleaning	8,977.43 €
	Trash	2,103.65 €
	Security	3,252.32 €
	Various common center cost	13,134.88 €
ESS - Costs with Purchasing Department		4,932.17 €
Warehouse Area		320
Total costs		**64,624.37 €**

A.2.2.4 ESS Costs AS IS 2019

2019		HCD	HCIS	HCC	HCTV	HCSant	HCL	HCSintra	HCT	Total
ESS - Warehouse Costs										
Direct Costs:	Others	1,048.20 €	204.18 €	473.07 €	621.61 €	0.00 €	388.09 €	465.70 €	816.31 €	4,017.15 €
Indirect Costs:	Rent	10,691.04 €	2,199.26 €	3,015.98 €	5,662.66 €	5,069.20 €	3,997.45 €	4,796.94 €	8,468.32 €	43,900.85 €
	Electricity	2,186.32 €	1,033.94 €	567.69 €	1,145.42 €	1,159.21 €	816.58 €	979.90 €	2,444.69 €	10,333.73 €
	Water	422.38 €	196.29 €	150.24 €	241.70 €	251.84 €	189.51 €	227.41 €	468.07 €	2,147.43 €
	Cleaning	2,990.34 €	1,592.32 €	473.36 €	1,067.86 €	1,330.41 €	788.06 €	945.67 €	3,561.13 €	12,749.15 €
	Trash	654.44 €	158.68 €	201.12 €	241.81 €	298.48 €	225.94 €	271.13 €	547.74 €	2,599.35 €
	Security	1,321.27 €	547.05 €	190.60 €	285.94 €	484.63 €	272.20 €	326.64 €	1,382.47 €	4,810.80 €
	Various common center cost	6,053.53 €	1,921.72 €	849.96 €	2,011.53 €	842.14 €	1,093.95 €	1,312.75 €	5,620.48 €	19,706.07 €
ESS - Costs with Purchasing Department		2,273.11 €	721.61 €	319.16 €	755.33 €	316.22 €	410.78 €	492.94 €	2,110.50 €	7,399.66 €
Warehouse Area		98	104	20	43	46	36	36	181	**564**
Total costs		27,640.64 €	8,575.05 €	6,241.19 €	12,033.86 €	9,752.13 €	8,182.56 €	9,819.07 €	25,419.71 €	**107,664.20 €**

2019		HCD	HCIS	HCC	HCTV	HCSant	HCA	HCSintra	HCT	Average
ESS - Warehouse annual costs per m^2										
Direct Costs:	Others	10.74 €	4.72 €	23.91 €	14.39 €	0.00 €	12.77 €	12.77 €	7.73 €	10.88 €
Indirect Costs:	Rent	109.58 €	50.84 €	152.44 €	131.08 €	110.98 €	131.50 €	131.50 €	80.21 €	112.27 €
	Electricity	22.41 €	23.90 €	28.69 €	26.51 €	25.38 €	26.86 €	26.86 €	23.16 €	25.47 €
	Water	4.33 €	4.54 €	7.59 €	5.59 €	5.51 €	6.23 €	6.23 €	4.43 €	5.56 €
	Cleaning	30.65 €	36.81 €	23.93 €	24.72 €	29.13 €	25.92 €	25.92 €	33.73 €	28.85 €
	Trash	6.71 €	3.67 €	10.17 €	5.60 €	6.53 €	7.43 €	7.43 €	5.19 €	6.59 €
	Security	13.54 €	12.65 €	9.63 €	6.62 €	10.61 €	8.95 €	8.95 €	13.09 €	10.51 €
	Various common center cost	62.05 €	44.43 €	42.96 €	46.56 €	18.44 €	35.99 €	35.99 €	53.24 €	42.46 €
ESS - Costs with Purchasing Department		23.30 €	16.68 €	16.13 €	17.48 €	6.92 €	13.51 €	13.51 €	19.99 €	15.94 €
Total costs per m^2		283.30 €	198.23 €	315.45 €	278.56 €	213.51 €	269.17 €	269.17 €	240.77 €	**258.52 €**

A.2.2.4 ESS Costs TO BE 2019

2019		Central Warehouse
ESS - Warehouse Costs		
Direct Costs:	Others	3,481.78 €
Indirect Costs:	Rent	18,896.34 €
	Electricity	8,152.63 €
	Water	1,779.16 €
	Cleaning	9,234.14 €
	Trash	2,109.47 €
	Security	3,362.82 €
	Various common center cost	13,588.19 €
ESS - Costs with Purchasing Department		5,102.39 €
Warehouse Area		320
Total costs		**65,706.93 €**

