The Effects of Education Models on the Improvement of Public Knowledge of Chronic Kidney Disease

Vitarani Dwi Ananda Ningrum,* Rahma Yuantari,**
Dian Medisa,* Irwan Nuryana Kurniawan***

**Department of Pharmacy, Universitas Islam Indonesia, Yogyakarta, Indonesia,*
***Faculty of Medicine, Universitas Islam Indonesia, Yogyakarta, Indonesia,*
****Department of Psychology, Universitas Islam Indonesia, Yogyakarta, Indonesia*

Abstract

Introduction: *Chronic kidney disease (CKD) is a global health problem with consistently increasing prevalence and incidence, poor prognosis, and high cost. CKD ranks third in funding in Indonesia, reaching IDR 2.3 trillion/year in 2018. Integrated Guidance Post (Posbindu) program affiliated to PHC (Puskesmas) with community cadres has been launched as a community empowerment effort to suppress CKD incidence. This study aimed to strengthen the capacity of Posbindu cadres as the health driving force about CKD to encourage public awareness of CKD risk factors.*
Method: *This quasi-experimental study with one group pretest-posttest design compared four education models for Posbindu cadres in four PHC in Yogyakarta to improve their knowledge of CKD. All education models used the smart module with models 3 and 4 explicitly involving health-worker collaboration. Model 1 used posters, model 2 used leaflets, while model 4 also used posters and leaflets. Knowledge of CKD was assessed through a previously-validated questionnaire with four knowledge domains.*
Result: *All of the 86 cadres were women aged 43.7±8.6 years, mostly with at least high-school education and no risk factors for CKD predisposition. The results showed that model 4 significantly improved knowledge of CKD risk factors, symptoms and examination, and prevention behavior. Meanwhile, improvement in the last domain about CKD treatment was likely affected by model 3.*
Conclusion: *This study confirmed health-worker collaboration's significance in increasing public knowledge of CKD. Adding various printed education media effectively increased knowledge of CKD, particularly in cadres with higher educational attainment.*

Keywords: *Education, Knowledge, Chronic kidney disease, Community*

Korespondensi: **Vitarani Dwi Ananda Ningrum**
E-mail: *vitarani.ningrum@uii.ac.id*

Pengaruh Model Edukasi terhadap Peningkatan Pengetahuan Masyarakat tentang Penyakit Ginjal Kronik

Vitarani Dwi Ananda Ningrum, Rahma Yuantari,***
Dian Medisa, Irwan Nuryana Kurniawan****

**Jurusan Farmasi, Universitas Islam Indonesia, Yogyakarta, Indonesia,*
***Fakultas Kedokteran, Universitas Islam Indonesia, Yogyakarta, Indonesia,*
****Program Studi Psikologi, Universitas Islam Indonesia, Yogyakarta, Indonesia*

Abstrak

Pendahuluan: *Penyakit gagal ginjal kronik (GGK) menjadi masalah kesehatan dunia dengan prevalensi dan insidensi yang meningkat secara konsisten, ber prognosis buruk dan berbiaya tinggi. Di Indonesia, penyakit tersebut menempati urutan ketiga pembiayaan tertinggi yakni sebesar Rp 2,3 triliun/tahun pada tahun 2018. Pencanangan program Pos Pembinaan Terpadu (Posbindu) yang berafiliasi dengan puskesmas melibatkan kader dari kalangan masyarakat telah dilakukan sebagai upaya pemberdayaan masyarakat dalam menekan insidensi GGK. Penelitian ini bertujuan untuk memperkuat kapasitas kader Posbindu sebagai tenaga penggerak masyarakat tentang GGK untuk meningkatkan kewaspadaan faktor risiko penyakit tersebut.*
Metode: *Penelitian eksperimen-kuasi one group pretest-posttest design ini membandingkan antara empat model edukasi kepada kader Posbindu di empat Puskesmas Yogyakarta dengan peningkatan pengetahuan tentang penyakit GGK. Semua model edukasi menggunakan modul pintar kader dan khusus pada model 3 dan 4 melibatkan kolaborasi tenaga kesehatan. Selain itu, media edukasi model 1 juga menggunakan poster, model edukasi 2 menggunakan leaflet, sedangkan model edukasi 4 juga menggunakan poster dan leaflet. Penilaian pengetahuan tentang GGK menggunakan kuesioner yang terdiri dari 4 domain pengetahuan yang telah divalidasi pada studi sebelumnya.*
Hasil: *Sebanyak 86 kader posbindu yang seluruhnya berjenis kelamin perempuan, berusia 43,7±8,6 tahun dan mayoritas berpendidikan minimal SMA serta tanpa faktor risiko penyakit predisposisi GGK. Hasil penelitian menunjukkan edukasi model 4 memberikan pengaruh kategori large effect terhadap peningkatan pengetahuan pada domain faktor risiko, gejala dan pemeriksaan GGK serta pencegahan GGK. Sementara itu, 1 domain pengetahuan lainnya terkait pengobatan GGK, dipengaruhi peningkatannya pada pemberian edukasi model 3.*
Kesimpulan: *Penelitian ini mengkonfirmasi keutamaan keterlibatan kolaborasi tenaga kesehatan untuk meningkatkan pengetahuan masyarakat terkait penyakit GGK. Penambahan variasi media edukasi cetak lebih efektif untuk kelompok responden berpendidikan lebih tinggi.*

Kata kunci: *Edukasi, Pengetahuan, Penyakit ginjal kronik, Masyarakat*

Introduction

Chronic kidney disease (CKD) is a worldwide health issue of which prevalence and incidence consistently increase, the cost is high, and the prognosis is poor. Along with the growing number of older adults, hypertension, diabetes mellitus, and obesity lead to a continuously increasing prevalence of CKD. A systematic review and meta-analysis identified CKD global prevalence of 11-13%, with the majority being at stage 3.[1] Meanwhile, based on the data of National Health Insurance (JKN) of Indonesia in 2018, CKD ranked third in the highest-cost disease list, reaching IDR 2.3 trillion/year.[2] It is acknowledged that low public awareness of the risk factors for kidney disease can become a barrier in early detection and prevention.[3] Therefore, as part of the three pillars of Healthy Indonesia Program, community empowerment programs are expected to reduce CKD incidence.

