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Research Article

The Effect of Education Models on Changed Misconceptions About Long-Term Medication Inducing Renal Impairment

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ABSTRACT

Medication misconceptions become a factor for nonadherence. Education for Posbindu cadres is required as a community empowerment to reduce predispositions to chronic kidney disease caused by medication nonadherence. This quasi-experimental research involved one group pretest-posttest design aiming to compare four education models for Posbindu cadres in PHCs in Yogyakarta with changes in misconceptions about antihypertensives and antidiabetics in long-term use-induced renal impairment. All models employed the cadre smart module with models 3 and 4 involving health-worker collaboration. The added educational media were posters (model 1), leaflets (model 2), and posters-leaflets (model 4). Misconception changes were assessed using a validated questionnaire. Eighty-six female cadres aged 43.7±8.6 years were involved with the majority being at least high-school graduates without hypertension and diabetes mellitus risk factors. Model 3 significantly affected all knowledge domains with discussion and clarification of understanding becoming the strength of the techniques used therein. The results proved the importance of health-worker collaboration in health promotion to increase public knowledge of health and drug use, but varied education media could give no guarantee of improvements in such misconceptions. Interactive techniques through knowledge construction assisted by health-workers, especially for unfamiliar domains among society, are recommended to improve the effectiveness of similar education.

INTRODUCTION

Inadequate understanding of the concept of long-term medication becomes one of the factors for high levels of nonadherence. Most people think and feel worried that taking medication regularly can have a negative impact on their health, especially on the kidneys (Cea-Calvo *et al.,* 2020; Karter *et al.,* 2010). In fact, some chronic diseases, such as hypertension and diabetes mellitus (HDM), actually require a healthy lifestyle and medication adherence to prevent complications (Perkumpulan Endokrinologi Indonesia, 2019). Most patients already feel healthy after taking the prescribed drugs, as in both patients with diabetes mellitus (DM) (50.4%) and hypertension (59.8%) (Kementerian Kesehatan RI, 2019) and they often think they no longer need medication to control their blood glucose and blood pressure (Gadkari and McHorney, 2012). The national data on misconceptions are obtained from all of the regions in Indonesia, including from

Yogyakarta Province. These data have led to an increase in the reported incidence of HDM-induced complications, including kidney failure, stroke, and cardiovascular diseases, in the last 5 years, and in 2018 the increase reached 1.8%, 3.9%, and 8.3%, respectively.

This situation is also found in some other countries in studies of medication nonadherence, such as primary medication nonadherence (PMN) of antidiabetic drugs (da Costa *et al.,* 2015), including insulin (Karter *et al.,* 2010). In addition, nonadherence to prescription refills within the next 180 days was shown in hypertension medication (Raebel *et al.,* 2011). This pattern is also confirmed in a study involving 646 patients with cardiovascular diseases, including hypertension, as one of the predictors of medication nonadherence after hospitalization (Paasche-Orlow *et al.*, 2012). Similarly, in studies of HDM patients in Indonesia, the level of adherence to medication is relatively low (Akrom *et al.*, 2019) and was correlated with concerns about adverse drug reactions (Perwitasari *et al.*, 2016). The highest level of ADR that the society is mostly concerned about is the declining of kidney function. Although it has been acknowledged in some studies that poor glycemic and blood pressure control can increase the incidence of fatal complications (Ningrum *et al.,* 2017; Petrie *et al.,* 2018; Tun *et al.,* 2017), nonadherence to long-term medication for chronic diseases remains a serious problem in many countries. Patients' belief in long-term medication has more negative than positive impacts, thereby reducing adherence rate by more than 20% (Devraj *et al.,* 2018; Lemay *et al.*, 2018). Patients' decision to take herbal medication and ignore the recommendations of health professionals because they consider drug therapy for HDM diseases to be ineffective was also identified as a factor that was significantly correlated with nonadherence (Atinga *et al.,* 2018; Widayanti *et al*., 2020). This apparently has led to increases in kidney failure among Indonesian people, such as those recorded in five public healthcare centers in Yogyakarta Province (12.87%) (Ningrum et al., 2017). Accordingly, healthcare providers are expected to adopt a therapeutic approach which considers patient's beliefs, values, and norms in drug use. This patient-centered approach can be started and strengthened through community empowerment programs as part of the three pillars of the Healthy Indonesia Program which is expected to improve public health in order to reduce the incidence of non-communicable diseases (NCDs).

