

Shifts in drugs use after the COVID-19 pandemic based on the analysis of ABC, VEN and ABC-VEN matrix

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Abstract

Background: The existence of the COVID-19 pandemic has caused a shift in medicine use in patients.

Objective: This study aims to determine patterns and differences in medicine use at Airlangga University Hospital before (2018 and 2019) and after (2020–2022) the COVID-19 pandemic based on ABC, VEN and ABC-VEN matrix analysis.

Methods: This study is a retrospective cross-sectional study. Data on all patients' medicine use items between January 1st, 2018 – December 31st, 2022 which obtained from the hospital information system will be analyzed according to category based on the principles of ABC analysis, VEN, and the ABC-VEN combination and a statistical t-test analysis in SPSS to find out differences in medicine use at the Universitas Airlangga Hospital in the pre-pandemic era of COVID-19 versus the era of the COVID-19 pandemic.

Results: Based on the results of the study, a total of 6893 drug items were obtained. There was a significant shift in the pattern of non-essential medicines use prescribed to patients after the COVID-19 pandemic ($p < 0,05$).

Conclusion: There was a shift in the pattern of use of prescribed non-essential medicines after the COVID-19 pandemic compared to before the pandemic occurred.

Keywords

Pandemic, COVID-19, drug management, drug use

Introduction

Medicine management activities are crucial in hospitals because they are carried out to ensure the availability of medicine in health services for patients. The activities include selection, needs planning, procurement, acceptance, storage, distribution, destruction and withdrawal, control, and administration needed for pharmaceutical service activities (Mellen and Pudjirahardjo 2013; Menkes 2016).

Medicine management activities in hospitals absorb a budget of around 40% of the total costs incurred by the hospital, for that reason various modeling and categorization are needed so that management can be more effective and efficient (Pamela et al. 2019).

Hospitals need to carry out routine evaluations of medicine management so that an overview of the use of medicine can be seen and to make effective and efficient

modeling. One of the evaluations that can be used is to use an ABC, VEN or combination of ABC-VEN analysis (Romadhon and Wardoyo 2021; Mustikawati et al. 2022).

ABC analysis divides medicine groups based on the size of the items on budget absorption where group A absorbs between 70–80% of the budget, group B absorbs 15–20% while group C absorbs around 5–10%. ABC analysis alone is not enough for units that provide health services because there are medicine that play a vital role in treatment but are not included in the group, so VEN analysis is also needed to evaluate a medicine management process (Mohammed and Workneh 2020; Nguyen et al. 2022).

The VEN analysis method is used based on the critical level of medicine use (Almahdy et al. 2021). The critical level of medicine use can be determined by each hospital based on existing needs (Menkes 2016). The classification of Vital, Essential and Nonessential medicine is carried out based on emergency service standards (Menkes 2018) and the National List of Essential Medicines (Menkes 2021). Given the consideration of budget absorption and availability of priority medicine for patient care, one method that can be used is to combine ABC analysis with VEN analysis (Mohammed and Workneh 2020; Nguyen et al. 2022).

The combination of ABC-VEN analysis is the development of a method that has the advantage of being able to analyze the evaluation of medicine needs in hospitals because this analysis can provide a critical description of medicine use and its impact on the hospital budget. This combination will produce medicine categories which are category I that consists of AV, BV, CV, AE, AN where all medicine that fall into this category have vital characteristics and absorb high budgets, category II which consists of BE, CE, BN where the medicine items that fall into this category are essential and the cost is lower than category I so that the control is carried out periodically, whereas category III consists of CN, which are non-essential items and very low value (Mohammed and Workneh 2020; Nguyen et al. 2022).

The spread of the Coronavirus Disease-19 (COVID-19) virus has been declared by the World Health Organization

(WHO) as a global pandemic in 2020. Based on research data from Asmarawati et al. in 2021, the first patient confirmed positive for the COVID-19 virus in Airlangga University Hospital was registered on March 14, 2020. This pandemic may cause a shift in medicine use in patients so that it will have an impact on the types of medicines to be purchased and on the Hospital budget compared to before the COVID-19 pandemic.

This study aims to determine patterns and differences in medicine use at Airlangga University Hospital before (2018 and 2019) and after (2020–2022) the COVID-19 pandemic based on ABC, VEN and ABC-VEN matrix analysis so that the results of this evaluation can be used to carry out strategies to improve medicine management that are more effective and efficient.

Materials and methods

This study is a retrospective cross-sectional study that aims to determine patterns and differences in medicine use at Airlangga University Hospital before and after the Covid-19 pandemic based on ABC, VEN, and ABC-VEN Matrix analysis. The data used comes from all use of patient medicine items from January 1st, 2018 until December 31st, 2022, which are obtained from the hospital information system.

