Socioeconomic factors of child basic immunization: Case of West Java Province

Patrisia Helena Saraswati¹, Ascobat Gani²

¹ Correspondence Author: patrisiahsp@gmail.com

¹Department of Administration and Health Policy, Faculty of Public Health, University of Indonesia, Indonesia

²Department of Administration and Health Policy, Faculty of Public Health, University of Indonesia, Indonesia

INDEXING

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ABSTRACT

Indonesia has committed to eradicating infectious diseases by launching an Expanded Program on Immunization (EPI) in 1977 with a focus on 6 diseases: tuberculosis, diphtheria, tetanus, pertussis, measles, and polio. According to the Basic Health Survey (RISKESDAS) 2018, the rate of basic immunization coverage for children in Indonesia was still below 60% and coverage between provinces varies. West Java was among the province with low child basic immunization coverage. The current study is designed to examine the socio-economic factors that influence child basic immunization using logistic regression. Socioeconomic data were extracted from the National Socioeconomic Survey (Susenas) 2017 and Village Potential (Podes) Survey 2018. The study finds that income, maternal education, location of residence, insurance ownership, availability of health facilities and health workers increase the likelihood of children getting immunized.

Kata Kunci:

Imunisasi Anak;
Faktor Sosial
Ekonomi;
Jawa Barat.

Indonesia telah memiliki komitmen untuk eradikasi penyakit menular dengan menjalankan Expanded Programme on Immunization (EPI) pada tahun 1977 dengan fokus pada 6 penyakit: TBC, difteri, tetanus, pertussis, campak dan polio. Menurut data Riset Kesehatan Dasar (RISKESDAS) 2018 angka cakupan imunisasi dasar anak di Indonesia masih dibawah 60% dan cakupan antar provinsi bervariasi. Jawa Barat adalah salah satu provinsi dengan cakupan imunisasi dasar anak yang rendah. Penelitian saat ini dirancang untuk memeriksa faktor-faktor sosial ekonomi yang mempengaruhi imunisasi dasar anak menggunakan regresi logistik. Data sosial ekonomi diambil dari Survei Sosial Ekonomi Nasional (Susenas) 2017 dan Survei Potensi Desa (Podes) 2018. Studi menemukan bahwa pendapatan, pendidikan ibu, lokasi tempat tinggal, kepemilikan asuransi, ketersediaan fasilitas kesehatan dan tenaga kesehatan meningkatkan kemungkinan anak-anak diimunisasi.

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INTRODUCTION

Immunization has proven to be the most cost-effective and safest health intervention program that reduces mortality and morbidity and increases the quality of life (Andre et al., 2008; M. Doherty et al., 2016; Favin et al., 2012; Greenwood, 2014). The benefits of immunization arise, either directly through immunity for those who obtain it or indirectly by developing herd immunity or immunity to other individuals in a broad environment (Andre et al., 2008). In 1974, the World Health Organization (WHO) launched the Expanded Program on Immunization (EPI), a global immunization program to ensure every child gets the benefits of immunization. The program has successfully increased the global vaccine coverage to above 70% in 2005 but there are variations between countries. The average immunization coverage in the European Union (EU) for diphtheria, pertussis, and tetanus (DPT) reach 99% but coverage in Malta is only 76%, Austria 83% and Latvia 89% (E. Doherty et al., 2014). Variation in vaccine coverage is also found in low- and middle-income countries (Hosseinpoor et al., 2016).

Indonesia has committed to eradicating infectious diseases by launching EPI in 1977 with a focus on 6 diseases: tuberculosis (BCG), diphtheria, tetanus, pertussis (DTP vaccine), measles, and poliomyelitis (Barnum et al., 1980). Immunization program in Indonesia has

resulted in smallpox eradication in 1974, free polio status in 2014 and elimination of maternal and neonatal tetanus in 2016. Although national immunization coverage continues to increase and immunization is provided free at community health centers (*puskesmas*), there are still areas in Indonesia where immunization coverage is low (Herliana & Douiri, 2017; Maharani & Tampubolon, 2015).

Based on the Basic Health Research survey (RISKESDAS), the national basic immunization coverage for children in 2013 was only 59.2% and decreased to 57.9% in 2018. Coverage at the provincial level varied from 19.5% (Aceh) to 92.1% (Bali). The rates were alarming as they were way below the target rate to achieve herd immunity.

