

The Extemporaneous Compounding at Primary Health Care Centers: Characteristic and Personnel

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Abstract

Objective: Extemporaneous compounding is still done for clinical practices in several countries, one of them is in Indonesia. This is due to unavailability or limited formula for pediatric patients or limited budget in the procurement of medicines. This study was aimed at recognizing the compounding personnel's characteristics and the characteristics of extemporaneous compounding based on prescriptions at primary health care centers.

Method: This study used cross sectional survey method conducted at 24 Primary Health Care Centers in Banyumas Regency, Central Java, Indonesia. Retrospective data collection was conducted on 1200 prescription sheets in the period between April to June 2017.

Result: Compounding personnel at Primary Health Care Centers in Banyumas Regency, Central Java, Indonesia consist of 59 personnel consisting of pharmacist (40.68%), pharmaceutical technicians (10.17%), compounding personnel having health educational background (22.03%) and those from non-health educational background (27.12%). Most of the compounding personnel are women (74.58%) while the rest of 25.42% is men. Mostly, compounding personnel working at the Primary Health Care Centers (35.60%) are in their productive age; they are between 20 to 30 years old. Most of their educational background are undergraduates (S1); they are 27 persons (45.76%). Commonly, the prescribers were general practitioners (79.75%), midwives (15.08%), dentists (2%), and nurses (3.17%). Children (97.67%) are the patients who are mostly prescribed at Primary Health Care Centers. The pediatric patients were dominated by 0–5 years-old children (74.33%) while adult patients were only 2.33%. The most common prescription is one extemporaneous compounding per prescription sheet as much as 97.58%. The form of extemporaneous compounding is mostly 96.42% oral; it consisted of 88.36% *puyer* (crushed tablet) and 8.06% suspension.

Conclusions: In this study, drug compounders in Primary Health Care Centers are mostly pharmacists. The prescribers of extemporaneous compounding in Primary Health Care Centers are mostly general practitioners, some midwives and nurses also prescribe. Patients receiving the prescription are dominated by pediatric patients range between 0–5 years old. It is common to find only one extemporaneous compounding per prescription sheet, with *puyer* being the most prevalent.

Keywords: extemporaneous compounding, characteristic, personnel, primary health care center

1. Introduction

Extemporaneous compounding is the process of providing medicines adjusted to individual needs due to limitations of medicine supply where the process can be performed in pharmacies or other health facilities (Allen, 2003). Extemporaneous compounding is still done for clinical practices in several countries. Although it is still debatable, because the deformation of the initial drug (from the industry) to the final preparation (in clinic and community) can change safety and efficacy from the drug (Buurma et al., 2003). In fact, extemporaneous compounding can cause chemical and physical reactions among its medicinal substances. It can also cause degradation and contamination, especially the compounding using water as one of its substances (Thiers, 1998); (Eileen Kairuz, Gargiulo, Bunt, & Garg, 2007).

Based on previous studies, the prevalence of extemporaneous compounding practices in several countries are quite low with a prevalence below 5% (Kristina, Wiedyaningsih, Widyakusuma, & Aditama, 2017). However, cases of extemporaneous compounding in Indonesia are quite prevalent, especially in Primary Health Care Centers due to unavailability or limited formula for pediatric patients or limited budget in the procurement of medicines in Primary Health Care Center (Widyaswari & Wiedyaningsih, 2012). Extemporaneous compounding of unlicensed or off-label drugs is commonly used for pediatric patients in Primary Health Care (Kimland & Odlind, 2012). The licensed drug supply shortage, especially drugs for pediatric patients has become the major reason for the compounding practice to be performed. Furthermore, the compounding makes the drug price cheaper and the physicians believe in the past experience about the compounding efficacy based on the progress of patient's health status (Giam & McLachlan, 2008; Buurma et al., 2003; Brion, Nunn, & Rieutord, 2003; Wiedyaningsih, Hakimi, Soenarto, & Suryawat, 2016).