Data collection is carried out by extracting data from reports on medicine use in hospitals obtained from the hospital system every year, namely 2018, 2019, 2020, 2021 and 2022. Data on medicine use in the pre-pandemic era of COVID-19 is defined as data for 2018 and 2019, as well as data on the medicine use in the COVID-19 pandemic era defined as data for 2020, 2021 and 2022. This data was then transferred to Microsoft Excel and analyzed according to the medicine category based on the principles of ABC, VEN, and ABC-VEN matrix analysis based on the operational definitions listed in Table 1. VEN categories are made based on the medicine items in the emergency service standard and the National Essential Medicines

Table 1. Operational definition of each class/category of medicine group.

| Class/Category | Group | Definition |
|----------------|--------------------|--|
| A | A | Item groups absorb 70% of the budget |
| B | B | Item groups absorb 20% of the budget |
| C | C | Item groups absorb 10% of the budget |
| V | V | Item groups whose availability is vital, for example: emergency medicines based on emergency service standards |
| E | E | Item groups whose availability is essential, for example: medicines for chronic diseases, pain relievers and so on |
| N | N | Item groups whose availability is non-essential, for example: supplements and multivitamins |
| AV | AV | Important medicine groups and absorb large budgets |
| BV | BV | Important medicine groups by use |
| CV | CV | Medicine group must be available but does not have an impact on finances |
| AE | AE | Important medicine groups by value |
| AN | AN | Medicine group that absorbs large budgets |
| BE | BE | Medicine group that can be controlled at moderate levels, can be based on previous consumption |
| CE | CE | Medicine group that can be controlled at moderate levels, can be based on previous consumption |
| BN | BN | Medicine group that can be controlled at moderate levels, can be based on previous consumption |
| CN | CN | Medicine group that has only a low impact on services and finances |
| Category I | AV, BV, CV, AE, AN | The priority group of medicines should always be available |
| Category II | BE, CE, BN | Main medicine group that can be controlled through prior use |
| Category III | CN | Additional medicine groups that can be controlled as needed |

List. The results of the ABC-VEN combination analysis are then categorized into Category I (AV, BV, CV, AE, AN), Category II (BE, CE, BN), and Category III (CN). The data analysis is then carried out by a t-test statistical analysis in SPSS to find out differences in medicine use at the Airlangga University Hospital in the pre-pandemic COVID-19 era versus the COVID-19 pandemic era. The value of the Indonesian Rupiah (IDR) currency is determined based on the valuation of the Rupiah exchange rate in each year of medicine use data.

Results

Based on the results of the study, a total of 6893 drug items were obtained, with details of the use of drug items in each year listed in Table 2.

Table 2. Number of drug items used in 2018–2022.

| Year | Number of Drug Items Used |
|--------------|---------------------------|
| 2018 | 1401 |
| 2019 | 1362 |
| 2020 | 1207 |
| 2021 | 1418 |
| 2022 | 1505 |
| Total | 6893 |

ABC analysis

The results of the analysis using the ABC method at Airlangga University Hospital During 2018–2022 (Table 3) showed that item A group with a sequential total of respectively 98, 102, 73, 93 and 109 items, with the percentage of all medicine items used in hospital respectively being 7.00%, 7.49%, 6.05%, 6.56%, 7.24%. In calculating the absorption of group A budget during 2018–2022 absorbed a budget respectively of Rp. 13,223,481,450 (69.77%), Rp. 14,755,239,669 (69.94%), Rp. 12,943,283,294 (69.82%), Rp. 15,081,553,671 (69.90%), Rp. 18,318,737,550 (69.91%), with an average use of 5 years of Rp.

14,864,459,127 ± 2,143,293,183 (69.87 ± 0.07%). The results of group B and C analysis can be seen in Table 3. Based on the results of data analysis (Table 4), in 2018–2020 there were 2 items that absorbed the highest budget, there were Adalat Oros 30 mg tab and Novorapid 100IU/3ml with values of 5.46% and 5.28% (2018), 7.41% and 5.44% (2019), 5.91% and 5.01% (2020), 5.89% and 5.02% (2021) and in 2022 with a value of 6.38% and 5.00%. Based on the data in Table 4, there was a highest change in rank 3 items in 2020–2022 compared to 2018 and 2019, with the following details, novomix 30–70 100IU/ml (4.14%, 2018), novomix 30–70 100IU/ml (3.41%, 2019), Resfar 200 mg/ml injection (2.85%, 2020), Octalbin 25% 100 ml (3.41%, 2021) and in 2022 Ryzodeg 100IU/ml of 4.15%.