A.2.2.4 ESS Costs AS IS 2020

2020		HCD	HCC	HCTV	HCSant	HCA	HCSintra	HCL	HCT	Total
ESS - Warehouse Costs										
Direct Costs:	Others	1,067.07 €	481.59 €	632.79 €	0.00 €	279.42 €	158.03 €	470.73 €	1,424.57 €	4,514.20 €
Indirect Costs:	Rent	10,691.04 €	3,015.98 €	5,662.66 €	5,069.20 €	2,827.26 €	1,598.98 €	4,762.95 €	14,517.12 €	48,145.20 €
	Electricity	2,225.67 €	577.91 €	1,166.04 €	1,180.08 €	587.94 €	332.51 €	990.47 €	4,266.32 €	11,326.93 €
	Water	429.98 €	152.94 €	246.05 €	256.38 €	136.45 €	77.17 €	229.86 €	816.85 €	2,345.67 €
	Cleaning	3,044.17 €	481.89 €	1,087.08 €	1,354.36 €	567.40 €	320.90 €	955.87 €	6,214.68 €	14,026.34 €
	Trash	666.22 €	204.74 €	246.17 €	303.85 €	162.68 €	92.00 €	274.05 €	955.88 €	2,905.60 €
	Security	1,345.05 €	194.03 €	291.09 €	493.35 €	195.98 €	110.84 €	330.16 €	2,412.61 €	5,373.12 €
	Various common center cost	6,162.50 €	865.26 €	2,047.74 €	857.29 €	787.64 €	445.46 €	1,326.91 €	9,808.54 €	22,301.34 €
ESS - Costs with Purchasing Department		2,314.03 €	324.91 €	768.93 €	321.92 €	295.76 €	167.27 €	498.26 €	3,683.13 €	8,374.20 €
Warehouse Area		98	20	43	46	22	36	36	181	**481**
Total costs		27,945.73 €	6,299.25 €	12,148.54 €	9,836.42 €	5,840.53 €	3,303.16 €	9,839.26 €	44,099.71 €	**119,312.60 €**

2020		HCD	HCC	HCTV	HCSant	HCA	HCSintra	HCL	HCT	Average
ESS - Warehouse annual costs per m2										
Direct Costs:	Others	10.94 €	24.34 €	14.65 €	0.00 €	13.00 €	13.00 €	13.00 €	7.87 €	12.10 €
Indirect Costs:	Rent	109.58 €	152.44 €	131.08 €	110.98 €	131.50 €	131.50 €	131.50 €	80.21 €	122.35 €
	Electricity	22.81 €	29.21 €	26.99 €	25.84 €	27.35 €	27.35 €	27.35 €	23.57 €	26.31 €
	Water	4.41 €	7.73 €	5.70 €	5.61 €	6.35 €	6.35 €	6.35 €	4.51 €	5.87 €
	Cleaning	31.20 €	24.36 €	25.16 €	29.65 €	26.39 €	26.39 €	26.39 €	34.34 €	27.99 €
	Trash	6.83 €	10.35 €	5.70 €	6.65 €	7.57 €	7.57 €	7.57 €	5.28 €	7.19 €
	Security	13.79 €	9.81 €	6.74 €	10.80 €	9.12 €	9.12 €	9.12 €	13.33 €	10.23 €
	Various common center cost	63.16 €	43.73 €	47.40 €	18.77 €	36.63 €	36.63 €	36.63 €	54.19 €	42.15 €
ESS - Costs with Purchasing Department		23.72 €	16.42 €	17.80 €	7.05 €	13.76 €	13.76 €	13.76 €	20.35 €	15.83 €
Total costs per m2		286.43 €	318.38 €	281.22 €	215.36 €	271.65 €	271.65 €	271.65 €	243.66 €	**270.00 €**

A.2.2.4 ESS Costs TO BE 2020

2020		Central Warehouse
ESS - Warehouse Costs		
Direct Costs:	Others	3,872.16 €
Indirect Costs:	Rent	18,896.34 €
	Electricity	8,419.94 €
	Water	1,880.27 €
	Cleaning	8,956.98 €
	Trash	2,300.75 €
	Security	3,272.98 €
	Various common center cost	13,489.09 €
ESS - Costs with Purchasing Department		5,065.18 €
Warehouse Area		320
Total costs		**66,153.69 €**

