Combining ABC and VED Analysis for Managing Medicine Inventory (Case Study at Community Development Elderly in Indonesia)

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Abstract—**Community development elderly is a community managed by the non-government organization (NGO) with obtaining the funding from several sources involving government, donations and own community. Currently, there are many activities related to physical fitness for elderly people such as gymnastics, physical leisure activities, and other social activities. Nevertheless, older adults have many threats of illness that could have appeared suddenly. Thus, it needs a series of activities to prevent the emergence of disease. This study aims to determine appropriate programs of older adults based on illness complaints through analyzing the medicine inventory. This study combined ABC and VED analysis of inventory model in supporting healthcare consulting services for a community development elderly in Indonesia. The application ABC analysis found some item from three categories consisting category A of 33 items, category B of 26 items and Category C of 26 items. Then, VED analysis classification of medicine into seven items of Vital, 12 items of Essential and 12 items of Desirable. Thus, the result of a healthcare consulting service was obtained that older adults needed 31 types of medicines. The finding of this study also showed that the high frequency of illness complaints from older adults related to problems of Neurological, Hypertension, and Musculoskeletal. The implication of this study proved that the community development elderly must consider providing the priority programs of healthcare consulting services focus on three main problems of older adults. Further study is suggested to implement safety stock and reorder point for providing medicine inventory.**

Keywords— **ABC; elderly; inventory; medicine; VED.**

I. INTRODUCTION

Health is a key factor in the quality of life for human in carrying out their daily activities. They required to pay the attention in maintaining the physical and spiritual health without distinction between the age of young and old [1]. Thus, most paramedics suggested doing health counseling to prevent the occurrence of chronic diseases. Therefore, this served for gaining knowledge about healthcare and providing medicine when the physical condition begins to decline.

There is a community development elderly located in a village at Indonesia which this community serves as a center for fostering programs for the elderly. In running the programs, this community arranges the events related to maintaining health for older adults. Currently, there are many activities related to physical fitness for elderly people such as gymnastics, physical leisure activities, and other social activities. The older adults have many threats of illness that could have appeared suddenly [2]. This occurs due to many factors including food, weather and the spread of the developing virus. Thus, older adults required to pay attention to their health in continuing daily activities. To find out the solution to the problem, several programs are needed by an organizer of community development for older adults in healthcare consulting services.

Ideally, healthcare consulting services is not only in the form of knowing the illness complaints of older adults but also it needs to check the health through several examinations. The blood is one of the leading indicators in looking at the health condition of patients [3]. Also, the American Diabetes Association suggests that people over the

age of 45 undergo testing of blood every three years, or more frequently for those at high risk. Then, there was a study which recommends the high-risk individuals should have to do the blood pressure measurement [4]. Furthermore, the activities of healthcare consulting services also require medicines and vitamins to prevent the occurrence of disease for older adults. There are many different types of medicines which have varying prices that are required in healthcare consulting services. Healthcare consulting services need programs to help the older adults with considering the provision of medicines inventory based on the cost of expenditure and function of medicines to fulfill the patient's requirement.

There was a study adopted the ABC analysis for managing inventory which it aims to classify the types of products based on the level of investment absorbed in the provision of inventory [5]. However, ABC analysis limited because this model only covers related to financial classification [6]. In this case study, the management of community development elderly requires procurement medicines based on the needs and functions of the medicines. Moreover, there was research found the inventory model with adopting VED analysis able to be used to categorize inventory based on customer needs [7]. Therefore, this model classified and clustered the products based on the requirement of customer involving a level of *vital, essential* and *desirable*.

Indeed, the purpose of this study required to determine appropriate programs of older adults based on the illness complaints through combining ABC and VED analysis in supporting of healthcare consulting services for a community development elderly in Indonesia. Moreover, the significance of this study shows that community development elderly need a strategic recommendation for their management. It is achieved by minimizing the cost of procurement medicines and providing appropriate medicines based on the needs of older adults. Furthermore, the management is expected to know the illness complaints felt by older adults. Thus, healthcare consulting services can be directed based on the needs of older adults in doing prevention against disease.