Regulation of Indonesian Health Ministry no. 74 on Pharmacy Service Standard at Primary Health Care Center states that pharmacy service in Primary Health Care Center is led by a pharmacist as the person in charge. Pharmacists and/or pharmacy technicians may undertake the compounding in community health centers. These technicians assist pharmacist in pharmaceutical-related works such as pharmacy vocational high school graduates, diploma graduates of pharmacy and pharmaceutical analysts. Only 17.5% Primary Health Care Centers in Indonesia have already employed pharmacists. Meanwhile, 32.2% of centers have not hired any pharmacy personnel. The primary health care centers employing pharmacists and pharmacy personnel provide better pharmaceutical services rather than the primary health care centers do not employ them, in term of medical service (Herman, Handayani, & Siahaan, 2013). In addition, extemporaneous compounding done by non-compounders has a higher risk because there is a possibility where they get difficulty in performing extemporaneous compounding services. It may happen because they did not get knowledge and training on extemporaneous compounding before (Zaid, Al-Ramahi, Shahed, Saleh, & Elaraj, 2012). The dosages form in prescription are usually solid, liquid and semi-solid form. However, it can also be in form of licensed crushed tablet, content of capsules, medicinal powders dissolved or suspended into a liquid medicine, medicinal powder divided into smaller sizes and then packaged into sachets and a mixture of ointment/cream (Thiers, 1998; Brion et al., 2003). In Indonesia, prescriber frequently order the pharmacist to make *puyer* preparation (Wiedyaningsih, 2005). *Puyer* is the traditional name in Indonesia for pulverizing and or mixing a type of medicine tablet or more, or opening capsule for its contain. Meanwhile in some other countries, most of the compounded medicines are semi-solid preparations for topical application (Kristina et al., 2017). Dermatology preparations in form of topical medicines are generally compounded in some developed countries such as United States of America (the US), Australia, and Netherland. Oral medicines in form of oral solution or suspension are also available but it is limited (Martin et al., 2009; Pappas, MacPherson, & Stewart, 2002); Buurma et al., 2003). This research aims to identify the characteristics of compounding personnel and the characteristics of extemporaneous compounding at Primary Health Care Centers.

2. Methods

2.1 Study Design

The study was an observational study with cross sectional descriptive survey method at Primary Health Care Centers in Banyumas Regency, Central Java, Indonesia for 3 months (April to June 2017). The study was consisted of two parts of survey. Both surveys used retrospective data collected from April to June 2017 at Primary Health Care Centers in Banyumas Regency, Central Java, Indonesia. The prior survey investigated the percentage of extemporaneous compounding prescription at public health care center. The centers would not be opted in the next survey if the percentage felt under 5%. The later survey data explored the characteristics of human resources of the compounders and the compounding prescription at public health care centers in Banyumas Regency, Central Java, Indonesia. The later survey was conducted by observation to the human resources of the compounder and identification the extemporaneous compounding prescription which were sampled.

2.2 Sample Criteria

Population in this research was all extemporaneous compounding found in 28 Primary Health Care Centers in Banyumas Regency, Central Java, Indonesia.

2.2.1 Inclusion Criteria

Based on the prior survey, the inclusion criteria in this study were all extemporaneous compounding prescriptions from Primary Health Care Centers in Banyumas Regency, Central Java with a percentage of extemporaneous compounding $\geq 5\%$, prescribed by doctors, midwives and nurses intended for adult and pediatric patients. The data

of prior survey are used to select Primary Health Care Centers as its sample based on criteria of extemporaneous compounding in the Primary Health Care Center $\geq 5\%$.

2.2.2 Exclusion Criteria

Exclusion criterion in this study is prescriptions without any extemporaneous compounding. Primary Health Care Center with its extemporaneous compounding less than 5% of the total prescriptions found in Primary Health Care Center should also be excluded from our study. Based on the results of a survey of prescriptions at 28 health centers, there are four Primary Health Care Centers with less than 5% extemporaneous compounding of total prescriptions in the Primary Health Care Centers. Therefore, the four centers are not included in the sampling, so that the samples in this study are 24.

Total number of extemporaneous compounding taken is 1200 from 24 Primary Health Care Centers in Banyumas Regency, Central Java, Indonesia. Prescription sampling from each Primary Health Care Center is conducted by randomly stratified the data on the number of extemporaneous compounding from survey results of the compounding that executed before.

2.3 Ethical Considerations

The Ethics approval was obtained from Ethics Commission of Faculty of Medicine, Universitas Jenderal Sudirman (a public higher institution in Indonesia).

2.4 Data Collection and Analysis

Data collection was conducted in stages by collecting prescription samples from the primary health care centers located closest to the researchers to the most remote ones. It was done by researchers with involvement of trained surveyor pharmacists in each sampling at each primary health care center. The data collection was coordinated by researchers, where in each sampling the researchers participated in the sampling to control and supervise them. The obtained data are written in data collection sheets and then the data are analyzed descriptively. The data collection sheet was developed by literature search and also from the expert researchers.