A.2.2.4 ESS Costs AS IS 2021

2021		HCD	HCC	HCTV	HCSant	HCA	HCSintra	HCL	HCT	Total
ESS - Warehouse Costs										
Direct Costs:	Others	1,086.27 €	490.25 €	644.19 €	0.00 €	284.45 €	160.87 €	479.20 €	1,450.21 €	4,595.45 €
Indirect Costs:	Rent	10,691.04 €	3,015.98 €	5,662.66 €	5,069.20 €	2,827.26 €	1,598.98 €	4,762.95 €	14,517.12 €	48,145.20 €
	Electricity	2,265.73 €	588.31 €	1,187.02 €	1,201.32 €	598.52 €	338.50 €	1,008.29 €	4,343.12 €	11,530.82 €
	Water	437.72 €	155.69 €	250.48 €	260.99 €	138.90 €	78.56 €	234.00 €	831.55 €	2,387.90 €
	Cleaning	3,098.96 €	490.56 €	1,106.65 €	1,378.74 €	577.61 €	326.67 €	973.08 €	6,326.54 €	14,278.81 €
	Trash	678.22 €	208.43 €	250.60 €	309.32 €	165.60 €	93.66 €	278.99 €	973.09 €	2,957.90 €
	Security	1,369.27 €	197.52 €	296.33 €	502.23 €	199.51 €	112.83 €	336.11 €	2,456.04 €	5,469.84 €
	Various common center cost	6,273.42 €	880.84 €	2,084.60 €	872.72 €	801.82 €	453.48 €	1,350.79 €	9,985.10 €	22,702.77 €
ESS - Costs with Purchasing Department		2,355.68 €	330.76 €	782.77 €	327.71 €	301.09 €	170.28 €	507.22 €	3,749.42 €	8,524.93 €
Warehouse Area		98	20	43	46	22	36	36	181	**481**
Total costs		28,256.32 €	6,358.35 €	12,265.28 €	9,922.23 €	5,894.77 €	3,333.83 €	9,930.63 €	44,632.20 €	**120,593.61 €**

2021		HCD	HCC	HCTV	HCSant	HCA	HCSintra	HCL	HCT	Average
ESS - Warehouse annual costs per m2										
Direct Costs:	Others	11.13 €	24.78 €	14.91 €	0.00 €	13.23 €	13.23 €	13.23 €	8.01 €	12.32 €
Indirect Costs:	Rent	109.58 €	152.44 €	131.08 €	110.98 €	131.50 €	131.50 €	131.50 €	80.21 €	122.35 €
	Electricity	23.22 €	29.74 €	27.48 €	26.30 €	27.84 €	27.84 €	27.84 €	24.00 €	26.78 €
	Water	4.49 €	7.87 €	5.80 €	5.71 €	6.46 €	6.46 €	6.46 €	4.59 €	5.98 €
	Cleaning	31.76 €	24.79 €	25.62 €	30.19 €	26.87 €	26.87 €	26.87 €	34.96 €	28.49 €
	Trash	6.95 €	10.53 €	5.80 €	6.77 €	7.70 €	7.70 €	7.70 €	5.38 €	7.32 €
	Security	14.03 €	9.98 €	6.86 €	11.00 €	9.28 €	9.28 €	9.28 €	13.57 €	10.41 €
	Various common center cost	64.30 €	44.52 €	48.25 €	19.11 €	37.29 €	37.29 €	37.29 €	55.17 €	42.90 €
ESS - Costs with Purchasing Department		24.14 €	16.72 €	18.12 €	7.17 €	14.00 €	14.00 €	14.00 €	20.72 €	16.11 €
Total costs per m2		289.61 €	321.37 €	283.92 €	217.24 €	274.18 €	274.18 €	274.18 €	246.60 €	**272.66 €**

A.2.2.4 ESS Costs TO BE 2021

2021		Central Warehouse
ESS - Warehouse Costs		
Direct Costs:	Others	3,941.86 €
Indirect Costs:	Rent	18,896.34 €
	Electricity	8,571.50 €
	Water	1,914.12 €
	Cleaning	9,118.20 €
	Trash	2,342.17 €
	Security	3,331.89 €
	Various common center cost	13,731.89 €
ESS - Costs with Purchasing Department		5,156.35 €
Warehouse Area		320
Total costs		**67,004.32 €**

A.2.2.4 ESS Costs AS IS 2022

2022		HCD	HCC	HCTV	HCSant	HCA	HCSintra	HCL	HCT	Total
ESS - Warehouse Costs										
Direct Costs:	Others	1,105.83 €	499.08 €	655.78 €	0.00 €	289.57 €	163.77 €	487.83 €	1,476.32 €	4,678.17 €
Indirect Costs:	Rent	10,691.04 €	3,015.98 €	5,662.66 €	5,069.20 €	2,827.26 €	1,598.98 €	4,762.95 €	14,517.12 €	48,145.20 €
	Electricity	2,306.52 €	598.90 €	1,208.39 €	1,222.94 €	609.29 €	344.59 €	1,026.44 €	4,421.29 €	11,738.37 €
	Water	445.60 €	158.50 €	254.99 €	265.69 €	141.40 €	79.97 €	238.21 €	846.52 €	2,430.88 €
	Cleaning	3,154.74 €	499.39 €	1,126.57 €	1,403.55 €	588.01 €	332.55 €	990.59 €	6,440.42 €	14,535.83 €
	Trash	690.42 €	212.18 €	255.11 €	314.88 €	168.59 €	95.34 €	284.01 €	990.61 €	3,011.14 €
	Security	1,393.91 €	201.08 €	301.66 €	511.27 €	203.10 €	114.87 €	342.16 €	2,500.25 €	5,568.30 €
	Various common center cost	6,386.35 €	896.69 €	2,122.12 €	888.43 €	816.26 €	461.64 €	1,375.11 €	10,164.83 €	23,111.42 €
ESS - Costs with Purchasing Department		2,398.08 €	336.71 €	796.86 €	333.61 €	306.51 €	173.35 €	516.35 €	3,816.91 €	8,678.38 €
Warehouse Area		98	20	43	46	22	36	36	181	**481**
Total costs		28,572.49 €	6,418.51 €	12,384.13 €	10,009.59 €	5,949.99 €	3,365.06 €	10,023.65 €	45,174.27 €	**121,897.68 €**