VEN analysis

Based on the results of this analysis, the number of items in medicine group V from 2018–2022 were 186, 225, 204, 204 and 242 items respectively, with a percentage of the total medicine items of 13.29%, 16.53%, 16.92%, 14.40% and 16.08%. Based on the calculation, item V absorbed the budget in 2018–2022 in the amount of Rp.3,009,559,623 (15.88%), Rp. 4,674,883,142 (22.16%), Rp. 4,744,366,552 (25.59%), Rp. 5,799,683,471 (26.88%), Rp. 6,224,116,173 (23.75%), respectively with 5 years average use of Rp. 4,890,557,792 ± Rp. 1,246,119,609 (22.85 ± 4.29%). Essential medicine items (E) absorbed the largest budget among medicine items V or N, with 5 years average usage of Rp. 15,912,512,171 ± 2,220,969,618 (74.94 ± 4.87%). The value of the N item group can be seen in Table 5.

ABC-VEN matrix analysis

Based on the results of the ABC-VEN combination analysis (Table 6), showed the amount of item in AV group in 2018–2022 were 25, 29, 24, 31 and 30 items respectively with the percentages of 1.79%, 2.13%, 1.99%, 2.19% and 1.99% of the total items. This group absorbed the budget for 2018–2022 with a value of IDR

Table 3. Results of the ABC analysis of patient medicine use at Universitas Airlangga Hospital in 2018–2022.

| Year | Class | Number of Items | % of items | Value of Rupiah | % Rupiah Value |
|---------------------|-------|-----------------|--------------|--------------------------------------|----------------|
| 2018 | A | 98 | 7.00 | Rp 13,223,481,450 | 69.77 |
| | B | 215 | 15.36 | Rp 3,824,469,421 | 20.18 |
| | C | 1087 | 77.64 | Rp 1,905,254,034 | 10.05 |
| 2019 | A | 102 | 7.49 | Rp 14,755,239,669 | 69.94 |
| | B | 207 | 15.21 | Rp 4,221,318,677 | 20.01 |
| | C | 1052 | 77.30 | Rp 2,119,881,649 | 10.05 |
| 2020 | A | 73 | 6.05 | Rp 12,943,283,294 | 69.82 |
| | B | 165 | 13.68 | Rp 3,738,229,390 | 20.17 |
| | C | 968 | 80.27 | Rp 1,856,399,013 | 10.01 |
| 2021 | A | 93 | 6.56 | Rp 15,081,553,671 | 69.90 |
| | B | 199 | 14.04 | Rp 4,333,768,955 | 20.09 |
| | C | 1125 | 79.39 | Rp 2,159,309,891 | 10.01 |
| 2022 | A | 109 | 7.24 | Rp 18,318,737,550 | 69.91 |
| | B | 214 | 14.22 | Rp 5,260,539,106 | 20.08 |
| | C | 1182 | 78.54 | Rp 2,622,427,976 | 10.01 |
| 5 Years Average Use | A | 95.00 ± 13.62 | 6.87 ± 0.57 | Rp 14,864,459,127 ± Rp 2,143,293,183 | 69.87 ± 0.07 |
| | B | 200.00 ± 20.59 | 14.50 ± 0.74 | Rp 4,275,665,110 ± Rp 605,954,017 | 20.10 ± 0.07 |
| | C | 1082.80 ± 80.26 | 78.63 ± 1.23 | Rp 2,132,654,513 ± Rp 303,636,205 | 10.03 ± 0.02 |

Table 4. Top 10 Medicine use based on % rupiah value at Universitas Airlangga Hospital.