3. Results

Based on survey at Primary Health Care Centers in Banyumas Regency, Central Java, Indonesia it is found that all the surveyed centers already have pharmacist to be responsible for pharmacy service. Of the total of human resources, the percentage of pharmacist 40.68%, meanwhile there are only 6 people (10.17%) for pharmacy technician in Table 1. This means that there are only 6 Primary Health Care Centers with pharmacists and pharmacy technical personnel. Pharmacy technicians in this study consist of 2 pharmacist assistants, 3 diplomas associate pharmacists and a pharmaceutical analyst. A total 13 people other than pharmacy workers, namely 6 nurses, 1 dental nurse, 5 midwives, and 1 environmental health expert, perform compounding practices at Primary Health Care Centers which can be shown in Table 1. It is found that the non-health compounding personnel range from junior high school level (3 persons), senior high school (10 persons), high school of economics (1 person), vocational high school (1 person) and economics bachelor (1 person). Therefore, the totals of non-health compounders are 16 persons.

Based on the data in Table 1, the majority is female with 74.58%. In the age category, the finding showed that extemporaneous compounding in Primary Health Care Centers is mostly by staffs in productive age range between 20 to 30 years old (35.60%) and 27.12% of them ranged between 31 to 40 years old. In the category of length (period) of work, the extemporaneous compounding is mostly done by the ones who have been working for 0-5 years as many as 34 people or 57.63% in the Table 1. The workers appointed as Civil Servant (PNS) are 52.54% and the other by the Public Service Agency Region (BLUD) are 47.46% in Table 1.

Table 1. Characteristics of Compounding Personnel in Primary Health Care Centers (n=59)

		Number	Percentage (%)
Compounding Personnel	Pharmacist	24	40.68
	Pharmacy technicians	6	10.17
	Health compounder	13	22.03
	Non-Health compounder	16	27.12
Sex	Female	44	74.58
	Male	15	25.42
Age (in year)	20-30	21	35.60
	31-40	16	27.12
	41-50	11	18.64
	> 50	11	18.64
Work Status	Civil Servants	31	52.54
	Employee of the Regional Public Service Agency (BLUD)	28	47.46
Length of Work (in year)	0 – 5	34	57.63
	6 – 10	8	13.56
	11 – 20	5	8.47
	21 – 30	11	18.64
	> 30	1	1.70
Education Level	Junior High School	3	5.09
	Senior High School	17	28.81
	Diploma 1 (D1)	1	1.70
	Diploma 3 (D3)	11	18.64
	Bachelor Degree 1 (S1)	27	45.76

Table 1 shows the highest level of education for the compounding personnel is undergraduate (S1) of 27 persons. Twenty-four of them are pharmacists and have taken the pharmacist profession program, 2 persons graduated from nursing (undergraduate), and 1 person graduated from economics major. Meanwhile the lowest level of education for the compounding is undergraduate from Junior High School (3 persons).

Figure 1 shows that 79.75% of the extemporaneous compounding were prescribed by general practitioners and 15.08% by midwives. Group of patients prescribed with most is children patients (97.67%). Otherwise, the frequency is low in adult group with only 2.33% in the Table 2. In Table 2, 74.33% of patients aged 0-5 years receiving most extemporaneous compounding.

From the sampling result of 1200 prescription sheets of the compounding in Primary Health Care Centers, the previous (initial) dosage form based on each prescription sheet (n= 1328) consists of 89.23% solid (tablets), 7.45% liquid (syrup or suspension), and 3.32% semi-solid (unguent or cream) in the Table 3. The final dosage form (n=1229) consists of 88.36% solid (*puyer*) 8.06% liquid (suspension) and 3.58% semi-solid (unguent/cream) in Table 3.

Figure 2 shows that the study of 1200 prescription, instruct to make 1229 final preparation of which 96.42% is per oral and 3.58% into topical preparation. It is frequent to come across only one compounding instruction per prescription sheet as much as 97.58% in Figure 3.

A notable finding seen in table 4, the *puyer* is the most compounding preparation to be instructed in prescription (86.83%) contrarily unguent/cream is the least (2.83%).