Community empowerment for health improvement should involve the community as an active government partner in preventing CKD. The government has made various efforts, including the launch of Integrated Guidance Post (Posbindu), affiliated with the primary healthcare center (PHC)/*Puskesmas* in each sub-district empowered by some cadres

selected from the community. Posbindu cadres are expected to be the first driving force of the community to maintain health, including kidney health. This can be done through health promotion programs to improve public knowledge and behavior of maintaining kidney health. A survey involving 516 community members shows that less than 50% understand that hypertension is a predisposing factor for CKD, and only 17.8% are knowledgeable about the early symptoms of kidney disease.[4] In addition, research in five (5) PHC in Yogyakarta Province finds that 12.87% of type-2 DM patients experience CKD, with the majority being in stage three and two patients being in the final stage, which requires hemodialysis.[5] Therefore, increasing public knowledge and behavior in maintaining kidney health through appropriate education is essential for sustainable strategies to reduce CKD morbidity and mortality.

Several studies have proved that community driving force and health literacy improvement can reduce chronic diseases and comorbidities, including kidney disease.[6,7] Posbindu cadres become the nearest health partners to refer to in the community as part of the community. Many patients prefer to exchange treatment information with their neighbors instead of contacting healthcare workers due to the frequency of interaction.[8] Consequently, increasing the health literacy of Posbindu cadres becomes a rational approach to provide higher quality Posbindu services.[9]

Most of the education-related to CKD is directed toward CKD patients regarding improving the quality of life or preventing disease progression toward End-Stage Renal Disorder (ESRD) that requires hemodialysis.[10-12] On the other hand, education for the community that focuses on knowledge of kidney disease remains seriously limited. Therefore, this study compares several education models for Posbindu cadres using various media containing CKD knowledge enrichment to improve their capacity to suppress CKD incidence as part of the health promotion programs.

Methods

This study uses a quasi-experimental one-group pretest-posttest design that involved Posbindu cadres in four primary healthcare centers – Godean II PHC, Gamping II PHC, and Sleman PHC Ngaglik I PHC – in Sleman Regency of Yogyakarta Province. The study design for each group is presented in Table 1. Registered Posbindu cadres who have been routinely active in public activities for the last three months were included in this study, while illiterate Posbindu cadres were excluded. An informed consent form was signed by each Posbindu cadre who fulfilled the inclusion criteria of the research participant. This research has passed an ethical review indicated by approval No. 13/Ka.Kom. Et/70/KE/VIII issued by the ethics committee of the Faculty of Medicine of Universitas Islam Indonesia.

Table 1. Research Design Showing The Effects of Education Models on the Improvement of Public Knowledge of CKD

Group of Posbindu Cadres	Pretest	Intervention	Posttest
G	O_1	X	O_2
Godean II PHC (n=25)	Level of knowledge of chronic kidney disease	Smart Module (Modul Pintar Kader), poster	Level of knowledge of chronic kidney disease
Sleman PHC (n=19)		Smart Module (Modul Pintar Kader), leaflet	
Gamping II PHC (n=24)		Smart Module (Modul Pintar Kader), education from health workers	
Ngaglik I PHC (n=18)		Smart Module (Modul Pintar Kader), education from health workers, poster, leaflet	

Education Models

In this study, a different education design was provided for each PHC. Model 1 was designed for the Posbindu cadres in Godean II PHC, while Model 2 was used in Sleman PHC. In Model 3, a health-worker collaboration was provided for the cadres in Gamping II PHC, and Model 4 was prepared for Ngaglik I PHC Posbindu cadres. The posters, leaflets, and innovative modules contained education materi-

als prepared by a clinical pathologist and two clinical-community pharmacists, while Model 3 and 4 involved a collaboration between a doctor and a pharmacist. The implementation followed the standard operating procedures previously prepared via a focus group discussion. Table 2 and Table 3 show the details of each education model.

Data Analysis

The cadres' knowledge of CKD before and after the education sessions were described using univariate analysis. In such analysis, percentiles were calculated. Percentile norms became the basis for the assessment of respondents' knowledge in this study of

Table 2. Detail Description of Education Model 1 and 2

Activity	Education Model 1		Education Model 2	
	Detail	PHC	Detail	PHC
Pretest Session	A developed and validated questionnaire		A developed and validated questionnaire	
Distribution of Education Media	Poster on PHC walls A set of smart module for each cadre	Godean II	Leaflets for each cadre A set of smart module for each cadre	Sleman
Posttest Session	A developed and validated questionnaire		A developed and validated questionnaire	

Table 3. Detail Description of Education Model 3 and 4

Activity	Education Model 3		Education Model 4	
	Detail	PHC	Detail	PHC
Pretest Session	A developed and validated questionnaire	Gamping II (with a one-month interval between stages)	A developed and validated questionnaire	Ngaglik I (with a one-month interval between stages)
Distribution of Education Media	A set of smart module for each cadre		Poster on PHC walls A set of smart module for each cadre Leaflets for each cadre	
Education Session - Stage 1 by health workers	Education materials delivered by a pharmacist and doctor in a large class		Education materials delivered by a pharmacist and doctor in a large class	
Education Session - Stage 2 by health workers	A case to solve with guidance from a pharmacist and a doctor in a small class		A case to solve with guidance from a pharmacist and a doctor in a small class	
Education Session - Stage 3 by health workers	A review in a large class		A review in a large class	
Posttest Session	A developed and validated questionnaire		A developed and validated questionnaire	

