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# Implementing Distribution Requirement Planning in Medan City Health Department's Medicine Distribution System

**Salsabila Isnain Nuha[1)*], Suendri[2)], Aninda Muliani Harahap[3)]**
[1)2)3)]Universitas Islam Negeri Sumatera Utara, Medan, Indonesia
[1)]salsaa086@gmail.com, [2)]suendri@uinsu.ac.id, [3)]anindamh@uinsu.ac.id

**ABSTRACT**

One of the pharmacy installations located in the Medan city area was tasked with overseeing the management of pharmaceutical inventory for public health facilities, ensuring adequate stock levels, and processing medication-related data, including receiving supplies and LPLPO forms from 41 Public Health Centers. Supervisors at the pharmacy installation were responsible for dispensing medications, while medication managers at the Public Health Centers handled medication requests by completing LPLPO forms and sending them to the installation. Issues arose regarding the accuracy of medication data within its operations, encompassing aspects such as initial stock, receipt of medications, inventory management, medication disbursement (including usage, damaged, or expired items), remaining stock, medication requests, and discrepancies between reported and actual medication quantities. The objective of this study was to establish a web-based data processing system utilizing the Distribution Requirement Planning (DRP) methodology. The DRP approach offered significant insights for forecasting medication stock demands and effectively guided the pharmacy installation in meeting the medication needs of the Public Health Centers. Furthermore, the DRP method shed light on the distribution process costs, thus serving as a valuable tool for enhancing cost efficiency and effectiveness. Results obtained through the DRP approach provided a more efficient distribution process, yielding a notable 93% reduction in expenditure. Additionally, the DRP method successfully anticipated future requirements by employing structured calculations that delineated demand levels experienced by each Public Health Center, accounting for the distinct needs of each facility.

**Keywords:** DRP; Distribution; Medication; Public Health Center; Website

## INTRODUCTION

The Information System was a combination of information technology and human activities utilizing this technology to support operations and management. It was used to store and analyze input data, as well as generate report formats reflecting the provided data (Batubara & Nasution, 2023). Stock management operations were part of the logistical activities of an organization, encompassing locations, facilities, distribution, inventory, communication, administration, and storage. Stock management involved understanding the planning process, determining needs, storage, distribution, and maintenance (Janah et al., 2022). Computerized information systems were utilized in nearly every department and governmental sector, including the Health Resource and Health Office sectors that accommodated the Pharmacy Installation. The Health Service Pharmacy Installation in Medan City was tasked with storing and distributing health supplies, which were then provided to community health facilities in Medan. Medications were distributed to provide the appropriate types and quantities of inventory, while also preventing stock shortages, accumulation, and maintaining stock levels. The Pharmacy Installation had to effectively handle medicine data due to the diverse responsibilities associated with medicine management. Medicine data management included receiving medicines from suppliers and receiving LPLPO data (Usage Reports and Medicine Request Sheets) in paper form from 41 Public health centers in Medan, distributing medicines to public health centers, managing Pharmacy Installation/Public health center inventory, and bookkeeping. Medicines were distributed at the Medan City Pharmacy Installation by all room supervisors, while medicine requests were handled by Public health center medicine managers. Public health centers received a direct medicine delivery system from the pharmacy installation, while medicine requests were made by filling out LPLPO (usage and medicine request sheets) from the public health centers to the Pharmacy Installation. There were still issues with the accuracy of medicine data in its activities, such as initial stock, medicine receipts, medicine inventory, medicine disbursement (usage, damaged/expired), remaining stock, medicine requests, and discrepancies between reported and actual medicine quantities.

The project aimed to build a web-based data processing system by adopting the Distribution Requirement Planning (DRP) technique, which could assist in processing medicine distribution data. The anticipated benefits of

* Corresponding author

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medicine distribution data processing at the Medan City Health Office could cover all existing processes. Supported by previous research (Muttaqin et al., 2020) titled "Design and Scheduling of Household Product Distribution Activities Using the Distribution Requirement Planning (DRP) Method at PT. XYZ to Align Product Deliveries to Retailers," it achieved success in satisfying client demands to an ideal level, increasing sales performance by delivering orders on time and in the right quantity, and reducing the delivery of large or small-sized goods. Cost efficiency in delivery was also achieved, where the difference between actual delivery costs and projections resulted in savings.

The DRP method itself could be used for medicine distribution to public health centers, where this method could provide valuable information for planning and forecasting medicine stock demand. Thus, the Medan City Health Office Pharmacy Installation was capable of providing sufficient medicine stock to meet public health center demands. Furthermore, the DRP method provided information on the costs incurred during the distribution process, making it a guide for cost efficiency and effectiveness in distribution. The goal of this project was to build a web-based data processing system using the DRP method, with the hope of addressing existing issues in medicine distribution at the Medan City Pharmacy Installation and improving efficiency and effectiveness in medicine stock management. The implementation of the DRP method would provide a solution to a more efficient medicine distribution process, with a reduction in distribution costs of up to 93%. Additionally, the DRP method was expected to provide the necessary information for planning and forecasting medicine stock demand, as well as identifying future needs based on varying demand levels from each Public health center.

## LITERATURE REVIEW

In 2019, a study was conducted on the scheduling system for the distribution of motorcycle products using the Distribution Requirement Planning (DRP) method at PT. Nusantara Surya Sakti (NSS) branch in Kefamenanu. The results of the study indicated that the PT NSS Kefamenanu branch had successfully addressed issues related to product fulfillment by minimizing stockpiles and inventory gaps in each warehouse (Kelen & Sikas, 2019).