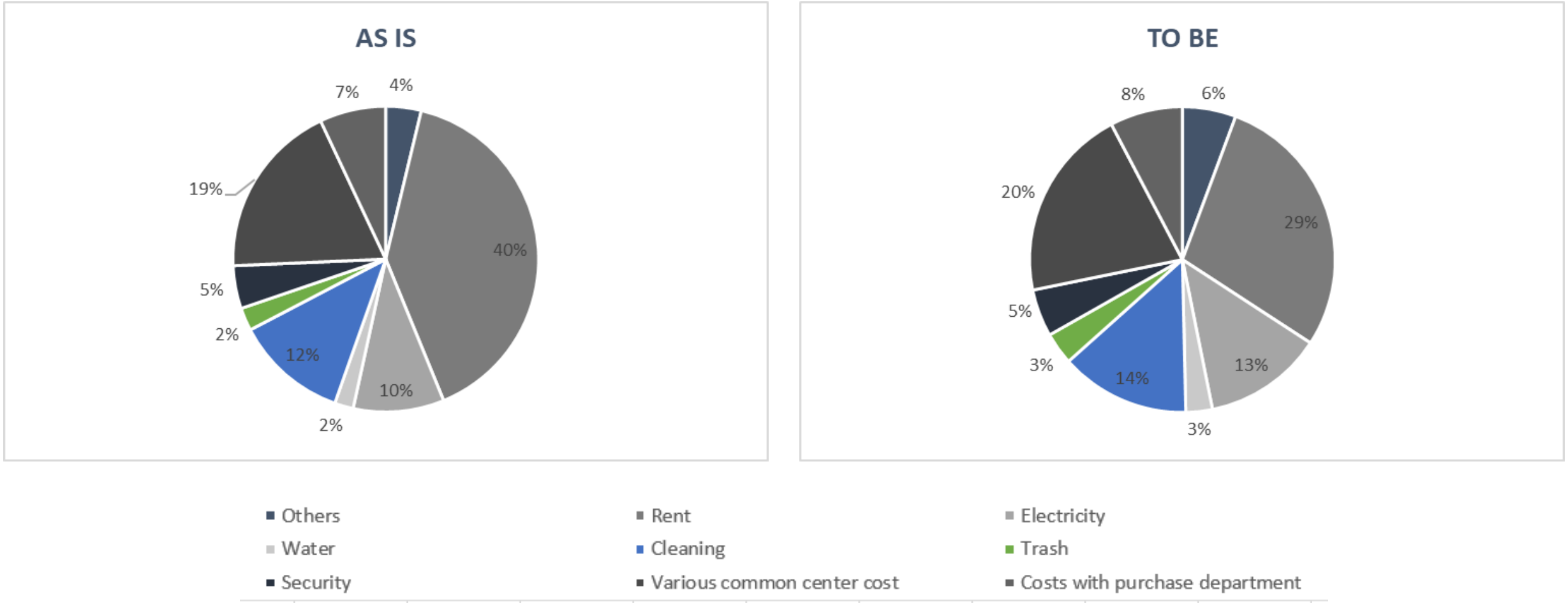
2022		HCD	HCC	HCTV	HCSant	HCA	HCSintra	HCL	HCT	Average
ESS - Warehouse annual costs per m2										
Direct Costs:	Others	11.33 €	25.23 €	15.18 €	0.00 €	13.47 €	13.47 €	13.47 €	8.16 €	12.54 €
Indirect Costs:	Rent	109.58 €	152.44 €	131.08 €	110.98 €	131.50 €	131.50 €	131.50 €	80.21 €	122.35 €
	Electricity	23.64 €	30.27 €	27.97 €	26.77 €	28.34 €	28.34 €	28.34 €	24.43 €	27.26 €
	Water	4.57 €	8.01 €	5.90 €	5.82 €	6.58 €	6.58 €	6.58 €	4.68 €	6.09 €
	Cleaning	32.33 €	25.24 €	26.08 €	30.73 €	27.35 €	27.35 €	27.35 €	35.58 €	29.00 €
	Trash	7.08 €	10.72 €	5.91 €	6.89 €	7.84 €	7.84 €	7.84 €	5.47 €	7.45 €
	Security	14.29 €	10.16 €	6.98 €	11.19 €	9.45 €	9.45 €	9.45 €	13.81 €	10.60 €
	Various common center cost	65.46 €	45.32 €	49.12 €	19.45 €	37.97 €	37.97 €	37.97 €	56.16 €	43.68 €
ESS - Costs with Purchasing Department		24.58 €	17.02 €	18.45 €	7.30 €	14.26 €	14.26 €	14.26 €	21.09 €	16.40 €
Total costs per m2		292.85 €	324.41 €	286.67 €	219.15 €	276.74 €	276.74 €	276.74 €	249.60 €	**275.36 €**