Knowledge Assessment Instrument

We assessed the cadres' knowledge of CKD before and after the education model was implemented. The pretest and posttest used the same questionnaire developed and validated in a previous study (in review), and in filling out the questionnaire, the participants were guided by the research team. The questionnaire consisted of four knowledge domains with Cronbach's alpha 0.703. Posttest (after the education sessions) was done three months after pretest (prior to the education sessions) was carried out.

education models. P_{20} is the 20th percentile, which indicates scores below or equal to 20% of the distribution of the knowledge variable data, P_{40} is the 40th percentile, which shows scores under or equal to 40% of the data distribution, and so forth for P_{60} and P_{80}. Respondents' knowledge is considered very low if their scores are lower than the P_{20} score. The low category applies to participants' scores that are equal to P_{20} score up to less than P_{40} score. Meanwhile, if the scores are equal to P_{40} score up to below P_{60} score, equal to P_{60} score until equal to P_{80} score, and greater than P_{80} score, they are categorized as medium,

high, and very high, respectively.

Pre-test is a score of respondents' knowledge of a domain before they receive an education. Post-test is a score of subjects' knowledge of a particular domain after receiving education. Both of the pre-test and post-test scores in each knowledge domain in this study have their own score range, which is dependent on the number of questions and the score range for each knowledge domain. In addition, the knowledge levels before and after the education sessions were assessed using the paired t-test to determine the effects of the education model in data with a normal distribution, while in a non-normal distribution, the Wilcoxon test was used. R-value was used as an effect-size parameter for the significance of the intervention effects, and r2 represented the significance of the education effects in a percentage unit. The research results were interpreted using three classifications (small, medium, and large effect) of the significance of effect size from referred literature.[13]

Table 4. Interpretation of the Effect Size

Percentage of Variance Explained, r^2	
$r^2 = 0.01$	Small
$r^2 = 0.09$	Medium
$r^2 = 0.25$	Large

Results

Recruitment of Research Subjects

Four primary healthcare centers were selected as the research locations since their Posbindu cadres have been actively participating in preventing, controlling, and managing non-communicable diseases in their community. A total of 95 Posbindu cadres gave their consent to participate in the study upon completing the pretest questionnaire. This was proven by their consecutive presence for a minimum of three months in regular activities. During the study, three cadres were not present in the education session stage 2, 4 cadres who skipped the education session stage 3, and 2 cadres who did not complete the posttest. Therefore, up to the end of the research, 86 cadres fully participated as respondents. Figure 1 shows the cadre recruitment scheme.

Distribution of Respondent Characteristics

The launch of Gerakan Posbindu in Indonesia in December 2015 was expected to establish Posbindu in every village in Indonesia.

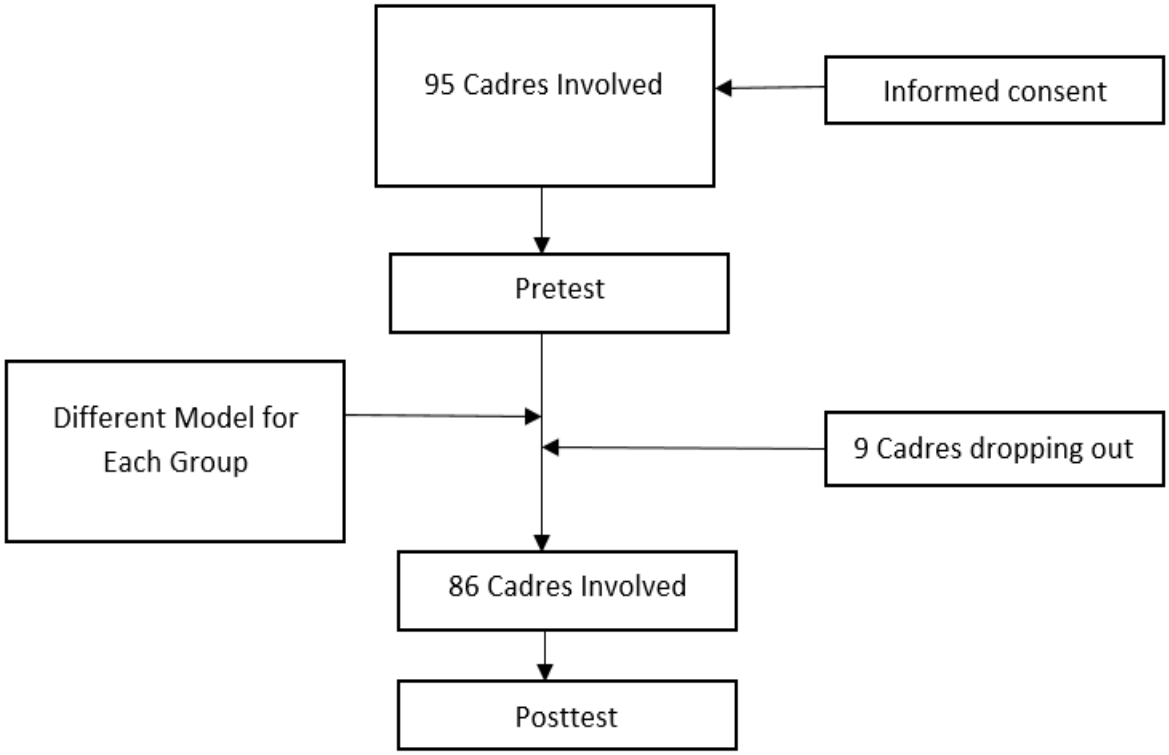

Figure 1. Respondent Recruitment Scheme

Table 5. Characteristics of Respondents

Category	Primary healthcare center (research location)				Total Frequency n (%)	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 Attainment						0.060
Primary	6	3	8	0	17 (19.8%)	
Middle and High	18	16	17	18	69 (80.2%)	
Occupation						0.054
Housewife	23	18	16	16	73 (84.9%)	
Non-housewife	1	1	9	2	13 (15.1%)	
History of Chronic Disease						0.187
None	14	8	18	13	53 (61.6%)	
Some	10	11	7	5	33 (38.4%)	
History of Chronic Disease in the Family						0.305
None	8	9	10	10	37 (43.0%)	
Some	16	10	15	8	49 (57.0%)	
History of Medication (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%)	