In the same year, another study titled "Design and Scheduling of Household Product Distribution Activities Using the Distribution Requirement Planning (DRP) Method at PT. XYZ to Align Product Deliveries to Retail" was conducted. This study also demonstrated an improvement in performance in fulfilling orders according to schedule and correct quantity using the DRP method. The research findings indicated a reduction in product deliveries that did not meet specifications, along with achieving cost efficiency in delivery (Muttaqin et al., 2020).

Subsequently, in 2022, a study was conducted on the Web-based Distribution Management Information System at PT. Artomo Pangan Indonesia. The results of this study showed that the system was capable of managing data collection, procurement, and delivery management, as well as managing inventory data using stock in & stock out features. This system also enhanced the transparency of the delivery process through confirmation of goods receipt (Pribadi & Arsad, 2022).

Through previous research used as references in the development of this study, innovations were identified such as the management of pharmacy/health center inventory and bookkeeping. This study not only focused on design and calculations but also included the development of a website application that could be implemented and utilized effectively. This application utilized the DRP method for medicine distribution to public health centers, providing essential information for planning and forecasting medicine stock demand. Consequently, the Pharmacy Installation of the Medan City Health Office could provide sufficient medicine stock to meet the demands of public health centers.

## METHOD

This research employed the Research & Development (R&D) method to gather data, which is a specific approach aimed at producing and testing new products according to specific needs. Additionally, the Rapid Application Development (RAD) approach was also applied in system development. RAD is known as a rapid and iterative software development method, focusing on developing products that provide quick benefits to users. The combination of these two methods was expected to enhance the validity, quality, and effectiveness of this research (Syahranitazli & Samsudin, 2023).

### Research Methodology

This study employed the Research and Development (R&D) method. According to Sugiyono (2017), R&D is a research approach aimed at developing and testing the effectiveness of a product or program. The development research technique consists of two primary objectives: designing a product and evaluating its efficiency in achieving its intended goals. The initial objective is referred to as the development function, while the subsequent one is known as validation. Thus, development research can be more accurately described as a series of development activities

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accompanied by validation efforts (Syahputra et al., 2024). This research utilized 8 stages of Research and Development (R&D) as follows:

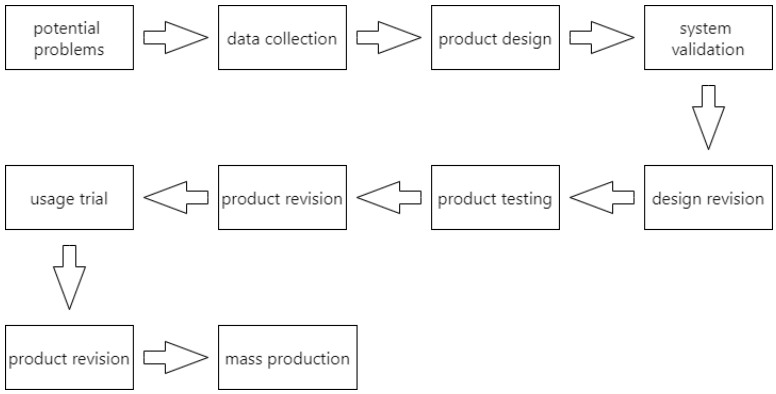


Fig 1. R&D Method (Fakhri et al., 2021)

The study commenced by identifying potential challenges and issues within the research object, where "potential" referred to elements that added value to the researched product, while "issues" signified the gap between expectations and reality, serving as the basis for further investigation. The subsequent step involved the collection of relevant data and information following the identification of potential issues, which formed the foundation for designing product developments aimed at addressing existing problems, including clarification of concepts or theoretical frameworks that strengthened the resulting product. To develop a new operational system, an examination of the performance of existing systems was conducted to identify weaknesses, leading to the formulation of a new product design that efficiently managed the distribution of medication between public health centers and healthcare facilities. Subsequently, design validation was carried out to ensure the superiority of the new design, and identified weaknesses were then rectified to facilitate product evaluation. The product underwent testing to compare effectiveness and efficiency with the old system, with the test results serving as the basis for product revisions. This evaluation and revision process paved the way for the implementation of the new system, which still required ongoing reviews to identify emerging issues to be addressed as needed.

**System Development Methodology**

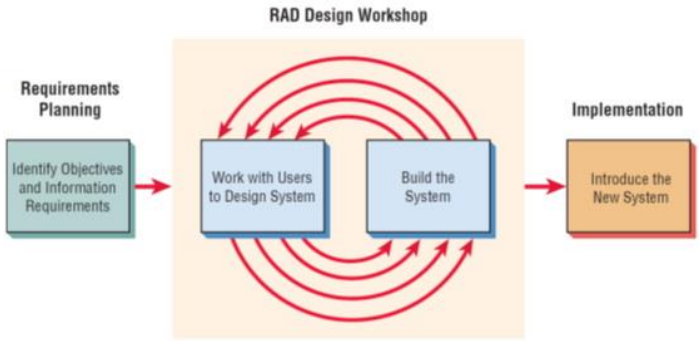


Fig 2. Rapid Application Development (RAD) Model (Nurtjahjani et al., 2022)

In the RAD method, there were several stages as follows (Hidayat & Hati, 2021):

Requirements Planning
During the Interview, document, and literature study, it was conducted to determine the goals of the application or system to be developed. The main goal was to understand the information demands needed.