A.2.2.4 ESS Costs TO BE 2022

2022		Central Warehouse
ESS - Warehouse Costs		
Direct Costs:	Others	4,012.81 €
Indirect Costs:	Rent	18,896.34 €
	Electricity	8,725.79 €
	Water	1,948.57 €
	Cleaning	9,282.33 €
	Trash	2,384.33 €
	Security	3,391.86 €
	Various common center cost	13,979.07 €
ESS - Costs with Purchasing Department		5,249.17 €
Warehouse Area		320
Total costs		**67,870.27 €**

A.2.2.4 ESS

Weight of Costs in Total ESS



AGENDA

A.2

Medicines Warehouse: Centralized vs Decentralized

i. Recommendation

ii. **Costs Analysis**

- i. Stocks
- ii. FTE's
- iii. Areas & Revenues
- iv. ESS
- v. **CAPEX**

A.2.2.5 CAPEX – AS IS

Investment	Cost	Total Cost
4 New repackaging machines	29 mil euros/ machine	116 mil euros
Maintenance Contracts	1 500 euros per year/ machine	40 500 euros
	Total CAPEX	156 500 euros

A.2.2.5 CAPEX – TO BE

Investment	Cost	Total Cost
Infrastructures such as ventilation, refrigeration and extraction systems	300 euros per square meter	96 000 euros
Shelves, computers, fridges, safes, office supplies and so on	Not taken into consideration	Not taken into consideration
New repackaging machines capable of ampules repackaging	75 000 + 7500 (maintenance)	82 500 euros
	Total CAPEX	178 500 euros

A.2.2.5 CAPEX – Repackaging Machine

	Features
Model/ Manufacturer	Calypso Easy / Sinteco
Price	75 000 euros
Maintenance Cost	1500 euros/year
Capacity	1000 (average); 1200 (max) doses/hour
Types of medicine	Blisters, Capsules, Bottles, Ampoules, Syringes

AGENDA

A.1 Diagnosis

A.2 Medicines Warehouse: Centralized vs Decentralized
- i. Recommendation
- ii. Centralized warehouse and purchasing department
- iii. Costs Analysis

A.3 **Unitary Doses: Centralized vs Point-of-Care**
- i. **Distribution**
- ii. CAPEX

A.4 Galenic Formulation
- i. Recommendation
- ii. Areas

A.5 Implementation, Risks & Mitigations

A.3.1 Decentralized Unitary Doses

Route Norte

2018

5x a week, daily
CW
HCD
HCC
HCS
HCTV
Hsant
CW

	Daily
Distance	267
Travel time with stops	303
Total time per route	5,05
Gas	40,00 €
Tolls	16,65 €
# FTE	0,75
Total	56,65 €

2019

5x a week, daily
CW
HCD
HCC
HCS
HCTV
HC Leiria
Hsant
CW

	Daily
Distance	371
Travel time with stops	385
Total time per route	6,42
Gas	55,50 €
Tolls	22,75 €
# FTE	1
Total	**78,25 €**

2020

5x a week, daily
CW
HCD
HC Almada
HCC
HCS
HCTV
HC Leiria
Hsant
CW

	Daily
Distance	391
Travel time with stops	429
Total time per route	7,15
Gas	58,46 €
Tolls	26,25 €
# FTE	1
Total	**84,71 €**

Route Tejo

2018

6 times a week, 2x a day
CW
HCD
HCIS
CW

	Daily
Distance	23
Travel time with stops	98
Total time per route	1,63
Gas	3,41 €
Tolls	0,00 €
# FTE	0,5
Total	**3,41 €**

2019

6 times a week, 2x a day
CW
HCD
HCT
CW

	Daily
Distance	23
Travel time with stops	98
Total time per route	1,63
Gas	3,41 €
Tolls	0,00 €
# FTE	1
Total	**3,41 €**

2020

6 times a week, 2x a day
CW
HCD
HCT
CW

	Daily
Distance	23
Travel time with stops	98
Total time per route	1,63
Gas	3,41 €
Tolls	0,00 €
# FTE	1
Total	**3,41 €**

Route Clinics

2018

3x a week
CW
HCD
C Alvalade
C Almada
C Belém
C Miraflores
C S. Domingos
C Mafra
CW

	Daily
Distance	138
Travel time with stops	275
Total time per route	4,58
Gas	20,70 €
Tolls	4,95 €
# FTE	0,75
Total	**25,65 €**

2019

3x a week
CW
HCD
C Alvalade
C Almada
C Belém
C Miraflores
C S. Domingos
C Mafra
CW