| NO | Years of Medicine Use | | | | | | | | | |
|----|--|----------------|--|----------------|--|----------------|---|----------------|--|----------------|
| | 2018 | | 2019 | | 2020 | | 2021 | | 2022 | |
| | Product names | % Rupiah value | Product names | % Rupiah value | Product names | % Rupiah value | Product names | % Rupiah value | Product names | % Rupiah value |
| 1 | Adalat Oros 30mg tab Bayer [†] | 5.47 | Adalat Oros 30mg tab Bayer [†] | 7.41 | Adalat Oros 30mg tab Bayer [†] | 5.91 | Adalat Oros 30mg tab Bayer [†] | 5.89 | Adalat Oros 30mg tab Bayer [†] | 6.38 |
| 2 | NovoRapid 100IU/ml 3ml Flexpen Novo Nordisk [†] | 5.28 | NovoRapid 100IU/ml 3ml Flexpen Novo Nordisk [†] | 5.44 | NovoRapid 100IU/ml 3ml Flexpen Novo Nordisk [†] | 5.01 | NovoRapid 100IU/ml 3ml Flexpen Novo Nordisk [†] | 5.02 | NovoRapid 100IU/ml 3ml Flexpen Novo Nordisk [†] | 5.00 |
| 3 | NovoMix 30–70 100IU/ml 3ml Flexpen Novo Nordisk [†] | 4.14 | NovoMix 30–70 100IU/ml 3ml Flexpen Novo Nordisk [†] | 3.41 | Resfar 200mg/ml Inf Fahrenheit [†] | 2.85 | Octalbin 25% 100ml Kalbe [†] | 3.41 | Ryzodeg 100IU/ml 3ml Flextouch Novo Nordisk [†] | 4.15 |
| 4 | Micardis 80mg Tab Boehringer [†] | 3.78 | Harnal OCAS tab Astellas [†] | 2.29 | NovoMix 30–70 100IU/ml 3ml Flexpen Novo Nordisk [†] | 2.67 | Resfar 200mg/ml Inf Fahrenheit [†] | 2.90 | Keytruda 25mg/ml MSD [†] | 2.12 |
| 5 | MabThera 500mg/50ml for Inf | 3.15 | Levemir 100IU/ml 3ml FlexPen Novo Nordisk [†] | 2.21 | Roculax 10mg/ml 5ml Inj Kalbe [†] | 2.48 | Rocuronium bromide 50mg/5ml @5ml Inj Bernofarm [†] | 2.66 | Albunorm 25% 100ml Harsen [†] | 2.03 |
| 6 | Lantus Solostar 100IU/mL 3ml Flexpen Sanofi [†] | 2.94 | Concor 2.5mg tab Merck [†] | 1.44 | Levemir 100IU/ml 3ml FlexPen Novo Nordisk [†] | 2.34 | Levemir 100IU/ml 3ml FlexPen Novo Nordisk [†] | 2.28 | Lansoprazole 30mg Inj Fahrenheit [†] | 1.79 |
| 7 | Harnal OCAS tab Astellas [†] | 2.09 | Ecosol NaCl 0.9% 100ml B BRAUN [†] | 1.38 | Harnal OCAS tab Astellas [†] | 1.92 | Tygacil 50 mg inj Pfizer [†] | 2.05 | Herzemab 440mg Inj Kalbe [†] | 1.73 |
| 8 | Levemir 100IU/ml 3ml FlexPen Novo Nordisk [†] | 1.98 | Apidra Solostar 100iu/ml Flexpen Sanofi Aventis [†] | 1.35 | Rocuronium bromide 50mg/5ml @5ml Inj Bernofarm [†] | 1.74 | Ryzodeg 100IU/ml 3ml Flextouch Novo Nordisk [†] | 1.72 | Renogen 2000IU/0.5ml Inj Darya Varia [†] | 1.57 |
| 9 | Navelbine 10mg/ml Inj Menarini [†] | 1.28 | Lantus Solostar 100IU/mL 3ml Flexpen Sanofi [†] | 1.34 | Tygacil 50 mg inj Pfizer [†] | 1.60 | Rocuronium 10mg/ml 5ml Inj Dexa [†] | 1.33 | Levemir 100IU/ml 3ml FlexPen Novo Nordisk [†] | 1.28 |
| 10 | Stalevo Tab Novartis [†] | 1.26 | Redditux 500mg/50ml inj Ferron [†] | 1.34 | Brilinta 90mg tab Astra Zaneca [†] | 1.58 | Herzemab 440mg Inj Kalbe [†] | 1.30 | Sansulin Log-G DispoPen Sanbe [†] | 1.24 |

Table 5. VEN analysis results of patient medicine use at Universitas Airlangga Hospital in 2018–2022.

| Year | Class | Number of items | % Of items | Value of rupiah | % Rupiah value |
|---------------------|-------|-----------------|--------------|--------------------------------------|----------------|
| 2018 | V | 186 | 13.29 | Rp 3,009,559,623 | 15.88 |
| | E | 1130 | 80.71 | Rp 15,618,808,538 | 82.41 |
| | N | 84 | 6.00 | Rp 324,836,744 | 1.71 |
| 2019 | V | 225 | 16.53 | Rp 4,674,883,142 | 22.16 |
| | E | 1067 | 78.40 | Rp 16,187,013,400 | 76.73 |
| | N | 69 | 5.07 | Rp 234,543,452 | 1.11 |
| 2020 | V | 204 | 16.92 | Rp 4,744,366,552 | 25.59 |
| | E | 921 | 76.37 | Rp 13,259,452,601 | 71.53 |
| | N | 81 | 6.72 | Rp 534,092,544 | 2.88 |
| 2021 | V | 204 | 14.40 | Rp 5,799,863,471 | 26.88 |
| | E | 1127 | 79.53 | Rp 15,132,042,782 | 70.14 |
| | N | 86 | 6.07 | Rp 642,726,264 | 2.98 |
| 2022 | V | 242 | 16.08 | Rp 6,224,116,173 | 23.75 |
| | E | 1163 | 77.28 | Rp 19,365,243,536 | 73.91 |
| | N | 100 | 6.64 | Rp 612,344,923 | 2.34 |
| 5 Years Average Use | V | 212.20 ± 21.64 | 15.44 ± 1.54 | Rp 4,890,557,792 ± Rp 1,246,119,609 | 22.85 ± 4.29 |
| | E | 1081.60 ± 96.22 | 78.46 ± 1.73 | Rp 15,912,512,171 ± Rp 2,220,969,618 | 74.94 ± 4.87 |
| | N | 84.00 ± 11.11 | 6.10 ± 0.66 | Rp 469,708,786 ± Rp 180,773,357 | 2.20 ± 0.79 |