The community should be empowered to improve their health and to become an active government partner in the prevention of NCDs, including HDM as well as kidney failure. The local governments in Indonesia have made various efforts, such as launching the Integrated Guidance Posts (Posbindu) as an affiliation of the primary healthcare center (PHC) in every sub-district involving some community cadres. It is expected that Posbindu cadres become the first driving force for public health care. Health promotion programs can be implemented to improve the involvement of Posbindu cadres as the driving force who should own an enhanced knowledge capacity and role. Two studies have proved that improving health literacy and involving community driving force can help reduce chronic diseases and comorbidities (Cheadle *et al.*, 2011; Devraj *et al.,* 2018). In addition, patients tend to ask their neighbors for information on treatment rather than asking health workers because patients and their neighbors interact more frequently (Kvarnström *et al.,* 2018), thus emphasizing the need to improve Posbindu cadres' health literacy to be able to provide quality health interventions (Ringsberg *et al.,* 2018). Meanwhile, there is still lack of education that focuses on changing the misconceptions about the use of routine drugs for chronic diseases in the community. Accordingly, this study aimed to compare some education models that use varied media, regarding changes in the misconceptions about routine drugs in order to provide an alternative education method which is effective to strengthen beliefs in the importance of adherence to long-term medication in chronic diseases to reduce complications.

METHODS

This quasi-experimental research was conducted with a one group pretest-posttest design involving Posbindu cadres in four PHC in Sleman Regency in the Province of Yogyakarta Special Region. During the period of February – November 2019. The data collection began since the research permit was submitted to Yogyakarta Provincial Health Office and to the public healthcare centers as the research location. The cadres' baseline knowledge was measured, and the measurements of the education levels up to the post-education assessment of the cadres' knowledge were conducted. The study used a saturated sampling technique in which all cadres from the selected public healthcare centers who had met the criteria were involved in the study. The four PHCs involved were Ngaglik I, Sleman,

Gamping II, and Godean II. Table 1 shows the study design of the groups. This research involved all Posbindu cadres who are registered and play an active role in the community based on their routine activities for at least the last three months. Posbindu cadres who could not read nor write were excluded from the study. Posbindu cadres who met the criteria signed an informed consent form for research involvement. The Posbindu cadre recruitment scheme is shown in Figure 1. The research obtained an ethical approval from the Faculty of Medicine of Universitas Islam Indonesia No. 14/Ka.Kom.Et/70/KE/VIII.

Education Models

This study provided education with a different design for each PHC where the study was located. Education model 1 was for Posbindu cadres at PHC Godean II, and education model 2 was given for Posbindu cadres at PHC Sleman. Meanwhile, education model 3 and model 4 were for Posbindu cadres from PHC Gamping II and PHC Ngaglik I, respectively. The education materials put in the poster, leaflet, and cadre's smart module were prepared by experts consisting of 1 clinical pathologist and 2 clinical-community pharmacists. Meanwhile, the implementation of education by health workers in education models 3 and 4 involved one doctor and one pharmacist with the stages following the standard operating procedures (SOP) that have been prepared through a previous focus group discussion (FGD) supplemented in this manuscript. The details of the education models are presented in Table 2.