	Daily
Distance	138
Travel time with stops	275
Total time per route	4,58
Gas	20,70 €
Tolls	4,95 €
# FTE	1
Total	**25,65 €**

2020

3x a week
CW
HCD
C Alvalade
C Belém
C Miraflores
C S. Domingos
C Mafra
CW

	Daily
Distance	112
Travel time with stops	244
Total time per route	4,07
Gas	16,76 €
Tolls	3,20 €
# FTE	1
Total	**19,96 €**

A.3.1 Centralized Unitary Doses

Route Norte

2018

5x a week, daily
CW
HCD
HCC
HCS
HCTV
Hsant
CW

	Daily
Distance	535
Travel time with stops	606
Total time per route	10,1
Gas	160,01 €
Tolls	33,30 €
# FTE	2
Total	193,31 €

2019

5x a week, daily
CW
HCD
HCC
HCS
HCTV
HC Leiria
Hsant
CW

	Daily
Distance	742
Travel time with stops	770
Total time per route	12,83
Gas	222,01 €
Tolls	45,50 €
# FTE	2
Total	**267,51 €**

2020

5x a week, daily
CW
HCD
HC Almada
HCC
HCS
HCTV
HC Leiria
Hsant
CW

	Daily
Distance	782
Travel time with stops	858
Total time per route	14,3
Gas	233,85 €
Tolls	52,50 €
# FTE	2
Total	**286,35 €**

Route Tejo

2018

6 times a week, 2x a day
CW
HCD
HCIS
CW

	Daily
Distance	46
Travel time with stops	196
Total time per route	3,27
Gas	13,64 €
Tolls	0,00 €
# FTE	0,5
Total	**13,64 €**

2019

6 times a week, 2x a day
CW
HCD
HCT
CW

	Daily
Distance	46
Travel time with stops	196
Total time per route	3,27
Gas	13,64 €
Tolls	0,00 €
# FTE	1
Total	**13,64 €**

2020

6 times a week, 2x a day
CW
HCD
HCT
CW

	Daily
Distance	46
Travel time with stops	196
Total time per route	3,27
Gas	13,64 €
Tolls	0,00 €
# FTE	1
Total	**13,64 €**

Route Clinics

2018

3x a week
CW
HCD
C Alvalade
C Almada
C Belém
C Miraflores
C S. Domingos
C Mafra
CW

	Daily
Distance	138
Travel time with stops	275
Total time per route	4,58
Gas	20,70 €
Tolls	4,95 €
# FTE	0,75
Total	**25,65 €**

2019

3x a week
CW
HCD
C Alvalade
C Almada
C Belém
C Miraflores
C S. Domingos
C Mafra
CW

	Daily
Distance	138
Travel time with stops	275
Total time per route	4,58
Gas	20,70 €
Tolls	4,95 €
# FTE	1
Total	**25,65 €**

2020

3x a week
CW
HCD
C Alvalade
C Belém
C Miraflores
C S. Domingos
C Mafra
CW

	Daily
Distance	224
Travel time with stops	488
Total time per route	8,13
Gas	67,02 €
Tolls	6,40 €
# FTE	1
Total	**73,42 €**

A.3.1 Total Costs

Total Distribution Costs - Decentralized Unitary Doses

	2018	2019	2020	2021	2022	5 years
Gas & Tolls	20 860 €	26 476 €	27 452 €	27 550 €	27 649 €	129 987 €
Renting Trucks	28 800 €	43 200 €	43 200 €	43 200 €	43 200 €	201 600 €
FTE	22 740 €	34 690 €	35 315 €	35 950 €	36 597 €	165 293 €
Distribution Total	72 401 €	104 366 €	105 967 €	106 700 €	107 447 €	**496 880 €**

Total Distribution Costs - Centralized Unitary Doses

	2018	2019	2020	2021	2022	5 years
Gas & Tolls	62 777 €	82 067 €	95 124 €	95 496 €	95 875 €	431 340 €
Renting Trucks	57 600 €	57 600 €	57 600 €	57 600 €	57 600 €	288 000 €
FTE	34 110 €	46 254 €	47 086 €	47 934 €	48 797 €	224 181 €
Distribution Total	154 487 €	185 921 €	199 811 €	201 030 €	202 272 €	**943 521 €**

AGENDA

A.1 Diagnosis

A.2 Medicines Warehouse: Centralized vs Decentralized
- i. Recommendation
- ii. Centralized warehouse and purchasing department
- iii. Costs Analysis

A.3 **Unitary Doses: Centralized vs Point-of-Care**
- i. Distribution
- **ii. CAPEX**

A.4 Galenic Formulation
- i. Recommendation
- ii. Areas

A.5 Implementation, Risks & Mitigations

A.3.2 CAPEX - PDA

Nº PDAs per Point-of-Care

	Category A x2	Category B x6	Clinics x5
Operating Room	1	1	-
Intermediate & Intensive CU	1	1	-
Hospital Admission	4	1	-
Urgencies	1	-	-
Gastroenterology	1	1	-
Others	4	2	1
Total	**12**	**6**	**1**

