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Determinants of Contraceptive Discontinuation
in Indonesia:
Further Analysis of the 2017
Demographic and Health Survey

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ABSTRACT

Indonesia is experiencing a great challenge in achieving replacement-level fertility, a total fertility rate of 2.1 children per woman. A persistent level of contraceptive discontinuation can contribute to this phenomenon. This study aims to examine the determinants of contraceptive discontinuation in Indonesia, using data from the 2017 Indonesia Demographic and Health Survey (DHS). We use the DHS monthly contraceptive calendar and the Gompertz proportional hazards model for analysis. The unit of analysis is the episode of contraceptive use during 3-62 months before the survey among women in union age 15-49. The outcome variable is the duration of the risk period up to the occurrence of the contraceptive discontinuation. The independent variables include a method-related factor (type of contraceptive method discontinued), demographic factors (age, parity, and contraceptive intent), and socioeconomic and cultural factors (internet use, mobile phone ownership, education, work status, place of residence, household wealth status, and women's participation in decision-making).

The results of the study show that almost 3 of every 10 contraceptive use episodes in Indonesia were discontinued within 12 months of starting an interval of use. Discontinuations due to side effects and health concerns were by far the largest contributor to the overall discontinuation rate in Indonesia, with pill episodes showing the highest 12-month contraceptive discontinuation rates, followed by injectable episodes. The study also found that higher hazard of contraceptive discontinuation were associated with pill use compared with other methods, and for women who were older, had fewer children, spaced births, ever used the internet, had a mobile phone, had more education, were currently not employed, lived in a rural area, were in the lowest and second household wealth quintile, and did not participate in decision-making.

The findings from this study reveal important determinants of contraceptive discontinuation and present guidance crucial for improving family planning services in Indonesia in order to reduce unnecessary and unintentional contraceptive discontinuation. The higher contraceptive discontinuation due to side effects/health problems and for the two most favored methods, pills and injectables, may suggest a need for better provider-client communication and counseling, and improvements in contraceptive technology. Similarly, for women in the groups with higher risk of discontinuation, our findings suggest a need for more family planning counseling on contraceptive discontinuation management.

Key words: Contraceptive discontinuation, contraceptive use episode, hazard ratio, Gompertz, Indonesia

1 INTRODUCTION

1.1 Background

Indonesia is the fourth most populous country in the world, after China, India, and the United States of America. The results of Indonesia's 2015-2045 Population Projection show that the country's population is estimated to be about 267 million in 2019 and to increase to 319 million in 2045 (BAPPENAS et al. 2018). The extent of population change will depend on the success of Indonesia's family planning program in reducing fertility levels in some provinces that have higher than replacement-level fertility and also maintaining fertility at the replacement level in provinces with lower than replacement-level fertility.

After a successful period of fertility decline between 1971 and 2000, Indonesia experienced the stalling of fertility during 2000-15. The results of the 2002-03, 2007, and 2012 Indonesia Demographic and Health Surveys (DHS) show that the country's total fertility rate (TFR) was stagnant at 2.6 children per woman, while the results of the 2000 and 2010 Population Census indicated a slight increase in the TFR from 2.3 to 2.4. The stalling of fertility has been attributed in part to a slow increase of contraceptive prevalence and a steady increase in contraceptive discontinuation rates.

As Figure 1 shows, according to the Indonesia DHS surveys conducted between 2002-03 and 2017, the 12-month contraceptive discontinuation rate for all methods increased gradually from 21% in 2002-03 to 29% in 2017 (Statistics Indonesia et al. 2003, 2007, and 2013; BKKBN et al. 2018). It appears that pills have been driving the increase in the discontinuation rate, rising from 32% in 2002-03 to 46% in 2017, while discontinuation for most other methods has shown a decrease or not much change. In 2017, 12% of women were currently using pills as a contraceptive method—the second-most used method reported in the DHS survey, after injectables (BKKBN et al. 2018).
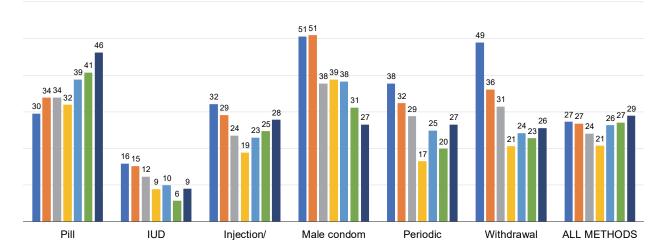
Figure 1   Twelve-month contraceptive discontinuation rate: Indonesia 1991-2017

This progressive increase in the contraceptive discontinuation rate can affect the achievement of fertility and development goals in Indonesia. Contraceptive discontinuation can expose women to the risk of unintended pregnancies and unwanted children that in turn can threaten the health and wellbeing of mothers and children. Therefore, the *Rencana Pembangunan Jangka Menengah Nasional* (National Medium Term Development Plan/RPJMN) 2015-2019 targeted to reduce the contraceptive first-year discontinuation rate to 24.6 in 2019 (BAPPENAS 2014). Reaching this target will require serious efforts, given that the 12-month contraceptive discontinuation rate has continued to show an increase in each DHS survey up to the most recent in 2017 (BKKBN et al. 2018).