1,969,747,073 (10.39%) each, Rp.2,955,043,497 (14.01%), Rp. 3,227,132,276 (17.41%), Rp. 4,447,289,085 (20.61%) and Rp 4,219,781,110 (23.75%) of the total budget. Data for the AE, AN, BV, BE, BN, CV, CE and CN groups can be seen in Table 6. Afterward, based on this data it was categorized into category I which consisted of AV, BV, CV, AE and AN group, Category II consisted of BE, BN and CE while category III consisted of CN. Based on the calculation results of this matrix, the number of category I items in 2018–2022 was 259, 298, 253, 266 and 320 items

respectively with a total percentage of all items of 18.50%, 21.90%, 20.98%, 18.77% and 21.26%. Category I Group absorbed a budget with a value of Rp.14,263,294,001 (75.26%) in 2018, Rp. 16,475,079,314 (78.09%) in 2019, Rp. 14,460,517,571 (78.01%) in 2020, Rp. 15,434,128,057 (76.17%) in 2021 and Rp.20,274,361,081 (77.38%) in 2022 of the total budgets each year, with an average usage of 5 years of Rp. 16,381,476,005 ± 2,415,722,684 (76.98 ± 1.23%). Details on the use of category II and III medicines can be seen in Table 7.

Table 6. Results of the ABC-VEN combination analysis of patients' medicine use at Universitas Airlangga Hospital in 2018–2022.

| Year | Category | Number of items | % of items | Value of rupiah | % Rupiah value |
|------|----------|-----------------|------------|-------------------|------------------|
| 2018 | AV | 25 | 1.79 | Rp 1,969,747,073 | 10.39 |
| | AE | 71 | 5.07 | Rp 11,160,360,092 | 58.88 |
| | AN | 2 | 0.14 | Rp 93,374,286 | 0.49 |
| | BV | 42 | 3.00 | Rp 714,750,857 | 3.77 |
| | BE | 163 | 11.64 | Rp 2,950,336,156 | 15.57 |
| | BN | 10 | 0.71 | Rp 159,382,408 | 0.84 |
| | CV | 119 | 8.50 | Rp 325,061,693 | 1.72 |
| | CE | 896 | 64.00 | Rp 1,508,112,290 | 7.96 |
| | CN | 72 | 5.14 | Rp 72,080,050 | 0.38 |
| | 2019 | AV | 29 | 2.13 | Rp 2,955,043,497 |
| AE | | 72 | 5.29 | Rp 11,727,489,827 | 55.59 |
| AN | | 1 | 0.07 | Rp 72,706,345 | 0.34 |
| BV | | 57 | 4.19 | Rp 1,213,823,040 | 5.75 |
| BE | | 145 | 10.65 | Rp 2,913,855,333 | 13.81 |
| BN | | 5 | 0.37 | Rp 93,640,304 | 0.44 |
| CV | | 139 | 10.21 | Rp 506,016,605 | 2.40 |
| CE | | 850 | 62.45 | Rp 1,545,668,240 | 7.33 |
| CN | | 63 | 4.63 | Rp 68,196,803 | 0.32 |
| 2020 | | AV | 24 | 1.99 | Rp 3,227,132,276 |
| | AE | 47 | 3.90 | Rp 9,448,299,037 | 50.97 |
| | AN | 2 | 0.17 | Rp 267,851,982 | 1.44 |
| | BV | 45 | 3.73 | Rp 1,090,429,197 | 5.88 |
| | BE | 110 | 9.12 | Rp 2,471,610,804 | 13.33 |
| | BN | 10 | 0.83 | Rp 176,189,389 | 0.95 |
| | CV | 135 | 11.19 | Rp 426,805,079 | 2.30 |
| | CE | 764 | 63.35 | Rp 1,339,542,760 | 7.23 |
| | CN | 69 | 5.72 | Rp 90,051,173 | 0.49 |
| | 2021 | AV | 31 | 2.19 | Rp 4,447,289,085 |
| AE | | 59 | 4.16 | Rp 10,326,218,780 | 47.86 |
| AN | | 3 | 0.21 | Rp 308,045,806 | 1.43 |
| BV | | 39 | 2.75 | Rp 903,740,271 | 4.19 |
| BE | | 146 | 10.30 | Rp 3,175,638,816 | 14.72 |
| BN | | 14 | 0.99 | Rp 254,389,868 | 1.18 |
| CV | | 134 | 9.46 | Rp 448,834,114 | 2.08 |
| CE | | 922 | 65.07 | Rp 1,630,185,187 | 7.56 |
| CN | | 69 | 4.87 | Rp 80,290,590 | 0.37 |
| 2022 | | AV | 30 | 1.99 | Rp 4,219,781,110 |
| | AE | 75 | 4.98 | Rp 13,757,287,284 | 52.51 |
| | AN | 3 | 0.20 | Rp 292,957,625 | 1.12 |
| | BV | 58 | 3.85 | Rp 1,419,599,337 | 5.42 |
| | BE | 150 | 9.97 | Rp 3,726,923,471 | 14.22 |
| | BN | 6 | 0.40 | Rp 150,621,413 | 0.57 |
| | CV | 154 | 10.23 | Rp 584,735,726 | 2.23 |
| | CE | 938 | 62.33 | Rp 1,881,032,781 | 7.18 |
| | CN | 91 | 6.05 | Rp 168,765,886 | 0.64 |

