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Public acceptance of a hypothetical Ebola virus vaccine in Aceh, Indonesia: A hospital-based survey

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ABSTRACT

Objective: To determine the acceptance towards a hypothetical Ebola virus vaccine (EVV) and associated factors in a non-affected country, Indonesia.

Methods: A hospital-based, cross-sectional study was conducted in four regencies of Aceh, Indonesia. A set of pre-tested questionnaires was used to obtain information on acceptance towards EVV and a range of explanatory variables. Associations between EVV acceptance and explanatory variables were tested using multi-steps logistic regression analysis and the Spearman's rank correlation.

Results: Participants who had knowledge on Ebola virus disease (EVD) were 45.3% (192/424) and none of the participants achieved 80% correct answers on the knowledge regarding to EVD. About 73% of participants expressed their willingness to receive the EVV. Education attainment, occupation, monthly income, have heard regarding to EVD previously, socio-economic level, attitude towards vaccination practice and knowledge regarding to EVD were associated significantly with acceptance towards EVV in univariate analysis ($P < 0.05$). In the final multivariate model, socio-economic level, attitude towards vaccination practice and knowledge regarding to EVD were the independent explanatory variables for EVV acceptance.

Conclusions: The knowledge of EVD was low, but this minimally affected the acceptance towards EVV. However, to facilitate optimal uptake of EVV, dissemination of vaccine-related information prior to its introduction is required.

1. Introduction

Ebola virus disease (EVD) has the potential of causing high mortality in human population. The worst outbreak since the first EVD case of 1976 was reported during the 2014's epidemic[1]. During the epidemic, a total of 27741 people were affected, with 41% case-fatality rate[2]. In an effort to develop an effective control strategy, the World Health Organization (WHO) in collaboration with pharmaceutical firms embarked on the development of Ebola virus vaccines (EVV)[3,4]. After a few clinical trials, a vaccine has been found to be efficacious and effective[5].

In view of the recent advances in EVV and the global impact of the recent outbreak in West African countries, it is obvious that introduction of the EVV is imminent once approved for public use. Although the mode and pattern of EVD introduction are not clear now, areas affected by the last outbreak will be among the priority areas. However, the EVV will also be introduced in other areas with low risk of Ebola virus outbreak such as Indonesia and other archipelago countries. No case of EVD was reported in Indonesia, but the country is on a major travel route as well as near Philippines which had reported EVD[6]. This raises concern on acceptance towards EVV in such areas that are considered low-risk areas. Therefore, this study aimed to determine the acceptance of a hypothetical EVV by inhabitants of Aceh, Indonesia. The outcome of this study will give insight to challenges that may encounter in the course of EVV introduction.

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The study was performed according to the Helsinki declaration and approved by Ethical Clearance Committee of the School of Medicine, Syiah Kuala University, Banda Aceh, Indonesia. Informed written consent was obtained from participants.

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2. Materials and methods

2.1. Ethical approval and conduct

This study protocol was approved by the Ethical Clearance Committee of the School of Medicine, Syiah Kuala University, Banda Aceh, Indonesia (approval 315/KE/FK/2015). Prior to enrollment, the study was explained to the participants and they gave their written consent before participating.

2.2. Study area

This study was conducted in eight health facilities (hospital or Community Health Centre [Puskesmas]) in five cities within four regencies of Aceh (Nagan Raya, Aceh Selatan, Langsa and Banda Aceh) from 1st August to 30th December, 2015. Aceh, one of the 34 provinces in Indonesia, consists of 23 regencies (Kabupaten/Kotamadya) and is located in westernmost part of Indonesian archipelago with a total population of approximately 4 906 800 in 2014[7]. The region is strategically located in mobilization of both Aceh's economic and tourism across the Indian Ocean[8]. Therefore, it is a hotspot for travellers and with a high risk of infectious diseases transmission through travelling.