Few studies have been carried out on the patterns and determinants of contraceptive discontinuation. Among the reasons is that the study of contraceptive discontinuation requires monthly calendar contraceptive use history data. Monthly calendar data are very complicated and more difficult to handle and analyze than most kinds of data. Besides, the analytical methods to study contraceptive discontinuation, such as the life table technique and hazards model, are new to most researchers.

Some studies have been conducted on contraceptive discontinuation correlates in Indonesia. Ali, Cleland, and Shah (2012) studied the causes and consequences of contraceptive discontinuation. They found that method-related reasons were the main causes of contraceptive discontinuation in Indonesia, followed by side effects/health concerns. They also found that a substantial percentage of studied women were at risk of pregnancy after discontinuing—that is, a mistimed and unwanted current pregnancy or live birth. Other researchers have investigated factors associated with contraceptive discontinuation in Indonesia (Arifin 2003; Bradley, Schwandt, and Kan 2009; Curtis and Blanc 1997; Fathonah 2000). These include, among women studied, the type of contraceptive method discontinued, age, parity, contraceptive intent, mass media exposure, level of education, place of residence, wealth status, and work status.

However, in the second decade of this century, the socioeconomic and development situations in Indonesia have changed significantly compared with earlier years. These changes are the result of increasing globalization and advances in information and communication technology, in particular increasing use of the internet and mobile phone ownership, including among married women. The results of the 2017 Indonesia DHS show that around half of married women of reproductive age used the internet in the last 12 months before the survey, and almost four in five women had a mobile phone (BKKBN et al. 2018). Today, the internet and mobile phone are becoming increasingly important instruments for information dissemination, education, and communication. Their uses involve opening web pages, electronic mail, and social media (GDS, Ministry of Health, and ICF 2018). Unlike the approach of conventional mass media, such as television, radio, and newspaper, which provides one-way information, education, and communication (IEC), the internet and mobile phone allow for a two-way IEC approach between the providers and users. Media exposure through the internet and mobile phone can affect reproductive health behavior (Lou et al. 2006), including contraceptive discontinuation, through better access to information on "what to do" and "where to go for help/advice" when encountering problems with contraceptive use. Yet, few studies have examined the effect of internet use and mobile phone ownership on contraceptive discontinuation.

In addition, there has been a significant improvement in women's empowerment in Indonesia, as measured in the reduction of the Gender Inequality Index (GII). The United Nations Development Program (UNDP) reported that Indonesia's GII declined from 0.500 in 2013 to 0.453 in 2018 (UNDP 2014; UNDP 2018). In

2017, the global GII was 0.441, lowest in Sweden (0.039) and highest in Yemen (0.834). Further, the share of female graduating in science, mathematics, engineering, manufacturing, and construction at the tertiary level during 2007-2017 was relatively high, at 15% (UNDP 2018). Specifically, the results of the 2017 Indonesia DHS indicate that around 7 in every 10 women of reproductive age in Indonesia participated in making decisions on all three household matters included in the survey (their own health care, main household buying, and visits to their family or relatives). Yet, the effects of women's empowerment on contraceptive discontinuation have been less well investigated.

Therefore, there is a need to reexamine the correlates of contraceptive discontinuation in Indonesia, taking into account the current socioeconomic progress in the country, involving use of the internet, mobile phone ownership, and women's participation in decision-making as determinants. Generally, this study aims to investigate the determinants of contraceptive discontinuation in the current setting of Indonesia. Specifically, the study seeks to examine the patterns and differentials of contraceptive discontinuation by the type of contraceptive method discontinued and the demographic, socioeconomic, and cultural background characteristics of women, and to assess the effects of these factors on contraceptive discontinuation in Indonesia. Understanding the factors that affect contraceptive discontinuation will help policy formulation to reduce contraceptive discontinuation and achieve the RPJMN 2020-2025 contraceptive discontinuation target in Indonesia.

1.2 Conceptual Framework

Davis and Blake (1956) proposed a theoretical framework of factors affecting fertility. They argued that socioeconomic factors affect fertility through proximate determinants, including contraceptive use. Therefore, socioeconomic factors influence contraceptive behavior, including discontinuation. Based on the findings of previous studies, factors associated with contraceptive discontinuation can be grouped into method-related, demographic, and socioeconomic and cultural factors.