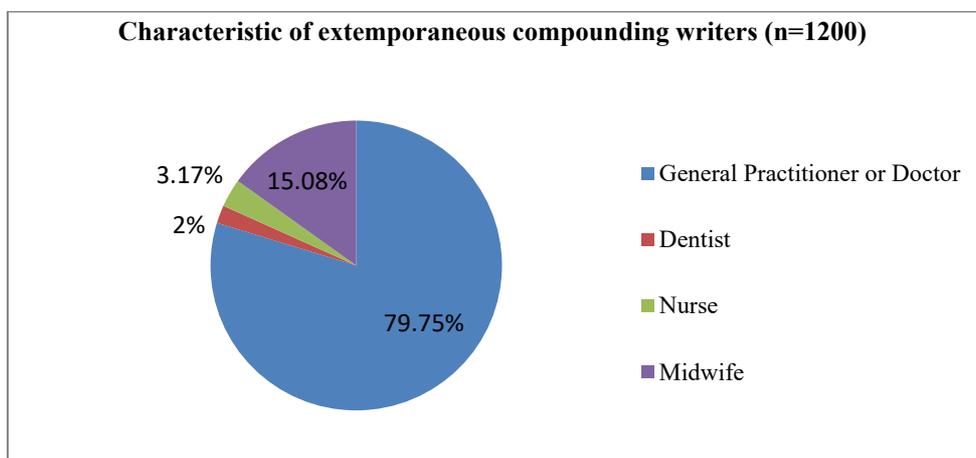


Figure 1. Characteristic of extemporaneous compounding writers

Table 2. Characteristic of patient extemporaneous compounding in Primary Health Care Centers (n = 1200)

		Number	Percentage (%)
Patient	Children	1172	97.67
	Adult	28	2.33
Age of Patient (in year):	0 – 5	892	74.33
	6 – 11	274	22.83
	12 – 16	6	0.5
	17 – 25	7	0.58
	26 – 35	3	0.25
	36 – 45	6	0.5
	46 – 55	6	0.5
	56 – 65	5	0.43
	> 65	1	0.08

Table 3. Initial medicine/dosage form (n=1328) and final medicine/dosage (n=1229) form based on extemporaneous compounding in Primary Health Care Centers

		Number	Percentage (%)
Initial Medicine/Dosage Form (n=1328)	Solid (tablet)	1185	89.23
	Liquid (syrup/suspension)	99	7.45
	Semi-solid (unguent/ cream)	44	3.32
Final Medicine/Dosage Form (n=1229)	Solid (<i>puyer</i>)	1086	88.36
	Liquid (suspension)	99	8.06
	Semi-solid (unguent/ cream)	44	3.58

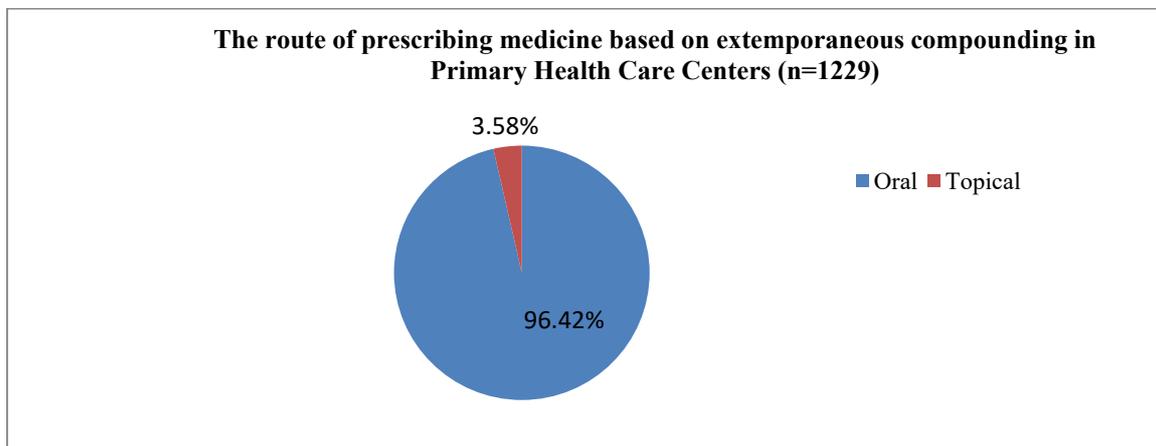


Figure 2. The route of prescribing medicine based on extemporaneous compounding in Primary Health Care Centers