Test of Differences in Medicine Use Based on Each Class/Group in the Pre-Covid19 Era Compared to the Covid-19 Era.

Based on the results of the differences using t-test (Table 8), the results showed that the difference in mean cost of medications for each group used were analyzed using independent t-test and no statistically significant difference was found in the pre-covid19 era compared to the covid-19 era ($p > 0.05$). However, for the nonessential medicine cluster (N), there were significant differences in the pre-pandemic COVID-19 era compared to the COVID-19 pandemic era ($p < 0.05$). This is because during the COVID-19 pandemic era there was a huge number of multivitamins and supplements used for patients who were confirmed positive for Covid-19.

Discussion

Medicine management control is a critical matter for pharmaceutical services in hospitals, because the budgetary need for medicine absorbs about 40% of the total hospital budget per year. Absorption of a high enough budget requires best medicine management in the hospital. The pharmacy department is a unit responsible for medicine management in the hospital whose activities start from selection, planning, procurement, acceptance, storage, distribution and control (Mellen and Pudjirahardjo 2013); (Menkes 2016). Less optimal medicine management in hospitals can result in excess or shortage of medicine stocks used to service patients and the large number of expired medicines in certain stock hospitalization periods (Laukati et al. 2022). One way that can be used to optimize

Table 7. Results of categorization analysis of patients' medicine use at Universitas Airlangga Hospital in 2018–2022.

| Month/year | Category | Number of items | % of items | Value of rupiah | % Rupiah value |
|---------------------|--------------|-----------------|--------------|--------------------------------------|----------------|
| 2018 | Category I | 259 | 18.50 | Rp 14,263,294,001 | 75.26 |
| | Category II | 1069 | 76.36 | Rp 4,617,830,854 | 24.36 |
| | Category III | 72 | 5.14 | Rp 72,080,050 | 0.38 |
| 2019 | Category I | 298 | 21.90 | Rp 16,475,079,314 | 78.09 |
| | Category II | 1000 | 73.48 | Rp 4,553,163,878 | 21.58 |
| | Category III | 63 | 4.63 | Rp 68,196,803 | 0.32 |
| 2020 | Category I | 253 | 20.98 | Rp 14,460,517,571 | 78.01 |
| | Category II | 884 | 73.30 | Rp 3,987,342,953 | 21.51 |
| | Category III | 69 | 5.72 | Rp 90,051,173 | 0.49 |
| 2021 | Category I | 266 | 18.77 | Rp 16,434,128,057 | 76.17 |
| | Category II | 1082 | 76.36 | Rp 5,060,213,871 | 23.45 |
| | Category III | 69 | 4.87 | Rp 80,290,590 | 0.37 |
| 2022 | Category I | 320 | 21.26 | Rp 20,274,361,081 | 77.38 |
| | Category II | 1094 | 72.69 | Rp 5,758,577,665 | 21.98 |
| | Category III | 91 | 6.05 | Rp 168,765,886 | 0.64 |
| 5 Years Average Use | Category I | 279.20 ± 28.67 | 20.28 ± 1.54 | Rp 16,381,476,005 ± Rp 2,415,722,684 | 76.98 ± 1.23 |
| | Category II | 1025.80 ± 87.25 | 74.44 ± 1.78 | Rp 4,795,425,844 ± Rp 659,735,350 | 22.58 ± 1.27 |
| | Category III | 72.80 ± 10.69 | 5.28 ± 0.59 | Rp 95,876,900 ± Rp 41,599,742 | 0.44 ± 0.13 |