2.3. Study design and sampling

This study was conducted approximately 16 months after Ministry of Health of Republic of Indonesia announced the alertness for EVD in Indonesia. Study participants were patients' family members that visited the infection and non-infection outpatients within periods of study. The minimum sample size required was 385, based on the assumption that the EVV acceptability rate was 50%, 5% margin of error and 95% confidence interval (*CI*). The number of participants from each study site was gathered proportionally to the size of population of regency. The regencies were selected randomly from 23 regencies of Aceh.

2.4. Study of instrument reliability

The questionnaires used for the study were adapted from previous studies[9-12]. A preliminary study was conducted to measure the reliability of questionnaires among 25 participants, recruited with the same inclusive criteria of this study, in Lhokseumawe regency. Cronbach's alpha score $\geqslant 0.7$ was considerate as good internal consistency.

2.5. Study variables

2.5.1. Response variable

The response variable in this study was EVV acceptance. To assess the participants' acceptance towards EVV, a hypothetical EVV was described to participants. They were informed that the EVV would be safe and protective against Ebola virus infection. To elicit the EVV acceptance, participants were asked to respond the questions regarding to their willingness to be vaccinated and to vaccinate their children (if they have children). The possible responses were on a 5-point Likert scale indicating their agreement ranging from 1 (very unlikely), 2 (unlikely), 3 (somewhat likely), 4 (likely) to 5 (very likely).

2.5.2. Explanatory variables

Information on age, gender, educational attainment, type of occupation, religion, marital status, type of residence, monthly income and socioeconomic status (SES) was collected. Monthly income was assessed by asking the participants to choose the most suitable amount of money they earned from a list provided. The SES was generated using principal component analysis[10] based on the ownership of 15 household asset indicators such as radio, landline phone, refrigerator, motorcycles, cars and other electronics and house characteristics. The full list of the indicator assets and the construction approach of the asset index have been published elsewhere[12]. The SES was classified into 5 quintiles based on constructed asses index. The first quintile was the poorest and the fifth quintile was the least poor. The participants were also asked if they have heard about EVD prior to the study and the sources of information on EVD.

Attitude towards vaccination practice was measured using five questions adopted from previous study[10]. The questions included the attitude towards the safety and importance of vaccine, and the previous experiences regarding to vaccination practices. Each statement had five responses on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree) and a higher score indicating more positive attitude. Finally, knowledge regarding to EVD was collected based on participants' response to a set of seven questions on transmission and prevention methods of EVD adapted from previous related study[9].

2.6. Data analysis

Scores of each question were summed up to arrive at a single value within EVV acceptance, attitude towards vaccination practice and knowledge regarding to EVD domain. Additive scores for these domains ranged from 2 to 10, 5 to 25 and 0 to 7, respectively. For statistical analysis, these domains were dichotomized into good and poor based on an 80% cutoff point.

Associations between EVV acceptance and explanatory variables were tested using multi-step logistic regression analysis. In the univariate logistic regression, all explanatory variables were included and significant explanatory variables ($P \leqslant 0.05$) were entered into the multivariate analysis. The estimated odds ratio (OR) was interpreted in relation to one of the categories designated as the reference category. Confounding factors were explored by comparing the difference between the crude OR in univariate and the adjusted OR in multivariate analyses[13].

In addition, the Spearman's rank correlation (r_s) was used to assess the correlations between acceptance towards EVV and three explanatory variables (asset index, attitude towards vaccination practice and knowledge regarding to EVD). The *CI* for r_s was calculated as described previously[14]. All *P* values were two tailed and $P < 0.05$ was considered statistically significant. All analyses in this study were performed using SPSS version 15 (Chicago, IL, USA).

3. Results

3.1. Participant characteristics and the source of EVD information

In this study, 500 participants were interviewed and 424 (84.8%) were included in the final analysis. The remaining 76 interviews were excluded from the analysis due to incomplete data. The characteristics of participants were shown on Table 1. The average age of participants was (35.80 ± 10.55) years and the gender ratio was approximately equal. There was no illiterate participant involved

Table 1
Univariate and multivariate logistic regression analysis showing predictors of EVV acceptance (good *vs.* poor) (n = 424).