II. MATERIAL AND METHOD

A. Material

1) Medicine Inventory for the Elderly

Elderly is a natural process that it not be avoided. Therefore, this condition is not a disease, but it is a process that gradually leads to cumulative change. It is caused by the decrease in body resistance in the face of stimuli from within and outside the body. Some institutions defined the category of elderly. WHO stated that the age of 60 years was the age of the beginning of the elderly [8]. The most of problem appeared in this age involving losses in hearing and seeing.

Moreover, they were easily infected heart disease, stroke, chronic respiratory disorders, and cancer. Indonesian government develops regulations on the welfare of the elderly with stipulating the age limit of the elderly in Indonesia is 60 years and above [9]. Determination of age of the elderly by the government aims to be able to play a role

in the government's programs and not burden for the community.

Illness complaint of elderly is often different from young adults. Therefore, disease on the elderly is a combination of abnormalities arising from disease and the aging process. Furthermore, there was a study described that this is an age-related decline in the ability of the cells to maintain the tissue [10]. Thus, the elderly cannot survive the disease and repair the damage suffered. To solve this problem, the Government of Indonesia supports programs related to empowering older adults. There are several types of health services to the elderly include five efforts: promotive, preventive, early diagnosis and treatment, disability restriction and recovery [11].

The high competition of the health industry encourages providers to increase their productivity to serve customers. Currently, many companies produce various types of medicines with varying prices and different brand. There was study revealed that the healing of the disease could use various types of medicines for the patients [12]. Thus, the price of medicines is challenging to control. Price is one of the significant determinants of the cost and purchasing power of medicines because price control aims to ensure the availability of medicines at all times and affordability for the patient.

Furthermore, to obtain the right medicine for the treatment of the patient, it needs supervising from many parties who have the authority in providing medicine includes doctors and pharmacists. Nevertheless, they have limited in managing the medicines in large quantities. Thus, it needs to implement the inventory models for the case of medicines to assist in the management to provide service to the patients based on price control and availability of medicine.

2) ABC-VED Analysis

The core business of industry is to manage raw materials to be manufactured into finished goods. In supporting on managing raw materials and finished products, it required a strategy in assisting the production process which this strategy is known as inventory management. Also, inventory models were used to manage products with the right amount of time and the right processes [13]. There are many benefits to implement the application of inventory management [14], [15]. There was a study found the strategy of inventory can be used as a buffer in managing the production, so the manager can prevent a shortage of raw material and control production process [16]. In addition, the strategy of inventory also able minimizing the use of labor and capital resources on manufacturing [17]. However, holding large amounts of inventory is waste because a lot of capital was absorbed in the inventory. Then, large amounts of inventory caused several problems involving fluctuating inventories, inaccurate forecasts and low utilization of inventories.

There are many inventory models that are widely used by researchers [18], [19] involving ABC (Always Better Control), VED (Vital, Essential, Desirable), HML (High, Medium, Low), FSN (Fast, Slow moving and Non-moving) and SDE (Scarce, Difficult, Easy). These models are used for different conditions based on purchasing costs and storing costs kept as low as possible.

ABC analysis is an application of inventory with supporting the Pareto diagram. This model manages inventory based on the type of items from a high value to a low value. Moreover, ABC analysis classifies inventory into three categories including A, B, and C with different values. Category A described the inventory has a high annual volume. This category has about 70% of the total value of inventory although the amount is small. Thus, it must get earnest attention because it has an impact on the high cost. Category B has an intermediate value of the annual volume which represents about 20% of the total value of inventory. Thus, a moderate inventory control technique is needed. Category C has a low yearly volume of roughly 10% of the total value of inventory. Thus only a simple control technique is required. Moreover, VED analysis able to manages inventory based on consensus or requirement of the customer. Also, the application of VED analysis is used in classifying products carried out based on the level of *vital, essential* and *desirable*.