The method-related factors of contraceptive discontinuation include the type of contraceptive method. It has been found to be the main determinant of contraceptive discontinuation (Ali, Cleland, and Shah 2012; Alihonou et al. 1997; Alvergne, Stevens, and Gurmu 2017; Arifin 2003; Barden-O'Fallen et al. 2018; Bradley, Schwandt, and Khan 2009; Curtis and Blanc 1997; Fathonah 2000; Khalifa, Abdelaziz, and Sakr 2017; Mahumud et al. 2015; Modey, Aryeetey, and Adanu 2014; Parr 2003). The results of these studies found that the risks of contraceptive discontinuation were higher for modern contraceptive methods than for traditional methods. Further, they found that women are more likely to experience side effects/health concerns—which contribute to more than half of the reasons for discontinuing contraception—when they use modern contraceptive methods than when they use traditional methods (Alvergne, Stevens, and Gurmu 2017).

The demographic causes of the risk of discontinuing contraception can include women's age, parity, and contraceptive intent. Many studies have found that contraceptive discontinuation is related to women's age (Ali, Cleland, and Shah 2012; Alihonou et al. 1997; Alvergne, Stevens, and Gurmu 2017; Arifin 2003; Bradley, Schwandt, and Khan 2009; Curtis and Blanc 1997; Grady, Hayward, and Florey 1988; Grady, Hayward, and Florey 1988; Fathonah 2000; Khalifa, Abdelaziz, and Sakr 2017; Mahumud et al. 2015; Macquarrie et al. 2014; Modey, Aryeetey, and Adanu 2014; Simmons et al. 2019; Wang and Hong 2017). The authors found higher contraceptive discontinuation to be associated with younger age because younger

women of reproductive age usually use contraception for spacing births while older women usually use contraception to limit births, so are less likely to discontinue use.

Parity also determines the risk of discontinuing contraception (Arifin 2003; Bradley, Schwandt, and Khan 2009; Grady, Hayward, and Florey 1988; Curtis and Blanc 1997; Khalifa, Abdelaziz, and Sakr 2017; MacQuarrie et al. 2014; Mahumud et al. 2015; Modey, Aryeetey, and Adanu 2014; Simmons et al. 2019; Wang and Hong 2017). These studies found that the risk of contraceptive discontinuation was higher among lower-parity women than higher-parity women. The authors described that lower-parity women still wanted more children to reach their ideal number of children, while higher-parity women might already have achieved their fertility goals so were more likely to continue contraception.

Contraceptive intent is a proxy for the intensity of women's reason to prevent pregnancy (Curtis and Blanc 1997). The risk of discontinuing is influenced by contraceptive intent (Arifin 2003; Curtis and Blanc 1997; Fathonah 2000; Modey, Aryeetey, and Adanu 2014; Wang and Hong 2017). The results of these studies found that intention to space births is associated with higher risk of contraceptive discontinuation because women who wanted more children and were using contraception to space births would discontinue contraceptive use in order to reach their wanted number of children. A study in Bangladesh also found that fertility preference, whether married women of reproductive age wanted to space or to limit births, was important in determining contraceptive discontinuation (Mahumud et al. 2015).

The socioeconomic and cultural determinants of contraceptive discontinuation could involve media exposure through internet use and mobile phone ownership, education, employment status, place of residence, wealth status, and women's empowerment. The importance of media exposure on reproductive behavior has been shown in studies. Bradley, Schwandt, and Khan (2009) found that higher exposure to media can increase the risk of contraceptive discontinuation in some countries, but can decrease the risk in other countries. In some cases, higher media exposure can enable women to find information on how to solve their method-related problems after discontinuing, while in other cases it can provide women with knowledge on how to handle problems caused by their contraceptive method, and thus continue use. Gerber (2011) and Lou et al. (2006) found a positive impact of access to the internet on reproductive behavior, improving awareness of sexual and reproductive matters, including more favorable attitudes toward the provision of contraceptives to sexually active young people. Further, a study by Ihsan and Samosir (2017) observed that internet access increased the odds of practicing contraception.

The importance of mobile phone ownership on contraceptive outcomes has also been studied. In Burkina Faso, where mobile phone penetration and the use of modern contraception has increased rapidly, Greenleaf et al. (2019) found that mobile phone ownership was associated with the use of a modern contraceptive method. They proposed that mobile phones could be used for family planning promotion and knowledge dissemination and could deliver family planning interventions distantly, which in turn could increase the use of modern contraception. However, the effects of mobile phone ownership on contraceptive discontinuation in Indonesia have not been studied.

Education influences the risk of contraceptive discontinuation. Studies have found that the risk of discontinuing contraception is higher among higher educated women (Ali, Cleland, and Shah 2012; Alvergne, Stevens, and Gurmu 2017; Arifin 2003; Barden-O'Fallen et al. 2018; Bradley, Schwandt, and Khan 2009; Grady, Hayward, and Florey 1988; Fathonah 2000; Khalifa, Abdelaziz, and Sakr 2017;

Macquarrie et al. 2014; Mahumud et al. 2015; Modey, Aryeetey, and Adanu 2014; Simmons et al. 2019). These studies have observed that women with more education have a better understanding of the causes of contraceptive discontinuation, in particular side effects and health concerns, and also better capability to prevent unwanted pregnancy when discontinuing contraception.