Variable (n)		Good EVV acceptance [n (%)]	Univariate logistic regression		Multivariate logistic regression	
			OR (95% *CI*)	*P*	aOR (95% *CI*)	*P*
Total (424)		311 (73.3)				
City or regency				< 0.001**		
	Banda Aceh (R) (65)	37 (56.9)	1			
	Nagan Raya (100)	59 (59.0)	1.08 (0.57–2.04)	0.792		
	Meukek (100)	88 (88.0)	5.55 (2.55–12.07)	< 0.001**		
	Langsa (75)	56 (74.7)	2.23 (1.09–4.56)	0.028		
	Tapaktuan (84)	71 (84.5)	4.13 (1.91–8.91)	< 0.001**		
Age group				0.447		
	17–29 (R) (143)	111 (77.6)	1			
	30–44 (192)	136 (70.8)	0.70 (0.42–1.56)	0.164		
	45–59 (78)	55 (70.5)	0.68 (0.36–1.28)	0.244		
	60–84 (11)	9 (81.8)	1.29 (0.26–6.31)	0.747		
Sex						
	Male (R) (187)	129 (69.0)				
	Female (237)	182 (76.8)	1.48 (0.96–2.29)	0.072		
Education#				< 0.001**		0.292
	Primary school (R) (25)	14 (56.0)	1		1	
	Junior high school (66)	34 (51.5)	0.83 (0.33–2.10)	0.702	0.45 (0.16–1.25)	0.126
	Senior high school (175)	131 (74.9)	2.33 (0.99–5.53)	0.053	0.85 (0.32–2.24)	0.744
	Diploma (84)	73 (86.9)	5.21 (1.89–14.35)	0.001*	1.04 (0.27–1.01)	0.953
	University graduate or higher (74)	59 (79.7)	3.09 (1.16–8.16)	0.023*	0.76 (0.19–2.99)	0.696
Occupation#				< 0.001*		0.332
	Farmer (R) (91)	50 (54.9)	1		1	
	Student/University student (21)	14 (66.7)	1.64 (0.60–4.44)	0.331	0.59 (0.15–2.27)	0.451
	Housewife (87)	66 (75.9)	2.57 (1.35–4.89)	0.004	1.36 (0.62–2.98)	0.436
	Entrepreneur (89)	65 (73.0)	2.22 (1.19–4.14)	0.012	1.34 (0.41–4.35)	0.132
	Private employee (65)	54 (83.1)	4.02 (1.86–8.68)	< 0.001**	1.79 (0.83–3.83)	0.624
	Civil servant (71)	62 (87.3)	5.64 (2.50–12.72)	< 0.001**	2.18 (0.61–7.77)	0.230
Religion						
	Muslim (R) (421)	309 (73.4)				
	Others (3)	2 (66.7)	0.72 (0.06–8.07)	0.794		
Marital status				0.793		
	Unmarried (R) (70)	52 (74.3)	1			
	Married (343)	250 (72.9)	0.93 (0.51–1.67)	0.810		
	Widowed (11)	9 (81.8)	1.55 (0.30–7.89)	0.593		
Monthly income (IDR)#				0.001*		0.743
	< 1 million (R) (167)	105 (62.9)	1		1	
	1–2 million (138)	107 (77.5)	2.03 (1.22–3.38)	0.006*	1.26 (0.69–2.29)	0.446
	2–3 million (82)	69 (84.1)	3.13 (1.60–6.12)	0.001*	1.49 (0.60–3.68)	0.382
	> 3 million (37)	30 (81.1)	2.53 (1.04–6.10)	0.039*	0.98 (0.30–3.18)	0.986
Type of residence						
	Suburb (R) (320)	238 (74.4)	1			
	City (104)	73 (70.2)	0.81(0.49–1.32)	0.402		
Commitment decision maker in the family						
	No (R) (122)	97 (79.5)	1			
	Yes (302)	214 (70.9)	0.62 (0.37–1.03)	0.070		
Heard EVD before¶						
	No (R) (232)	161(69.4)	1			
	Yes (192)	150 (78.1)	1.57 (1.01–2.44)	0.044*	0.78 (0.41–1.47)	0.447
Socio-economic status#				< 0.001**		0.005
	Poorest quintile (R) (85)	39 (45.9)	1		1	
	2nd (85)	59 (69.4)	2.67 (1.42–5.01)	0.002*	2.12 (1.05–4.29)	0.034*
	3rd (84)	74 (88.1)	8.72 (3.96–19.15)	< 0.001**	4.62 (1.89–11.30)	0.001*
	4th (85)	72 (84.7)	6.53 (3.15–13.53)	< 0.001**	3.71 (1.46–9.43)	0.006*
	Richest quintile (85)	67 (78.8)	4.39 (2.24–8.60)	< 0.001**	1.90 (0.68–5.25)	0.216
Attitude towards vaccination practice#						
	Poor (R) (127)	197 (66.3)				
	Good (297)	114 (89.8)	4.45 (2.28–8.29)	< 0.001**	2.92 (1.41–6.09)	0.004*
Knowledge regarding EVD#						
	Poor (R) (315)	213 (67.6)				
	Good (109)	98 (89.9)	4.26 (2.19–8.30)	< 0.001**	2.45 (1.16–5.14)	0.018*