Table 8. Test results for differences in each class/group of medicine use.

| Class/Group | Pre-Pandemic COVID-19 | | Pandemic COVID-19 | | p |
|--------------|-----------------------|------------------|-------------------|------------------|-------|
| | Average | SD | Average | SD | |
| A | Rp 13,989,360,559 | Rp 1,083,116,623 | Rp 15,447,858,172 | Rp 1,083,116,623 | 0.696 |
| B | Rp 4,022,894,049 | Rp 280,614,800 | Rp 4,444,179,150 | Rp 280,614,800 | 0.527 |
| C | Rp 2,012,567,842 | Rp 151,764,642 | Rp 2,212,712,293 | Rp 151,764,642 | 0.551 |
| V | Rp 3,842,221,383 | Rp 1,177,561,553 | Rp 5,589,448,732 | Rp 761,984,584 | 0.129 |
| E | Rp 15,902,910,969 | Rp 401,781,511 | Rp 15,918,912,973 | Rp 3,128,025,617 | 0.995 |
| N | Rp 279,690,098 | Rp 63,846,999 | Rp 596,387,910 | Rp 56,047,221 | 0.010 |
| Category I | Rp 15,369,186,657 | Rp 1,563,968,393 | Rp 17,056,335,570 | Rp 2,956,442,242 | 0.525 |
| Category II | Rp 4,585,497,366 | Rp 45,726,458 | Rp 4,935,378,163 | Rp 892,191,721 | 0.635 |
| Category III | Rp 70,138,427 | Rp 2,745,870 | Rp 113,035,883 | Rp 48,509,712 | 0.321 |

medicine management is to periodically evaluate medicine use (Indarti et al. 2019; Laukati et al. 2022). The purpose of this evaluation is to optimize inventory which is a priority or less priority both in terms of the importance of the use of medicine items and budget requirements.

The analysis that can be used to evaluate a medicine use is the ABC-VEN combination. This analysis provides medicine items that need to be managed in priority (Purwaningsih et al. 2021). Pharmacy department need to extract data on medicine use every year and have a list of vital, Essential and Non-essential medicines that are circulating in the hospital, in order to carry out a routine and comprehensive analysis of medicine use.

Based on the results of evaluating medicine use, using the ABC analysis method during 2018–2022 at Airlangga University Hospital, the results for groups A, B, C were obtained as shown in Table 3. Based on these data, the number of items in the ABC group has not changed much from year to year, but the value of the Rupiah absorption was getting higher every year which could be due to the absorption of the budget which was increasing every year due to the development of services and the number of patients.

Based on Table 3, there have been changes in item A in 2020 and 2021, where item A in 2018 was 98 items and in 2019 there were 102 items but in 2020 there were 73 items. Based on the data shown in Table 3, there is a change in ranking to the 3rd item that absorbs the most of the budget in 2020, there are Novomix to Resfar (N-acetylcysteine).

The decrease in the number of group A items and changes in these items occurred because in 2020 there was a COVID-19 pandemic where this virus attacked more of the respiratory tract of patients (Haryani et al. 2022). In 2020, a lot of positive COVID-19 patients who were treated at Airlangga University Hospital received Resfar (N-acetylcysteine) injection therapy. This is in accordance with the management of COVID-19 therapy issued in 2020, which stated that SARS-CoV-2 or COVID-19 infection is associated with an imbalance of oxidants and antioxidants which results in inflammation and tissue damage. Glutathione is an antioxidant that is found in the body and plays a role in protecting cells from oxidative stress. N-acetylcysteine (NAC), which is often used as a mucolytic medicine, has antioxidant properties directly or indirectly through the release of cysteine groups as precursor compounds in the glutathione synthesis process (Burhan et al. 2020).

In 2021, there was another change in item number 3 which absorbed the largest budget, namely from Resfar (N-acetylcysteine) injection to Octalbin 25% (Human Albumin) injection, this occurred due to an increase in the need for human albumin for Covid-19 patients. In June-September 2021, in Indonesia there was a wave of COVID-19 variant delta, which often causes the patient's condition to be in the moderate to severe stage. Patients with moderate to severe COVID-19 infection are correlated with lower albumin levels than patients with mild-moderate levels of infection (Turcato et al. 2022). The price of

this human albumin product was also relatively expensive, which was around Rp. 1,200,000 / bottle which resulted in absorbing a fairly high budget.