Design Workshop

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At this stage, the proposed system was aimed to ensure a deeper understanding of the demands and previous studies. In this stage, the identification of involved actors could be observed.

Implementation

At this stage, the researcher implemented the study on the medicine distribution information system at the Medan City Health Office. The implementation was based on the previously determined process and interface design. At this level, the system coding was also done gradually. In Requirement Planning, Design Workshop, and the implementation of Distribution Requirement Planning (DRP). Afterward, system testing was conducted using black box testing to compare manual calculation results with the system output.

**Distribution Requirement Planning (DRP)**

DRP is a method to comprehensively describe the ideal distribution tasks that need to be accomplished (Pua et al., 2021). DRP is a mechanism to determine when to replenish inventory based on the demand phase of each item in a distribution channel (Aulia et al., 2022).

Essentially, the DRP method entails steps that are nearly similar to material requirement planning (MRP) and the assumptions used between the two. The following are the steps involved (Kulsum et al., 2020):

Netting Calculation

This involves calculating net requirements, which is the difference between gross requirements and planned receipts, and the available beginning inventory. The data required for netting calculation are: Gross requirements for each period; Inventory on hand at the beginning of planning; Planned receipts for each planning period, the formula for the netting procedure is explained as follows:

$$POH_T = (On - Hand)_{T-1} - (GR)_{T-1} + (SR)_{T-1} \quad (1)$$

$$(NR)_{T-1} = (GR)_T - (SR)_T - POH_T \quad (2)$$

Description:

$POH_T$ = Planned on hand (inventory on hand) in period T
$GR_T$ = Gross requirement (gross demand) in period T
$SR_T$ = Scheduled receipt (scheduled arrival) in period T
$NR_T$ = Net requirement (net demand) in period T

The net requirement had to be marked as a positive figure equal to the negative increase of existing inventory at the same time. If lot sizing was used, the net requirement served as a prediction of material shortages, thus it had to be included in the calculation of planned order receipts and not just compute the increase in negative value indicated in the on-hand inventory rows.

Lot Size Calculation

To perform lot size calculation, the first thing to consider is to understand the formula equation to obtain its value. Then, implement it based on the data we have. The formula equation for lot size itself uses the Economic Order Quantity (EOQ) method.

$$EOQ = \sqrt{\frac{2.Rm.C}{H}} \quad (3)$$

Description:

Rm : Average monthly demand
C : Shipping cost per month
H : Holding cost per month

Forecast Demand

Forecast Demand serves the function of creating a sequence of estimates, or forecasts, of the quantity of products or items that will occur during a specified period in the future. The forecast demand process itself can be conducted using the Exponential Smoothing method. Exponential Smoothing is an auxiliary method that employs weighted average comparisons of historical data. The following is the formula equation for exponential smoothing.

$$F_t = \alpha \times D_t + (1 - \alpha) \times F_{t-1} \quad (4)$$

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Description:
$F_t$ : Forecast for period t
$\alpha$ : Smoothing factor ($0 < \alpha < 1$), which determines the extent of the latest data's impact on the forecast.
$D_t$ : Actual data for period t.
$F_{t-1}$ : Forecast for the previous period.

The explanation of the analysis results from the DRP calculations is as follows:
On-hand balance represents the inventory of goods available in the warehouse.
Order quantity is the amount of goods to be shipped.
Safety stock is the buffer inventory that meets demand.
Lead time is the frequency of time from ordering to product receipt.
Gross requirement, the gross demand is determined from the total weekly demand or projections.
Scheduled receipt is the receipt schedule.
Project on hand is the inventory on hand obtained from the project on hand + scheduled receipts - gross requirements.
Net requirement is the net demand obtained from scheduled receipts - project on hand + safety stock.
Planned order receipt is a product receipt strategy where orders are placed one week before ordering (planned order releases).

## RESULT

### Requirements Planning

Analysis of the System

The analysis of the existing system at the Ministry of Health's Belawan Office involved several workflows and roles, including those of the public health centers, the Ministry of Health's Belawan Office itself, and logistics. The process began with the public health centers recording their needs and requesting logistics, such as medications, from the Ministry of Health's Belawan Office. Subsequently, the Ministry of Health's Belawan Office recorded the needs of each health center, prepared the ordered logistics, and sent the delivery data to logistics. The logistics then delivered the orders to the respective public health centers. The drawback of this system was that public health centers continuously placed orders without managing their medication stocks, resulting in weekly logistics deliveries and increased shipping and medication ordering costs by the Ministry of Health's Belawan Office. Based on the analysis of the existing system, the researcher proposed a more complex system. The analysis commenced with the Ministry of Health's Belawan Office implementing the DRP method in the system using the previous year's medication expenditure data as a reference. The outcome was a table predicting each health center's medication expenditure for one year. Subsequently, the Ministry of Health's Belawan Office compiled a list of logistics deliveries to each health center at the beginning of the period to meet the safety stock requirement of each health center based on the DRP implementation results. As the period approached its end, public health centers provided their logistics requirements data. Then, the Ministry of Health's Belawan Office compared the DRP prediction results with the actual demands. If they matched, the Ministry of Health's Belawan Office created delivery data for logistics according to the DRP prediction. If not, the Ministry of Health's Belawan Office generated delivery data according to the actual health center demands and recorded them for data prediction updates in the following year.