aOR: Adjusted odds ratio; IDR: Indonesian rupiah; OR: Odds ratio; R: Reference group; *: Significant at 0.05; **: Significant at 0.01; ¶: Included in multivariate analysis.

and more than a half of participants (62.8%) never attend to the university. The large majority of the participants (99.3%) were Muslims and 83.5% of participants were married. More than a third of the participants earned less than 1 million Indonesian Rupiah (US$ 81) each month and about 70% (302/424) of the participants were decision maker in their family.

After approximately 16 months, the Health Ministry of Republic of Indonesia announced the alertness for EVD in Indonesia, less than a half of the participants (45.3%) had heard about EVD. There was no participant who achieved 100% correct answers on the knowledge regarding to EVD and the highest score achieved was 71.4%. Based on 80% cutoff point of the highest score, approximately 25% (109/424) of the participants were considered having good knowledge regarding to EVD (Table 1).

Regarding to information sources of EVD, 61.4% (118/192) of participants who knew EVD heard about EVD from TV and less than 10% received the information from governmental institutions such as governmental posters or health care providers (Figure 1).

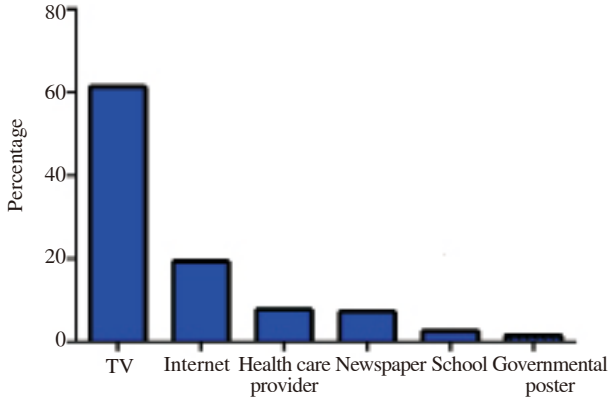

Figure 1. Sources of Ebola information among study participants (n = 192).

3.2. EVV acceptance and associated factors

Approximately 74% (311/424) of participants expressed that they were likely and very likely to receive the EVV. The acceptance of EVV was significantly different among cities or regencies (P < 0.001). The highest acceptance was in Aceh Selatan regency (Meukek [88.0%] and Tapaktuan [84.5%]) whereas the lowest was in Banda Aceh, the capital city of Aceh (56.9%). In general, the highest EVV acceptance was found among those who had good attitude towards vaccination practice and good knowledge regarding to EVD, which was approximately 90%.

