

Research Paper

The Influence of Father and Mother's Joint Decision Making on Children's Basic Immunization

Empirical Research on Indonesia's Demographic and Health Survey 2017

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ABSTRACT

The 2017 diphtheria outbreaks in Indonesia shows the downside of inadequate immunization for certain group that could endanger public health. Despite years of government intervention on this vaccine-preventable disease, insofar mandating basic vaccination for children from an early age, ultimately, it is parents that will decide on having their children being immunized. Utilizing the 2017 Indonesia Demographic and Health Survey, this study aims to uncover the association between parents' decision-making processes and their demographic variables to their children's immunization completion status. Logistic regression suggests discussion between parents in household's major purchases, more likely to result in complete basic immunization for their children. Additionally, mothers' traits, which are education, frequency of access to mass media, and exposure to medical professionals, are positively associated with compliance with basic vaccines administration. Differences in compliance can also be observed in children's gender and order of birth.

Keywords: health, demographic, vaccination, DHS, Indonesia

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1. Introduction

Children are the assets of a family and, by extension, the nation. The future livelihood of the society rests on their hands. Failure to guard their wellbeing means arresting their progress and development, wasting away these assets, and jeopardizing the nation's future. Vaccination is one of the ways to protect human beings from illnesses. This brings about results that contribute immensely in controlling infections such as polio, measles, and smallpox, among others (World Health Organization [WHO], 2013b).

Currently, there are children who have not received complete immunization, and some have never received immunization since birth. Indonesia's Ministry of Health data suggests that from 2014 to 2017, as much as 8.88% of children between 12 to 23 months old have not received basic immunization or have not been fully immunized (Ministry of Health, 2017b). Based on Indonesia's Ministry of Health decree (Ministry of Health, 2017a), children aged 1-year old ought to have already completed their basic immunization (hepatitis B, BCG immunization, DPT and polio 1, DPT and polio 2, DPT and polio 3, and measles) in a certain order. Basic immunization consists of immunization against hepatitis B (recommended vaccine administration time: month 0 since birth), BCG (month 1), poliomyelitis (month 1 for the first shot, and the next 3 subsequent months for the last 3), tuberculosis (month 2 for the first shot, and the next 2 months for the last 2), diphtheria (month 2 for the first shot, and the next 2 months for the last 2, and month 18), pertussis (month 2 for the first shot, and the next 2 months for the last 2, and month 18), tetanus (month 2 for the first shot, and the next 2 months for the last 2, and month 18), pneumonia and meningitis caused by Hemophilus Influenza type b (month 2 for the first shot, and the next 2 months for the last 2), and measles (month 9).

Studies on children vaccination often focused on determinants of complete immunization. These factors include external household factors, the medical professional's presence during labor, and a high association with children's vaccination completion (Efendi et al., 2020). The study also found notable differences among children with complete and incomplete basic vaccination in terms of parents' education level, socioeconomic status, and residential region (Efendi et al., 2020). Another determinant, a household health handbook, plays a role in childhood vaccination, as it gives a home-based record and health information to both family and health worker (Osaki et al., 2009). Nonetheless, there is no new information on new factors associated with complete vaccinations, aside from what has already been confirmed in other similar studies.

On the other hand, as children are not able to decide for themselves, whether they will get a vaccination or not is the responsibility of their parents (Pearce et al., 2008) as their current primary caregivers. Internal and external factors may influence outcomes in every family decision, including immunization issues. Safety concerns (MacDonald et al., 2018; Smailbegovic et al., 2003; Smith et al., 2004) and religious beliefs (Choudhary et al., 2019; Dubé et al., 2014; Paterson et al., 2018) often influence a family decision in taking the vaccine. Parents' attitudes also influence children's vaccination coverage (Esposito et al., 2014). Moreover, the mother's perception of the dangers of communicable diseases could prove to be the key in determining immunization (Houtrouw & Carlson, 1993). In the rise of vaccination disinformation that could affect vaccination hesitancy (Syiroj et al., 2019), young-parents with only primary education degrees are more concerned about the safety of the vaccines (Yufika et al., 2020). As mothers are more concerned about vaccines safety than fathers are (Yufika et al., 2020), these disparities can result from the unequal quality of information between parents. Discussions between the father and mother are argued to reduce the gap in severity perception, as this factor is associated with parents' vaccination acceptance (Boes et al., 2017), which could potentially lead to better compliance. This dialogue process is also reflected in other issues not limited to children's healthcare.

In relation to this, the current study aims to explore the dynamic between parents as a new determinant for immunization completion. As it stands, the decision for children to be immunized is motivated by parenting strategy on their beliefs, benefit to their livelihood, barriers, and associated risks. These elements are thought to result from knowledge accumulation and other external factors during the period before the decision to vaccinate takes place. In relation to that, a dialog between parents could be a medium for an argument, an exchange of information, reinforcements of personal beliefs, and risks perception associated with it. Existing household decision-making structures could indicate whether such discussions often occur in the family. If one party has a better understanding of the issue, positive conceptions could then be transferred, increasing the chance of encouraging results, such as the decision to immunize. Additionally, the ability to meet the immunization requirements for the children can be

reflected through its completion status. It is hypothesized that when a joint decision exists in the family, the dialogue about children's immunization before the final verdict occurs.

Thus, this study tries to make a case of whether there is an association between vaccination completion on children and the way their parent decides on household issues. Other parents' demographic factors, which represent their supposedly knowledge and beliefs on immunization from previous studies, will also be considered. The age range for the children will be 12–35 months, as they supposedly have already taken the national mandatory basic immunization ([Ministry of Health, 2017a](#)) at the age of 12 months. Additionally, the vaccination section on the main data for this research, the 2017 SDKI, collect vaccination information of children aged 0 to 35 months. Despite the age span of 12 to 23 months being the common unit analysis in preschool vaccination studies, the allowance for catching up to the delayed vaccinations ([WHO, 2019a](#)) gives way to assess completion that compensates immunization delay to older age groups. This catch-up strategy was used previously in Indonesia, targeting school students ([WHO, 2007](#)). Africa also had been the subject of this method to reduce mortality rates due to measles, targeting children from 9 months to at least 5 years old, and had achieved a decline in measles prevalence ([Arevshatian et al., 2007](#)). Furthermore, older children tend to have up-to-date vaccination compared to younger ones ([Koivogui et al., 2018](#)). The resulting outcome of this study is thought to be useful for relevant stakeholders in understanding vaccination completion factors in more diverse target populations. Moreover, identifying more characteristics to better define the health policy's focus could improve the national immunization program.

Literature Review

Despite its apparent effectiveness, recent development suggests that there are widespread anti-vaccination sentiments. The reasons range from the old false beliefs that vaccines cause autism to serious complications that vaccinations may cause ([Žuk et al., 2019](#)). False information ([Deer, 2011](#)) is proven to affect the immunization rate of children ([Doucleff, 2014](#)). This situation might have led to a decrease in vaccination coverage, endangering the immunization's progress.

Conversely, the 2019 World Health Organization (WHO) global situation report suggests that outbreaks or mortality from vaccine-preventable diseases are still happening. Hepatitis B resulted in 887,000 estimated deaths in 2015 ([WHO, 2019b](#)). Therefore, health bodies suggest early age vaccination against several illnesses to have optimal protection ([Centers for Disease Control and Prevention \[CDC\], 2020](#)) as diseases can strike anytime and anywhere. An estimated 2 to 3 million deaths could be prevented each year due to the provision of diphtheria, tetanus, pertussis, and measles vaccines ([WHO, 2019c](#)).