Furthermore, several studies were using ABC-VED analysis for managing medical inventory. There was study adopted ABC-VED analysis in medical store on their case [20]. They found that ABC-VED matric analysis system is an optimal medicine inventory management system at a healthcare setting and able to achieve both times saving and assured the availability of needed medicine. There was a study at the medical store using this method [21]. They concluded that scientific inventory management tools need to apply routinely for the efficient medical store. Thus, most of the studies revealed that ABC and VED analysis able to help the management to identify the categories of medical need focused managerial control. ABC and VED analysis succeed to increase productivity and generate income on medicine inventory. This case study requires recommendations of healthcare programs for a community development elderly in Indonesia which this program is more appropriate whenever done based on the needs of the older adults. Thus, this study needs to identify illness complaint of the patient. To know complaints, it is not only being done by interviewing patients but also it required health examination.

B. Method

Community development elderly is a community managed by the non-government organization (NGO) with obtaining the funding from several sources involving government, investors and own community. This community development served to foster older adults. There are many partnerships involved in this community including government, medical doctor, nurse, pharmacist, and typical village. For fostering the programs of community development elderly, it required supporting from whole entities related to this activity. To more the detail, entities in this community development had their respective roles in mobilizing the program for older adults. A medical doctor had a responsibility to provide healthcare through consultation and medical examination. The nurse had a duty to support the medical doctor in serving the patient. After older adults consulting with a medical doctor, they were provided medicines by the pharmacist with offering advice to patient how to consume the medicines. Then, the

government and typical village had the duty to organize the older adults and responsible for the activity. Figure 1 shows the relevant entities in community development elderly along with their duties.
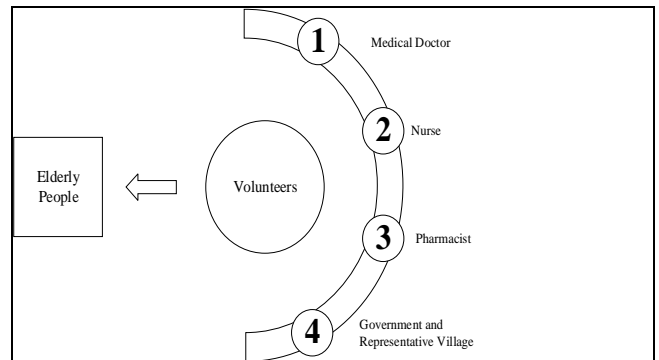

Fig 1. Entities in community development elderly

Moreover, this study focused on conducting healthcare consulting services for elderly people. The data of the older adults in this village showed that older adults consisting of six groups of community empowerment. This community was fostered and empowered by the local community through volunteer. Also, this community categorized age for older adults counted age above 60 years. Then, this community development was expected to serve as well as a health information center in the form of providing education to the public and volunteers of healthcare programs. Healthcare consulting service was done by mobilizing the volunteers that have been formed to support community older adults. For more detail, the volunteer obtained knowledge related to healthcare programs from a medical doctor, and then they continue to educate the older adults. It aimed to appoint the person in charge and consistency in assisting with the healthcare consulting service of older adults.

This research focused on a case study in a village by looking at the phenomenon that occurs in public health services. There was a study revealed that to conduct the phenomenon in a case study, it can adopt the qualitative approach [22]. Furthermore, this approach supported researchers to understand in depth the information and problems by directly observing an event [23]. Regarding obtain the detailed problem, it was conducted through the interviews with the respondents in the case study.

The location of this study was conducted in a village in Indonesia. Data collection was done by the approach of Participatory Action Research (PAR). There was a study described that PAR can effectively interact with respondents and deeply identify user issues [24]. Furthermore, this approach explained that researchers were directly involved in the activities of the community. There were 81 elderlies with different illness complaints who come on the healthcare program, and this activity was organized by community development elderly. Thus, data of participants who attend this program were processed become research respondents. Data of illness complaints were obtained from the results of medical examination by measuring an indicator of blood pressure, blood glucose, uric acid, and cholesterol. Also, to obtain in-depth information related to illness complaints of

older adults, it was conducted through a semi-structured interview [25]. The following process for managing medicine inventory by combining ABC and VED analysis to determine illness complaints of older adults can be seen below:

1) Procurement of medicines: Healthcare consulting services for older adults require medicines for debriefing in maintaining their health. Thus, this requires the procurement of various medicines for the patients. Moreover, the medicine is obtained from the distribution agent to get the appropriate price.