The risk of contraceptive discontinuation is associated with work status of women. Bradley, Schwandt, and Khan (2009) and also Macquarrie et al. (2014) found that the risk of discontinuing contraception was lower among women who worked in the last year than among other women. Women who worked were more likely to limit their number of children so they could work well or pursue their careers, and hence were more likely to continue contraception.
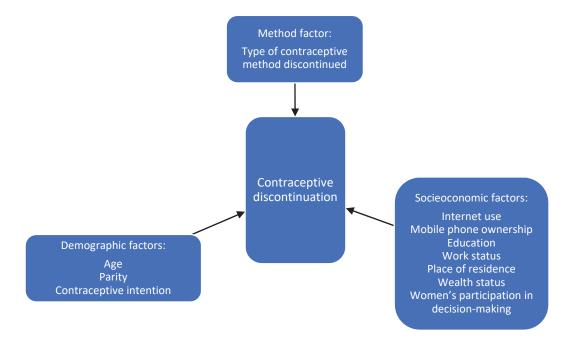
Place of residence also affects contraceptive discontinuation (Ali, Cleland, and Shah 2012; Alvergne, Stevens, and Gurmu 2017; Arifin 2003; Barden-O'Fallen et al. 2018; Bradley, Schwandt, and Khan 2009; Curtis and Blanc 1997; Fathonah 2000; Khalifa, Abdelaziz, and Sakr 2017; Macquarrie et al. 2014; Mahumud et al. 2015; Modey, Aryeetey, and Adanu 2014). Women residing in more developed regions, in particular urban areas, were found to be associated with higher risk of contraceptive discontinuation, which could be caused by better access to family planning information and services that allows women to discontinue contraception in order to find better methods for them.

The risk of discontinuing contraception also relates to the wealth status of women. Studies by Alvergne, Stevens, and Gurmu 2017, Bradley, Schwandt, and Khan (2009), Curtis and Blanc (1997), Khalifa, Abdelaziz, and Sakr (2017), Macquarrie et al. 2014, Mahumud et al. 2015, and Wang and Hong (2017) found that higher contraceptive discontinuation rates were related to poorer household wealth status. They described that women from poorer households did not have enough financial resources to discuss problems encountered with contraceptive use, in particular consultations with medical personnel at the health facility, and to find a remedy to their problems, which usually required money, and hence had higher risk of contraceptive discontinuation.

Women's empowerment has been found to be associated with reproductive health outcomes. Studies by Ahmed et al. (2010), Corroon et al. (2014), and Sebayang, Efendi, and Astutik (2017) found that women's empowerment is associated with higher use of child and maternal health services and with modern contraceptive use. They argued that more empowered women have higher autonomy, including in their reproductive health matters. Yet, the effect on contraceptive discontinuation of women's empowerment, such as women's participation in decision-making, has been rarely examined. Other factors that studies have found to be important in determining the risk of contraceptive discontinuation include women's HIV status, HIV testing, ethnicity, and religion. These factors are not included in this study because the data are not available.

Based on the above theoretical foundations and empirical studies, our study selected 11 factors that were associated with contraceptive discontinuation. These include: the method factor—the type of contraceptive method discontinued; demographic factors—women's age, number of living children (parity), and contraceptive intent; and socioeconomic and cultural factors—women's use of the internet, mobile phone ownership, education, work status, place of residence, wealth status, and participation in decision-making. Therefore, as described in Figure 2, the conceptual framework of the study hypothesizes that these factors influence contraceptive discontinuation in Indonesia.

Figure 2   **Conceptual framework for determinants of contraceptive discontinuation in Indonesia**

2   DATA AND METHODS

2.1   Data

The scope of analysis of the study is Indonesia, among women in union age 15-49. The data used came from the 2017 Indonesia DHS. The data on women were weighted to account for sampling probability and nonresponse so that results were nationally representative of women in union age 15-49. In addition, the data are adjusted to account for the complex survey design and robust standard errors.

The unit of analysis is the episode of contraceptive use to all women in union age 15-49, defined as a continuous use period of a particular method of contraception. Therefore, data from the DHS monthly calendar data were used in the analysis. The calendar is monthly retrospective history of pregnancies, births, terminations, and episodes of contraceptive use for the 5 years before the survey. The 2017 Indonesia DHS also collected month-by-month retrospective history of reasons for discontinuation in any month when a contraceptive method was discontinued, source of contraception in any month when a contraceptive method was started, and marital status since January 2012 until at the time of the survey (July-August 2017).