Notes:
**Chi-square test*
***Type-2 DM, hypertension, and their complications based on BMI, blood pressure, random blood glucose, and cholesterol using finger-prick blood sampling*

Data from the Ministry of Health (2017) show that Posbindu in Indonesia has increased by 20% ever since. Meanwhile, Sleman Regency has the highest number of Posbindu among the five regencies/municipalities in Yogyakarta Special Province to date, reaching 35% of the total. The demographic characteristics of Posbindu cadres from four primary healthcare centers (PHC) in Sleman are shown in Table 5.

Description of Posbindu Cadres' CKD Knowledge Levels Before and After Education

A questionnaire with fifteen questions was provided before and after the education sessions to describe Posbindu cadres' levels of knowledge of CKD. Four CKD knowledge domains were included: risk factors, symptoms and examination, treatment, and prevention. The description values of all of the questionnaire parts used the percentile norm and were categorized into five knowledge levels, including very low, low, intermediate, high, and very high. The respondents' knowledge levels in all domains and the effect size of each education model are shown in Table 6 and Table 7.

Discussion

This study found that most respon-

Table 6. Description of Posbindu Cadres' CKD Knowledge Levels

Category	Norm	Frequency							
		Education Model 1		Education Model 2		Education Model 3		Education Model 4	
		Pretest	Posttest	Pretest	Posttest	Pretest	Posttest	Pretest	Posttest
CKD risk factor knowledge domain with n (%)									
Very low	$X < P_{20}$ (0.3333)	7(28.0%)	1(4.0%)	1(5.3%)	3(15.7%)	4(16.67%)	1(4.17%)	4(22.2%)	2(11.11%)
Low	$X \leq X < P_{40}$ (0.4467)	6(24.0%)	2(8.0%)	0(0%)	3(15.7%)	2(8.33%)	2(8.33%)	3(16.67%)	1(5.55%)
Intermediate	$X \leq X < P_{60}$ (0.5567)	0(0%)	0(0%)	8(42.1%)	1(5.3%)	3(12.50%)	0 (0%)	5(27.78%)	0(0%)
High	$X \leq X \leq P_{80}$ (0.8900)	9(36.0%)	13(52.0%)	6(31.6%)	0(0%)	9(37.50%)	5(20.83%)	3(16.67%)	3(16.67%)
Very high	$X > P_{80}$	3(12.0%)	9(36.0%)	4(21.1%)	12(63.2%)	6(25.0%)	16(66.67%)	3(16.67%)	12(66.67%)
Total		25(100%)	25(100%)	19(100%)	19(100%)	24(100%)	24(100%)	18(100%)	18(100%)
CKD symptoms and examination knowledge domain									
Very low	$X < P_{20}$ (0.3350)	0(0%)	0(0%)	0(0%)	0(0%)	5(20.83%)	1(4.17%)	5(27.78%)	2(11.11%)
Low	$X \leq X < P_{40}$ (0.8350)	0(0%)	2(8.0%)	5(26.3%)	1(5.3%)	7(29.17%)	7(29.17%)	5(27.78%)	0(0%)
Intermediate	$X \leq X < P_{60}$ (1.1700)	12(48.0%)	10(40.0%)	4(21.05%)	1(5.3%)	5(20.83%)	4(16.67%)	2(11.11%)	3(16.67%)
High	$X \leq X \leq P_{80}$ (1.3350)	3(12.0%)	4(16.0%)	0(0%)	0(0%)	6(25.0%)	4(16.67%)	0(0%)	0(0%)
Very high	$X > P_{80}$	10(40.0%)	9(36.0%)	10(52.65%)	17(89.4%)	1(4.17%)	8(33.33%)	6(33.33%)	13(72.22%)
Total		25(100%)	25(100%)	19(100%)	19(100%)	24(100%)	24(100%)	18(100%)	18(100%)
CKD treatment knowledge domain*									
Very low	$X < P_{20}$ (0.0000)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)
Low	$X \leq X < P_{40}$ (1.0000)	6(24.0%)	7(28.0%)	9(47.36%)	6(31.57%)	4(16.67%)	0(0%)	6(33.33%)	4(22.22%)
High	$X \leq X \leq P_{80}$ (1.0000)	19(76.0%)	11(44.0%)	10(52.63%)	7(36.84%)	20(83.33%)	14(58.33%)	12(66.67%)	11(61.11%)
Very high	$X > P_{80}$	0(0%)	7(28.0%)	0(0%)	6(31.57%)	0(0%)	10(41.67%)	0(0%)	3(16.67%)
Total		25(100%)	25(100%)	19(100%)	19(100%)	24(100%)	24(100%)	18(100%)	18(100%)
CKD prevention knowledge domain									
Very low	$X < P_{20}$ (3.2500)	3(12.0%)	1(4.0%)	2(10.5%)	0(0%)	3(12.50%)	4(16.67%)	5(27.78%)	1(5.56%)
Low	$X \leq X < P_{40}$ (3.5000)	7(28.0%)	4(16.0%)	1(5.3%)	0(0%)	4(16.67%)	5(20.83%)	6(33.33%)	2(11.11%)
Intermediate	$X \leq X < P_{60}$ (3.7500)	4(16.0%)	10(40.0%)	1(5.3%)	1(5.3%)	6(25.0%)	3(12.50%)	4(22.22%)	1(5.56%)
High	$X \leq X \leq P_{80}$ (3.8750)	3(12.0%)	0 (0%)	11(57.85%)	10(52.63%)	3(12.50%)	3(12.50%)	0(0%)	9(50%)
Very high	$X > P_{80}$	8(32.0%)	10(40.0%)	4(21.05%)	8(42.1%)	8(33.33%)	9(37.50%)	3(16.67%)	5(27.78%)
Total		25(100%)	25(100%)	19(100%)	19(100%)	24(100%)	24(100%)	18(100%)	18(100%)