Table 1. Study design of the effects of education models on changes in the misconceptions about long-term medication

Posbindu Cadre	Pretest	Intervention	Posttest
G	O_1	X	O_2
PHC Godean II (n=25)	Level of misconception about routine drugs for hypertension and DM causing kidney failure	Smart cadre module and poster	Level of misconception about routine drugs for hypertension and DM causing kidney failure
PHC Sleman (n=19)		Smart cadre module and leaflet	
PHC Gamping II (n=24)		Smart cadre module and health-worker collaboration	
PHC Ngaglik I (n=18)		Smart cadre module, health-worker collaboration, poster, and leaflet	

Table 2. Education models for Posbindu cadres

Activity	Education Model			
	1 PHC Godean II	2 PHC Sleman	3 PHC Gamping II	4 PHC Ngaglik I
Pretest	Using a questionnaire developed and validated in a previous study			
Education Media Distribution	Using posters for PHC and a smart module set for the cadres	Using leaflets and a smart module set for the cadres	Using a smart module set for the cadres	Using posters for PHC, leaflets, and a smart module set for the cadres
Stage 1 from health workers	-	-	A doctor and pharmacist delivering education materials in a large class	
Stage 2 from health workers	-	-	A doctor and pharmacist giving guidance in a small class for resolving a sample case	
Stage 3 from health workers	-	-	Giving a review in a large class	
Posttest	Using a questionnaire developed and validated in a previous study			

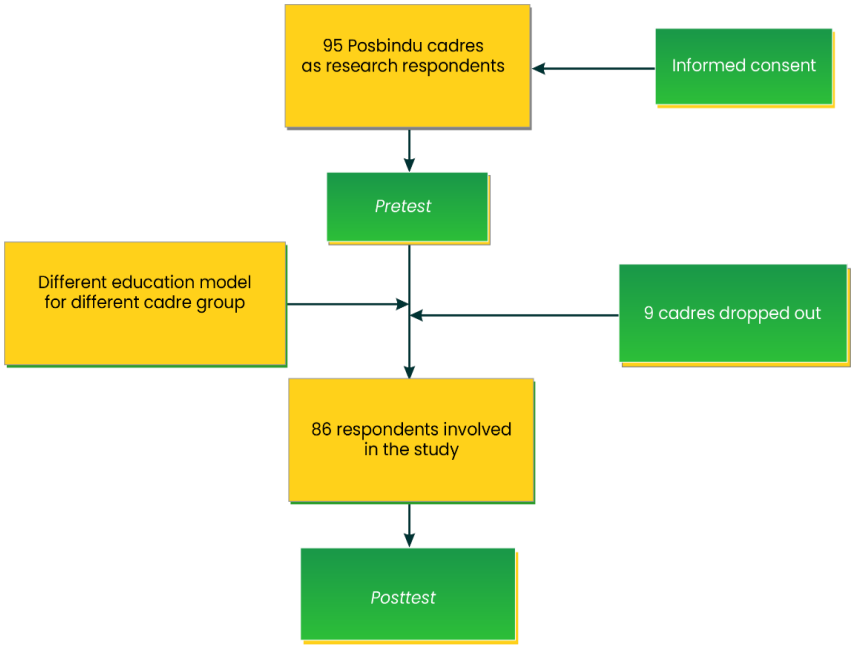

Figure 1. Respondent recruitment scheme

Instrument to Assess Misconception Levels

Assessment of the knowledge levels regarding misconceptions about routine drugs was performed for Posbindu cadres in the group before and after education using the same questionnaire that was developed and validated in previous research (Kurniawan *et al.,* 2020). The questionnaire consisted of 19 open-ended questions with 4 questions on the knowledge of hypertension and diabetes mellitus therapy, 8 questions on the knowledge of long-term medication use misconceptions, 5 questions on the knowledge of drugs that can induce kidney failure, and 2 questions on the knowledge of risk factors for kidney failure. The answers to each question were transformed into a score of 0 – 2 with the correct answer receiving the highest score. Meanwhile, the Cronbach's alpha coefficients in each knowledge domain were 0.823, 0.805, 0.581, and 0.698, respectively. The domain with Cronbach's alpha 0.581 (knowledge of drugs that can induce kidney failure) was re-examined through additional discussion with experts and by increasing the number of subjects. The research team guided the participants in completing the questionnaire with an interval of 3 months between before education (pretest) and after education (posttest) for all models.