Contraceptive discontinuation can be defined as initiating contraceptive use and later ending use for any reason while still at possibility of an unplanned pregnancy (Castle and Askew 2015). In the DHS, the contraceptive discontinuation rate is defined as the percentage of episodes discontinued within 12 months by reason for discontinuation according to specific method among women age 15-49 who experienced an episode of contraceptive use within the 5 years preceding the survey,.

Reasons for contraceptive discontinuation include method failure (became pregnant while using), desire to become pregnant, other fertility-related reasons (infrequent sex/husband away, difficult to get pregnant/menopausal, and marital dissolution/separation), side effects/health concerns, wanted more effective method, other method-related reasons (lack of access/too far, costs too much, and inconvenient to use), and other reasons (BKKBN et al. 2018). These reasons then can be grouped as: contraceptive failure; reduced need for contraception (desire to become pregnant, infrequent sex/husband away, difficult to get pregnant/menopausal, and marital dissolution/separation); in need of contraception (side effects/health concerns, wanted more effective method, lack of access/too far, costs too much, and inconvenient to use); and other reasons (Curtis and Blanc 1997). In this study, the determinants of contraceptive discontinuation for all reasons were examined.

The analysis of contraceptive discontinuation risk was for the 5 years before the survey. As many women do not realize that they are pregnant in their first trimester, the period of 3 months before the survey was excluded to avoid underestimation of contraceptive discontinuation due to method failure. Therefore, the period of observation was restricted to 3-62 months before the survey. Contraceptive use episodes that started before month 62 in the calendar and lasted into the observation period were considered as late entries in the estimation of the discontinuation rate. Episodes of female sterilization use were excluded in the analysis because this method cannot be discontinued. Episodes of other methods (lactational amenorrhea method and "other methods") were also excluded from the analysis because few women in the sample were users of these methods. As a woman may contribute more than one contraceptive episode, the analysis included 25,930 contraceptive use episodes to 17,784 women in union age 15-49.

The quality of data was evaluated, because retrospective data were used in this study. Retrospective data, including calendar data, often show heaping patterns about common intervals of time. For instance, a woman might report her use of injectables as a 12-month duration though it might actually have been 13 months. Although retrospective memory ability can be a problem, there are specific situations where it indicates correct heaping of contraceptive use time. In Indonesia, the 3-month injectable is the most used contraceptive method, with a prevalence of 39%, according to the 2017 Indonesia DHS (BKKBN et al. 2018). So, heaping of contraceptive use duration at 3-month intervals was anticipated to probably correctly suggest discontinuation (see Figure 3). Heaping at 6 and 12 months was also observed, but in general the heaping level observed is not considerable enough to substantially influence discontinuation rate estimates.

Figure 3   Percentage distribution of reported contraceptive use episode durations: Indonesia DHS 2017

2.2   Variables

2.2.1   Dependent variable

The outcome variable in this study is the duration of the risk period up to the occurrence of the contraceptive discontinuation. Therefore, it is subject to nonresponse in the sample due to right-censoring, since the complete duration is not known for the episodes that are still ongoing at the end of the observation period. These incomplete episodes are also included in the analysis, and event history analysis is employed to manage the right-censoring (Kleinbaum and Klein 2005; Yamaguchi 1991).

2.2.2   Independent variables

The independent variables are grouped into method-related, demographic, and socioeconomic and cultural factors. The method-related variable consists of the contraceptive method discontinued, grouped into pill, IUD, injectables, implant, condom, and traditional methods (periodic abstinence and withdrawal).

The demographic variables comprise: age, parity, and contraceptive intent. Age is the woman's age at the start of the episode of use (years). Parity is the number of living children at the end of the episode of use. The number of living children at the start of the episode can be different from the number of living children at the end of the episode due to the possibility of child death during the contraceptive use episode. If a woman experienced child death during a contraceptive episode, she might discontinue the episode in order to replace the dead child. Parity is grouped into three categories: no children or one child, two to three children, and four or more children. Contraceptive intent refers to whether the contraceptive episode was for spacing or limiting births (Curtis and Blanc 1997). It is: (i) desired status of the next birth after the contraceptive use episode (spacing if 'wanted then' or 'wanted later' and limiting if 'unwanted'); (ii) current fertility preferences if there is a birth following the contraceptive use episode; or (iii) if not available, comparison between the ideal number of children and actual family size (spacing if the ideal number of children is greater than actual family size and limiting if the ideal number of children is smaller than actual family size).

The socioeconomic variables include internet use, mobile phone ownership, education, work status, place of residence, and wealth status. internet use refers to ever-use of the internet in the past year, in two categories: ever and never. Mobile phone ownership is whether the woman had a mobile phone at the time of survey: yes and no. Women's education is the highest educational level attained at the time of the survey, grouped into four categories: no schooling, some primary, some secondary, and higher education. Work status, measured at the time of the survey, is grouped into two categories: currently not employed and currently employed. Place of residence at the time of the survey is considered as either urban or rural. Women's wealth status is the household wealth index quintile at the time of the survey, grouped into lowest, second, middle, fourth, and highest. The cultural variable consists of the women's participation in decision-making, categorized as: do not participate, partially participate, and fully participate.