WHO acknowledges the need for early protection against preventable diseases laid out commendations for routine immunization ([WHO, 2019c](#)). While infants may already have received fractional protection from their mothers' passive transference of antibodies, their eventual waning is expected; thus, further active immunization for infants is needed. Moreover, vaccine administration must follow a certain order as all the shots could not be administered all at once. Nonetheless, WHO also acknowledges that certain physical conditions could prevent children from getting complete immunizations.

Through its decision-making body, World Health Assembly, WHO also had provided a framework with Global Vaccine Action Plan in 2012 to ensure universal access to immunization ([Daugherty et al., 2019](#); [WHO, 2013a](#)). The outline contains targets such as 90% national immunization coverage for all injections, allowing certain proportions of the population not to have a complete vaccination. Herd immunity targeted program can save costs while still decreasing the incidence of diseases ([Ortega-Sanchez et al., 2008](#)).

In accordance with WHO's recommendations, Indonesia's Ministry of Health has enacted a vaccination-specific Ministerial Decree ([Ministry of Health, 2017a](#)). Children from zero to 12 months are the subject of mandatory basic immunization. The administration consists of Hepatitis B, Poliomyelitis, Tuberculosis, Diphtheria, Pertussis, Tetanus, Pneumonia, Meningitis, and Measles. This set is a part of the national immunization program, along with advanced, additional, and specific ones, covering a broader age range.

Nevertheless, cases as in Korea measles outbreak in 2013 ([Park et al., 2013](#)) and Indonesia's diphtheria outbreaks in 2017 ([Tosepu et al., 2018](#)) still occur. Thus, it is argued that vaccination hesitance is still prevalent in society. People believe that vaccination has an adverse effect on them and can be associated

with vaccination compliance (Lyn-Cook et al., 2007), while acceptability is related to perceived susceptibility, benefits, and barriers (Marlow et al., 2009).

Health Belief Model (HBM) was developed by psychologists in the 1950s and tried to explore people's attitude towards rejection of preventive methods, which was the direction that public health services shifted to in that era (Becker, 1974; Glanz et al., 2008). HBM proposed several constructs that revolve around beliefs that influence humans before they sprang into health-related action. Personal probability of contracting diseases and their severity are threat factors. The later parts are possible benefits of impending behavioral change that individuals could earn, perceived barriers to change, and self-confidence. These factors, combined with socioeconomic and demographic characteristics and hard-to-generalize cues to action, will eventually change individual behaviors (Glanz et al., 2008).

On the other hand, the Theory of Planned Behavior (TPB) (Ajzen, 1991) can also be utilized to give another point of view regarding vaccination. The intention is influenced by attitudes toward behavior, subjective norms, and perceived control over behavior. Alternatively, the provider's positive attitude and confidence in self-efficacy could give credence to the success of the vaccination program (McCave, 2010). Non-compliance to vaccination, which can be considered unhealthy, could also be explained by the protection motivation theory (PMT). The model is based on people's intention to protect themselves (Rogers, 1975).

These two models had been used to explain children's vaccination status based on their parent's internal factors. As one of the main drivers for immunization is prevention, the probability of childhood vaccination is also greatly affected by beliefs and perception (Flood et al., 2010, pp. 1448–1467). When parents become wary (Wang et al., 2014) or perceived threat trumps vaccine's efficacy and safety, their children will likely be vaccinated (Flood et al., 2010).

Children might be the subject of early vaccination programs by relevant governmental health bodies. Presently, the latest Indonesia Demographic and Health Survey 2017 (National Population and Family Planning Board et al., 2018) indicates that approximately 35% of children between 12 to 23 months have not been getting complete basic immunization, even after the Ministry of Health had targeted in 2014 (Ministry of Health, 2015) that at least 90% of children should have been fully immunized. The figures show that despite the government intervention, ultimately, their parents will decide on having them immunized or not.

Hisnanick and Coddington (2000) adopted Becker's (1991) altruism utility theory that parents' utility is reflected on their children's utility, which is driven by their current and future wellbeing, represented by the decreasing chances of their morbidity. Vaccination is thought to be one way of investing in children's wellbeing (Hisnanick & Coddington, 2000). Nonetheless, despite its apparent effectiveness, the sentiment of vaccine hesitancy continues to grow (Luthy et al., 2009). As vaccine providers can attest, parents with negative perceptions of immunization could also hinder the children's vaccination (McCave, 2010). In some cases, couples have decided on vaccinations even before their child is born (Glanz et al., 2013). However, vaccination decision is not definite and rest on a combination of the sources of parents' knowledge (Weiner et al., 2015), perception, and trust in the vaccine provider (Larson et al., 2011).

As suggested by the TPB, societal norms could play a role in human behavior. These customs work by shaping the parent's perceptions on the necessity of vaccination (Wang et al., 2014), in the form of medical professionals (Lau et al., 2013), social pressure (Wang et al., 2015), or even partners/spouses (Wang et al., 2014). Spouse pressure is believed to be the closest part to when vaccination decision about to happen, occurring during joint discussions that the parents had before making the immunization decision for their children. The model's combination can be utilized to gather more information. A study in Canada attempted to use both TPB and PMT to investigate vaccination intention in several groups with differing access to vaccines. The end products combine different determinants that influence the intention to vaccinate in each group (Gainforth et al., 2012). The result gives an indication that the joint model is useful in understanding various demographics in the population and opens possibilities for tailored interventions.

The decision for children to be immunized is motivated by parenting strategy on their beliefs, benefit to their livelihood, barriers, and associated risks. These elements are thought to result from knowledge accumulation and other external factors influencing the period before the decision to vaccinate takes place. In relation to that, a dialog between parents could be a medium of an argument, an exchange of information, reinforcements of personal beliefs, and risks perception associated with it. Existing household decision-making structures could indicate whether such discussions often occur in the family.

If one party has a better understanding of the issue, positive conceptions could then be transferred, increasing the chance of encouraging results, such as the decision to immunize. Additionally, the ability to meet the immunization requirements for the children can be reflected through its completion status.

Based on Figure 1, children's immunization accomplishment status will then be examined. Its completeness is measured through whether the children have completed their age-appropriate mandated vaccination. Moreover, according to problem formulation, research objectives, and empirical studies, it is hypothesized that when a joint decision exists in the family, the dialogue about children's immunization before the final verdict occurs. Lastly, it is hypothesized that basic vaccination will be completed if the child lives in rural areas, from well-off households, is female, and firstborn, parents with a high educational degree; with the mother having frequent access to newspaper, radio, or internet at least once a week, and is also being assisted by medical professionals in both antenatal care and birth delivery; and in possession of a health/vaccination card.