Data Analysis

A univariate analysis was used to describe the knowledge levels among Posbindu cadres in PHC before and after education regarding misconceptions about long-term medication use in HDM. This analysis was done by calculating percentiles and categorizing respondents' knowledge as very low, low, intermediate, high, and very high. Meanwhile, the paired t-test was used to measure the level of misconceptions among Posbindu cadres before and after education and to determine the effect of education in normal distribution of data, and the Wilcoxon test was used for non-normal distribution of data. Data were analyzed using SPSS software version 19 (IBM Corp., Armonk, NY, USA) with a p value of <0.05 considered to be statistically significant. The significance of the effect of intervention used the effect-size parameter (r value), whereas the significance of education effect was symbolized by the value of r^2 expressed in percentages. The calculation of r value in data with a normal distribution used the following formula.

$$r = \sqrt{\frac{t^2}{t^2+d}}$$

Meanwhile, the calculation of r value in data with a non-normal distribution used the formula $r = z/\sqrt{N}$. To interpret the results of the study, the researcher used references from the literature which determined 3 (three) significance classifications of effect size (Sullivan and Feinn, 2012).

Table 3. Respondent Characteristic Distribution

Category	Primary Health Center				Total Frequency	*p* Value*
	Godean II	Sleman	Gamping II	Ngaglik I		
Age (years)						0.106
< 40	8	1	9	5	23 (26.7%)	
≥ 40	16	18	16	13	63 (73.3%)	
Educational background						0.060
Elementary	6	3	8	0	17 (19.8%)	
Junior & senior high	18	16	17	18	69 (80.2%)	
Profession						0.054
Housewife	23	18	16	16	73 (84.9%)	
Non-housewife	1	1	9	2	13 (15.1%)	
Chronic disease history						0.187
None	14	8	18	13	53 (61.6%)	
Some	10	11	7	5	33 (38.4%)	
Chronic disease history in the family						0.305
None	8	9	10	10	37 (43.0%)	
Some	16	10	15	8	49 (57.0%)	
Medication history (the last 6 months)						0.275
None	20	17	19	18	74 (86.0%)	
Some	4	2	6	0	12 (14.0%)	
Nuclear family members in health sector						0.651
None	22	16	20	16	74 (86.0%)	
Some	2	3	5	2	12 (14.0%)	
Risk factor**						0.799
None	18	14	20	15	67 (77.9%)	
Some	6	5	5	3	19 (22.1%)	

*Chi-square test
**Risk factors for type-2 DM, hypertension, and the complications were assessed through physical examination and finger-prick blood sampling to obtain the BMI, blood pressure, random blood glucose, and cholesterol levels

RESULTS AND DISCUSSION

Research Subject Recruitment

The selection of the four PHC in this research location was based on the active participation of Posbindu cadres in the prevention, control, and management of NCDs in their environment proven by their consecutive attendance for at least three (3) months. During the completion of pretest questionnaire, there were 95 Posbindu cadres from the four PHCs who gave their consent to be involved in this research. However, nine Posbindu cadres dropped out during the study, in which three cadres did not attend stage 2, four cadres did not attend stage 3, and two cadres did not attend the posttest, leaving 86 respondents involved until the end of the study.

Respondent Characteristic Distribution

The 2015 launch of the Posbindu Movement in Yogyakarta Province was aimed to establish 440 Posbindu in each village. To date, Sleman Regency has the largest number of Posbindu (35% of the total) compared to the other regencies/municipalities in Yogyakarta Province. Table 3 shows the demographic characteristics of the cadres in the Posbindu of four PHC in Sleman Regency.