2) Application of ABC analysis: Application of ABC analysis requires to implement because medicines have varying prices. Thus, it needs to calculate the budget of medicines expenditure to perform healthcare consulting services for older adults. ABC analysis can classify the type of medicines based on the selling price level that consider on the cumulative cost percentage item A, B, and C, in the form of 70, 20 and 10%, respectively.

3) Healthcare consulting services: This service is given to elderly people to identify illness complaints and medical treatment. The medical team does the examination by supporting medical tools. Then, they are accompanied by pharmacists in distributing medicines for older adults.

4) Application of VED analysis: The requirement of medicines needs to be analyzed to determine the classification of product required by older adults. VED analysis is applied based on the classification of Vital (V), Essential (E) and Desirable (D). As a result, the patient obtains the medicines that are always needed to maintain the health of older adults.

5) Combining ABC and VED analysis: ABC and VED analysis have limitations in its application, so both methods need to be combined. Combinatory is implemented by adopting the rule of product approach [26]. As a result, nine combinations are emerging from ABC, and VED analysis include AV, BV, CV, AE, BE, CE, AD, BD, and CD. Furthermore, this combination is proceeded to obtain the categories in the procurement of medicines. There are three categories medicines involving high priority level or Category I (AV, BV, CV, AE, AD), Category II or average level (BE, CE, BD) and Category III or low level (CD).

6) Diagnose disorder: Results of combining ABC and VED analysis provides the type of medicines needed based on three categories. These results are analyzed by medical doctors to identify diseases based on illness complaints by elderly people.

III. RESULTS AND DISCUSSION

A. Results

This case study showed that healthcare consulting service provided 85 types of medicines that were commonly used by the public. These medicines were held randomly to anticipate the complaints of older adults. Furthermore, several tools were used as indicators in the health examination of the older adults including blood pressure,

blood glucose, uric acid, and cholesterol. Thus, the cost of healthcare consulting service consists of two items which It involved the cost of medicine and health examination (medical tools). The highest cost in this event was on providing tools in medical check-up around 53% of the total cost. As consequently, it given the significantly affect for a program of healthcare consulting service for older adults because there was a high investment in this activity.

All medicine was classified using ABC analysis before the program of healthcare consulting service. It served to cluster the medicines based one three categories of ABC analysis. Figure 2 shows the results of application ABC analysis based on three categories using Pareto Diagram. The application ABC analysis obtained some item from three categories consisting category A of 33 items, category B of 26 items and Category C of 26 items. The implication of this result describes that the type of medicine does not have an insignificant price difference. Therefore, it is caused by category A, B and C have almost a similar total number of medicine.
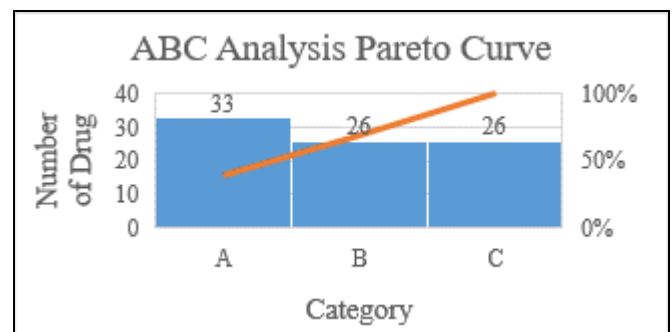

Fig 2. Application ABC analysis

Moreover, healthcare consulting service was done at a village that has authorized by the government. Older adults were invited through supporting representative village and volunteers of community development. Then, paramedic such as a medical doctor, nurse, and the pharmacist was involved in this event. A series of the event consists of transfer knowledge about healthcare for a community, health examination and providing medicine. After one week, the paramedic communicated with older adults to check the medicines that were given to ensure satisfied of the patient.