Data Collection

Data collection was conducted by searching for and gathering relevant data related to the research framework to be conducted (Hasibuan & Suendri, 2023). The author had made several visits to the Medan City Health Office and requested data on medicine demand from the various public health centers in Medan. Below is an example of the data collection results obtained by the author regarding medicine demand from several public health centers.

Table 1. List of Medicine Requests 2022

| Months | Public Health Center | | | | | |
|---|---|---|---|---|---|---|
| | Rantang | Sei Agul | Helvetia | Darussalam | Bestari | Glugur Kota |
| January | 38.464 | 19.163 | 34.268 | 44.887 | 14.054 | 30.939 |
| February | 39.415 | 21.735 | 40.106 | 49.497 | 12.007 | 12.007 |
| March | 38.853 | 27.678 | 45.519 | 35.136 | 9.868 | 9.868 |
| April | 38.685 | 32.140 | 31.169 | 50.559 | 13.936 | 13.936 |
| May | 39.824 | 29.394 | 43.557 | 35.577 | 17.025 | 17.025 |

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| | | | | | | |
|---|---|---|---|---|---|---|
| June | 40.867 | 24.895 | 31.180 | 33.526 | 9.806 | 9.806 |
| July | 38.738 | 20.717 | 35.251 | 41.052 | 10.276 | 10.276 |
| August | 42.913 | 18.894 | 45.168 | 51.094 | 20.098 | 20.098 |
| September | 44.475 | 20.507 | 42.097 | 44.820 | 15.797 | 15.797 |
| October | 39.551 | 20.063 | 34.758 | 36.661 | 11.933 | 11.933 |
| November | 44.439 | 18.780 | 33.283 | 51.983 | 14.241 | 14.241 |
| December | 43.492 | 30.696 | 45.561 | 32.147 | 15.781 | 15.781 |

The total list of medicines in the table represents the demand that occurred in 2022. The requested medicines will then be delivered using pickup trucks owned by the Medan City Health Office. The delivery process takes place in the first week of each month. The delivery process itself incurs a considerable cost, with a delivery fee set at IDR 10,000 per kilometer. Therefore, the expenditure required for delivery costs is as follows.

Table 2. List of Delivery Costs

| Total Days | Delivery Cost per km | Number of Vehicles | Average Total Distance Traveled | Delivery Cost |
|---|---|---|---|---|
| 5 days | IDR 10.000 | 12 | 339 km | IDR 3.390.000 |

It can be seen in the table above that the monthly delivery incurs a cost of IDR 3,390,000, with a delivery fee of IDR 10,000 per kilometer. Such a distribution system is not sufficiently effective due to several weaknesses, such as inefficient utilization of transportation modes, lack of detailed load calculations, and others.

As for the storage costs, the Health Office has set the cost for storing each remaining medicine at 15% of its original price in each period. Where each medicine is priced at an average of IDR 3,000, so the storage cost for each medicine is IDR 450. The following table shows the storage costs incurred by the Health Office using the method they applied for the six clinics used as examples in this DRP calculation.

Table 3. Storage Costs Using Company Method

| Year | Remaining Items | Storage Cost | Delivery Cost | Total Storage Cost | Total Delivery Cost |
|---|---|---|---|---|---|
| 2022 | 10.692 | IDR 450 | IDR 280.000 | IDR 4.811.400 | IDR 3.360.000 |

The data processing represented the initial stage in forming data for later use in implementing the DRP method. Data processing began with the search for safety stock by calculating its standard deviation from the 2022 clinic data. Subsequently, the next step was to determine the forecast demand value using the exponential smoothing method, followed by calculating the Lot size value from the data using the EOQ (Economic Order Quantity) method. The final step was to determine the on-hand value using the median of the previously obtained forecast demand.

DRP Implementation Results

After going through various previously outlined stages, the next step is to consolidate all these calculations into one table to facilitate the interpretation of the implementation results of the DRP method. Below are the implementation results of the DRP method.

DRP Implementation at Rantang Public Health Center

Table 4. DRP for Rantang Public Health Center

| **RANTANG PUBLIC HEALTH CENTER** | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Lot Size** | 7126 | | | | | | | | | | | **Safety Stock** | 44971 |
| **Lead Time** | 0 | | | | | | | | | | | **On Hand** | 39803 |
| GR | | 38464 | 38654 | 39303 | 38819 | 38913 | 40033 | 40441 | 39573 | 43225 | 43490 | 40529 | 44250 |
| POH | 39803 | 1339 | 48201 | 5864 | 45100 | 6187 | 45141 | 4700 | 45046 | 1821 | 45007 | 4478 | 45040 |
| NR | | 0 | 82286 | 0 | 77926 | 0 | 78816 | 0 | 79844 | 0 | 86640 | 0 | 84742 |
| POR | | 0 | 85517 | 0 | 78055 | 0 | 78987 | 0 | 79919 | 0 | 86676 | 0 | 84812 |
| **PORI** | | **0** | **85517** | **0** | **78055** | **0** | **78987** | **0** | **79919** | **0** | **86676** | **0** | **84812** |

From the table above, several points can be elaborated as follows:
Demand Quantity: 490,931

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Ordering Cost: 490,931 × IDR 900 = IDR 441,837,900
Shipping Cost: 6 × IDR 280,000 = IDR 1,680,000
Storage Cost: 34,896 × IDR 450 = IDR 15,703,214
Total Cost: IDR 441,837,900 + IDR 1,680,000 + IDR 15,703,214 = IDR 459,220,214