In 2022 there was another change in item number 3 which absorbed the largest budget, namely from Octalbin 25% (Human Albumin) injection to Ryzodeg 70/30 (70% degludec, 30% aspart). The use of Ryzodeg insulin also replaced the use of Novomix insulin (30% aspart and 70% protamine aspart) in 2022. Based on the results of a phase 3a clinical trial which compared Insulin Degludec/Insulin Aspart (IDegAsp) and Biphasic Insulin Aspart 30 (BIAsp 30) in uncontrolled type 2 diabetes patients who previously used insulin premix 1–2× a day, it was found that using IDegAsp twice a day has better effectiveness in controlling HbA1C and Fasting Glucose Level, and has a smaller hypoglycemic effect compared to BIAsp 30. This type of Ryzodeg insulin has a faster onset of action than Novomix, but has a longer duration of action than Novomix. This type of intermediate acting insulin like Novomix often has a ‘shoulder’ effect which results in an increased risk of hypoglycemia in daily use. This shoulder effect occurs in the hours after eating which is caused by the interaction between protamine and non-protamine insulin which prolongs the action of short-acting prandial components. This causes the use of Ryzodeg to be preferred by doctors compared to intermediate acting insulin such as Novomix (Fulcher et al. 2014; Atkin et al. 2015; Wibisono et al. 2021).

Based on the VEN analysis, the results showed that the composition of the VEN items with the most total essential medicine items compared to the V and N medicine items in the hospital as shown in Table 5, so that these essential medicine items absorbed the largest total budget. Medicine items included in this essential group are widely used for various patient therapies in hospitals.

The use of these essential medicine is very dynamic, hence in planning their needs one must always look at changes in consumption of these types of medicine. The total number of VEN drug items at Airlangga University Hospital changes every year, this happens because data on the use of drug items is based on trade names, not their ingredients, so medicine with the same content can be different items but remain in the same category.

Based on the results of the test of drug use per class/category during the pre-pandemic COVID-19 era and the COVID-19 pandemic era as shown in Table 8, the data obtained indicated that there were significant differences in the use of non-essential medicine. During the COVID-19 pandemic era, the value of non-essential medicines increased compared to before, this was due to the large use of multivitamins and supplements in COVID-19 patients. This is in accordance with the 2020 COVID-19 management guidelines which stated that COVID-19 patients from mild to severe degrees could be given multivitamins which could help boost the immune system of COVID-19 patients (Sugihantono et al. 2020).

In the drug procurement process, if there is a vacancy for a drug with a certain brand, another brand of drug with the same content will be procured to meet the demand for the drug. This has an impact on adding types of drug items to

the hospital's list of vital, essential, and non-essential medicines so that drug items purchased to cover the vacancies of certain medicine will have a small use value. Therefore, if only ABC analysis is used to evaluate drug use, these drug items will be included in group C even though these types of medicine are essential medicine and are very necessary for patient care in hospitals. ABC analysis is an analysis that focuses on the impact of drug items on the absorption of the existing budget, but does not pay attention to the use of these drug items is important in the hospital. On the other hand, the VEN analysis only focuses on whether the items available at the hospital are important or not, regardless of whether the drug items impact the budget. This needs an analytical method to facilitate the importance of the availability of a drug item in the hospital and its effect on budget absorption in the hospital. The analytical method that can be used is to combine ABC analysis with VEN or commonly known as matrix ABC-VEN analysis. This analysis method will produce various combinations of drug items A, B and C with drug items V, E and N. The result of this combination is that there are AV, AE, AN, BV, BE, BN, CV, CE, and CN drug groups which are then categorized into 3 categories, namely Categories I, II and III. Based on the results of the data analysis above, it can be concluded that medication management or procurement can focus more on drug items that fall into category I so that they are always available in sufficient quantities for the continuity of patient care at the hospital as well as, so that the use of the budget for expenditure medicine could be more efficient.

The limitation of this research is that this research is only limited to the use of drug items that are inputted into the management information system of the Universitas Airlangga Hospital, so that when there is use of drugs that are not inputted, the use of these drugs will also not be detected in the data collection of this study. The validity of the Universitas Airlangga Hospital Management Information System must also be maintained to maintain the validity of the data sampled in this study.

Conclusion

- Based on the results of the ABC analysis, there was a shift in the pattern of drug use at Airlangga University Hospital which was prescribed to patients after the COVID-19 pandemic compared to before the pandemic.
- There was a significant difference in the use of non-essential medicine during the COVID-19 pandemic compared to before the pandemic.
- The ABC-VEN matrix analysis method is a method that combines ABC analysis with VEN. This method will produce various combinations of drug items A, B and C with drug items V, E and N. The result of this combination is that there are drug groups AV, AE, AN, BV, BE, BN, CV, CE, and CN which will be categorized into Category I, II, and III. This analytical method was able to facilitate the importance of the availability of a priority drug item and its effect

on the absorption of the hospital budget so that the results of the analysis can be used as a reference in planning drug needs for the next year. This is done so that the drug procurement process in hospitals can run more effectively and efficiently.

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