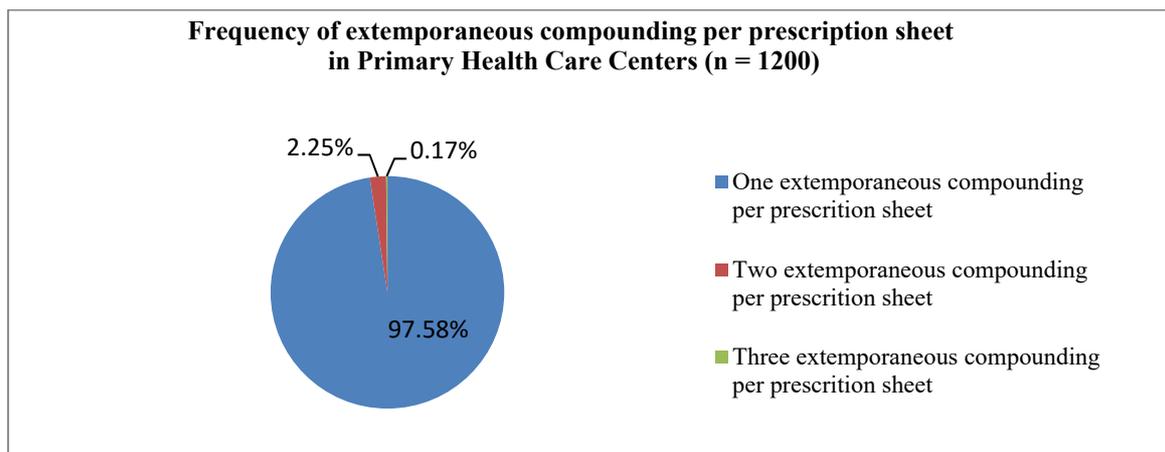


Figure 3. Frequency of extemporaneous compounding per prescription sheet in Primary Health Care Centers

Table 4. Characteristic of medicine/dosage form per prescription sheet (n=1200) in Primary Health Care Centers

	Medicine/Dosage Form	Number	Percentage (%)
One extemporaneous compounding per prescription sheet	<i>Puyer</i> (crushed tablet)	1.042	86.83
	Suspension	95	7.92
	Unguent/ cream	34	2.83
Two extemporaneous compounding per prescription sheet	<i>Puyer</i> (crushed tablet)	13	1.09
	<i>Puyer</i> (crushed tablet) & suspension	4	0.33
	<i>Puyer</i> (crushed tablet) & unguent / cream	10	0.83
Three extemporaneous compounding per prescription sheet	<i>Puyer</i> (crushed tablet)	2	0.17

4. Discussion

Extemporaneous compounding at Primary Health Care Centers are not only carried out by pharmacists and pharmacy technical personnel but also by other health workers which are called health-compounder. Health compounder are the persons who hold health-related degree other than pharmacy and allowed to help the process

of extemporaneous compounding in pharmacy installation of Primary Health Care Center. Furthermore, this practice is still in accordance with the Regulation of Health Minister no. 74 on Standard Pharmaceutical Services stating that other health workers may be assigned to provide limited pharmaceutical services. These limited pharmaceutical services include the prescription services. Besides that, non-health compounders were found in the compounding practice in Primary Health Care Center. Non-health compounders are the people with no health education background who assist compounding services in Primary Health Care Center.

More women (74.58%) do the extemporaneous compounding than men (25.42%) because women deemed to be more accuracy, expertise, thoroughness, cleanliness and neatness in Indonesia community especially in providing service (Nurjanah, Aurista, & Kusuma, 2014).

In the category of years of work, it is seen that the work of extemporaneous compounding is mostly done by the ones who have been working for 0-5 years (57.63%). This happened because it was the beginning of the implementation of BLUD (Regional Public Service Agency) 5 years ago. The implementation has implications for financial management at primary health care centers that can be managed independently. The primary health care centers can manage and use operational funds directly without going through the health department. It aims to improve health services to the community optimally as well as to have the appointment of human resources in Primary Health Care Center by BLUD system which began to use for the last 5 years since the issuance of Minister of Home Affairs Regulation No. 61 of 2007 on the Technical Guidelines for Financial Management of BLUD and also reinforced by Presidential Regulation of Indonesia No. 32 in 2014 on Management and Utilization of National Health Insurance on capitation fund at Local Government First Level Health Facility, so the number of employees working for 0 - 5 years are at most among other timeframes. This is supported by the introduction of the Regional Public Service Agency (BLUD) system at the Primary Health Care Center, and from 34 people working within period of 0-5 years, there are 28 people as BLUD employees of 6 people are Civil Servants and all pharmacists working in Primary Health Care Center are all appointed by the Regional Public Service Agency (BLUD) system. The comparison between the human resources appointed as civil servant and the system of Public Service Agency (BLUD) is not too significant.