2.3   Statistical Analysis

The data were analyzed descriptively and inferentially using STATA 15. Descriptively, univariate and bivariate analyses were performed. Univariate analysis involves the percentage distribution of the independent variables. It is the percentage distribution of method-related, demographic, and socioeconomic and cultural characteristics of women. Bivariate analysis between the independent variables and the outcome variable was carried out by estimating the 12-month contraceptive discontinuation rate, using the life table technique, by the method-related, demographic, and socioeconomic and cultural factors.

Inferential analysis of the effects of method-related, demographic, and socioeconomic and cultural factors on contraceptive discontinuation in Indonesia was done using the survival analysis. A primary advantage of hazard models for the analysis of duration data is its capability to deal with censored observations (Kleinbaum and Klein 2005; Yamaguchi 1991). A Gompertz proportional hazards model is employed, since its Akaike's information criterion (AIC) and Bayesian information criterion (BIC) is low and it represents the contraceptive discontinuation process (Macquarrie et al. 2014). Gompertz hazards models are fully parametric models and estimated using likelihood procedures. These models assume hazards are proportional across groups (Allison 1995; Cleves et al. 2010).

The hazard rate h_t is the instantaneous risk of a contraceptive discontinuation at month t, given that the contraceptive is still used just prior to that month. It is the limit of the number of contraceptive

discontinuations per unit time divided by the number at risk as the time interval approaches zero. Hazard rates of contraceptive discontinuation are assumed to be a log linear function of parameters for the effects of the independent variables. The value for event i at time t, denoted by $h_i(t)$, is given as

$$h_i(t) = h_0(t) \exp\left[\sum \beta_k X_k(t)\right]$$

where $h_0(t)$ is the baseline hazard function.

The baseline hazard function is as follows.

$$h_0(t) = \exp(\gamma t) \exp(\beta_0)$$

where γ is the shape parameter. If γ is positive, then the hazard of discontinuing the contraceptive use episode exponentially increases over time. If γ is negative, then the hazard of contraceptive discontinuation exponentially decreases over time. Further, if γ is zero, then the hazard of contraceptive discontinuation is constant and reduces to the exponential model $h(t) = \exp\left[\beta_0 + \sum \beta_k X_k(t)\right]$ (Kleinbaum and Klein 2005).

As mentioned, the study uses a Gompertz proportional hazards model of contraceptive discontinuation. The independent variables are the contraceptive method discontinued, age, parity, and contraceptive intent at the start of contraceptive episode, internet use, mobile phone ownership, education, work status, place of residence, wealth status, and women's participation in decision-making.

The test statistic G^2 was used to test the effects of all covariates in the model simultaneously. This statistic follows chi square distribution with k degrees of freedom. The significance of each covariate was tested using z test statistic that follows standard normal distribution. Tests were conducted at the significance level 0.05.

Results are presented as the hazard ratios (exponentiated parameter estimate). The parameter estimate for a categorical variable X_k, with two categories, implies that the hazard rate of contraceptive discontinuation to women who have the characteristic of interest ($X_k = 1$) is $\exp(b_k)$ times as much hazard rate of contraceptive discontinuation for events to women who are in the reference category characteristic ($X_k = 0$), controlling for the effects of other covariates and time. Meanwhile, the positive parameter estimate for a continuous variable X_k implies that if X_k increases by one unit, the hazard rate of contraceptive discontinuation will increase by $\exp(b_k)$ time.

This study made some assumptions—that the independent variables are not time varying but remain as measured at the time of the survey; and that internet use, mobile phone ownership, education, work status, place of residence, wealth status, and women's participation in decision-making do not change much during the 5 years before the survey. For the outcome variable, it was also assumed that contraceptive use episodes for the same woman, if the woman has more than one contraceptive use episode during the observation period, are independent episodes.

3   RESULTS

3.1   Characteristics of Women

Table 1 presents the percentage distribution of contraceptive use episodes in the 5 years before the survey according to method-related, demographic, and socioeconomic and cultural factors. The table shows that more than half of the episodes were for injectables (51%). It is consistent with the contraceptive method mix at the time of the 2017 Indonesia DHS, which shows that injectables were the most used method of contraception, at 46% of currently married women (BKKBN et al. 2018). The second-most episodes were for the pill (23%), which was also the second most used method at the time of the DHS survey, at 12%. Episodes for the IUD and implants were much lower in number (5% and 7% respectively), and episodes of condom use were lowest, at 4%.