This study found that all of the cadres in the four PHCs were women, housewives, mostly aged more than 40 years old (average: 43.7±8.6), and with at least a high school diploma. Regarding the risk factors for NCDs, more than half of the cadres had none since their body mass index (BMI), blood pressure, and random blood glucose, cholesterol, and uric acid values were 24.7±4.3 kg/m2, 120/80 mmHg, 101 mg/dL, 200 mg/dL, and 4.8 mg/dL on average, respectively. In contrast to the proportion of their family members who had chronic diseases, the majority of the respondents did not suffer from chronic diseases and did not have members of the nuclear family with a health-related profession. Table 3 shows there were no significant differences seen among several demographic factors of these cadres ($p > 0.05$).

Table 4. Effect of education model on each domain of knowledge

Education Model	Mean / SD		*p* Value	Effect Size (r)	Category
	Pretest	Posttest			
Domain: knowledge of hypertension and diabetes mellitus therapy (Cronbach's alpha 0.823)					
1	1.0350 / 0.21201	1.2800 / 0.16471	0.000*	0.7929	large effect
2	0.8289 / 0.28016	0.8684 / 0.27543	0.597	0.0127	no effect
3	0.8281 / 0.28507	1.1597 / 0.26228	0.000*	0.8518	large effect
4	0.8542 / 0.28196	0.8333 / 0.40423	0.863	0.0424	no effect
Domain: knowledge of routine drug misconception (Cronbach's alpha 0.805)					
1	0.6050 / 0.16008	0.9550 / 0.23352	0.000*	0.8314	large effect
2	0.4079 / 0.13720	0.7368 / 0.20368	0.000*	0.8646	large effect
3	0.5417 / 0.22014	0.8854 / 0.26559	0.000*	0.7994	large effect
4	0.4375 / 0.25814	0.7986 / 0.35907	0.000*	0.7752	large effect
Domain: knowledge of drugs that can induce kidney failure (Cronbach's alpha 0.581)					
1	0.6200 / 0.34641	0.6200 / 0.42622	1.000	0	no effect
2	0.0842 / 0.12589	0.1947 / 0.19571	0.005*	0.6069	large effect
3	0.1583 / 0.21653	0.5042 / 0.33425	0.000*	0.7281	large effect
4	0.0944 / 0.18302	0.5944 / 0.37491	0.000*	0.7873	large effect
Domain: knowledge of risk factors for kidney failure (Cronbach's alpha 0.698)					
1	0.3100 / 0.26300	0.6700 / 0.41908	0.001*	0.691	large effect
2	0.1184 / 0.17417	0.4605 / 0.36575	0.004*	0.6549	large effect
3	0.0937 / 0.1773	0.7292 / 0.51561	0.000*	0.7665	large effect
4	0.0139 /0.05893	0.3611 / 0.28726	0.001*	0.7592	large effect

Description of the Levels of Misconception Owned by Posbindu Cadres Prior to and after the Education Program

Successful chronic disease management is known to be influenced by patient's ability to understand health-related information, thus emphasizing education for Posbindu cadres to increase their capacity as an additional community support for patients with limited understanding and low frequency of interaction with health workers (Bosworth, 2010). This first-ever research on the effect of education on changing misconceptions about long-term medication use in HDM diseases answered the problem of medication nonadherence through reinforcement of Posbindu cadres' role as the community driving force. Each cadre group was given an intervention with dissimilar education models. The education in groups 3 and 4 involving a collaboration of health workers was conducted in three stages. This approach was in line with the recommendation from a systematic review and meta-analysis study which found the education frequency was effective if given for 2-3 sessions, with no significant differences when more sessions were provided (Tan *et al.,* 2019).