- QR code recognition
- Glintt Software Included
- Price **600 euros.**

A.3.2 CAPEX - Cabinets

Cabinets per Hospital

	Double Shelves	Simple Shelves	Total	Total €
HCIS/ HCT	8	7	15	€ 28 900
HCD	-	-	-	-
HCTV	2	-	2	€ 4 600
HCC	2	-	2	€ 4 600
HC Sant	2	-	2	€ 4 600
HC Sintra	2	-	2	€ 4 600
HC Leiria	2	-	2	€ 4 600
HC Almada	2	-	2	€ 4 600
Clinics	-	-	-	-
TOTAL	20	7	27	**€ 56 500**

AGENDA

A.1 Diagnosis

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A.3 Unitary Doses: Centralized vs Point-of-Care
- i. Recommendation
- ii. Costs Analysis

A.4 **Galenic Formulation**
- i. **Recommendation**
- ii. Areas

A.5 Implementation, Risks & Mitigations

A.4.1 Galenic Formulation – Legal Analysis

To perform sterile manipulation at Central Warehouse, JMS need to request Infarmed a manufacturing license. JMS can also ask Infarmed to extend its current hospital license to the Central Warehouse.

MANIPULAÇÃO ESTÉRIL

REGIME JURÍDICO DOS MEDICAMENTOS DE USO HUMANO (Lei n.º 51/2014, de 25 de Agosto)
DL n.º 176/2006, de 30 de Agosto (versão actualizada)

Artigo 3.º
Definições
w) «Fórmula magistral», qualquer medicamento preparado numa farmácia de oficina ou serviço farmacêutico hospitalar, segundo uma receita médica e destinado a um doente
determinado;

CAPÍTULO III
Fabrico, importação e exportação
SECÇÃO I Fabrico Artigo 55.º

Âmbito de aplicação
1 - O fabrico, total ou parcial, de medicamentos no território nacional está sujeito a autorização do INFARMED, I.P.
2 - A autorização de fabrico é igualmente exigida para as operações de divisão, acondicionamento, primário ou secundário, ou apresentação.
....
4 - Excetuam-se do disposto nos números anteriores:
a) As operações de preparação, divisão, alteração de acondicionamento ou apresentação efetuadas em farmácias por farmacêuticos ou outras pessoas legalmente habilitadas, com vista à dispensa de medicamentos;

A.4.1 Galenic Formulation – Legal Analysis

Artigo 56.º
Requisitos
1 - A autorização de fabrico é requerida pela pessoa singular ou coletiva que fabrique ou pretenda fabricar medicamentos no território nacional.
2 - Sob pena de indeferimento, o requerimento:
a) Especifica os medicamentos a fabricar e as respetivas formas farmacêuticas;
b) Indica o local de fabrico ou de controlo;
c) Assegura o cumprimento das exigências técnicas e legais em matéria de direção técnica, instalações, equipamentos e possibilidades de controlo;
d) Identifica o diretor técnico.
3 - A autorização só é concedida se o requerente dispuser de instalações devidamente licenciadas e de equipamentos adequados, com as características estabelecidas na legislação aplicável, cumprindo as boas práticas de fabrico previstas na lei.
4 - Os requisitos previstos nos números anteriores devem estar preenchidos na data da apresentação do requerimento, cabendo ao requerente comprovar os elementos e dados
constantes do requerimento.
5 - O cumprimento dos requisitos referidos no n.º 3 é confirmado pelos serviços competentes do INFARMED, I.P., designadamente por via de inspeção ou inquérito, antes da decisão de concessão ou recusa da autorização

Artigo 60.º
Diretor técnico
1 - O titular de autorização de fabrico fica obrigado a dispor, de forma permanente e efetiva, de um diretor técnico, que assume as obrigações previstas no artigo seguinte.
2 - O titular da autorização pode assumir a função de diretor técnico, desde que reúna as condições definidas no presente decreto-lei.
3 - As funções de diretor técnico são assumidas por farmacêutico especialista em indústria farmacêutica, inscrito na Ordem dos Farmacêuticos e sujeito aos deveres resultantes do
Decreto-Lei n.º 288/2001, de 10 de novembro, na redação que lhe foi conferida pelo
Decreto-Lei n.º 134/2005, de 16 de agosto.

A.4.1 Galenic Formulation – Legal Analysis

To perform non-sterile manipulation at Central Warehouse, JMS need to request Infarmed a manufacturing license. JMS can also ask Infarmed to extend its current hospital license to the Central Warehouse.