Previous studies have shown the association of socio-economic factors with child immunization. Socio-economic factors such as household income, maternal education, residential status, number of siblings, insurance ownership, tribe, sex, parental occupational status, were found to be significantly associated with child immunization (Adenike et al., 2017; Bhuiya et al., 1995; E. Doherty et al., 2014; Herliana & Douiri, 2017; Lauridsen & Pradhan, 2011). Understanding the socio-economic factors of immunization is crucial for developing further interventions to increase coverage (Adenike et al., 2017; Bhuiya et al., 1995; E. Doherty et al., 2014; Herliana & Douiri, 2017; Lauridsen & Pradhan, 2011).

A number of studies evaluated the socio-economic factors of child immunization at the national level but assessment on what happens at the provincial level is limited (Herliana & Douiri, 2017; Maharani & Tampubolon, 2015). Assessment at the provincial level is needed as the immunization program is designed and conducted by the local governments both at the provincial and district levels. Based on RISKESDAS 2018, West Java is among the provinces with the lowest child immunization coverage in Indonesia (58.3%). West Java was also hit by measles and diphtheria outbreak in 2015 and 2017 (Harapan et al., 2019). This study analyses the socio-economic factors of basic immunization in West Java.

RESEARCH METHOD

The research combined household survey data from the 2017 National Socio-Economic Survey (Susenas) and 2018 Village Potential (Podes). Information on immunization status and the following household socio-economic characteristics were taken from Susenas: household income, mother's level of education, residential status (urban/rural), child insurance coverage, household head's access to the internet. Data on health facilities and health personnel were obtained from Podes. For the purpose of the study, only health facilities that provide immunization services were used: hospitals, community health centers (*puskesmas*), and village health posts (*posyandu*). Meanwhile, for data on health workers, we use medical doctors and other health workers. The information generated from Podes was linked with household characteristics used in Susenas using the municipality ID that both data use.

Information on immunization in SUSENAS was obtained based on the respondent's responses. Susenas asked parents whether they had their children receive the following basic immunizations: BCG (tuberculosis), polio, DPT (diphtheria, tetanus, and pertussis), measles and hepatitis B. Out of 4,843 children, only 31% were able to show immunization cards with 52% failing to show immunization cards and the remaining 17% with no immunization cards. The low percentage of immunization cards shown to the enumerators may cause

recalled bias. We only counted at least one dose of each type of child basic immunization (based on EPI standard) to avoid bias. If children received at least one dose of each vaccine (total 5 doses), we classified the children as immunized (=1) while children who did not receive each vaccine or not receiving any immunization were classified as not immunized (=0).

To answer whether the independent variable has an association with the probability of children age 12-59 months being immunized, we used logistic regression and built the following model:

$$Y_i = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \dots + \beta_n X_n + e$$

Where Y_i as the dependent variable/variable of interest is binary data. In logistic regression, the dependent variable y has 2 values with a probability of p . This model focuses on the determinant of the probability of p on an outcome and not on its alternative probability, $1-p$.

$$Y_i = \begin{cases} 1, \text{with probability } p \\ 0, \text{with probability } 1 - p \end{cases}$$

The model was determined as follows:

$$Y_i = \beta_0 + \beta_1 x + \beta_2 mom_{sch} + \beta_3 commune + \beta_4 hh_{ins} + \beta_5 hh_{inet} + \beta_6 rs_{1000} + \beta_7 puskesmas_{1000} + \beta_8 posyandu_{1000} + \beta_9 dokter_{1000} + \beta_{10} nakeslain_{1000} + e$$

With,

- Y_i : Children aged 12-59 months who received at least 1 (one) dose of each type of vaccination of basic child immunization (BCG, DPT, polio, measles, hepatitis B). Binary variable with 1 = immunized; 0 = unimmunized
- x : expenditure per capita per person (in the form of a log)
- Commune : residence status (1 = urban and 0 = rural)
- mom_sch : mother's education (years of schooling)
- h_ins : child insurance coverage (1 = own insurance and 0 = no insurance)
- h_inet : Household head's access to internet (1 = access and 0 = no access)
- rs_1000 : ratio of hospitals per 1000 population
- Puskesmas_1000: ratio of community health centers per 1000 population
- Posyandu_1000: ratio of village health posts per 1000 population
- doctor_1000 : ratio of doctors per 1000 population
- nakeslain_1000: ratio of other health workers per 1000 population

RESULTS AND DISCUSSION

Descriptive Analysis

A descriptive statistics table shows that from a total of 4,843 children, 74.87 % of children received at least 1 dose of each type of basic immunization. The remaining 25.13 % of children do not have complete immunization or do not receive any immunization. This means that West Java is missing the WHO immunization target and failing to provide basic primary care services. Figure 1. Highlights the variation between municipalities in West Java. Only 7 out of 27 municipalities have coverage above 80% and there are 2 municipalities which coverage is lower than 40%.