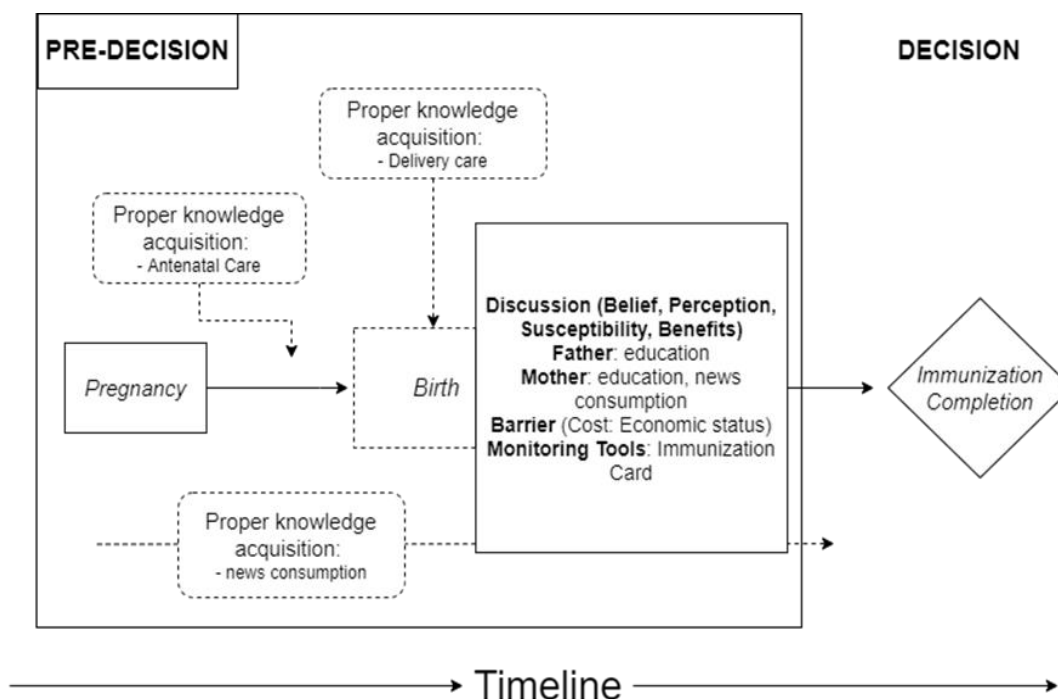


Figure 1. Research Framework

2. Methodology

2.1 Data Source

This research uses the National Health and Demographic Survey (Survei Demografi dan Kesehatan Indonesia, SDKI). The survey's microdata for this study is obtained from The DHS Program website ([The Demographic Health Survey \[DHS\] Program, 2020](#)).

The main goal of the SDKI is to provide the latest estimates on basic demographic and health indicators. The survey stipulates an illustrative picture of the population and both maternal and child health in Indonesia. Furthermore, the other objectives are to measure national targets on health programs and participation and use of health services by men and their families.

Information about children's immunization in Indonesia is also available in the National Socio-Economic Survey (Survei Sosial Ekonomi Nasional, SUSENAS), which is also being conducted by BPS-Statistics Indonesia (BPS), the national statistics agency. However, the SUSENAS provides limited vaccination information, such as basic information of when immunization was taken, with no ways to pair mothers and their respective children, despite living in the same household.

On the other hand, the pairing in the SDKI is possible regardless of the mother's relationship status to the head of households where they lived. Furthermore, couples residing in the same dwelling could be identified conveniently in the SDKI, providing more information on characteristics and dynamics between the pair than the SUSENAS. These distinct attributes are the SDKI's

advantages over the SUSENAS, which could be used to examine their associations to numerous health-related information in the dataset.

The objective of the SDKI is to provide the latest estimates on basic demographic and health indicators, which can be used to measure national targets on health programs and participation and use of health services by men and their families. Couples residing in the same dwelling could be identified and paired, along with their offsprings, providing more information on families' characteristics and dynamics, enabling examination of their associations to numerous health-related information in the dataset.

2.2 Data Strategy

The 2017 SDKI was funded by Indonesia Government and jointly conducted by the BPS, Indonesia's National Population, Family Planning Board (BKKBN), and Ministry of Health Indonesia. The latest field survey takes place from July 24 to September 30 in 2017, with prior surveys done in 1987, 1991, 1994, 1997, 2002 to 2003, 2007, and 2012. On the technical level, the ICF International, a publicly-traded consulting and technology services company, assisted through the Demographic and Health Surveys (DHS) Program, a program by the United States Agency for International Development (USAID). The dataset used in this study was obtained from The DHS Program website ([The DHS Program, 2020](#)). This independent agency within the US federal government is known for providing funding and technical assistance in conducting population and health surveys in many developing countries. Despite using the template from the DHS model, not all questions were included in the 2017 SDKI, as the local context was important to be considered.

The 2017 SDKI was conducted in all provinces in Indonesia (34 provinces). Using two-stage stratified sampling, the survey covered 1970 census blocks drawn from the 2010 Indonesia Population Census. The first stage systematically and proportionally selected census blocks to their household size, which were ordered by wealth index category and stratified by place of residence, urban and rural. Next, the blocks' household content was updated, followed by systematically selecting 25 households from each block. This process was expected to bring about 49,250 household samples. Around 59,100 women respondents from 15 to 49 years old and approximately 24,625 males from 15 to 24 years old were anticipated to be interviewed. On the other hand, a further similar systematic selection process was made to select eight households to get around 14,193 married men between the ages 15 to 54 which would also then be interviewed.

Out of the available questionnaires used in the 2017 SDKI, this study makes use of the information coming from the Woman's and Household Questionnaire. Other forms are the Married Man and the Never Married Man Questionnaire. The team of BPS officers used the face-to-face interview method, comprising a supervisor, a field editor, two male and four female interviewers, and respondents. This formation was used to better extract information from the respondents due to the sensitive nature of the questions.; private information is being one of them. Women from 15 to 49 years old provided children specific information and were asked about their birth history in the past 5 years from the moment questions were asked. Based on the information of all live births, more detailed information was questioned for their last two children.

After the field interview was conducted, the questionnaires were then sent to the BPS-Statistics central office for data entry processing. The results of which were then sent to the BKKBN. The final process for the microdata was done by the DHS Program, where the original variable names in the 2017 SDKI were recoded into new files with new codenames to facilitate comparison to other countries ([The DHS Program, 2020](#)). From the original 4 forms, Woman, Household, Married Man, and Never Married Man Questionnaire, the new data sets were generated, in which each of those comprises of combinations of variables taken from the 4 forms. The new datasets are:

- 1.IDPR71FL IDPR71SV Household Member Recode,
- 2.IDBR71FL IDBR71SV Births Recode,
- 3.IDCR71FL IDCR71SV Couples' Recode,
- 4.IDHR71FL IDHR71SV Household Recode,
- 5.IDIR71FL IDIR71SV Individual Recode,
- 6.IDKR71FL IDKR71SV Children's Recode, and
- 7.IDMR71FL IDMR71SV Men's Recode.

Out of all of the available questionnaires used in the 2017 SDKI, this study uses the main information coming from the Woman's and Household Questionnaire, specifically the **IDKR71FL IDKR71SV Children's Recode** dataset.

Women from 15 to 49 years old provided children specific information and were asked about their birth history in the past 5 years from the moment questions were asked. The dataset for this study comprises vaccination data on children and their mother's characteristics from the Woman's Questionnaire and the wealth index data from the Household questionnaire. In total, 6,942 children from 12 to 35 months of age were able to be identified. Missing values were then dropped, resulting in 6,135 cases of children aged 12 to 35 months, along with their respective mother's information, that were be used in this study.

2.3 Data Analysis

This research used Logistic Regression to obtain Odds Ratio at 95% Confidence Interval and to determine whether parents' decision making on specific issues, along with children's and their parent's other characteristics, have relation to the completeness of their children's basic vaccination. The regression is a binary classification model to estimate chances of observation with specified characteristics whether it would fall into one of two available categories based on their predicted likelihood. Additionally, the data cleaning, calculation, and statistical procedure were performed using the SPSS 13, Statistical Package for the Social Sciences software.

Children's completeness of vaccination is then divided into two outcomes, uncompleted and completed immunization. Disregarding the degree of overall completeness, if at least one immunization has not been administered after the children reached the age of 12 months, the sample will be categorized as uncompleted vaccination. This decision emphasizes that in the event the children miss one of the basic immunizations, even though all other prior immunization has been taken, whether timely or not, they are considered a hazardous agent, posing a danger not only to themselves but also to their surroundings. Therefore, it is fitting to use the Logistic Model instead of Regression, as the predicted probabilities are limited to around numeric value 0 or 1, representing uncompleted or completed vaccination, rather than any values between the two figures.