Educational status, monthly income, have heard regarding to EVD previously, SES. Because variable "have heard regarding to EVD previously" is also significant in univariate (P < 0.05). In the final multivariate analysis, only SES, attitude towards vaccination practice and knowledge regarding EVD were the independent explanatory variables for EVV acceptance (Table 1). There was an increased odds of accepting EVV among participants which was classified to 2nd, 3rd and 4th quintile compared to the poorest group with OR 2.12, 4.62 and 3.71, respectively. In addition, participants who had good attitude towards vaccination practice and good knowledge on EVD had higher intention to accept EVV approximately 3.0 and 2.5 times compared to their counterparts.

Correlation analysis also confirmed that SES, attitude towards vaccination practice and knowledge regarding EVD had significant correlation with EVV acceptance (r_s = 0.32, r_s = 0.54 and r_s = 0.33, respectively, P < 0.001) (Table 2). This analysis revealed that attitude towards vaccination practice was the most robust independent predictor for EVV acceptance.

Table 2
Correlation between explanatory variables and EVV acceptance (n = 424).

Variables	Correlation (95% *CI*)	*P*
Asset index – EVV acceptance	0.32 (0.24–0.39)	< 0.001**
Attitude towards vaccination practice – EVV acceptance	0.54 (0.47–0.60)	< 0.001**
Knowledge regarding to EVD – EVV acceptance	0.33 (0.26–0.41)	< 0.001**

**: Significant at 0.01.

In this study, we also asked each participant to mention three major important characteristics of EVV as the main reasons for EVV acceptance from list provided. There were 88 participants who answered two characteristics only, therefore, 1 184 answers in total were received. EVV should be halal (not contain human fetuses, gelatin from pork, alcohol, and human and animal parts) was the most important characteristic (24.1%) followed by EVV should be protective against Ebola virus infection (22.4%) (Figure 2). The price of EVV seemed not be a substantial obstacle for EVV acceptance.

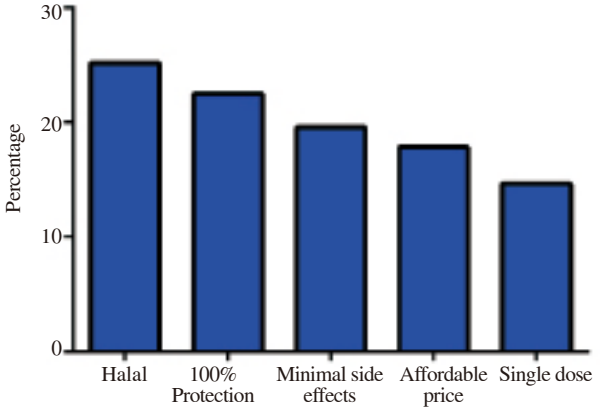

Figure 2. Major vaccine characteristics as main reasons for acceptance towards EVV (n = 1 184).

4. Discussion

This study was conducted to assess the public acceptance towards EVV and its associated factors in Aceh, Indonesia. We found that the knowledge regarding to EVD among participants was very low, but EVV acceptance was relatively high. The independent explanatory variables for EVV acceptance were SES, attitude towards vaccination practice and knowledge on EVD.

The level of public knowledge regarding to EVD in this study is

lower compared to other studies in the countries where the EVD epidemic took places such as in Nigeria[15,16] and in Liberia[17]. The studies in Nigeria reported that 43.1% and 45.4% of the participants had satisfactory knowledge of EVD transmission and preventive measures[15]. However, the difference in the reports could be attributed to varied scoring system and the cutoff point used. The low level of knowledge among participants in Aceh could be explained by the fact that Indonesia did not have a confirmed Ebola case.