Application of VED analysis was made based on a medical record. The result of healthcare consulting service was obtained that the older adults needed 31 types of medicines. For instance, an older adult needs several medicines for him/her illness. Then, one box of medicine consists of some medicine strip in the form of a tablet which patient will provide one medicine strip. Thus, the amount of medicine requirement was calculated based on the total number of medicine strip. These medicines were further processed adopting VED analysis based on the level of medicine requirements. It found there was a classification of medicine consist of 7 items of *Vital* (V), 12 items of *Essential* (E) and 12 items of *Desirable* (D). Also, the result of VED analysis found a total number of medicine requirement for elderly people which it was 223 number of medicine requirement. For more detail, the category of *Vital, Essential* and *Desirable* consist of 156, 51 and 16 number of

medicine requirement respectively. The result of VED analysis can be found at Table I which this medicine is clustered based on elderly people needs.

TABLE I
LIST OF MEDICINE USING VED ANALYSIS

No	Medicine	Category VED
1	Tab. Beneuron	*Vital* (V)
2	Tab. Ranitidine 150 mg	
3	Tab. Amlodipine 5 mg	
4	Tab. Renadinac 50 mg	
5	Tab. Ibuprofen 400 mg	
6	Tab. B complex	
7	Tab. Omeprazole 20 mg	
8	Tab. Pyrexin 500 mg	*Essential* (E)
9	Tab. Alleron 4 mg	
10	Tab. Meloxicam 15 mg	
11	Tab. Allopurinol 100 mg	
12	Tab. Antasida 200 mg	
13	Tab. Meloxicam 7,5 mg	
14	Tab. Simvastatin 10 mg	
15	Tab. Ambroxol 30 mg	
16	Tab. Captopril 25 mg	
17	Syrup Domperidone 60 ml	
18	Tab. Fargetix 500mg	
19	Tab. Glibenclamide 5 mg	
20	Ointment Betametason 15 g	*Desirable* (D)
21	Tab. Cetirizine 10 mg	
22	Tab. Salbutamol 4 mg	
23	Tab. Samcobion	
24	Powder Salycil 60 g	
25	Ketoconazole cream	
26	Tab. Metformin 500 mg	
27	Tab. Methylprednisolone 4 mg	
28	Tab. Metronidazole 400 mg	
29	Tab. Omegdiar	
30	Tab. Scopma Plus	
31	Syrup Yusimox	

The analysis was continued by combining ABC and VED analysis into the matric to determine illness complaint of older adults. ABC analysis processed 85 types of medicine, and VED Analysis found 31 types of medicine. From this model, it was combined into a matric based on illness complaint of older adults. Matric combining ABC and VED analysis provided a new category of A, B and C consist of 45.16%, 35.48%, and 19.35% respectively. Then, a new category of Vital, Essential and Desirable consist of 22.58%,

38.71%, and 38.71% respectively. The result of matric combining ABC and VED analysis can be seen in Table II.

Furthermore, the highest level of combination showed that the matric of AV have the highest expenditure and was required by older adults which consisted of 3 types of medicines involving *Beneuron, Amlodipine,* and *Renadinac.* Metric of BV consisted of 2 types of medicines involving *Ranitidine* and *B Complex.* Matric of CV consisted of 2 types of medicines involving *Ibuprofen* and *Omeprazole.* Matric of AE consisted of 6 types of medicines involving *Pyrexin, Allopurinol, Antasida, Meloxicam, Simvastatin,* and *Fargetix.* Matric of AD consisted of 5 types of medicines involving *Cetirizine, Samcobion, Metformin, Methylprednisolone,* and *Yusimox.* Also, combinations of other categories indicated the level of medicine based on the total expenditure and need of the patient.

Moreover, the result of matric ABC and VED analysis was grouped into three categories which can be seen in Table III. Category I was the highest level requirement to consider which it showed 58.06%. This value can be concluded that the type of medicine to be a priority to maintain the health of elderly people. Then, category II was the average level which it showed 32.26%. Lastly, category III was the lowest level required to consider which it showed 9.68%. Then, it was suggested by the research that the management more focus and stringent control on Category I medicine. The middle management level managed the Category II and Category III.

Medicines in category I was diagnosed by the medical team to determine the classification of disease or illness complaint. Table IV showed a combination of ABC and VED analysis able to classify the types of illness complaint of older adults.