Figure 1. Child Basic Immunization Coverage in West Java 2017

Source: Susenas 2017

This wide gap between districts urges an in-depth analysis of the municipalities and individual levels.

Table 1. Descriptive statistics

Variable	Description	Obs	Mean	Std. Dev.	%
ch_vasn	Basic child immunization	4,843	0.749	0.4338	
	1 = immunized				74,87
	0 = unimmunized				25,13
x	Expenditure per capita (log)	4,843	13.476	0.6520057	
commune	Residential status	4,843	0.663	0.473	
	1 = urban				66,26
	0 = rural				33,74
mom_sch	Mother's years of schooling	4,843	9.279	3.446892	
h_ins	Child insurance ownership	4,843	0.414	0.492527	
	1 = own an insurance				41,36
	0 = no insurance				58,64
h_inet	Parent's access to internet	4,843	0.387	0.4871981	
	1 = have access to internet				38,74
	0 = no access				61,26
rs_1000	Hospital/1000 population	4,844	0.013	0.0099705	
puskesmas_1000	Puskesmas/1000 population	4,844	0.074	0.0329677	
posyandu_1000	Posyandu/1000 population	4,844	1.24	0.347672	
dokter_1000	Dokter/1000 population	4,844	0.152	0.0855732	
nakeslain_1000	Other health worker/1000 population	4,844	0.45	0.2101071	

Source: Susenas 2017 and Podes 2018

According to Podes 2018, there were 590 hospitals in West Java, which included general hospitals and specialized maternity hospitals. The ratio of hospitals per 1000

population was around 0.013. Figure 2. Shows the variation of the ratio of hospital per 1000 population between municipalities.

Figure 2. The ratio of hospital per 1,000 populations by municipalities

Source: Podes 2018

The total number of community health centers in 27 municipalities was 3,142, consisting of community health centers with inpatient care and community health centers with only outpatient care. The ratio of community health centers per 1000 population is 0.074 or 74 community health centers serving 1 million populations. There were 56,700 village health posts and the ratio per 1,000 populations was 1.238. Village health posts have the highest ratio among the three types of health facility but it does not accessible every day. Village health posts operate once a month (or more).

West Java had less than 1 doctor per 1000 population. There were only 0.152 doctors per 1000 population or 15 doctors serving 100,000 people while the ratio of other health workers per 1000 population was 0.45 or 45 health workers serving 100,000 people. The average mother's level of education in West Java is considered low. The average mother's years of schooling is 9.28 years or not completing junior secondary school. The range of years of schooling is from Year 0 or no education to Year 19 at undergraduate level. Almost half of the children aged 12-59 months in West Java have insurance coverage (41.36%). Then 38.74 % household head has internet access. Having internet access allows parents to get information about immunization.

Bivariate Analysis

The bivariate test of the independent variables shows a significant relationship of all variables tested with the dependent variable (p -value < 0.001). Community health centers variable p -value slightly above the significance of the cut-off value used ($p < 0.025$). However, theoretically, community health centers are important to explain immunization. Therefore, community health centers variable along with other numerical variables will be included in the multivariate analysis.

Chi-square test results for 3 (three) independent categorical variables: residence status, child insurance ownership and household head's internet access, show a significant relationship between complete basic immunization with the child's residence (2, N = 4,843) = 25.02, $p = 0.001$, child insurance ownership (2, N = 4,843) = 13.21, $p = 0.001$ and household head internet access (2, N = 4,843) = 29.91, $p = 0.001$, so that all three variables can be included in multivariate analysis.

Multivariate Analysis

Table 2 shows the result of logistic regression analyses. Income, mother's level of education, geographical location, child insurance coverage, the ratio of the hospital, community health centers, village health posts, doctor and health workers per 1,000 population are all statistically significant at 5%. Among the independent variables, it seems that the ratio of community health centers to 1,000 population has the most dominant effect to child basic immunization (OR: 62.80; 95% CI: 1.12, 3504.65; $P < 0.001$), holding all other variables constant. The ratio of doctor and health workers per 1,000 populations is also influential with children having odd 34.7 and 4.9 times of getting basic immunization. Meanwhile, the impact of the ratio of hospital and village health posts per 1,000 populations is very dismal. Children who live in the area with a higher ratio of hospital and village health posts per 1,000 populations are less likely to be immunized than children who live in the area with a lower ratio of hospital and village health posts.

Mothers who have higher education are more likely to immunize their children than mothers with lower or no education. Children who live in an urban area, have better-off families and own health insurance are more likely to be immunized. However, the relationship between the parent's internet access relationship and child basic immunization is not statistically significant.