**Intermediate knowledge level was not included in this questionnaire domain since the obtained percentile norm was identical with that of the high knowledge level*

dents had no chronic diseases and no nuclear family members working in the health sector. All of the Posbindu cadres at the research locations were female with an average age of 43.7±8.6 years, a minimum of a high school diploma, and housewives. Meanwhile, more than 50% of the respondents had no risk factors for non-communicable diseases based on their BMI, blood pressure, random blood glucose, cholesterol, uric acid, or history of chronic disease in the family. In general, Table 5 shows no significant difference among some of the demographic factors of the Posbindu cadres in this study ($p > 0.05$).

Description of Posbindu Cadres' CKD Knowledge Levels Before and After Education

It is acknowledged that the success of

chronic disease management is affected by patients' understanding of health information; education for Posbindu cadres to improve their capacity; therefore, it becomes a form of community support for patients who have limited knowledge and lack of interaction with health workers.[14]

This study becomes the first research on the effects of education on the improvement of CKD knowledge, in response to the increasing prevalence of CKD, by strengthening the role of Posbindu cadres in PHC to serve as the driving force in the community. In this health promotion-based research, each group of cadres from each PHC received intervention in different education models. Education for the groups that involved health-worker collaboration was carried out in three stages, as previously explained in the research methods section. This is following what is recommended by a systematic review and meta-analysis in which the frequency of effective education should be given in 2-3 sessions, and there is no significant difference when given more frequently.[15]

Table 6. shows the four knowledge domains required to build a comprehensive understanding of CKD to increase awareness of CKD early detection and prevention. In general, more than half of the Posbindu cadres involved, prior to the education intervention, had very low to intermediate levels of knowledge in the four domains, particularly in the CKD symptoms and examination knowledge domain. The generally non-specific CKD symptoms,[16] limited laboratory test facilities in PHC as the front line of healthcare facilities, and lack of education for the public have reinforced such findings. In a previous study in 6 PHC, two patients were found with such symptoms as nausea, vomiting, and loss of appetite, and they required hemodialysis based on the result of the eGFR test as part of the research procedure.[5] Some PHC continues to use hyperuricemia as a marker for an early biochemical parameter of chronic kidney disease, although it is known that the glomerular filtration rate or urine albumin level becomes the standard parameter for assessing kidney function.[17] Using biochemical parameters such as albuminuria and eGFR, the Kidney Early Evaluation Program (KEEP), a community-based screening program involving nearly 30 thousand respondents in urban and rural areas in the US, has found that these parameters are associated with awareness of

Table 7. Effects of Education Model on the Knowledge Domains

Education Model	Mean±SD		P Value	Effect Size (r)
	Pretest	Posttest		
1	0.5011±0.3363	0.7600±0.4359	0.000	0.6996
2	0.5304±0.2024	0.8102±0.5466	0.035	0.4742
3	0.6817±0.33217	1.0983±0.5091	0.000	0.6721
4	0.4359±0.2337	0.8570±0.4618	0.003	0.6509
CKD symptoms and examination knowledge domain				
1	1.2016±0.4272	1.1154±0.3847	0.305	0.2089
2	0.7303±0.3059	1.1855±0.3801	0.001	0.6948
3	0.6615±0.4760	0.8333±0.3807	0.016	0.4909
4	0.4269±0.3398	1.1683±1.0292	0.001	0.8165
CKD treatment knowledge domain				
1	0.8611±0.4291	1.0000±0.7638	0.083	0.3464
2	0.5263±0.5129	1.0000±0.8165	0.029	0.4999
3	1.0150±0.4988	1.4167±0.5036	0.001	0.6687
4	0.6667±0.4851	0.9444±0.6391	0.132	0.3554
CKD prevention knowledge domain				
1	3.6700±0.4839	3.7100±0.3779	0.632	0.0985
2	3.8750±0.4229	4.2039±0.9263	0.076	0.4067
3	3.5885±0.3307	3.6354±0.4103	0.543	0.1276
4	3.5903±0.4368	3.9097±0.3316	0.003	0.6366

CKD incidence. In addition, concern for renal failure is less than 10% in early-stage CKD and is likely to be even lower in individuals who have no CKD, although they have a risk factor for developing such disease.[18] However, for Indonesia, it seems that this can only be performed in the future, given the numerous limitations in primary healthcare facilities previously described.

The fact that the majority of the public knowledge of CKD is limited occurs in a developing country like Indonesia and Australia, as a survey involving almost 1000 public respondents shows relatively the same results.[19] Therefore, this study's education intervention for Posbindu cadres is expected to improve public knowledge of CKD.

Meanwhile, the traditional education medium provided for all cadres is the smart module given that, in some studies of health promotion, this type of media, either alone or in combination with health-related skills training, has proved to be effective.[20–23] The smart module is distributed to each Posbindu cadre to increase self-capacity and allow Posbindu cadres to use it to provide health services in their regular activities.