Interestingly, a previous study found that respondents who had family members with medical background such as health care workers or medical students had a better acceptance towards EVV[18]. This might indicate that individual with medical professional background could be more accurate to deliver the information regarding to EVD to other community members. In our study, the most prominent information source regarding to EVD was TV and internet. Only less than 5% of the participants received the EVD information from health care workers or government advertisements. Therefore, hospital-based approach should be considered by government as a complementary strategy to disseminate EVD information in Indonesia in the future.

In univariate analysis, this study revealed that education attainment was correlated with EVV acceptance in univariate analysis but not in the final multivariate model. In general population, it seems that education is not a robust predictor for EVV acceptance. For example, a study in Sierra Leone found that there was no association between education level and EVD acceptance[18] while education was a predictor for EVV acceptance in Nigeria[9]. We speculated that education is an intermediate factor that affects other vaccine acceptance-related factors[11]. Previous studies also demonstrated that education could be a promoter[19-22] or a barrier[23-25] for a vaccination. We found that education attainment was correlated with knowledge regarding to EVD. Previous study also found that education level was associated with a better knowledge regarding to EVD[15]. However, another study found that education was not associated with knowledge regarding to EVD[16]. Taking together, it seems that education is a cofounding factor for knowledge regarding to EVD.

In this study, although the knowledge regarding to EVD was very low, the acceptance towards EVV was relatively high, which was approximately 73%. The acceptance rate was similar with other studies conducted during EVD epidemic in affected countries such as Sierra Leone[18] and Nigeria[9] with acceptance rate 72.5% and 80%, respectively. However, none of those studies provided information regarding to the willingness of public to vaccinate their children. In this study, the acceptance rate was a combination between willingness to be vaccinated and willingness to vaccinate the children of participants.

In multivariate analysis, SES, attitude towards vaccination practice and knowledge regarding to EVD were the independent explanatory variables for EVV acceptance. Attitude towards vaccination practice seemed to be the most robust predictor. This result is supported by previous studies that revealed that attitude towards vaccination practice was the most robust independent factor for vaccination against viral diseases[10,11]. It indicates that people who have comprehensive understanding regarding to the importance and safety of the vaccination and have good vaccination coverage tend to accept a new vaccine in the future.

One of the findings was the participants that were classified into richest group had no difference in EVV acceptance compared to poorest group whereas participants classified into 2nd to 4th quintile had significant better support towards EVV compared to poorest group. There are, at least, three possible explanations regarding to this finding. First, the most possible reason, this might indicate that SES is not a robust explanatory factor for EVV acceptance. SES is associated with some factors such as monthly income, types of occupation and educational attainment[11]. This confounding effect, in part, explains the inconsistency of SES as predictor for EVV acceptance. In addition, the effect of the SES also found to be inconsistent as it could be a promoter and a barrier[26] or had no association with vaccine acceptance[10,27]. Second, it could be an indication that the richest community members naturally have propensity to be hesitant for vaccination as mentioned before[26]. Third, in this study, the ownership of household assets and data for constructing the SES classification were collected based on self-reported from participants that could be influenced by desirably bias. Therefore, this has the potential of leading to wrong SES classification.

In addition, one of the strength of our study was that it was conducted in the region where no EVD was present. Therefore, the effects of the fear of potential EVD infection that might influence the responses were limited compared to other studies that were conducted during epidemic[9,18]. Inevitably, there are some limitations of our study. First, some participants might have provided socially desirable responses to some questions. Second, this study was conducted using a hypothetical EVV where hypothetical nature of the study might differ from the real acceptance. Therefore, acceptance rate in this study should be interpreted with caution. In this study, we hypothesized that the EVV would be safe and protective against Ebola virus infection and no information was related to administration procedure, the dose and the price were provided during the interview.

In conclusion, the level of knowledge regarding to EVD among study participants is very low. Although, it was hypothesized that EVV acceptance in a country with non-existent EVD case might be lower[9]. This study reveals that the acceptance towards EVV is relatively high. High SES, good attitude towards vaccination practice and good knowledge regarding to EVD are three independent explanatory variables for a better EVV acceptance.

Conflict of interest statement

We declare that we have no conflict of interest.

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