The overall test of the model shows that there is no misspecification ($p \text{ value} > 0.001$). A comparison between predicted outcomes and actual outcomes showed that the correctly specified values in this model are 75% where 3.632 observations are correctly specified. The sensitivity analysis shows that the results are robust.

Discussion

Since 1977, the government of Indonesia has made sure that every child gets the benefit of immunization by launching the Extended Programmed on Immunization (EPI). After 40 years of the program, immunization coverage has shown a lot of improvement. However, the increasing number of populations, geographical extends and social dynamics has posed many new challenges for immunization.

The coverage in 2017 is still below the WHO target rate to guarantee herd immunity. The national immunization coverage rate may show a rate of around 80-90%, but when we break down to provinces and municipalities, there is a high variation between areas. The alarm of low immunization coverage has been ringing with measles and diphtheria outbreak in 2005 and 2017. If coverage is nowhere to get higher, the government must work hard to find ways to achieve the minimum rate for herd immunity and to reach the whole population, especially the marginalized.

Table 3. Multivariate Analysis

Child Immunization	OR	Std. Error	p Value	95% CI	
Income	1.288	0.087	0.001***	1.129	1.469
Residence Status (Urban/Rural)	1.239	0.099	0.007**	1.059	1.450
Mother's Level of Education (years of schooling)	1,044	0.013	0.001***	1.019	1.068
Child insurance ownership	1.199	0.091	0.016*	1.034	1.392
Household head access to internet	1.050	0.088	0.560	0.891	1.238
Hospital/1000 population	2.88e-08	1.79e-07	0.005**	1.44e-13	0.006
Puskesmas/1000 population	62.807	128.877	0.044*	1.125	3504.653
Posyandu/1000 population	0.573	0.110	0.004**	0.393	0.836
Doctor/1000 population	34.714	23.763	0.001***	9.075	132.793
Other health workers/1000 population	4.942	1.192	0.001***	3.081	7.928
Cons	0.029	0.027	0.001***	0.005	0.181

* $p < 0,05$ ** $p < 0,01$ *5% ** $p < 0,001$

Multivariate analysis results showed that increasing the number of community health centers, doctors and health workers is important to improve immunization status. Community health centers are located in every sub-district in Indonesia. It plays the role of the first referral and provides basic primary care in the health system. By design, community health centers are responsible to assist village health posts in delivering primary care (Nazri et al., 2016). Based on the Ministry of Health regulation no 75 Year 2014, doctors and health workers from community health centers must support village health posts by training the cadres and also travel to villages to conduct immunization. Immunization services can only be administered by doctors, midwife or vaccinators from community health centers. Coordination between community health centers and village health posts is essential for immunization programs, but it takes community health centers to have enough health workers to serve all villages. Without support from community health centers, village health posts are only able to conduct limited services like baby weighting.

Community health centers also have promotive and preventive functions, so apart from delivering immunization program, community health centers also responsible conducting education and counselling to the population. Based on The Ministry of Health Regulation no. 75 Year 2014 on Community Health Centers there are 5 types of promotive and preventive health workers: environmental health workers, pharmaceutical workers, nutrition workers, public health workers, and health analysts. For community health centers to be able to carry out their functions, they need an appropriate number of health workers. The West Java Province Health Resources data (Dinas Kesehatan Provinsi Jawa Barat, 2017) showed that community health centers are lacking health workers. Only 11 % of the community health centers in West Java had a minimum of five preventive and promotive health workers, the rest did not. This explains why areas with a higher ratio of village health posts have less immunized children than areas with a lower ratio of village health posts. Lacking health resources affects the immunization program in village health posts.

Children in areas with a higher ratio of hospitals are not necessarily better immunized. The fact has shown worse conditions. Hospital is a health establishment that provides curative services, while immunization is prevention care. Hospitals also charge immunization

services as free immunization only available in community health centers or village health posts. Therefore people tend to go to community health centers (or village health posts) rather than a hospital to get their children immunized (Maharani & Tampubolon, 2015). The availability of more health facilities and health workers/physicians per population is very important to increase immunization coverage (Mitchell et al., 2008; van Doorslaer et al., 2018). It means that not only the number of health facilities and health workers/physicians that matter; the distribution of health facilities and workers/physicians also affects the ability to reach those who live in the rural, remote areas (Anand & Bärnighausen, 2007; Paramita et al., 2018).