Table 7 shows that education model 1, which uses a smart module and poster gives the most minimal effect compared to the other three models. Meanwhile, based on the changed proportion of cadres with high and very high knowledge levels, education model 1 relatively has no effect; instead, there is even a decreased level of knowledge of CKD treatment and prevention. Based on the obtained effect size, in CKD symptoms and examination knowledge domain, education model 1 only gives a small-sized effect, and even there is no effect from CKD prevention knowledge domain. Such findings become a matter of concern since both knowledge domains are associated with the cadres' knowledge to improve early awareness of CKD incidence and make efforts and improve their capacity as the first driving force of public health to prevent CKD. This has proved that the education media in model 1 is ineffective in improving knowledge in both domains.

In contrast, a review of 15 studies concludes that the integration of posters with other education media has improved knowledge and changed attitudes and behavior.[24] Even in the digital era, posters as a traditional medium have proved to be effective in health promotion programs, especially for adult respondents, according to a systematic review of 16 studies in both developed and developing countries.[25] In addition, the distribution of posters is required to reach a broader range of audiences in a more extended period provided that it is mounted in a safe place[26] and can reach the target audiences while they are active.[27] Education posters in research locations are also intended for the public, particularly patients with hypertension or DM, as is already done in this study. In general, even with the addition of another medium in the form of a smart module for each cadre, education model 1, which integrates both print media, cannot improve CKD knowledge among Posbindu cadres.

There is a different finding when education model 2 uses leaflets to replace posters distributed to each cadre, resulting in 75% increased knowledge (medium effect). The remaining proportion is the significant effect on the CKD treatment knowledge domain. Similar to posters, leaflets are still frequently used as a medium in health promotion programs.[25] Since the form of leaflets is relatively more practical, easy to carry, and more individually distributed, most health promotion programs continue to use them. Compared to posters, leaflets can improve Posbindu cadres' knowledge due to their practicality, and this is similar when leaflets are compared to the smart module, which is also individually distributed to the cadres. In terms of education media, although there is a large variety of digital media which have also proved to be effective in some specific cases,[28] the ease of access to education media using free internet services with strong digital network becomes the main requirement for digital media implementation[29] which has yet to be fulfilled in all of the regions in Indonesia.

In general, the findings related to educational models 1 and 2 did not show expected results probably due to the use of print media which are not interactive or unattractive since there are no audio-visual elements added, and it takes time and good reading skills to understand them. Qualitative preliminary research on the choices of educational media that interest the public is recommended for similar studies to improve the success of the program. Meanwhile, education model 3, which uses a smart module and involves health-worker collaboration, has comparable effects on the four knowledge domains, including small effect and significant effect each from two knowledge domains. A relatively similar effect to education model 1 is found in CKD symptoms and examination knowledge domain and CKD prevention knowledge domain, in which

education model 3 also gives an insignificant effect. Surprisingly, education model 2 has a more significant effect on improving both knowledge domains even though it involves no collaboration with health workers. In education model 3, the respondents also receive audiovisual education from the health workers, thereby giving them the opportunity for a review during discussions. Therefore, further qualitative studies are recommended to explore respondent factors that can affect the discrepancy of such outcomes.

As expected, education model 4, which involves the use of smart modules, posters, leaflets, and collaboration with health workers, has the most significant effect compared to the other three models. This education model significantly affects 75% of the assessed knowledge domains, and the remaining is a medium effect on the CKD treatment knowledge domain. A systematic review finds that more than 85% of education uses posters or leaflets, and 100% of education combines various intervention media in health promotion, and this has proved to be effective in increasing public knowledge and health status. A majority of intervention using visual media is more suitable for respondents with good health literacy, such as those in developed countries.[25] It is undeniable that Indonesian people currently have relatively low health literacy, and various literacy gaps are found in developing countries, including Indonesia[30] that urge the need for active contribution from health workers.[31] It is encouraging that adding visual media in education model 4 can improve knowledge. Also, it is not surprising since, when descriptively analyzed, the highest proportion of cadres with a minimum of a high school diploma, even reaching 100%, is found in Ngaglik I PHC. This is in line with some studies that reveal a significant correlation between educational attainment and the effectiveness of education or intervention.[32,33]

On the other hand, an intervention that involves collaboration with a doctor and pharmacist is implemented in education models 3 and 4. Health-worker collaboration is required in all health services to optimize health outcomes.[34,35] Although these two types of education involve the same doctor and pharmacist, the effect of education on CKD knowledge level that results in a significant effect on the majority of knowledge domains is only seen in education model 4.

While other countries already have Community-Based Health Workers, trained Posbindu cadres through structured programs to increase their capacity need to be encouraged to increase engagement and quality health promotion practices.[36–39] In general, even though the respondents have become Posbindu cadres, it is not easy for them to understand CKD materials without guidance from health workers. Several studies have found that patients with DM or hypertension who have received medication and treatment-related information from a doctor or pharmacist also have a relatively low level of medical knowledge, and this has a significant correlation with levels of adherence, thus posing a risk of developing complications such as chronic kidney disease.[40,41]

In general, this study's educational models can improve knowledge, especially regarding CKD risk factors. Meanwhile, education model 1 and model 3 are relatively unable to improve CKD symptoms and examination knowledge domain and CKD prevention knowledge domain. The selection of inappropriate education strategies can lead to failure to achieve the education goals. Health promoters need to pay close attention to the content and depth of an education material since some education sessions can be sufficiently delivered through print media. In contrast, other sessions require audiovisual techniques and health-worker collaboration or a combination thereof. Further studies related to the long-term impacts of such education in the form of increased awareness and improved behavior to maintain kidney health becomes an integral part of the sustainable process to improve the quality of health promotion programs.

A more comprehensive approach through collaborative work in health sciences to provide health promotion services for society by empowering Posbindu cadres becomes the strength of this study, which is also the first to be conducted in Indonesia. Although the best efforts have been made, the limited number of the respondents involved makes the generalization of the best educational method resulted from this study require further consideration.