Meanwhile, the description of Posbindu cadres' misconception levels was obtained

through completion of the questionnaire before and after the education, containing four knowledge domains, namely knowledge of HDM therapy, misconceptions about routine drug use, drugs that can induce kidney failure, and risk factors for chronic kidney disease. The description scores of all parts of the questionnaire employed a percentile norm with five knowledge categories, namely very low, low, intermediate, high, and very high. The cadres' misconception levels in all knowledge domains are displayed as supplement 1. Meanwhile, Table 4 shows the education model's effect size for each domain of knowledge.

The knowledge domains in the questionnaire are required to establish a complete understanding of the virtues of routine drugs, especially in DM and hypertension patients, to eliminate concerns about the kidney failure effect, to provide knowledge of which drugs can actually induce kidney failure, and to understand the risk factors for such disease. The cadre smart module becomes the standard education medium given that a number of health promotion studies that involve such medium either alone or completed with health-related skills training have proved its effectiveness (Albakri *et al.,* 2021; Askrening *et al.*, 2017; Shoemaker, 2017; Tiwari *et al.,* 2020).

Table 4 shows that the education model 1 involving the smart module and posters has a large effect category in 75% of the knowledge domains in the questionnaire. The integration of posters with other education media has been proved to increase knowledge, change attitude, and improve behavior (Ilic *et al.*, 2013). Research reviewing 16 studies in developing and developed countries revealed that as a traditional medium, posters have proved to remain effective for health promotion programs amidst the digital era to date with a specific effectiveness among adults (Barik *et al.,* 2019). Even though various digital media have been largely developed and evidently showed effectiveness in certain situations (Naslund *et al.*, 2019), easy access to education media via free services with strong Internet connection has become the essential part of the demand for its implementation (Maskell *et al.,* 2018) which remains only partly fulfilled in Indonesian regions. Furthermore, poster distribution is needed to approach a larger audience for a long-term target given that the placement ensures its safety (Hasanica *et al.,* 2020) and is able to reach the audience during their ongoing activities (Hoare *et al.*, 2016). The placement of education posters in the PHC studied also targets the public, especially patients with HDM therein.

However, in relation to the knowledge of which drugs can induce kidney failure, education model 1 has no effects on increasing the cadres' knowledge. Instead, this domain demonstrates reduced levels of knowledge as the proportion of respondents with high and very high knowledge levels declined by 8.7% (two respondents). The absence of mentoring from health workers in this type of education is likely to cause such unexpected results.

Similar findings related to the large proportion of the education effect on increasing the respondents' knowledge is shown in education model 2 which used the smart module and leaflets. The use of leaflets in health promotion programs remains as frequent as that of posters (Barik *et al.,* 2019) since their form is relatively practical, easy to bring, and easy to distribute individually. Different from the previous model, this education model 2 had no significant effect on HDM therapy knowledge domain. This education material includes both lifestyle improvement and disease management recommendation if there is a health condition based on an examination result showing increased blood pressure or blood glucose. Although the respondents have become Posbindu cadres, it is not always easy for them to understand the education materials without guidance from health workers. A number of studies have in fact found that DM or hypertensive patients who have obviously received medication and medication-related information from a doctor or pharmacist also have relatively low level of knowledge of drugs, and this significantly correlates with adherence levels (Jankowska-Polańska *et al.,* 2016; Mekonnen *et al.*, 2020).

On the other hand, a more complete intervention involving the collaboration of doctor and pharmacist is implemented in education models 3 and 4. Health-worker collaboration is required in all aspects of health services to optimize health outcomes (Alina Cernasev *et al*., 2021; Moghadam *et al.*, 2021). Although both types of education model involve the same doctor and pharmacist, the effect on knowledge of misconceptions about routine drugs with a large effect category in all knowledge domains only appears in the education model 3. Meanwhile, similar to the education model 2, the education model 4 has no effect on improving HDM therapy knowledge domain although the respondents also receive audiovisual education from health workers,

which apparently gives them the opportunity to have a review during the discussion. Therefore, further qualitative research is required to explore respondent-related factors which are likely to influence the difference in such education outcome. Since no significant difference is found in the respondents' characteristics between the two groups, the different effect of education between model 3 and model 4 probably becomes the cause of such different outcomes.