The survey obtained total number of 135.736 prescription sheets and 13.642 of them are extemporaneous compounding, with its average 10.05%. This result is higher compared to studies already conducted in some other countries where the prevalence for extemporaneous compounding is less than 5% (Kristina et al., 2017). It occurs because of the limited availability of medicines in Primary Health Care Centers (Widyaswari & Wiedyaningsih, 2012), and the request of the prescription writer to make the prescription (Kristina et al., 2017). The sample of the research in the form of extemporaneous compounding is taken based on the results of the survey. It was taken using stratified random sampling with 1200 compounded prescriptions. The extemporaneous compounding was prescribed by doctors (79.75%) and by midwives (15.08%). It happened because there were several Primary Health Care Centers applying a policy that patients aged 0–5 years old would be referred to the maternal and children care unit whose health workers are midwives due to the limited number of doctors working there. In addition, there were 3.17% of nurses prescribing medicines in Primary Health Care Centers due to unavailability of doctors attending outside activities or duties. In this case, nurses were temporarily assigned to replace the doctors in prescribing drugs for patients. As prescribing is not within one of nurses' and midwives' competencies, this activity, therefore, may allow irrational prescriptions to be existed. They prescribe more on personal experience or imitate the doctors without understanding the basic considerations in prescribing medicines for patients (Fahmiani, Arsin, & Jafar, 2012).

Patients aged 0-5 years received most compounding preparations (74.33%). Extemporaneous compounding is mostly given to pediatric patients due to the limited availability of appropriate medicines for them (Giam & McLachlan, 2008). Thus, it is necessary to have compounding process adjusted to the children dosage. In addition, it occurs due to the limited medicines availability in Primary Health Care Centers due to budget limitations in medicine availability (Widyaswari & Wiedyaningsih, 2012). This case can also be found in other countries such as in the UK, New Zealand, and Europe having the rate less than 5% (Kristina et al., 2017).

A study conducted by Virginia (2014) on pediatric patients in inpatient wards stated that ≤ 6 years old patients received more extemporaneous compounding compared to > 6 years old ones (Virginia, 2014). Additionally, the research conducted by Gede Piliarta et al. (2012), found that ≤ 5 years old patients had a greater proportion compared to > 5 years old patients. For children patients, the extemporaneous compounding was mostly in form of oral medicines: solid (*puyer*), liquid (suspension), and topical of semi-solid (unguent/cream). For adult patients, most of the compounded prescriptions were topical medicines of semi-solid medicines (unguent/ cream), although some of them received oral medicines of solid form such as captopril *puyer* hat should not be taken orally but

placed under the tongue. General practitioners or doctors often prescribe compounding preparations for patients due to various considerations such as limited drug stocks for children, cheaper prices, and efficiency in taking some medicines at once especially for children who sometimes do not really like taking medicines in large quantities. Thus, extemporaneous compounding of the medicines into one is more efficient (Widyaswari & Wiedyaningsih, 2012).

The previous dosage form based on each prescription sheet consisted of 1185 tablets. After the process of compounding was performed as instructed in the prescription, the given medicines had been changed into 1086 *puyer*. In Indonesia, most of medicines are formulated in the form of *puyer* (Wiedyaningsih, 2005), as stated in a research conducted in inpatient ward showing that most of the medicines given to pediatric patients are extemporaneous compounding of *puyer* (Virginia, 2014). In this research, there was a decrease of solid drugs from the initial form 1185 dosage form (tablets) to the final form 1086 dosage form (*puyer*) because 99 solid drugs initially were not crushed/pulverized. To make a suspension in clinical setting, tablets are crushed and inserted into a liquid form medicines such as syrup or already formulated suspension. Tablets are crushed and then added to syrup or already formulated suspension are an alternative way of giving medicines to children; it is to disguise unpleasant taste of the medicines. (Kairuz et al., 2007). All liquid drugs of extemporaneous compounding are in form of suspension because there are 99 of solid drugs (tablets) dispersed in the carrying fluid. Semi-solid preparations (unguent/cream) did not end up change into other forms of drugs.