Conclusion

To sum up, education model 4 has a significant effect (0.6366 – 0.8165) on most CKD knowledge domains. The addition of a variety of printed education media is more effective for respondents who have a minimum of a high school diploma.

Funding

The authors thank the Directorate of Research and Community Services of Universitas Islam Indonesia for funding the research.

Conflict of Interest

None declared

References

1. Hill NR, Fatoba ST, Oke JL, Hirst JA, O'Callaghan CA, Lasserson DS, et al. Global Prevalence of Chronic Kidney Disease – A Systematic Review and Meta-Analysis. PLoS ONE 2016;11. https://doi.org/10.1371/journal.pone.0158765.
2. Humas BPJS Kesehatan. Buletin Info BPJS Kesehatan 2020;77:24.
3. White SL, Polkinghorne KR, Cass A, Shaw J, Atkins RC, Chadban SJ. Limited knowledge of kidney disease in a survey of AusDiab study participants. Med J Aust 2008;188:204–8. https://doi.org/10.5694/j.1326-5377.2008.tb01585.x.
4. Chow KM, Szeto CC, Kwan BCH, Leung CB, Li PKT. Public lacks knowledge on chronic kidney disease: telephone survey. Hong Kong Med J Xianggang Yi Xue Za Zhi 2014;20:139–44. https://doi.org/10.12809/hkmj134134.
5. Ningrum VDA, Ikawati Z, Sadewa AH, Ikhsan MR. Kontrol Glikemik dan Prevalensi Gagal Ginjal Kronik pada Pasien Diabetes Melitus Tipe 2 di Puskesmas Wilayah Provinsi DIY Tahun 2015. Indones J Clin Pharm 2017;6:78–90. https://doi.org/10.15416/ijcp.2017.6.2.78.
6. Devraj R, Borrego ME, Vilay AM, Pailden J, Horowitz B. Awareness, self-management behaviors, health literacy and kidney function relationships in specialty practice. World J Nephrol 2018;7:41–50. https://doi.org/10.5527/wjn.v7.i1.41.
7. Cheadle A, Bourcier E, Krieger J, Beery W, Smyser M, Vinh DV, et al. The Impact of a Community-Based Chronic Disease Prevention Initiative: Evaluation Findings From Steps to "Health King County." Health Educ Behav 2011;38:222–30.
8. Kvarnström K, Airaksinen M, Liira H. Barriers and facilitators to medication adherence: a qualitative study with general practitioners. BMJ Open 2018;8:e015332. https://doi.org/10.1136/bmjopen-2016-015332.
9. Ringsberg KC, Olander E, Tillgren P, Thualagant N, Trollvik A. Concerns and future challenges of health literacy in the Nordic countries – From the point of view of health promotion practitioners and researchers. Scand J Public Health 2018;46:107–17. https://doi.org/10.1177/1403494817743903.
10. Lopez-Vargas PA, Tong A, Howell M, Craig JC. Educational Interventions for Patients With CKD: A Systematic Review. Am J Kidney Dis Off J Natl Kidney Found 2016;68:353–70. https://doi.org/10.1053/j.ajkd.2016.01.022.
11. Nunes JW, Greene J, Wallston K, Eden S, Shintani A, Elasy T, et al. Pilot Study of a Physician-Delivered Education Tool to Increase Patient Knowledge About CKD. Am J Kidney Dis Off J Natl Kidney Found 2013;62:23–32. https://doi.org/10.1053/j.ajkd.2013.01.023.
12. Danguilan RA, Cabanayan-Casasola CB, Evangelista NN, Pelobello MLF, Equipado CD, Lucio-Tong ML, et al. An education and counseling program for chronic kidney disease: strategies to improve patient knowledge. Kidney Int Suppl 2013;3:215–8. https://doi.org/10.1038/kisup.2013.17.
13. Cohen J. Statistical Power Analysis for the Behavioral Sciences. 2nd ed. New York: Routledge; 1988. https://doi.org/10.4324/9780203771587.
14. Bosworth HB. Challenges and strategies to improve patient health literacy and competencies. Patient Intell 2010;2:19–25. https://doi.org/10.2147/PI.S9491.
15. Tan JP, Cheng KKF, Siah RC-J. A systematic review and meta-analysis on the effectiveness of education on medication adherence for patients with hypertension, hyperlipidaemia and diabetes. J Adv Nurs 2019;75:2478–94. https://doi.org/10.1111/jan.14025.
16. Fraser SD, Blakeman T. Chronic kidney disease: identification and management in primary care. Pragmatic Obs Res 2016;7:21–32. https://doi.org/10.2147/POR.S97310.
17. Levey AS, Eckardt K-U, Tsukamoto Y, Levin A, Coresh J, Rossert J, et al. Definition and classification of chronic kidney disease: A position statement from Kidney Disease: Improving Global Outcomes (KDIGO). Kidney Int 2005;67:2089–100. https://doi.org/10.1111/j.1523-1755.2005.00365.x.
18. Tamura MK, Anand S, Li S, Chen S-C,