Implementation of DRP at Sei Agul Public health center

Table 5. DRP for Sei Agul Public Health Center

| SEI AGUL PUBLIC HEALTH CENTER | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Lot Size** | 5433 | | | | | | | | | | | **Safety Stock** | 32209 |
| **Lead Time** | 0 | | | | | | | | | | | **On Hand** | 20791 |
| GR | | 19163 | 19677 | 22924 | 28570 | 31591 | 28494 | 24059 | 20352 | 19217 | 20418 | 19806 | 21163 |
| POH | 20791 | 1628 | 36281 | 13357 | 33684 | 2093 | 33362 | 9302 | 32414 | 13197 | 36243 | 16437 | 33304 |
| NR | | 0 | 50258 | 0 | 47422 | 0 | 58610 | 0 | 43259 | 0 | 39430 | 0 | 36936 |
| POR | | 0 | 54330 | 0 | 48897 | 0 | 59763 | 0 | 43464 | 0 | 43464 | 0 | 38031 |
| **PORI** | | **0** | **54330** | **0** | **48897** | **0** | **59763** | **0** | **43464** | **0** | **43464** | **0** | **38031** |

From the table above, several points can be outlined as follows:
Demand Quantity: 287,949
Ordering Cost: 287,949 × IDR 900 = IDR 259,154,100
Shipping Cost: 6 × IDR 280,000 = IDR 1,680,000
Storage Cost: 56,014 × IDR 450 = IDR 25,206,210
Total Cost: IDR 259,154,100 + IDR 1,680,000 + IDR 25,206,210 = IDR 283,040,310

Implementation of DRP at Helvetia Public health center

Table 6. DRP for Helvetia Public Health Center

| HELVETIA PUBLIC HEALTH CENTER | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Lot Size** | 6921 | | | | | | | | | | | **Safety Stock** | 32209 |
| **Lead Time** | 0 | | | | | | | | | | | **On Hand** | 36487 |
| GR | | 34268 | 35436 | 41189 | 42649 | 33647 | 41082 | 31994 | 37234 | 44554 | 40629 | 34463 | 35739 |
| POH | 36487 | 2219 | 49835 | 8646 | 49049 | 15403 | 50452 | 18458 | 50434 | 5880 | 48303 | 13840 | 54232 |
| NR | | 0 | 81388 | 0 | 82174 | 0 | 73850 | 0 | 66948 | 0 | 82921 | 0 | 70070 |
| POR | | 0 | 83052 | 0 | 83052 | 0 | 76131 | 0 | 69210 | 0 | 83052 | 0 | 76131 |
| **PORI** | | **0** | **83052** | **0** | **83052** | **0** | **76131** | **0** | **69210** | **0** | **83052** | **0** | **76131** |

From the table above, several points can be outlined as follows:
Demand Quantity: 470,628
Ordering Cost: 470,628 × IDR 900 = IDR 423,565,200
Shipping Cost: 6 × IDR 280,000 = IDR 1,680,000
Storage Cost: 64,445 × IDR 450 = IDR 29,000,070
Total Cost: IDR 423,565,200 + IDR 1,680,000 + IDR 29,000,070 = IDR 454,245,270

Implementation of DRP at Darussalam Public health center

Table 7. DRP for Darussalam Public Health Center

| DARUSSALAM PUBLIC HEALTH CENTER | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Lot Size** | 7251 | | | | | | | | | | | **Safety Stock** | 54997 |
| **Lead Time** | 0 | | | | | | | | | | | **On Hand** | 44038 |
| GR | | 44887 | 49036 | 36572 | 49017 | 47563 | 33731 | 40299 | 50090 | 45447 | 37477 | 50451 | 34131 |
| POH | 44038 | 57156 | 8120 | 58555 | 9538 | 56234 | 22502 | 61960 | 11870 | 60681 | 23204 | 59760 | 25630 |
| NR | | 55846 | 0 | 83449 | 0 | 93021 | 0 | 72794 | 0 | 88574 | 0 | 82244 | 0 |
| POR | | 58005 | 0 | 87007 | 0 | 94258 | 0 | 79757 | 0 | 94258 | 0 | 87007 | 0 |
| **PORI** | | **58005** | **0** | **87007** | **0** | **94258** | **0** | **79757** | **0** | **94258** | **0** | **87007** | **0** |

From the table above, several points can be delineated as follows:
Demand Quantity: 500,293
Ordering Cost: 500,293 × IDR 900 = IDR 450,263,337

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Shipping Cost: 6 × IDR 280,000 = IDR 1,680,000
Storage Cost: 100,864 × IDR 450 = IDR 45,388,712
Total Cost: IDR 450,263,337 + IDR 1,680,000 + IDR 45,388,712 = IDR 497,332,049

Implementation of DRP at Bestari Public health center

Table 8. DRP for Bestari Public Health Center

| BESTARI PUBLIC HEALTH CENTER | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Lot Size** | 4808 | | | | | | | | | | | **Safety Stock** | 20801 |
| **Lead Time** | 0 | | | | | | | | | | | **On Hand** | 18281 |
| GR | | 18876 | 18700 | 17976 | 18064 | 18378 | 16995 | 18047 | 18734 | 18184 | 17298 | 20097 | 20762 |
| POH | 18281 | 23445 | 4744 | 25233 | 7168 | 22446 | 5451 | 21060 | 2326 | 22606 | 5308 | 23675 | 2913 |
| NR | | 21396 | 0 | 34032 | 0 | 32010 | 0 | 33397 | 0 | 36659 | 0 | 35590 | 0 |
| POR | | 24040 | 0 | 38464 | 0 | 33656 | 0 | 33656 | 0 | 38464 | 0 | 38464 | 0 |
| **PORI** | | **24040** | **0** | **38464** | **0** | **33656** | **0** | **33656** | **0** | **38464** | **0** | **38464** | **0** |