B. Discussion

The purpose of this study is to determine appropriate programs of older adults based on illness complaints through analyzing the medicine inventory. The result shows that the matric of combination ABC and VED analysis is able to classify the types of medicine based on the requirement of the older adults in term of cost expenditure of medicine and needs of medicine.

The result of the diagnose disorder in this study indicate that there are several diseases often appear for older adults. As a result, this is the main priority to be overcome soon. The organizer of community development elderly can prepare programs for empowering the elderly. Furthermore, this study provides the benefits in the form of appropriate medicine selection in the healthcare consulting service. Thus, the management can minimize the cost of medicine procurement because it is provided based on illness complaints of older adults. The organizer of community development also able to inform this result to paramedics such as doctors, pharmacists, and nurses to provide health services to provide better service and give satisfaction for elderly patients. Also, policymakers can play more active in servicing to overcome the elderly problems through several programs and funding more measured based on the results of this study

TABLE II
MATRIC COMBINING ABC AND VED ANALYSIS

Category	V		E		D		Total no. of medicine	%
	Combining	No. of medicine	Combining	No. of medicine	Combining	No. of medicine		
A	AV	3	AE	6	AD	5	14	45.16
B	BV	2	BE	5	BD	4	11	35.48
C	CV	2	CE	1	CD	3	6	19.35
Total		7		12		12	31	
%		22.58		38.71		38.71		100

TABLE III
CATEGORY OF COMBINING ABC-VED ANALYSIS

No	Category of medicine	Item	%
1	I	AV, BV, CV, AE, AD	58.06
2	II	BE, CE, BD	32.26
3	III	CD	9.68
Total			100

TABLE IV
LIST OF DIAGNOSING THE DISORDER

No	ABC-VED	Problem	Frequently
1	AV	Neurological problems	Very High
2		Hypertension problems	
3		Musculoskeletal problems	
4	BV	Gastric problems	High
5	CV	Viral fever problems	Medium
6	AE	Hyperuricemia problems	Moderate
7		Hyperlipidemia problems	
8		Dental problems	
9	AD	Allergy problems	Low
10		Anemia problems	
11	*	Other problems	Very Low

The volunteer will run programs for community development elderly. The concept of this research is to empower volunteers who are directly involved in a series of activities. This begins from the event of healthcare consulting service which volunteers participate in assisting the whole activities such as directing and accompanying older adults in health examinations. As a result, volunteers can directly listen to the directions from the medical doctor when the activity of consultation is in progress. Furthermore, the result of this research is submitted to the management of community development elderly to be followed up into the proposed programs. Then, the volunteer will be re-involved in a briefing to know the illness complaints that are often experienced by older adults.

Moreover, management of community development elderly can arrange programs together with volunteers in healthcare for older adults. Thus, the activities are undertaken by community development on target and by the needs of the elderly. Indeed, the role of volunteers in supporting community development of older adults is needed. The implications of this research can be implemented directly to the end user or older adults.

Several studies using ABC analysis which is implemented only focusing on managing inventory based on analysis of cost expenditure of product [27]. Then, VED analysis only considers managing inventory based on the requirement of the customer. Several studies integrated both of them. Most of the result succeed to classify the medicines for efficient

management of the pharmacy stores [28]. Thus, they adopted ABC-VED matric analysis to cluster the medicine requiring for optimal use of funds and avoid out-of-stock situations in the medical stores. Nevertheless, the limited study showed that most of the studies consider profit orientation from the provider of medicine. Managing medicine inventory must give an impact for the patient not only classify the cost of the product but also provide education and knowledge for the patient to increase awareness about their health.

This study contributes to determining to the diagnose of the disorder based on medicine that consumed by the patient through combining ABC and VED analysis. There are three main categories from diagnosing the disorder. This study recommends that the management of community development elderly must focus on medicine of category I to prevent the disease and provide stringent control on its expenses. Moreover, older adults have a limitation on access the medicine because they are bordered by several factors such as lack of knowledge related to medicine and high, different cost of medicine. To help the older adults, it needs to provide the programs for community development to provide the recommendation on empowerment the public in healthcare consulting service through this method. This study shows that combining ABC and VED analysis proven beneficial to propose a new function of the inventory model. Furthermore, this modification is required to overcome the problem of community development elderly according to the case study.