PREPARADOS NÃO ESTÉREIS

REGIME JURÍDICO DOS MEDICAMENTOS DE USO HUMANO (Lei n.º 51/2014, de 25 de Agosto)
DL n.º 176/2006, de 30 de Agosto (versão actualizada)

Artigo 3.º
Definições

bbb) «Preparado oficinal», qualquer medicamento preparado segundo as indicações compendiais de uma farmacopeia ou de um formulário oficial, numa farmácia de oficina ou em serviços farmacêuticos hospitalares, destinado a ser dispensado diretamente aos doentes assistidos por essa farmácia ou serviço

CAPÍTULO III
Fabrico, importação e exportação
SECÇÃO I Fabrico Artigo 55.º

Âmbito de aplicação
1 - O fabrico, total ou parcial, de medicamentos no território nacional está sujeito a autorização do INFARMED, I.P.
2 - A autorização de fabrico é igualmente exigida para as operações de divisão, acondicionamento, primário ou secundário, ou apresentação.
....
4 - Excetuam-se do disposto nos números anteriores:
a) As operações de preparação, divisão, alteração de acondicionamento ou apresentação efetuadas em farmácias por farmacêuticos ou outras pessoas legalmente habilitadas, com vista à dispensa de medicamentos;

A.4.1 Galenic Formulation – Legal Analysis

Artigo 56.º
Requisitos
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2 - Sob pena de indeferimento, o requerimento:
a) Especifica os medicamentos a fabricar e as respetivas formas farmacêuticas;
b) Indica o local de fabrico ou de controlo;
c) Assegura o cumprimento das exigências técnicas e legais em matéria de direção técnica, instalações, equipamentos e possibilidades de controlo;
d) Identifica o diretor técnico.
3 - A autorização só é concedida se o requerente dispuser de instalações devidamente licenciadas e de equipamentos adequados, com as características estabelecidas na legislação aplicável, cumprindo as boas práticas de fabrico previstas na lei.
4 - Os requisitos previstos nos números anteriores devem estar preenchidos na data da apresentação do requerimento, cabendo ao requerente comprovar os elementos e dados
constantes do requerimento.
5 - O cumprimento dos requisitos referidos no n.º 3 é confirmado pelos serviços competentes do INFARMED, I.P., designadamente por via de inspeção ou inquérito, antes da decisão de concessão ou recusa da autorização

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A.3 Unitary Doses: Centralized vs Point-of-Care
- i. Recommendation
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A.4 **Galenic Formulation**
- i. Recommendation
- ii. **Areas**

A.5 Implementation, Risks & Mitigations

A.4.2 Areas required by Infarmed

	Compartment Name	Compartment Function	Area (m2)
Production of Sterile formualtions / parenteral nutrition	Antechamber	Area dedicated the pharmacist: changes clothes and takes all necessary higienic precautions	14
	Preparation room	Preparation of sterile medication / parenteral nutrition	10
Production of cytotoxic products	Antechamber	Area dedicated the pharmacist: changes clothes and takes all necessary hygienic precautions	14
	Preparation room	Preparation of cytotoxic medication	10
Production of standardized formulations	Preparation room	2 spaces/rooms for preparation of standardized formulations	30
Control laboratory	Laboratory	Analysis of raw materials, work in progress and finished medication	10
		Total	88

AGENDA

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- ii. Costs Analysis

A.4 Galenic Formulation
- i. Recommendation
- ii. Costs Analysis

A.5 Implementation, Risks & Mitigations

A.5 Implementation Activities

Preparing the Warehouse	Main tasks and activities
Choosing the warehouse	• Final decision on which warehouse to choose does not depend on the centralization of the pharmacy
Getting the required licenses	• Communicate with the Infarmed – Head of Hospital Pharmacies and Executive Administrator at JMS • Prepare and hand in all necessary documents for evaluation by the Infarmed • The Infarmed visits and studies the conditions in the warehouse
Preparing the infrastructure and information system	• Study the optimal logistics in the warehouse, in terms of location of the following areas: reception, storage and expedition • Site construction • Buy and redistribute the equipment for the central warehouse • Verify security conditions in the central warehouse and secure temperature and humidity control • Plan daily schedule of working and opening hours, specific times for reception and expedition

A.5 Implementation Activities

Internal Organization	Main tasks and activities
Communicating with suppliers	• Meeting with suppliers, in order to clarify the changes in delivery location and new delivery schedules • Negotiation for potential gains, due to less and shorter delivery routes
Communicating internally and reallocation of Human Resources	• Develop an internal change management plan, in order to inform the employees of the changes • Communicate with the employees to understand their preferences in terms of location, schedules and skills • Training period for all employees who will be working in the central warehouse
Communicating with distributers (outsourcing)	• Get in touch with the chosen distributor • Meeting with the aim of clarifying the conditions, such as frequency of delivery, price of distribution and transport conditions

A.5 Implementation Activities

Transferring the activity	Main tasks and activities
Pilot with Category B Hospital (e.g.HCC)	• Transfer the stock and employees to the central warehouse • Monitor the results, also in terms of stock management • Develop solutions to optimize processes
Category B Hospitals and Clinics	• Transfer the activities of middle-sized hospitals to the central warehouse • Transfer the clinics activities
HCD + HCT	• Transfer the activity at HCT and HCD