The final drugs consisted of 96.42% oral and 3.58% topical drugs. This is somewhat similar to the extemporaneous compounding in New Zealand where oral drugs are given more widely than the topical ones (Kairuz et al., 2007). It is different with extemporaneous compounding in other countries such as in Palestine where most of compounding practices producing topical drugs, and then formed into oral drugs in form of solutions or suspensions (Zaid et al., 2012). Extemporaneous compounding in several other countries such as Australia, Sweden, and the US is dominated by topical drugs (Kristina et al., 2017). In addition, it is found that number of final drugs are 1229; it is higher than number of the prescriptions taken as the sample of this research (1200 prescription sheets). It is shown that there are one prescription sheet consisting more than one extemporaneous compounding of each prescription sheet. Two prescription sheets (0.17%) consisted three extemporaneous compounding of each prescription sheet consist of all *puyer*. Twenty-seven prescription sheets (2.25%) consisted two extemporaneous. The number of prescription sheet containing all *puyer* were 13 prescription sheets. A combination of *puyer* and suspensions were discovered in 4 prescription sheets, meanwhile combination of *puyer* and unguent/cream were 10 prescription sheets. Research conducted by Widyaswari and Wiedyaningsih (2012) in Primary Health Care Centers of Daerah Istimewa Yogyakarta found the same case that some patients receiving more than one compounding of each prescription sheet. The higher the number of extemporaneous compounding found in prescription indicating that there are limitations of medicines availability especially for pediatric patients in Primary Health Care Centers (Widyaswari & Wiedyaningsih, 2012). Besides that, the condition of the patients becomes the consideration to give the compounding prescription for the patients (Pappas et al., 2002). By giving it to pediatric patients, it is expected that it will be easier for them to take the medicine. On the other hand, the more medicines produced in extemporary compounding, the more problems in extemporaneous compounding are possible to occur such as physical and chemical incompatibilities as well as the instability of the active ingredients that have been prepared in extemporaneous compounding (Eileen Kairuz et al., 2007).

Although this research was conducted in a district located in Central Java, Indonesia this study took 1200 samples of prescriptions in 24 Primary Health Care Centers in order to describe human resources and characteristic of extemporaneous compounding condition related to the prescribing as well as extemporaneous compounding done in Primary Health Care Centers in Indonesia. Limitation of this research is the researcher did not collect the samples in other community pharmacy such as: drugstores (pharmacies), clinics, and hospitals.

5. Conclusion

In this study, drug compounders in Primary Health Care Centers are mostly pharmacists. The prescribers of extemporaneous compounding in Primary Health Care Centers are mostly general practitioners, some midwives and nurses also prescribe. Patients receiving the prescription are dominated by pediatric patients range between 0-5 years old. It is common to find only one extemporaneous compounding per prescription sheet, with *puyer* being the most prevalent.

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Competing Interests Statement

The authors declare that there are no competing or potential conflicts of interest.