IV. CONCLUSION

Model Inventory of combination ABC and VED analysis can determine the primary disorder of seniors through managing medicine inventory based on their illness complaint. Thus, the results of this study are used as the recommendations for the management of community development elderly in Indonesia by preparing programs of healthcare consulting service based on the requirement of the older adults. For its implementation, it can be done by programs related to providing education and prevention against the disease. Finally, this case study requires an application of medicine inventory tools for effective and efficient management of the community development elderly, efficient priority setting, decision making in purchase and distribution of medicine and stringent supervision on medicines belonging to essential categories.

This study only conducts a community within one area in Indonesia. Thus, it limited to generate finding because illness complaint of older adults depends on their lifestyle and disease that could be appeared suddenly. Further research is suggested to cooperate with the government such as Public Hospital and Clinic to obtain record illness complaint of seniors. Thus, it is easy to control the illness complaint and provide its medicine for the community. Also, for further theoretical study, it is advisable to calculate the safety stock of medicine to prevent a shortage of medicine for community development. Moreover, it also recommends calculating the re-order point to evaluate the accuracy of forecast demand for medicines and the purchase of a predetermined amount of replenishment medicine inventory.

REFERENCES

[1] A. M. L. Au et al., "Age-Friendliness and Life Satisfaction of Young-Old and Old-Old in Hong Kong," *Curr. Gerontol. Geriatr. Res.*, pp. 1–10, 2017.

[2] C. Stanke, M. Kerac, and C. Prudhomme, "Health Effects of Drought : a Systematic Review of the Evident," *PLOS Curr. Disasters*, pp. 1–38, 2017.

[3] A. Fehr, C. Lange, J. Fuchs, H. Neuhauser, and R. Schmitz, "Health monitoring and health indicators in Europe," *J. Heal. Monit.,* vol. 2, no. 1, pp. 3–20, 2017.

[4] R. Agarwal, "Implications of blood pressure measurement technique for implementation of Systolic Blood Pressure Intervention Trial (SPRINT)," *J. Am. Heart Assoc.,* vol. 6, no. 2, pp. 1–6, 2017.

[5] Y. Kumar, A. Lilhare, A. Sahu, B. Lal, and Y. Khaperde, "ABC Analysis for Inventory Management-Case Study of Sponge Iron Plant," *Int. J. Res. Appl. Sci. Eng. Technol.*, vol. 4, no. III, pp. 32–36, 2016.

[6] S. S. Mahagaonkar and A. A. Kelkar, "Application of ABC Analysis for Material Management of a Residential Building," *Int. Res. J. Eng. Technol.*, vol. 4, no. 8, pp. 2395–56, 2017.

[7] V. Yigit, "Medical Materials Inventory Control Analysis at University Hospital in Turkey," *Int. J. Heal. Sci. Res.*, vol. 7, no. 1, pp. 227–231, 2017.

[8] World Health Organization, "World Report on Ageing and Health," Switzerland, 2015.

[9] I. K. Astina, W. I. Wan Ahmad, and B. Budiyanto, "Quality of Life of Older Persons in Indonesia: Sex Differences," *Mediterr. J. Soc. Sci.*, vol. 6, no. 3, pp. 313–317, 2015.

[10] J. Oh, Y. D. Lee, A. J. Wagers, and S. Z. İmamoğlu, "Stem cell aging: mechanisms, regulators and therapeutic opportunities," *Nat Med,* vol. 20, no. 8, pp. 870–880, 2015.

[11] J. Schröders et al., How is Indonesia coping with its epidemic of chronic noncommunicable diseases? *A systematic review with meta-analysis*, vol. 12, no. 6. 2017.

[12] D. O. Kesler, L. O. Hopkins, E. Torres, and A. Prasad, "Assimilating Traditional Healing Into Preventive Medicine Residency Curriculum," *Am. J. Prev. Med.*, vol. 49, no. 5, pp. 263–269, 2015.