The unit of analysis is children between 12 to 35 months, covering children who supposedly have already taken the national mandatory basic immunization (Ministry of Health, 2017a) at the age of 12 months. The author hypothesizes that the completeness of childhood immunization is closely related to how parents make decisions in the family. Immunization completion became the dependent variable and was measured as complete and incomplete. Whenever a child between 12 to 35 months has completed all those vaccinations, they will be marked as having completed basic vaccination, regardless of when they do it. Conversely, missing even one vaccination will flag the child as not having completed their basic vaccination. The vaccination history was taken either from their health/vaccination card or mothers' confession.

Therefore, the dependent variable for this study is immunization completion, measured as complete and incomplete. The variable is taken from the Women Questionnaire, which also contains information for children aged 12 to 35 months regarding their history on the nine-basic vaccination. The vaccination history was taken either from their health/vaccination card or mothers' confession.

This study's main independent variables are decision-makers in the family on certain issues in the 2017 SDKI. Since there were no items that directly portray the actual decision-making being done in the family, proxy variables are used. The selected two questions represented health and monetary decisions and issues that are thought to be important in every family. Discussion between parents on those issues in the family embodies the primary hypothesis that the existence of dialogue between children's parents will yield improved decisions for children, and mandatory immunization injections are one of them. The queries in the questionnaire are:

1. (When the children got sick) Who makes the final decision on whether the child should be taken for medical treatment? (Code name: *decMEDKID*, gotten from Woman's Questionnaire, number 948B; the variable name *S648B*)
 - a. Respondent/the children's mother (coded as 0 (ref class)),
 - b. Husband (coded as 0 (reference class)),
 - c. Jointly by respondent and husband (coded as 1),
 - d. Jointly by husband and someone else (coded as 0 (reference class)),

- e. Jointly by respondent and someone else (coded as 0 (reference class)),
 - f. Other (coded as 0 (reference class)),
2. Who usually makes decisions about making major household purchases? (Code name: *decPURCH*, gotten from Woman's Questionnaire, number 923; the variable name V743B)
 - a. Respondent/the children's mother (coded as 0 (ref class)),
 - b. Partner/husband (coded as 0 (reference class)),
 - c. Jointly by respondent and partner/husband (coded as 1),
 - d. Someone else (coded as 0 (reference class)),
 - e. Other (coded as 0 (reference class)),

Both queries are accessible in the Woman's Questionnaire, with the informer being women aged 15 to 49 years old. The next step is making a group out of the provided answers. The option of joint discussion between spouses was recoded into 1, while any other answers were given 0; thus, the data type is nominal. The main take for this grouping is that joint discussion between a partner in the family will represent the main hypothesis; the presence of discussion between parents of the children will result in better results, one of which is basic vaccination uptake.

Controlled variables in this study represent characteristics of the family, parents, and children. Previous studies noted socioeconomic and demographic traits being the major determinants in completing children's immunization. Socioeconomic status and knowledge function were thought to influence each parent's personal beliefs, risk perception, and barrier overcoming ability. Moreover, children's own characteristics can be another determinant of their vaccination uptake. These factors are thought to contribute to the joint discussion between spouses in the family to a certain extent. Those variables, along with their respective recoded answers, are:

1. Gender of the child (variable name in the new dataset: *childGEN*), recoded by the author from the Woman's Questionnaire, question number 213; variable name in the **IDKR71FL IDKR71SV Children's Recode** data set is B4.
 - a. female, coded as 0 (reference category),
 - b. male, coded as 1.

Order of the childbirth in the family (*childORD*), recoded by the author from the Woman's Questionnaire; question number 212; variable name in the data set is BORD.

 - a. 1st child, coded as 0 (reference category),
 - b. 2nd children, coded as 1,
 - c. 3rd children, coded as 2,
 - d. 4ths to highest children, coded as 3.
2. Possession of health/vaccination card (*childCARD*) recoded by the author from the Woman's Questionnaire, questions number 504A, 505A, 506A, and 507A; variable name in the data set is H1/H1A.
 - a. Does not have/no longer in possession, coded as 0 (reference category),
 - b. In possession, coded as 1.
3. Place of residence (*famRESIDE*) recoded by the author from the Woman's Questionnaire, question number 5; variable name in the data set is V102.
 - a. Rural, coded as 0 (reference category),
 - b. Urban, coded as 1.
4. Mother of the children's formal education attainment (*momEDU*) recoded by the DHS Program from the Woman's Questionnaire, question number 108; variable name in the data set is V106.
 - a. No Education (never attended school), coded as 0 (reference category),
 - b. Primary (has completed primary high), coded as 1,
 - c. Secondary (has completed junior and or senior high), coded as 2,
 - d. Higher (has completed higher education), coded as 3.
5. Father of the children's formal education attainment (*dadEDU*) recoded by the DHS Program from Woman's Questionnaire, question number 904; variable name in the data set is V701.

- a. No Education (never attended school), coded as 0 (reference category),
 - b. Primary (has completed primary high), coded as 1,
 - c. Secondary (has completed junior and or senior high), coded as 2,
 - d. Higher (has completed higher education), coded as 3.
6. Antenatal care during the children pregnancy (*momANTECARE*), recoded by the author from the Woman's Questionnaire, question number 408 and 409; variable name in the data set is M2A, M2B, M2C, M2D, M2E, M2F, M2G, M2H, M2I, M2J, M2K, M2L, M2M, and M2N.
 - a. Non-medical professional, coded as 0 (reference category),
 - b. Medical Professional coded as 1.
 7. Mother's assistant to the children delivery (*momDELIVER*), taken from the Woman's Questionnaire, question number 429; variable names in the data set are M3A, M3B, M3C, M3D, M3E, M3F, M3G, M3H, M3I, M3J, M3K, M3L, M3M, M3N.
 - a. Non-medical professional, coded as 0 (reference category),
 - b. Medical Professional coded as 1.
 8. Mother's frequency of access to newspaper, radio, television, and the internet (*momMEDIA*), recoded by the author from the Woman's Questionnaire, question number 113, 114, 115, 119, 120, and 121; variable name in the data set are V157, V158, V159, V171A, and V171B.
 - a. Not at all/ Less than once a week, coded as 0 (reference category),
 - b. At least once a week, coded as 1,
 - c. Almost every day, coded as 2.
 9. Wealth Index (*famWEALTH*), given as a continuous number in the dataset, was calculated by the DHS Program dataset to each household sample. The calculation is based on socioeconomic variables in the Household Questionnaire, which are characteristics of the housing unit such as the source of drinking water, type of toilet facilities, construction materials of the floor, roof, outer walls of the house, and ownership of various durable goods. The resulting continuous variables are a composite measure of a household's cumulative living standard presented as 5 categories in the dataset by the IDHS. The author classifies given answers to:
 - a. Poorest and poorer, coded as 0 (reference category),
 - b. Middle, coded as 1,
 - c. Richer and richest, coded as 2.

Additionally, if an observation has certain characteristics given by independent variables, the model explanation would be how likely each sample results in uncompleted or completed vaccination. Furthermore, the goodness of fit measures would be based on the percentage of cases the overall proposed model correctly classifies by total samples available relative to the dependent variable.