References

- Allen, L. V. (2003). Contemporary Pharmaceutical Compounding. *The Annals of Pharmacotherapy*, 37(10), 1526. <https://doi.org/10.1345/aph.1C508>
- Brion, F., Nunn, A. J., & Rieutord, A. (2003). Extemporaneous (magistral) preparation of oral medicines for children in European hospitals. *Acta Paediatrica*, 92(4), 486-490. <https://doi.org/10.1111/j.1651-2227.2003.tb00583.x>
- Buurma, H., De Smet, P. A., van den Hoff, O. P., Sysling, H., Storimans, M., & Egberts, A. C. (2003). Frequency, nature and determinants of pharmacy compounded medicines in Dutch community pharmacies. *Pharmacy World and Science*, 25(6), 280-287. <https://doi.org/10.1023/B:PHAR.0000006521.41736.db>
- Eileen Kairuz, T., Gargiulo, D., Bunt, C., & Garg, S. (2007). Quality, safety and efficacy in the "off-label" use of medicines. *Current Drug Safety*, 2(1), 89-95. <https://doi.org/10.2174/157488607779315471>
- Fahmiani, Arsin, A. A., & Jafar, N. (2012). Factors Related to Medicine Prescribing for Non Pneumonial Upper Respiratory Infection (URI) and Non Spesifik Diarrhea in Public Health Centres Makassar in 2012. *Journal of Indonesian Epidemiology Community*, 1(2), 101-106, Retrieved from <http://repository.unhas.ac.id/handle/123456789/6941>
- Giam, J. A., & McLachlan, A. J. (2008). Extemporaneous product use in paediatric patients: a systematic review. *International Journal of Pharmacy Practice*, 16(1), 3-10. <https://doi.org/10.1211/ijpp.16.1.0002>
- Herman, M. J., Handayani, R. S., & Siahaan, S. A. (2013). Kajian Praktik Kefarmasian Apoteker pada Tatanan Rumah Sakit. *Kesmas: National Public Health Journal*, 7(8), 365-372. <https://doi.org/10.21109/kesmas.v7i8.23>
- Kairuz, T., Myftiu, J., Svirskis, D., Hasan, F., Lal, A., Patel, R., ... Garg, S. (2007). Extemporaneous compounding in New Zealand hospitals. *International Journal of Pharmacy Practice*, 15(2), 129-131. <https://doi.org/10.1211/ijpp.15.2.0008>
- Kimland, E., & Odlind, V. (2012). Off-Label Drug Use in Pediatric Patients. *Clinical Pharmacology & Therapeutics*, 91(5), 796-801. <https://doi.org/10.1038/clpt.2012.26>
- Kristina, S. A., Wiedyaningsih, C., Widyakusuma, N. N., & Aditama, H. (2017). Extemporaneous Compounding Practice By Pharmacists: A Systematic Review. *International Journal of Pharmacy and Pharmaceutical Sciences*, 9(2), 42. <https://doi.org/10.22159/ijpps.2017v9i2.15681>
- Martin, K. S., McPherson, T. B., Fontane, P. E., Berry, T., Chereson, R., & Bilger, R. (2009). Independent community pharmacists' perspectives on compounding in contemporary pharmacy education. *American Journal of Pharmaceutical Education*, 73(3). <https://doi.org/10.5688/aj730354>
- Nurjanah, S., Aurista, B., & Kusuma, T. H. (2014). The Analysis of The Characteristics of Gender for Service Quality in Food Industry Implemented by Small Medium Enterprises, *Proceedings of the National Conference of Universitas Terbuka*. Retrieved from <http://repository.ut.ac.id/id/eprint/4998>
- Pappas, A., MacPherson, R., & Stewart, K. (2002). Extemporaneous prescribing: whatever happened to it? A survey of Australian general practitioners. *Journal of Pharmacy Practice and Research*, 32(4), 310-314. <https://doi.org/10.1002/jppr2002324310>
- Thiers, B. H. (1998). Compounding is still appropriate in clinical practice. *Dermatologic Clinics*, 16(2), 329-330. [https://doi.org/10.1016/S0733-8635\(05\)70015-2](https://doi.org/10.1016/S0733-8635(05)70015-2)
- Virginia, D. M. (2014). Extemporaneous Compounding in pediatric patient on inpatient ward. *Jurnal Penelitian*, 18(1).
- Widyaswari, R., & Wiedyaningsih, C. (2012). Evaluation of Compounding Prescription Profile and Availability of Medicine Pediatric Formulation In Primary Health Care Diy Province. *Majalah Farmaseutik*, 8(3), 227-234.
- Wiedyaningsih, C. (2005). Investigation on drug dosage form: analysis of prescriptions available in pharmacy in kotamadya Yogyakarta. *Indonesian Journal of Pharmacy*, 201-207.

- Wiedyaningsih, C., Hakimi, M., Soenarto, Y., & Suryawat, S. (2016). The Use of The Theory of Planned Behavior to Predict Factors Influencing Physicians' decision To Prescribe Extemporaneous Compounding Dosage Form for Pediatric Outpatients. *Asian Journal of Pharmaceutical and Clinical Research*, 288-291.
- Zaid, A. N., Al-Ramahi, R., Shahed, Q., Saleh, B., & Elaraj, J. (2012). Determinants and frequency of pharmaceutical compounding in pharmacy practice in Palestine: Determinants and frequency of compounding in Palestine. *International Journal of Pharmacy Practice*, 20(1), 9-14. <https://doi.org/10.1111/j.2042-7174.2011.00157.x>

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