Among discontinued contraceptive use episodes, side effects/health concerns were the main reasons given for discontinuing (37%), followed by desire to become pregnant (24%). In addition, around 9% of the episodes were discontinued for wanting a more effective method. These figures indicate that a notable proportion of women remain at risk of unwanted pregnancy if they do not find or switch to more effective method of contraception.

By demographic characteristics, the majority of contraceptive use episodes were to women age 25-34, at 44%, followed by age 35 and older, at 30%. In addition, over half of episodes (54%) were to women with two or three children at the end of an episode, while 59% of episodes were to women whose contraceptive intent was spacing births.

By socioeconomic and cultural factors, the majority of contraceptive use episodes were to women who had never use the internet in the past year (55%), women who had a mobile phone (80%), women with a primary education (51%), women who were currently employed (51%), women in rural areas (52%), and women who fully participated in decision-making (66%).

Table 1   Percentage distribution of method-related, demographic, and socioeconomic and cultural characteristics of women: Indonesia DHS 2017

Characteristics	Number of episodes	Percentage
Method-related factor		
Contraceptive method discontinued		
Pill	6,065	23.4
IUD	1,418	5.5
Injectables	13,122	50.6
Implants	1,760	6.8
Condom	1,088	4.2
Traditional	2,476	9.5
Demographic factors		
Age at the start of the episode (years)		
15-24	6,837	26.4
25-34	11,435	44.1
35 and above	7,658	29.5
Parity (living children at the end of the episode)		
0-1	9,858	38.0
2-3	13,977	53.9
4+	2,094	8.1
Contraceptive intent		
Spacing	15,354	59.2
Limiting	10,576	40.8
Total		
Socioeconomic factors		
Internet use in the past year		
Ever	11,647	44.9
Never	14,276	55.1
Mobile phone ownership		
Have	20,701	79.9
Do not have	5,203	20.1
Education		
No education/incomplete primary	1,900	7.3
Primary	13,109	50.6
Secondary	7,451	28.7
Higher	3,469	13.4
Work status		
Currently employed	13,184	50.9
Not currently employed	12,741	49.1
Place of residence		
Urban	12,434	48.0
Rural	13,496	52.0
Household wealth index quintile		
Lowest	4,406	17.0
Second	5,382	20.8
Middle	5,632	21.7
Fourth	5,498	21.2
Highest	5,011	19.3
Cultural factor		
Women participation in decision-making		
Fully participate	17,111	66.0
Partially participate	5,193	20.0
Do not participate	3,625	14.0
Total	25,929	100.0

Note: The totals are not the same for all characteristics due to missing values.

3.2   Contraceptive Discontinuation by Method and Reason

Table 2 shows that nearly 3 of every 10 contraceptive use episodes (29%) are discontinued within 12 months of starting an interval of use. Discontinuations due to side effects/health concerns are by far the largest contributor to the overall discontinuation rate in Indonesia, at 12%. In addition, users of the pill have the highest 12-month contraceptive discontinuation rates (46%), followed by users of injectables (28%). Users of modern methods (IUD, injectables, implants, pill, and male condom) have lower rates of contraceptive

failure than users of traditional family planning methods (periodic abstinence and withdrawal) but have higher rates of discontinuing because of side effects/health concerns. Further, the 12-month contraceptive discontinuation rate due to reduced need (desire to become pregnant and other fertility-related reasons) is much lower for long-term methods of contraception (IUD and implants), and much higher for short-term methods (injectables, pill, and male condom) and for traditional family planning methods. Furthermore, the 12-month contraceptive discontinuation rate due to side effects/health concerns is highest for the pill (17% of episodes), followed by injectables (14%).

Table 2   Twelve-month contraceptive discontinuation rates by contraceptive method discontinued and reason for discontinuation: Indonesia 2017