From the table above, several points can be delineated as follows:
Demand Quantity: 206,744
Ordering Cost: 206,744 × IDR 900 = IDR 186,069,600
Shipping Cost: 6 × IDR 280,000 = IDR 1,680,000
Storage Cost: 46,191 × IDR 450 = IDR 20,785,860
Total Cost: IDR 186,069,600 + IDR 1,680,000 + IDR 20,785,860 = IDR 208,535,460

Implementation of DRP at Glugur Kota Public health center

Table 9. DRP for Glugur Kota Public Health Center

| GLUGUR KOTA PUBLIC HEALTH CENTER | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Lot Size** | 4808 | | | | | | | | | | | **Safety Stock** | 20801 |
| **Lead Time** | 0 | | | | | | | | | | | **On Hand** | 18281 |
| GR | | 18876 | 18700 | 17976 | 18064 | 18378 | 16995 | 18047 | 18734 | 18184 | 17298 | 20097 | 20762 |
| POH | 18281 | 23445 | 4744 | 25233 | 7168 | 22446 | 5451 | 21060 | 2326 | 22606 | 5308 | 23675 | 2913 |
| NR | | 21396 | 0 | 34032 | 0 | 32010 | 0 | 33397 | 0 | 36659 | 0 | 35590 | 0 |
| POR | | 24040 | 0 | 38464 | 0 | 33656 | 0 | 33656 | 0 | 38464 | 0 | 38464 | 0 |
| **PORI** | | **24040** | **0** | **38464** | **0** | **33656** | **0** | **33656** | **0** | **38464** | **0** | **38464** | **0** |

From the table above, several points can be outlined as follows:
Demand Quantity: 211,024
Ordering Cost: 211,024 × IDR 900 = IDR 189,921,600
Shipping Cost: 6 × IDR 280,000 = IDR 1,680,000
Storage Cost: 116,266 × IDR 450 = IDR 52,319,565
Total Cost: IDR 189,921,600 + IDR 1,680,000 + IDR 52,319,565 = IDR 243,921,165

**Design Workshop**

Design Workshop was a stage to design the system and its performance. In this subsection, the use case diagram, which depicted the relationship between users and the system within it, and the class diagram, which illustrated the structure of the system requirements, were explained.

Use case diagram

The use case diagram in the system to be developed in this study will depict the relationship between the administrator and the system to be designed (Shenita & Suendri, 2023). In this system, the administrator will be able to perform several actions such as inputting data, displaying data, and accessing detailed demand prediction from each health center. This system will solely focus on generating predictions from the data entered into it, based on the demand data from the previous year. Below is the use case diagram crafted by the author for this study.

* Corresponding author

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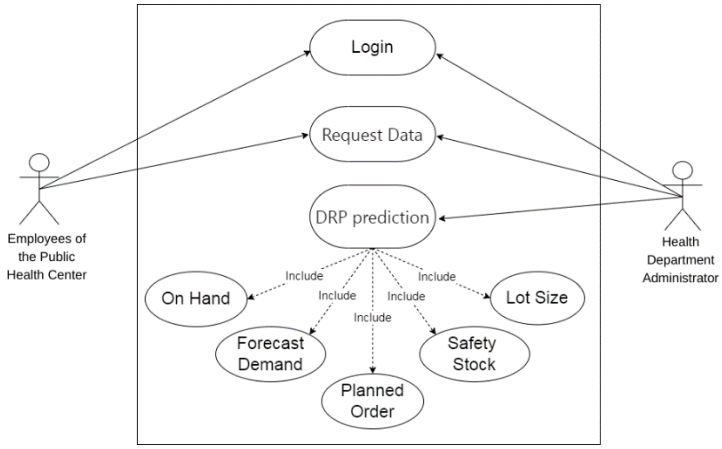


Fig 3. Use case diagram

Class diagram

The class diagram is a method or technique used to illustrate the relationship between a role within the system (Gunawan & Suendri, 2023). The roles within this system are administrators, and the class diagram serves to explain the relationship between administrators and the objects within the system to facilitate installation and integration when implementing the system. Thus, the limitations and capabilities of a role within the system can be clearly seen and serve as a reference to ensure that the system created aligns with the initial research objectives. Below is an illustration of the class diagram for the demand prediction system at public health centers in the city of Medan.