[13] W. Mwangi and M. T. Nyambura, "the Role of Inventory Management on Performance of Food," *Eur. J. Bus. Soc. Sci.*, vol. 4, no. 04, pp. 64–78, 2015.

[14] F. Lestari, U. Anwar, N. Nugraha, and B. Azwar, "Forecasting Demand in Blood Supply Chain (Case Study on Blood Transfusion Unit)," in *World Congress on Engineering, 2017*, vol. II, pp. 5–8.

[15] W. Sutopo, D. I. Maryanie, and Yuniaristanto, "Evaluation of value chain in the palm oil industry based on the SCOR model : a case study," *Int. J. Logist. Syst. Manag.*, vol. 21, no. 2, pp. 229–241, 2015.

[16] L. Wang, C. Cheng, Y. Tseng, and Y. Liu, "Demand-pull replenishment model for hospital inventory management : a dynamic buffer- adjustment approach," *Int. J. Prod. Res.*, no. December, pp. 1–14, 2015.

[17] R. Findlay, A. Webb, and J. Lund, "Implementation of Advanced Inventory Management Functionality in Automated Dispensing Cabinets," *Hosp. Pharm.*, vol. 50, no. 7, pp. 603–608, 2015.

[18] N. Gupta and P. Krishnappa, "Inventory Analysis in a Private Dental Hospital in Bangalore, India," *J. Clin. Diagnostic Res.*, vol. 29, no. 11, pp. 10–12, 2016.

[19] Manivel and R. Ranganathan, "Prioritized FSN Analysis Of Inventory Management In Private And Hospital Pharmacy Followed By Questionnaire," *Int. Res. J. Pharm.*, vol. 7, no. 12, pp. 104–113, 2016.

[20] S. Kant, P. Haldar, A. Singh, and A. Kankaria, "Inventory Management of Drugs at a Secondary Level Hospital Associated with Ballabgarh HDSS- An Experience from North India*,*" *J. Young Pharm.*, vol. 7, no. 2, pp. 113–117, 2015.

[21] M. S. Kumar and B. A. Chakravarty, "ABC - VED analysis of expendable medical stores at a tertiary care hospital," *Med. J. Armed Forces Indian,* vol. 1, pp. 24–27, 2015.

[22] H. Harrison, M. Birks, R. Franklin, and J. Mills, "Case Study Research Foundations and Methodological Orientations. *Qualitative Social Research,*" vol. 18, no. 1, 2017.

[23] P. Bogaert, T. Bochenek, A. Prokop, and A. Pilc, "A Qualitative Approach to a Better Understanding of the Problems Underlying Drug Shortages, as Viewed from Belgian, French and the European Union ' s Perspectives," *PLoS One,* vol. 10, no. 5, pp. 1–20, 2015.

[24] Akbarizan, F. Lestari, H. Nazar, S. Murhayati, and Mawardi, "Empowerment Agent Through Islamic Value in Preventing Palm Oil Plantation Fires Based on Public Participation," *J. Adv. Agric. Technol.*, vol. 4, no. 1, pp. 68–71, 2017.

[25] J. O'Keeffe, W. Buytaert, A. Mijic, N. Brozovic, and R. Sinha, "The use of semi-structured interviews for the characterization of farmer irrigation practices," *Hydrol. Earth Syst. Sci. Discuss.*, vol. 12, no. 8, pp. 8221–8246, 2015.

[26] J. L. Gross, Combinatorial Methods with Computer Applications. New York: Tylor and Francis Group, 2016.

[27] T. Chethana et al., "ABC analysis of drugs used in health camps organized in villages of Chintamani taluk, Karnataka, India," *Int. J. Community Med. Public Heal.*, vol. 4, no. 1, pp. 186–189, 2017.

[28] S. Dudhgaonkar, S. R. Choudhari, and N. p. Bachewar, "The ABC and VED analysis of the medical store of the tertiary care teaching hospital in Maharashtra, India," *Int. J. Basic Clin. Pharmacol.*, vol. 6, no. 9, pp. 2183–2188, 2017.