The proposed model used in this study and its explanation will be if an observation has certain characteristics given by independent variables, how likely each sample results in uncompleted or completed vaccination:

$$\log_b \frac{\text{completed basic vaccination}}{\text{incomplete basic vaccination}} = \beta_0 + \beta_1.decMEDKID + \beta_2.decPURCH + \beta_3.childGEND + \beta_4.childORD + \beta_5.famRESIDE + \beta_6.childCARD + \beta_7.momEDU + \beta_8.momANTECARE + \beta_9.momDELIVERY + \beta_{10}.momMEDIA + \beta_{11}.dadEDU + \beta_{12}.famWEALTH$$

The complete regression procedure done in the SPSS software would initially incorporate all the proposed variables in the Logistic Regression function. Afterward, the result would then be inspected to identify variables that do not significantly contribute to the model. Next, these variables are carefully being removed from the procedure, one by one, until all contained predictors have a significant contribution to the formula, is found. For simplicity, the backward stepwise selection function in the SPSS was used to reduce the number of models' independent variables, with the p-value used as removal criteria.

3. Results and Discussions

Descriptive Analysis Results

This first part of this chapter will examine the cross-tabulation of mandated immunization status with the planned explanatory variables and other traits from the 2017 SDKI. Vaccination status is classified as completed and uncompleted.

Table 1. Children's Group of Age and the Status of Vaccination, by Indonesia's Region (row percentage)

Provinces in Indonesia	Children's Group of Age (months)					
	12 to 23 (%)		24 to 35 (%)		12 to 35 (%)	
	Complete	Incomplete	Complete	Incomplete	Complete	Incomplete
Aceh	43.29	63.78	37.01	62.99	36.58	63.42
North Sumatera	51.52	56.71	51.33	48.67	47.13	52.87
West Sumatera	43.48	48.48	58.62	41.38	54.84	45.16
Riau	68.29	56.52	61.04	38.96	52.74	47.26
Jambi	52.50	31.71	62.16	37.84	65.38	34.62
South Sumatera	38.64	47.50	60.66	39.34	56.03	43.97
Bengkulu	71.05	61.36	63.04	36.96	51.11	48.89
Lampung	75.86	28.95	66.23	33.77	68.63	31.37
Bangka Belitung	64.79	24.14	86.11	13.89	79.79	20.21
Riau Islands	66.96	35.21	67.80	32.20	66.15	33.85
Jakarta	59.82	33.04	70.37	29.63	68.37	31.63
West Java	77.00	40.18	62.24	37.76	60.94	39.06
Central Java	27.78	23.00	82.01	17.99	79.35	20.65
Yogyakarta	70.30	72.22	38.46	61.54	32.26	67.74
East Java	51.38	29.70	75.98	24.02	72.97	27.03
Banten	78.79	48.62	59.30	40.70	54.87	45.13
Bali	78.00	21.21	94.12	5.88	88.10	11.90
West Nusa Tenggara	72.19	22.00	75.90	24.10	77.05	22.95
East Nusa Tenggara	58.46	27.81	72.67	27.33	72.40	27.60
West Kalimantan	44.74	41.54	59.46	40.54	58.99	41.01
Central Kalimantan	80.00	55.26	59.38	40.63	51.43	48.57
South Kalimantan	68.24	20.00	77.78	22.22	78.70	21.30
East Kalimantan	79.07	31.76	77.38	22.62	72.78	27.22
North Kalimantan	72.97	20.93	76.60	23.40	77.78	22.22
North Sulawesi	56.79	27.03	61.76	38.24	67.61	32.39
Central Sulawesi	61.82	43.21	60.00	40.00	58.33	41.67
South Sulawesi	66.67	38.18	71.74	28.26	66.34	33.66
Southeast Sulawesi	75.00	33.33	69.77	30.23	68.00	32.00
Gorontalo	54.72	25.00	75.86	24.14	75.32	24.68
West Sulawesi	50.65	45.28	55.56	44.44	55.12	44.88
Maluku	33.77	49.35	58.62	41.38	54.07	45.93
North Maluku	62.50	66.23	51.52	48.48	41.96	58.04
West Papua	38.78	37.50	71.43	28.57	67.07	32.93
Papua	59.93	61.22	55.26	44.74	45.98	54.02
Total	43.29	40.07	65.25	34.75	62.41	37.59

Source: IDHS Indonesia 2017, author's own calculation.

Based on Table 1, nationally, as much as 62.41% of children from 12 to 35 months old have been received all basic vaccination mandated by Indonesia's Ministry of Health. Breaking it down to age groups, the proportion of total completion for children from 12 to 23 and 24 to 35 months old is 59.93% and 65.35%, respectively. Furthermore, a look into the regional numbers and smaller age groups draws the same conclusion. No provinces managed to achieve the commended percentage for the targeted population of children from 12 to 23 months old. Less than a third of regions consistently achieved more than 70% basic vaccination completion for preschool children. Despite yielding the worst vaccination coverage in the lowest age group, Central Java shows improvement up to around 80% in older groups. Nonetheless, the same case cannot be applied to Aceh as it registers consistently low coverage across all

age groups. Additionally, Maluku is also among the provinces with the worst vaccination coverage for the targeted age group.

Table 2. Household Economic Status and Residential Area by Children's Aged Group and Vaccination Status (row percentage)

	Children's Age Group (%) in months				12 to 35	
	12 to 23		24 to 35		Complete	Incomplete
	Complete	Incomplete	Complete	Incomplete		
Poor	53,20	46,80	59,84	40,16	56,32	43,68
Middle	62,37	37,63	66,91	33,09	64,56	35,44
Rich	67,47	32,53	71,83	28,17	69,45	30,55
Rural	56,32	43,68	62,51	37,49	59,19	40,81
Urban	63,66	36,34	68,03	31,97	65,71	34,29
Total	59,93	40,07	65,25	34,75	62,41	37,59

Source: IDHS Indonesia 2017, author's own calculation.

The economic status shows different completion rates for children's vaccination status in the table above. Across all age groups, better economic status results in higher coverage for children's basic immunization. Moreover, overall compliance across all ages in urban areas is also higher than children in rural areas.

As shown in Table 3, the coverage for Hepatitis B recommended being administered within 24 hours of birth reached an 84.35% completion rate. Nevertheless, despite the higher compliance at around 90% for the first set of mandatory vaccines one month after birth, the subsequent set of injections gradually declined by approximately 10 to 15% for the DPT, Hepatitis B, HiB, and Polio.

Table 3. Completion Status of Recommended Vaccines for Children aged 12 to 35 months old (row percentage)

Commended schedule (at children's age)	Vaccines	Vaccine injection status (in %)	
		Yes	No
Month 0	Hepatitis B	84.35	15.65
Month 1	BCG	90.55	9.45
	(1 st) POLIO	91.26	8.74
Month 2	(1 st) DPT	88.93	11.07
	(1 st) Hepatitis B	88.93	11.07
	(1 st) HiB	88.93	11.07
	(2 nd) POLIO	89.32	10.68
Month 3	(2 nd) DPT	84.19	15.81
	(2 nd) Hepatitis B	84.19	15.81
	(2 nd) HiB	84.19	15.81
	(3 rd) POLIO	83.54	16.46
Month 4	(3 rd) DPT	77.25	22.75
	(3 rd) Hepatitis B	77.25	22.75
	(3 rd) HiB	77.25	22.75
	(4 th) POLIO	73.56	26.44
Month 9	MEASLES	81.65	18.35

Source: IDHS Indonesia 2017, author's own calculation.

Table 4 displays mothers' exposure to a medical professional before and during children's birth and the corresponding vaccination status of their last children aged 12 to 35 months. For prenatal care, children of mothers whom non-medical professionals helped have only 17.14% basic vaccination completion, whereas mothers assisted by medical professionals result in a significantly better 63.74% compliance rate. Similar results are also clearly shown in non-medical and medical professional attended deliveries, with the latter having a 65.57% completion rate of mandatory immunization for the children, as opposed to only 31.94 % for the former. In addition, the importance of the card is proven by the 67.09% completion rate of basic vaccination for children who have it, as opposed to only a 31.30% compliance ratio for those who have lost or do not possess it.