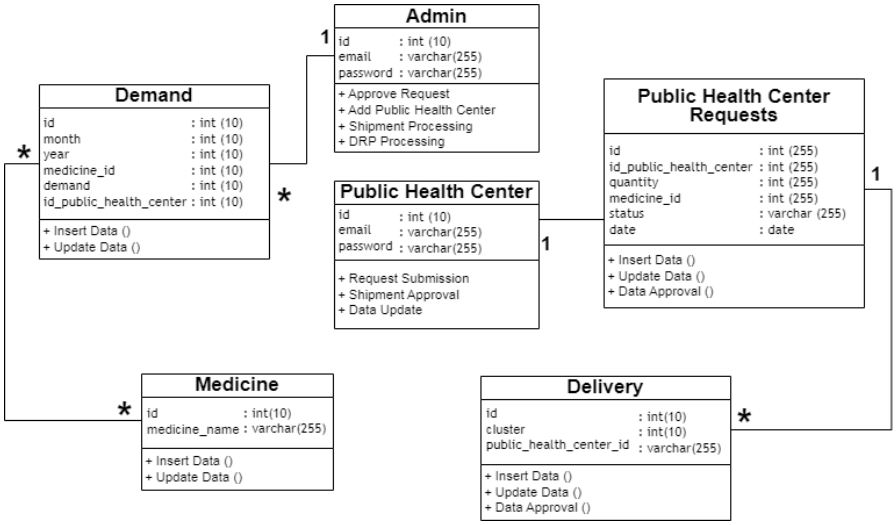


Fig 4. Class Diagram

In the class diagram, it was elucidated that an administrator was tasked with overseeing the processing of requests from all public health centers in the city of Medan. They possessed attributes such as username and password and were capable of accessing and inputting data. The processed data encompassed requests from 12 periods that had been traversed by each public health center and would be utilized to generate predictions using the DRP method. The outputs comprised gross requirements, safety stock, planned order releases, and others.

**Implementation**

The implementation phase is the final stage of this research series. During this phase, the author will construct the system according to the planning sequence outlined earlier.

Page Implementation (Health Center Employee)

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The dashboard page is the initial page of the system that appears when the user successfully logs in.


Fig 5. Dashboard Page Interface for Public Health Center

Request Page Implementation (Health Center Employee)
The request page is responsible for displaying the data of medicine requests inputted by health center employees.

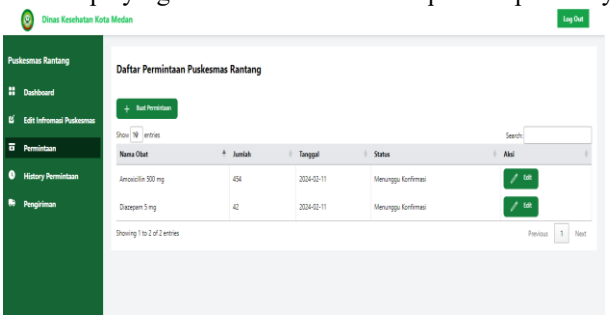


Fig 6. Health Center Request Page Interface

Health Center Request History Page Implementation
The request history page is responsible for displaying the history of medicine requests made by health center employees.

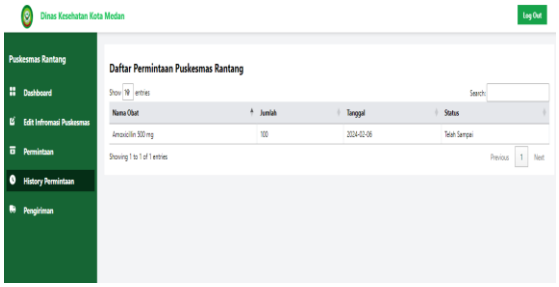


Fig 7. Public Health Center Request History Page

Dashboard Page Implementation (Administrator)
The dashboard page is the system page that appears upon successful login. The author built this page according to the previous interface design, focusing on diagrams and the results of calculations from the DRP method itself. Thus, the objectives of this research can be clearly displayed.

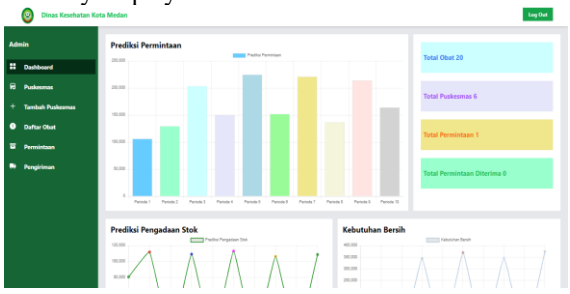


Fig 8. Administrator Dashboard Page Interface

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Health Center Page Implementation (Administrator)
This Health Center page functions to display the list of public health centers registered in the Belawan Health Department database. This page also displays the DRP calculations such as safety stock, lot size, project on hand, net requirement, and project order release.

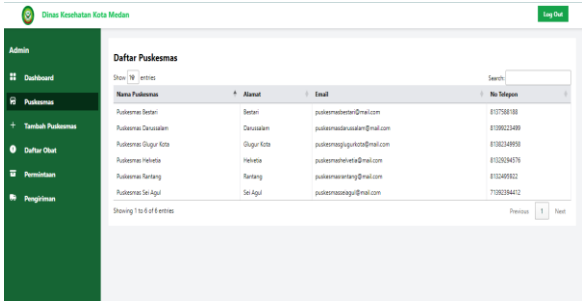


Fig 9. Public Health Center Page Interface (Administrator)

Add Health Center Page Implementation (Administrator)
This add health center page is used to add new health center data to the Belawan Health Department database by filling out the public health center addition form containing name, address, email, phone number, distance from health center, and password.

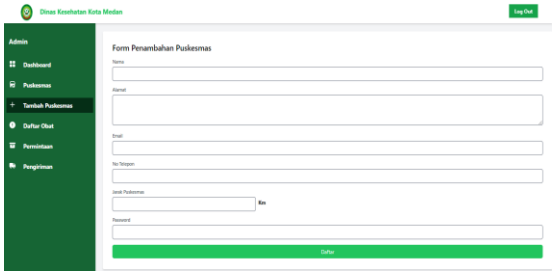


Fig 10. Add Public Health Center Page Interface (Administrator)

Medicine List Page Implementation (Administrator)
This Medicine List page functions to display the list of available medicine names, as well as features to add and edit medicine data.