Whaley-Connell AT, Stevens LA, et al. Comparison of CKD Awareness in a Screening Population Using the Modification of Diet in Renal Disease (MDRD) Study and CKD Epidemiology Collaboration (CKD-EPI) Equations. Am J Kidney Dis Off J Natl Kidney Found 2011;57:S17–23. https://doi.org/10.1053/j.ajkd.2010.11.008.
19. Gheewala PA, Peterson GM, Zaidi STR, Jose MD, Castelino RL. Public knowledge of chronic kidney disease evaluated using a validated questionnaire: a cross-sectional study. BMC Public Health 2018;18. https://doi.org/10.1186/s12889-018-5301-4.
20. Shoemaker J. Development and Implementation of the Health Education and Promotion Module for Incarcerated Mothers: Knowledge Gains and Future Implications. SAGE Open Nurs 2017;3:2377960817699623. https://doi.org/10.1177/2377960817699623.
21. Askrening A, Yulita H. The Effectiveness of Counseling through Vasectomy Module in North Kolaka, Indonesia. Int J Public Health Sci IJPHS 2017;6:231–6. https://doi.org/10.11591/ijphs.v6i3.7614.
22. Tiwari P, Naik PR, Nirgude AS, Datta A. Effectiveness of life skills health education program: A quasi-experimental study among school students of South India. J Educ Health Promot 2020;9. https://doi.org/10.4103/jehp.jehp_564_20.
23. Albakri U, Drotos E, Meertens R. Sleep Health Promotion Interventions and Their Effectiveness: An Umbrella Review. Int J Environ Res Public Health 2021;18:5533. https://doi.org/10.3390/ijerph18115533.
24. Ilic D, Rowe N. What is the evidence that poster presentations are effective in promoting knowledge transfer? A state of the art review. Health Inf Libr J 2013;30:4–12. https://doi.org/10.1111/hir.12015.
25. [25] Barik AL, Purwaningtyas RA, Astuti D. The Effectiveness of Traditional Media (Leaflet and Poster) to Promote Health in a Community Setting in the Digital Era: A Systematic Review. J Ners 2019;14:76–80. https://doi.org/10.20473/jn.v14i3.16988.
26. Hasanica N, Ramic-Catak A, Mujezinovic A, Begagic S, Galijasevic K, Oruc M. The Effectiveness of Leaflets and Posters as a Health Education Method. Mater Socio-Medica 2020;32:135–9. https://doi.org/10.5455/msm.2020.32.135-139.
27. Hoare KJ, Decker E. The role of a sexual health promotion leaflet for 15–18 year olds in catalysing conversations: A constructivist grounded theory. Collegian 2016;23:3–11. https://doi.org/10.1016/j.colegn.2015.01.002.
28. Naslund JA, Aschbrenner KA. Digital technology for health promotion: opportunities to address excess mortality in persons living with severe mental disorders. Evid Based Ment Health 2019;22:17–22. https://doi.org/10.1136/ebmental-2018-300034.
29. Maskell K, McDonald P, Paudyal P. Effectiveness of health education materials in general practice waiting rooms: a cross-sectional study. Br J Gen Pract 2018;68:e869–76. https://doi.org/10.3399/bjgp18X699773.
30. Aljassim N, Ostini R. Health literacy in rural and urban populations: A systematic review. Patient Educ Couns 2020;103:2142–54. https://doi.org/10.1016/j.pec.2020.06.007.
31. Lausen LH, Smith SK, Cai A, Meiser B, Yanes T, Ahmad R, et al. How is health literacy addressed in primary care? Strategies that general practitioners use to support patients. J Commun Healthc 2018;11:278–87. https://doi.org/10.1080/17538068.2018.1531477.
32. Alkatheri AM, Albekairy AM. Does the patients' educational level and previous counseling affect their medication knowledge? Ann Thorac Med 2013;8:105–8. https://doi.org/10.4103/1817-1737.109823.
33. Perera T, Ranasinghe P, Perera U, Perera S, Adikari M, Jayasinghe S, et al. Knowledge of prescribed medication information among patients with limited English proficiency in Sri Lanka. BMC Res Notes 2012;5:658. https://doi.org/10.1186/1756-0500-5-658.
34. Moghadam SS, Leal S. How Should Physicians and Pharmacists Collaborate to Motivate Health Equity in Underserved Communities? AMA J Ethics 2021;23:117–26. https://doi.org/10.1001/amajethics.2021.117.
35. Alina Cernasev, Meghana Aruru, Suzanne Clark, Komal Pate, Natalie DiPietro Mager, Vaiyapuri Subramaniam, et al. Empowering Public Health Pharmacy Practice—Moving fromCollaborative Practice Agreements to Provider Status in the U.S. Pharmacy 2021;9:1–9.
36. Eades CE, Ferguson JS, O'Carroll RE. Public health in community pharma-

cy: A systematic review of pharmacist and consumer views. BMC Public Health 2011;11:582. https://doi.org/10.1186/1471-2458-11-582.
37. Asmelashe Gelayee D, Binega Mekonnen G, Asrade Atnafe S. Practice and Barriers towards Provision of Health Promotion Services among Community Pharmacists in Gondar, Northwest Ethiopia. BioMed Res Int 2017;2017:e7873951. https://doi.org/10.1155/2017/7873951.
38. Agomo C, Udoh A, Kpokiri E, Agomo JO-O author C. Community pharmacists' contribution to public health: assessing the global evidence base. Pharm J n.d. https://pharmaceutical-journal.com/article/research/community-pharmacists-contribution-to-public-health-assessing-the-global-evidence-base (accessed June 8, 2021).
39. Kim K, Choi JS, Choi E, Nieman CL, Joo JH, Lin FR, et al. Effects of Community-Based Health Worker Interventions to Improve Chronic Disease Management and Care Among Vulnerable Populations: A Systematic Review. Am J Public Health 2016;106:e3–28. https://doi.org/10.2105/AJPH.2015.302987.
40. Jankowska-Polańska B, Uchmanowicz I, Dudek K, Mazur G. Relationship between patients' knowledge and medication adherence among patients with hypertension. Patient Prefer Adherence 2016;10:2437–47. https://doi.org/10.2147/PPA.S117269.
41. Mekonnen GB, Gelayee DA. Low Medication Knowledge and Adherence to Oral Chronic Medications among Patients Attending Community Pharmacies: A Cross-Sectional Study in a Low-Income Country. BioMed Res Int 2020;2020:e4392058. https://doi.org/10.1155/2020/4392058.