Table 4. Mother's interaction with medical professionals by Vaccination Status for Children aged 12 to 35 months old (row percentage)

Pregnancy Stages & Card Ownership	Assistant/Ownership Status	Immunization Status (%)	
		Complete	Incomplete
Prenatal care	No-Prof	17.14	82.86
	Med Prof	63.74	36.26
Birth delivery of the children	No-Prof	31.94	68.06
	Med Prof	65.57	34.43
Possession of Health/Vaccination Card	Have	31.30	68.70
	In possession	67.09	32.91

Source: IDHS Indonesia 2017, author's own calculation.

Figures in Table 5 illustrate the relation of knowledge variables to children's vaccination completion. Mothers who do not/rarely access various information sources, such as newspaper, radio, television, and the internet, have children aged 12 to 35 months with completion to basic vaccination as low as 47.37%. The more frequent media consumption for the mother, the higher the immunization compliance rate; those who access it at least once a week or more have more than a 60 % ratio of vaccination completion. Similar results can also be said for mothers and fathers with formal educational attainment. The higher the education level of both parents, the better percentage for their children's status of vaccination completion becomes, reaching almost 70% in overall compliance.

Table 5. Mother's exposure to medical professional by Vaccination Status for Children aged 12 to 35 months old (row percentage)

Access to Information & Education Achievement	Frequency/Degree	Vaccination Status (%)	
		Complete	Incomplete
Mother's regularity in accessing mass media	Not at all/Less than once a week	47.34	52.66
	At least once a week	61.99	38.01
	Almost every day	69.33	30.67
Mother's formal education achievement	No Education	42.47	57.53
	Primary	53.17	46.83
	Secondary	64.48	35.52
	Higher	69.51	30.49
Father's formal education achievement	No Education	50.72	49.28
	Primary	56.13	43.88
	Secondary	63.72	36.28
	Higher	69.21	30.79

Source: IDHS Indonesia 2017, author's own calculation.

As is shown in Table 6., when a joint decision was made in the family for certain issues, the completion rate for children vaccination is better than a single person or persons outside the family.

Table 6. Decision Maker on certain issues in the family by Vaccination Status for Children aged 12 to 35 months old (row percentage)

Issues	Decision Maker	Vaccination Status (%)	
		Complete	Incomplete
(When the children got sick) Who makes the final decision on whether or not the child should be taken for medical treatment?	Mother/Father/Others	61.63	38.37
	Joint decision by Mother and Father	63.17	36.83
Who usually makes decisions about making major household purchases?	Mother/Father/Others	59.78	40.22
	Joint decision by Mother and Father	64.08	35.92

Source: the 2017 SDKI, author's own calculation.

On the question of "(When the children got sick) Who makes the final decision on whether or not the child should be taken for medical treatment?", children's vaccination completion rate is 63,17% for decisions conducted jointly by the parent. This number is slightly higher 61,63% when the same issue is decided by the mother or father alone, or by other than parents. The same result goes for the information on "Who usually makes decisions about making major household purchases?". Families with both parents

had the final say on immunization achieved around 64% completion rate while families other than parents or either father or mother alone made the decision only achieved approximately 59% of complete immunization.

On the other hand, the final decision on vaccination could be different for each child. Based on their characteristics in Table 7, female children have a slightly higher basic vaccination compliance rate at 63.66% and 61.20% for male children. The difference in completion based on the birth order is also apparent as the highest compliance to mandatory immunization, around 66%, is shown for second-born children.

Table 7. Children's Characteristics by Vaccination Status for Children aged 12 to 35 months old (row percentage)

Gender, Birth Order, and Ownership of Vaccination/Health Card for Children	Category	Immunization Status (%)	
		Complete	Incomplete
Gender	Female	63.66	36.34
	Male	61.20	38.80
Birth Order	1st born	64.71	35.29
	2nd born	66.32	33.68
	3rd born	61.20	38.80
	4th born or higher	51.82	48.18

Source: IDHS Indonesia 2017, author's own calculation.

In addition, the incompleteness in basic vaccination rises for each child in the family. That is 38.80% for the third child, to 48.18% for the fourth child and after.

Logistic Regression Results

In determining completion vaccination status, logistic regression is used to measure the effects of family decision making on children's medical treatment and major household purchases; children's gender, birth order, and health/vaccination card ownership; mother's education, assistance on prenatal and birth delivery, and mass media exposure; father's education; and family's residential area and economic status.

Table 8. Logistics Regression Results (initial step)

Independent Variables (initial step)	B	Sig.	Exp(B)	95.0% C.I. for EXP(B)	
				Lower	Upper
decision-maker on children's emergency medical condition					
mother/father/other (ref)					
joint mother and father	0.059	0.304	1.060	0.948	1.186
decision-maker on household's major purchase					
mother/father/other (ref)					
joint mother and father	0.120	0.038	1.128	1.006	1.264
children's gender					
female (ref)					
male	-0.112	0.045	0.894	0.801	0.997
children's birth order					
firstborn (ref)		0.001			
2 nd born	0.148	0.038	1.159	1.008	1.333
3 rd born	-0.041	0.612	0.959	0.818	1.126
>= 4 th born	-0.186	0.035	0.831	0.699	0.987
possession of health/vaccination card					
doesn't have/not in possession (ref)					
in possession	1.305	0.000	3.687	3.116	4.363
family's place of residence					
rural (ref)					
urban	-0.026	0.682	0.974	0.859	1.104
mother's education attainment					
no education (ref)		0.056			
primary	-0.169	0.560	0.845	0.479	1.489
secondary	0.010	0.974	1.010	0.571	1.786
higher	0.106	0.726	1.112	0.613	2.017
mother ante natal care's assistant					
non-professional (ref)					
medical professional	0.941	0.000	2.562	1.657	3.961

Independent Variables (initial step)	B	Sig.	Exp(B)	95.0% C.I. for EXP(B)	
				Lower	Upper
mother delivery's assistant non-professional (ref)					
medical professional	0.977	0.000	2.657	2.167	3.258
mother's frequency of access to mass media not at all/less than once a week (ref)		0.039			
at least once a week	0.227	0.014	1.255	1.048	1.504
almost everyday	0.263	0.023	1.300	1.036	1.632
father's education attainment no education (ref)		0.839			
primary	-0.252	0.381	0.777	0.442	1.366
secondary	-0.248	0.390	0.780	0.443	1.374
higher	-0.222	0.464	0.801	0.442	1.451
household wealth index poor (ref)		0.062			
middle	0.077	0.341	1.080	0.922	1.266
rich	0.192	0.019	1.212	1.032	1.422
Constant	-2.386	0.000	0.092		

Source: IDHS Indonesia 2017, author's own calculation.

Table 8 shows all proposed independent variables incorporated into the logistic regression model, with its respective coefficient, the p-value for Wald statistic, and the odds ratio. Based on the significance of Wald chi-square to test whether each variable constant equals 0 as its null hypothesis, against the critical p-value of .05, this hypothesis is rejected for several variables. The overall result suggests that decision-maker on major household purchase, children's gender and birth order, possession of health/vaccination card, mother's educational attainment, mother's assistant during prenatal care and delivery, mother's frequency of access to mass media, and household economic status are associated with children's vaccination completion. Nevertheless, the rest predictor variables provide no sufficient indication to reject the null hypothesis. Among others is the decision-maker on children's emergency medical condition; there is no sufficient evidence to associate them with children's vaccination status once the other variables were controlled for.

The next step is to remove the independent variable with a p-value that gives each of those respective variables a non-significant verdict. The SPSS software provides a backward stepwise likelihood ratio function, which processes initial models and subsequent variables removal, all in one go.