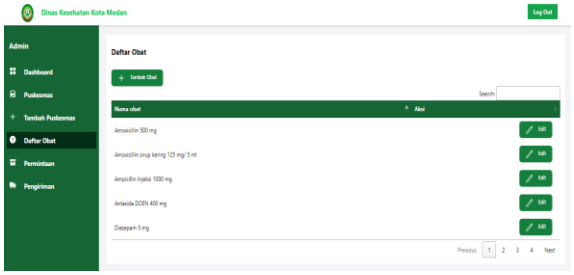


Fig 11. Medicine List Page Interface (Administrator)

Request Page Implementation (Administrator)
This Request page functions to display the list of requests. If the number of requests is equal to or less than the prediction, the request can be approved by the administrator so that the request from the health center can be accepted and sent. However, if the medicine request at the health center exceeds the predicted value, the administrator can reject the medicine request from the public health center.

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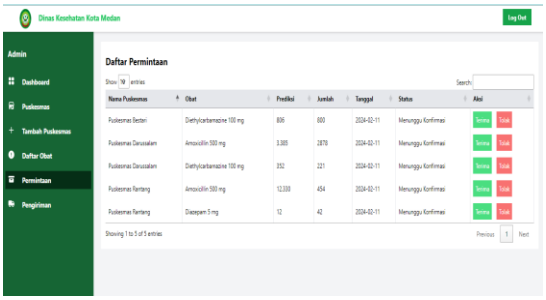


Fig 12. Request Page Interface (Administrator)

Delivery Page Implementation (Administrator)
This delivery page aims to display the list of goods deliveries along with related details.

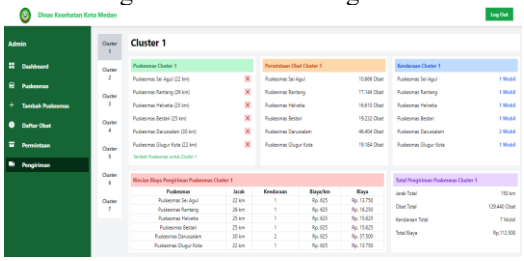


Fig 13. Delivery Page Interface (Administrator)

**Testing**

The system was tested using the black-box method, which focused on whether the program units met the functional requirements as described. This method constrained the input to validate the program's functional requirements. Testing was conducted by running the program that had been developed, and then observed whether it met the desired outcomes.

Table 9
Black-box Testing

| Testing on Health Department Administrator | | |
|---|---|---|
| Design of Input/Output | Expected Outcome | Result |
| Viewing Prediction for Medication Check | Displaying Public health centers Data Page along with DRP Predictions for Each public health centers | Success |
| Inputting Medication Data | Displaying Medication Data | Success |
| Accepting or Rejecting Medication Requests | Displaying List of Medication Requests from Public Health Centers | Success |
| Viewing Shipment Details | Displaying Medicine Requests, Vehicles, Distance, and Costs at Each Clinic in Every Cluster | Success |
| Testing on Public Health Center Staff | | |
| Design of Input/Output | Expected Outcome | Result |
| Medication Request Input | Displaying Medication Requests at Public Health Centers | Success |
| Viewing Approved Requests | Displaying Sent Request History | Success |
| Approving Receipt upon Arrival | Displaying List of Medication Requests at Public Health Centers | Success |

## DISCUSSIONS

The system developed utilizing the DRP Method provided crucial information for stock demand planning and forecasting. This facilitated the Medan City Health Office Pharmacy Installation in meeting the demand for medicines from the Public health center adequately. Moreover, the DRP Method also yielded insights into the costs incurred during the distribution process, thereby serving as a guide for enhancing cost efficiency and effectiveness in distribution. To ensure optimal performance of the distribution information system, it was imperative to utilize a laptop capable of preventing system crashes during operation. The minimum specifications required were an Intel(R) Celeron(R) CPU N3350 @ 1.10GHz 1.10 GHz processor with 4.00 GB of RAM, and a 64-bit operating system, x64-based processor. Moving forward, continual enhancement of database security became a necessity to mitigate potential

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damages. For future developments, it is recommended to explore alternative algorithms or methods to improve efficiency in calculations and medicine demand prediction processes.

## CONCLUSION

In the development of the medicine demand prediction system for all public health centers in the city of Medan, overseen by the Ministry of Health in Belawan utilizing web-based algorithms or DRP methods, it is evident that the medicine demand prediction system has been successfully developed, albeit within a relatively limited scope of implementation. This research exclusively focuses on the prediction process, omitting the incorporation of features typically found in an information system, such as public services, among others. The DRP method effectively forecasts future requirements through structured calculations and comprehensive assessments of demand levels experienced by each Public health center. Consequently, the requirements of each Public health center vary. The author identified a discrepancy in the medicine distribution process using the DRP method, highlighting that distribution need not occur continuously on a daily basis. Instead, distribution is necessary only at the month's end, as the DRP method reveals that not all public health centers necessitate restocking medicines daily or monthly. The author proposed a solution for a more efficient distribution process, resulting in a 93% reduction in expenditure compared to the previous method.

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