As previously described, model 4 uses a complete variety of education media, which not only involves collaboration from health workers but also uses smart module, posters, and leaflets, but it gives a relatively comparable effect to that of model 2 which involves only the smart module and leaflets. A systematic review showed that posters and/or leaflets are used in 85% education models while all of them (100%) combine posters and/or leaflets with other intervention media, which result in effectiveness to promote public health status and improve public knowledge. Most of the interventions involve visual media that suit respondents with a good level of health literacy, such as individuals in developed countries (Barik *et al.,* 2019). Indonesian people undeniably have a low level of health literacy to date, and Indonesia is among the developing countries with varied literacy gaps (Aljassim and Ostini, 2020), thus requiring health workers to contribute actively to promote health literacy (Lausen *et al.,* 2018). Therefore, the addition of visual media in the education model 4 is inefficient and less effective. It is known that a combination with video or games can become an option to increase the effectiveness of interventions in health promotion. A systematic review involving 54 studies showed that digital games as health promotion media suit not only all genders and ages but also have significant short-term and long-term effects other than behavioral improvement (DeSmet *et al.,* 2014). However, it is worth considering that limited Internet access is likely to become a major problem, apart from the sustainability, if such option is applied to the people in Indonesia. As a result, the use of videos is likely to give a more effective impact (Latif *et al.,* 2016), or an ideal option is to directly involve the community to better identify their needs through the provision of collaborative videos (Adam *et al.,* 2019).

Another finding of this research is the education model 3, in which the smart module and 3-stage education by collaborator health workers in a structured manner give the most significant effect on increased knowledge as opposed to the other three models. This is also reinforced by the results of knowledge domain assessment for education model 3 that range from 0.7281 to 0.8515. An unexpected finding from education model 3 for Posbindu cadres of PHC Gamping II shows that despite the highest proportion of cadres with basic educational attainment (47.06%), the education effect is the most significant. In contrast, some studies indicate that educational attainment is significantly associated with improved knowledge after interventions (Alkatheri *et al.*, 2013; Perera *et al.,* 2012). The discussion and clarification stages during the education sessions by health workers are likely to lead to such findings (Bonner *et al,*, 2012).

As expected, the majority of the education provided can have a significant effect on changing the misconceptions of routine drugs held by Posbindu cadres, except with the no-effect category in the knowledge of HDM therapy and drugs inducing kidney failure. In addition to the use videos as alternative interventions, these findings need to be followed up with qualitative research on respondent-related factors that correlate with intervention effectiveness. Given other countries already establish Community-Based Health Workers, Indonesia Posbindu cadres should be trained through structured programs to improve their capacity in order to increase engagement and improve the quality of health promotion programs (Agomo *et al.,* n.d.; Asmelashe Gelayee *et al.,* 2017; Eades *et al.,* 2011; Kim *et al.,* 2016).

Even though the best efforts have been made to obtain valid and reliable research results, some limitations were found in this study. The non-randomized selection of the public healthcare centers as the research location, including the inexistence of randomized allocation of educational models, could result in an inadequately strong causal correlation between interventions in the form of education models and changes in knowledge misconceptions when compared to the randomized studies. In addition, this study could not control such factor as information obtain by the cadres from other media, including from television and printed media, during the research period which could affect the changes in knowledge misconceptions. Therefore, generalization of the results of this study should be revisited and carefully applied to other populations.

CONCLUSION

The education model 3 gives a large effect on all knowledge domains related to changes in the misconceptions about routine drugs. The other three models have an insignificant effect on only one domain, especially on knowledge of hypertension and diabetes mellitus therapy. This study confirms the virtues of collaborative involvement of health workers through health promotion programs to increase public knowledge of health and drug use. In addition, diverse education media could give no guarantee of changed misconceptions about long-term medication.

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