Table 9. Logistics Regression Results (final step)

Independent Variables	B	Sig.	Exp(B)	95.0% C.I. for EXP(B)	
				Lower	Upper
decision-maker on household's major purchase mother/father/other (ref)					
joint mother and father	0.132	0.020	1.142	1.021	1.277
children's gender female (ref)					
male	-0.111	0.047	0.895	0.802	0.998
children's birth order firstborn (ref)		0.001			
2 nd born	0.148	0.037	1.160	1.009	1.334
3 rd born	-0.041	0.616	0.960	0.818	1.126
>= 4 th born	-0.186	0.034	0.830	0.699	0.986
possession of health/vaccination card doesn't have/not in possession (ref)					
in possession	1.305	0.000	3.687	3.116	4.362
mother's education attainment higher (ref)		0.022			
secondary	-0.060	0.835	0.942	0.534	1.660
primary	-0.291	0.004	0.748	0.615	0.910
no education	-0.114	0.163	0.892	0.761	1.047
mother ante natal care's assistant non-professional (ref)					
medical professional	0.941	0.000	2.563	1.658	3.962
mother delivery's assistant non-professional (ref)					

Independent Variables	B	Sig.	Exp(B)	95.0% C.I. for EXP(B)	
				Lower	Upper
medical professional	0.971	0.000	2.641	2.156	3.237
mother's frequency of access to mass media					
not at all/less than once a week (ref)		0.049			
at least once a week	0.218	0.017	1.244	1.039	1.489
almost everyday	0.249	0.029	1.283	1.026	1,603
household wealth index					
poor (ref)		0.062			
middle	0.066	0.401	1.069	0.915	1.248
rich	0.181	0.019	1.199	1.031	1.394
Constant	-2.587	0.000	0.075		

Source: IDHS Indonesia 2017, author's own calculation.

The above table shows reduced predictor variables for vaccination completion. The surviving variables are decision-maker on the major household purchase being the sole variable of interest, controlled by children's characteristics, which are gender, birth order, and health/vaccination card possession; mother's trait, comprised education attainment, mother's assistant during prenatal care and delivery, mother's frequency of access to mass media; and lastly, household economic status. For the mother's educational background, the reference category is then reversed, as the initial model gives the reference category a significant result, but none of the other education classifications yields the same result.

The reading for the final logistic regression model would be that families with joint-decision-making in major household purchases are 1.142 times more likely to have their children complete their basic vaccination than families with only the father or the mother or other people being the sole decision-maker on the issue. Compared to female preschool children, its male of the same age group are 0.895 times less likely to have completed mandated basic immunization. The same can also be said for vaccination card possession, with a high 3.687 odds ratio for those who have it. Infant second-born children are more likely to administer all basic vaccines, with the odds of 1.160 times greater than the firstborn. Conversely, compared with the same child, fourth children or higher's likelihood to mandated vaccination completion are 0.830 times less.

Another associated factor in better vaccination status for children is whether their mothers are being cared for by a medical professional during antenatal care and birth delivery. In the former, the likelihood of children's immunization completion is 2.563 times more compared to being taken care of by a non-medical professional. The same can also be said to the latter, with the difference only in odds ratio, which is 2.641.

Mothers' frequency of accessing mass media such as newspapers, radio, tv, or the internet, could lead to the completeness of their children's vaccination. The odds are more than 1.2 times higher than the vaccination completion likelihood for children with mothers who never or rarely access said media. On the contrary, for other knowledge functions that are educational attainment, children of mothers with primary school degrees are 0.748 less likely to have finished all mandated immunization than those with mothers with diplomas or higher educational backgrounds. Lastly, children in middle and upper economic level households are 1.069 and 1.199 more likely to have completed their mandated vaccination than they who reside in poor household.

Discussion

This study found indication that joint decision by parents of children aged 12 to 35 months old on major household purchases is associated with the completion of basic vaccination for their children, compared to families who decide on the issue solely by father, mother, or family outsiders. This brings about the idea that dialogue between parents also happens on other topics, such as health issues, particularly in children's vaccination. Other studies find that when there is only one or no adult in the household, which could mean that every decision on domestic issues was being done solo, decrease the odds for children to be immunized (Qiu-Shultz, 2013). As the theory of planned behavior suggests, the pressure from people's social networks, with spouses or partners among them, could influence decisions on health issues (Kahn et al., 2008; Brunson, 2013). The presence of discussion between parents is believed to lead to positive attitudes on immunization.

On the other hand, this research also shows that there is not enough evidence to suggest how parents decide in the case of emergency medical conditions for children aged 12 to 35 months old to be associated

with completing basic vaccination. There are other intricacies involved in deciding health care for children, as living with partners can also lead to vaccine hesitancy (Bocquier et al., 2018). This might be related to the time when the result will occur as the consequences of the decision. Emergency medical conditions need immediate attention as medical procedures also need to be immediately done. Often, parents need to react promptly, being given limited time to consider and no incentive to delay the decision. Issues such as major household purchases allow parents to ponder every related aspect, such as currently available resources, before concluding. Its deadline is not immediate and can be extended given budget and other constraints. The same assumption can be applied to vaccination. Parents have much more time to consider despite a fixed schedule, which is relative to childbirth.

Additionally, family economic status contributes to parents' attitudes towards children's vaccination. Families that reside in economically privileged households are more likely to have children with complete basic vaccination than those who live in poor households. Socioeconomic factors are argued to play a much stronger role (Danis et al., 2010) in shaping parents' perception and beliefs, as it influences the parent's degree of access and exposure to various knowledge sources. Although the government has provided the vaccines for free (Ministry of Health, 2017a), vaccination seems to be underappreciated as vaccine-preventable diseases still contribute to child deaths, mainly in the middle to low-income countries (Black et al., 2010), suggesting less than expected demand for it. This study finding is similar to Australia, that partial vaccination is prevalent among the disadvantaged groups despite the existence of a free national immunization program (Fielding et al., 2017). Those in better economic status have higher percentage of children who completed basic vaccination.

The Australian study mentions that additional costs that have to be covered by the households, such as transportation, are deemed the reason for partial immunization. This research shows that a higher percentage of completed basic immunization happens to those in urban areas compared to those in rural areas. These findings provide evidence that a physical accessibility factor contributes to an increase in monetary spending, thus, the ability to get into basic children's vaccination. These inferences show that healthcare barriers go beyond covering only the medical fee, as residential characteristics will further increase the monetary cost incurred to the household in the targeted population. Also, the administration of the complete set of basic vaccinations for children is done all at once. Repeated travel to the vaccination center to complete all sets of immunization is needed, which may increase the overall cost from the household side. Thus, compliance for each vaccine could also be varied. Time factor could come into play as each subset of vaccines has a different time schedule.

As noted from this study, the compliance rates for all basic vaccination are not uniform between schedules. The reasons could be different access barriers across months of vaccination or families not feeling the urge to push for immunization completion. Therefore, aside from minimizing economic hindrances and geographical barriers, proper knowledge dissemination is a practical measure to help seedling immunization urgency to the families. Information on the importance of more vaccine administrations beyond the months close to the children's birth must be accentuated, especially when the children have not reached 12 months old. In order to do that, one way is to make the most of the mother's visits to health facilities by informing them while having a monitoring tool in place.

This research also found that mothers helped by a medical professional during prenatal care or childbirth are significantly associated with their children having complete basic immunizations. Additionally, the mother's visitation to medical professionals before and after the births yields a high completion rate for basic vaccination. This finding is similar to the Afghanistan study, which proved that antenatal care visits to health facilities by the mother (Shenton et al., 2018) are associated with the increase of likeliness to complete immunization. The interaction with the medical professionals likely alters parents' negative beliefs on immunization as vaccination plans before pregnancy and delivery often lead to refusal or delay in vaccine administration (Glanz et al., 2013). In addition, the direct interaction is also found to improve vaccination knowledge and advance vaccination status (Kaufman et al., 2018). These moments can be utilized by medical professionals in sharing reliable health knowledge to the families, with mothers, in particular, being the agent of information in between.