The importance of health facilities and health workers to increase immunization coverage is also supported by the findings from the analysis of household determinants, were maternal education, household income, residential status and child health insurance influence the likelihood of immunization. Mother's level of education was found to be important for child immunization in the household (Adenike et al., 2017; Desai & Alva, 1998; McNeil et al., 2019). There are differences between educated and uneducated mothers or mothers with different levels of education, in making decisions. Educated mothers have better information about the benefit of immunization and can access information (Danis et al., 2010; Desai & Alva, 1998; Herliana & Douiri, 2017; Maharani & Tampubolon, 2015). This finding has an important implication on provinces like West Java where the maternal level of education is low. The health sector, including provincial and municipality governments, should be able to identify programs to reach out to the less educated mothers, ways on how to approach them and help them understand immunization (McNeil et al., 2019).

The importance of maternal education to improve immunization coverage is also related to the ability of health workers to provide immunization education. Many studies mention the importance of health workers in providing education about health to the community. Furthermore, the need for health workers who have good communication skills to deliver health messages so that parents who doubt the benefits and safety of immunization can change their minds. Health workers who have a positive perception of immunization will find it easier to invite others to get immunizations, while health workers who doubt the benefits and safety of vaccines will find it difficult to convince others. The data which states that 38% of household heads in West Java have access to the internet provides information that the internet can be used as a medium for delivering health messages.

Children from households with higher incomes are more likely to be immunized. West Java is among the provinces with the highest number of poorest households in Indonesia (together with East Java and NTT). For the poor and those who live in remote areas (or areas that are geographically difficult to access), the cost of getting immunized is higher (Hodge et al., 2014). Although basic immunization services are funded by the government (free), the cost of going to a health facility and the opportunity cost to bring a child to a health facility is borne by the household (Bhuiya et al., 1995; Herliana & Douiri, 2017; Hu et al., 2018; Maharani & Tampubolon, 2015). In areas where the number of health facilities is very limited and geographical conditions are difficult, higher costs, both time and actual transportation cost, to visit health facilities hinder many households get their children immunized.

As a short-term solution, local governments can provide demand-side subsidy to poor households. Incentives in the form of cash assistance can be given to poor households who have children under 5 years of age who have immunization cards and complete basic immunizations. This form of demand-side subsidy has advantages, where benefits are more targeted and thus reduce the risk of spillover where benefits are received by non-target groups. In the long run, the mechanism requiring basic immunization must be made more assertive, for example by requiring mandatory immunization for children going to primary school. The Italian government, since 2017 and France since 2018 have begun requiring children entering primary school to have complete immunization. This obligation effort is considered to be very effective in increasing immunization coverage and decreasing the immunization gap (Trentini et al., 2019). Efforts to require basic immunization as a condition for school registration must have plans and strategies so that the rejection for moral reasons, beliefs, and philosophies or health reasons, can be controlled. The government needs to be clear about which risks of infectious diseases are greatest and immunization has the legitimacy to be required without exception and which infectious diseases have lower risks and still allow for exclusion for a number of reasons that are considered valid (Arora, K.S, Jacobs, A.J., Morris, 2018).

The availability of insurance coverage increases health consumption. A number of studies have noted that those who have insurance coverage consume far greater health services (Gouda et al., 2016; Herliana & Douiri, 2017). Indonesia already has a place social health insurance scheme called the BPJS Kesehatan that targets universal coverage in 2019. The data from Susenas 2017 on the lack of insurance coverage for more than 50 % of children in West Java gives the information where BPJS Kesehatan should focus. Both national and local governments can collaborate to increase the subscription of BPJS in West Java.

CONCLUSION

Child immunization coverage in West Java is still far below the target rate for herd immunity. Outbreaks of measles and diphtheria have become important alarms for the local government to quickly catch up with missed immunizations. To be able to reach out to the high-risk groups, understanding the socio-economic condition of the population is important, especially where there is evidence that socioeconomic factors matter. Community health centers with a sufficient ratio of doctors and health workers to the population should be the main focus to increase immunization coverage. Education programs, counseling for the poor population, especially women with a low level of education, should be designed and launched. Incentives for the poor are also important to increase the demand for immunization by the poor population. Compulsory complete immunization for school entrance is also necessary. And lastly, increased coverage of health insurance such as BPJS can be the driver for better immunization.

There are two limitations of this research: (1) We use multi-sources of cross-sectional data: Susenas 2017 and Podes 2018. The variables tested in this study are limited to the available variables that Susenas and Podes provide, (2) Immunization data is collected based on confession rather than immunization records (only 30% of the samples have immunization record books), (3) The latest immunization data only available in Susenas

2017. Starting in 2018, the immunization module in Susenas has been transferred to Riskesdas which raw data are not accessible for the public.

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