In addition, this study also gives credence that possession of health/vaccination cards provided by the health institution can make a difference in vaccination completion. This study finds that having health/vaccination cards is more likely to lead to children in the family having a complete basic vaccination. The outcome is consistent with Brewer's (2017) finding that parents' behavior on keeping immunization records could increase vaccination for children. The cards could be some sort of reminder

for parents of the importance of giving children protection to preventive diseases. As shown in the past, the high risk of delayed vaccination occurred when families had no idea when their children's next immunization is due (Lieu et al., 1994). Moreover, this card could also serve as a monitoring tool to the visited healthcare facilities to give relevant information on a particular vaccine that should be administered to the infant at any given time. Medical professionals could give information on the benefits of and official schedules of mandated basic vaccination for children, paving the way for mothers' inclination to vaccines conformity. The mother is thought to gain better insight and ensure that their preschool children are completely protected from most vaccine-preventable illnesses. Nevertheless, similar knowledge can be sought from other sources, as more educated people will want to look for more information to reinforce their beliefs on the benefits of vaccination to children's wellbeing.

There is an indication that mothers accessing newspaper, radio, television, or the internet at least once a week is more likely to result in children's vaccination completion, compared to mothers who do not or rarely access any mass media at all. The same can be said for mothers with high education which is associated with their children having better basic immunization compliance. The higher the mother's formal educational degree and their frequency of exposure to other knowledge sources, the higher the basic immunization completion rate becomes. The former finding is in sync to other studies that find educational attainment of the mothers are positively correlated to the immunization coverage as it leads to the low likelihood of having their children unimmunized at all ages (Bobo et al., 1993; Ekouevi et al., 2018; Ntenda, 2019).

Extra caution should be taken despite this positive finding as there is a rise in vaccination conspiracies in the internet and social media (Stein, 2017). Extra effort is needed from the medical worker side, as apparently their trustworthiness affects parents' acceptance of vaccination (Glanz et al., 2013). One of the reasons is the pediatrician's inclination to speak more regarding the benefit than the risk (Glanz et al., 2013). This could lead to parents, especially those who are still on the fence over-vaccination, to seek more information outside medical circles, such as their social circles. Research in Canada found that internet searches on vaccination are an important factor in vaccine safety perception (Tustin et al., 2018). Mass media, such as television, exposes women to positive knowledge (Betsch et al., 2018). Positive knowledge that could influence beliefs is needed to assist well-informed vaccination decisions because parents also tend to delay information due to the lack of information (Glanz et al., 2013). However, it should be known that large portions of the vaccine-related video information on the internet discourage vaccine use (Basch et al., 2017). Therefore, taking control of the information narrative should be done by continuously promoting vaccination by any means possible. Moreover, the information should also address issues and concerns regarding the benefits and parents' obligation to vaccination and the risks of it. When parents think of low-risk perceptions for such disease or doubt vaccine effectiveness, they tend to under-vaccinate or even refuse to vaccinate their children (Dunaway, 2018).

On the other hand, vaccination decisions are different among children in the same family. Male is less likely to get the complete set of basic vaccines administration in comparison to female. Moreover, in comparison to the firstborn, the fourth children in the family are less likely to have complete mandated immunization, while the second-born indicates the opposite. Additionally, the increasing percentage of basic immunization completion increases until the second child and then drops afterward. The former result contradicts findings in India that female children tend to be under-vaccinated compared to their male counterparts (Rohit et al., 2018). Additionally, the fourth or higher-order number of children is less likely to complete mandatory vaccination than the firstborn. This result is consistent with other studies in the US describing that the odds of immunization for children decreased when there were four or more children in the household (Qiu-Shultz, 2013). These differences in treatment are thought to be related to how parents value each of their children differently. Another study in India concluded that religion significantly influences vaccination status (Lakshmanasamy, 2021). Additionally, races also play a part in differing perceptions on immunization (Chen et al., 2007). In this case, it could be assumed that the religion or cultural context plays a role, with one society valuing a certain gender higher than the other.

Moreover, differing risk perceptions are also probably assigned to each child, resulting in different healthcare treatments. After all, decision-making on health is not consistent over time and is an evolving process (Glanz et al., 2013). Furthermore, there is also a possibility that an increase in the number of family members decreases the time and resources dedicated to each child (Blake, 1989; Becker, 1991). Other research also produced similar outcomes, as more children in the family increase the risk of delayed immunization (Lieu et al., 1994; Shono & Kondo, 2015). Therefore, external intervention on these parents'

resources should be devised since public health is also at greater risk when there is a possibility of disease dispersion from unvaccinated children.

As shown in the basic vaccination status in Indonesia, numbers from provinces and age groups show the need for urgent interference. No provinces managed to achieve the 90 % commended percentage for the targeted population of children from 12 to 23 months old. Less than a third of regions consistently achieved more than 70% basic vaccination completion for preschool children. Aceh, a religiously conservative area, governed under strict sharia law, registers consistently low coverage across all age groups. This issue might be the reason for the low vaccination coverage, as religious believers are often associated with groups that refuse vaccination (Pierik, 2017; Ruijs et al., 2013). Maluku is also among the provinces with the lowest vaccination coverage for the targeted age group. Going by the fact that this province is also among the provinces with the lowest Gross Regional Domestic Product (GRDP) in Indonesia (Badan Pusat Statistik [BPS] Indonesia, 2018), the weakness in the regional government's monetary power might contribute to poor implementation of basic health care deliverance for its people. Nevertheless, Central Java, despite yielding the worst vaccination coverage in the lowest age group, shows improvement in older groups, up to around 80%. This number makes a case for the effectiveness of catching up vaccination program.

Conclusions

There is a hint that the existence of dialogue between parents in the family can be associated with better compliance in basic immunization. Nevertheless, more parents' background information needs to be observed as traits such as religion and race are not available in the data used in this research. These characteristics can play a role in understanding the thought process and beliefs of the main actors on vaccination decider.

Additionally, as each vaccine is administered not all at once, its compliance varies. Thus, vaccination completion can be further examined in finding the determinant of specific inoculation. Despite completeness of basic immunization being used as main metrics in national programs in various countries, vaccination coverage does not assess the degree of postponement. Age-specific children's exposure, for example, 24 months and under, provides no clues of indication whether there were delayed vaccine-injection that is also critical in providing maximum immunity against the targeted diseases (Frieden et al., 2011). On the other hand, premature vaccinations with a decreased interval between inoculations could cause a less-than-optimal immunity, giving a misleading sense of health security. Thus, during the period that children stay under-vaccinated, the amount and extent of delayed vaccination could then be studied to better indicate vaccination status and public health.

Lastly, all proposed variables for children's mothers show significant result in determining children's vaccination. In relation to national programs of basic immunization, more specific policies targeting mothers can be devised to improve its result. Pregnancy and children delivery is a crucial time for a vaccination-related intervention. As reliable sources of health-related knowledge, health professionals could be mandated to proactively educate the mothers and community, not only about the benefits of vaccination but also the risks involved, whenever possible. Information dissemination on vaccination needs to be continuously done in every way possible, such as traditional news sources, which can be complemented with proper use of the internet. In addition, the balance, validity, and delivery of the information should also be considered. Well informed-based discussion could potentially lead to positive results, particularly in perception and decisive actions on childhood vaccination.

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