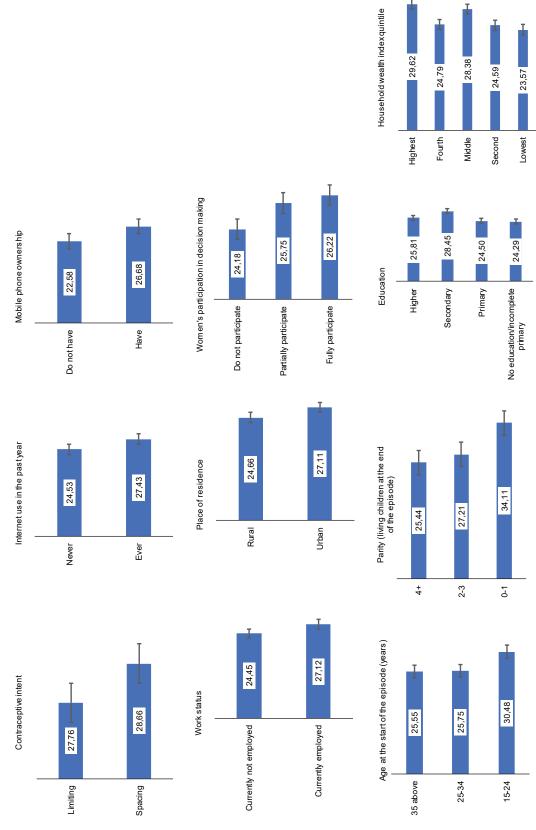| Contraceptive method discontinued	Method failure	Desire to become pregnant	Other fertility-related reasons	Side effects/ health concerns	Wanted more effective method	Other method-related reasons	Other reasons	Any reason
IUD	0.6	0.8	0.3	4.8	0.2	1.1	1.1	9.0
Injectables	0.5	4.5	4.7	13.8	1.4	1.3	1.6	27.8
Implants	0.2	0.6	0.2	5.0	0.1	0.2	0.2	6.4
Pill	3.1	9.5	6.2	16.7	6.0	1.6	3.2	46.2
Male condom	2.1	4.5	6.7	2.4	2.7	5.9	2.3	26.5
Periodic abstinence	5.8	4.6	9.1	0.8	4.2	0.1	1.9	26.5
Withdrawal	5.5	6.6	3.3	1.2	6.6	0.5	2.0	25.7
All methods	1.6	5.2	4.5	11.4	2.9	1.3	1.9	28.9

The 12-month contraceptive discontinuation rate differs by demographic and socioeconomic and cultural factors (Table 3 and Figure 4). By demographic factors, the older the age of the women, the lower the 12-month contraceptive discontinuation rate. The 12-month contraceptive discontinuation rate is lowest among women age 35 and older at the start of the contraceptive use episode (26%), and highest among women age 15-24 at the start of the contraceptive use episode. The higher the number of living children at the end of the contraceptive episode, the lower the 12-month discontinuation rate. More than one-third (34%) of contraceptive use episodes among women who do not have any children or have one child at the end of the episode discontinued use within 12 months of starting, compared with more one-fourth (25%) among women with four children or more at the end of the episode. The 12-month contraceptive discontinuation rate is slightly higher among women who space births than among women who limit births (29% versus 28%).

By socioeconomic and cultural factors, the 12-month contraceptive discontinuation rate is somewhat higher among women who ever used the internet in the past year than among women never used the internet in the past year (27% versus 25%), and higher among women who have a mobile phone than among women who do not have one (27% versus 23%). By educational attainment, the rate is highest among women with secondary education (28%) and lowest among women with no education or incomplete primary education (26%). It is higher among currently employed women compared with unemployed women (27% versus 25%). Urban women have a higher discontinuation rate than rural women (27% versus 25%). Among the wealth quintiles, discontinuation rates are highest among women in the highest household wealth quintile (30%) and lowest among women in the lowest quintile (24%). Furthermore, women who participate in household decision-making, whether fully or partially, have higher 12-month discontinuation rates (26%) compared with women who do not participate (24%).

Table 3   **Twelve-month contraceptive discontinuation rates by demographic and socioeconomic and cultural factors: Indonesia DHS 2017**

Factor	12-month contraceptive discontinuation rate
Demographic factors	
Age at the start of the episode (years)	
15-24	30.5 [28.9-32.1]
25-34	25.7 [24.5-27.0]
35 above	25.6 [24.1-27.1]
Parity (living children at the end of the episode)	
0-1	34.1 [32.7-35.6]
2-3	27.2 [25.9-28.5]
4+	25.4 [22.6-28.4]
Contraceptive intent	
Spacing	28.7 [27.5-29.8]
Limiting	27.8 [26.4-29.2]
Socioeconomic factors	
Internet use in the past year	
Ever	27.4 [26.2-28.7]
Never	24.5 [23.4-25.7]
Mobile phone ownership	
Have	26.7 [25.7-27.7]
Do not have	22.6 [20.8-24.4]
Education	
No education/incomplete primary	24.3 [21.0-27.7]
Primary	24.5 [23.3-25.7]
Secondary	28.4 [26.7-30.2]
Higher	25.8 [23.9-27.8]
Work status	
Currently employed	27.1 [25.9-28.3]
Not currently employed	24.5 [23.2-25.7]
Place of residence	
Urban	27.1 [25.9-28.3]
Rural	24.7 [23.4-25.9]
Household wealth index quintile	
Lowest	23.6 [21.2-26.0]
Second	24.6 [22.8-26.4]
Middle	28.4 [26.3-30.5]
Fourth	24.8 [23.0-26.6]
Highest	29.6 [27.7-31.6]
Cultural factor	
Women's participation in decision-making	
Fully participate	26.2 [25.2-27.3]
Partially participate	25.8 [23.6-28.0]
Do not participate	24.2 [22.0-26.4]

Figure 4   Twelve-month contraceptive discontinuation rates by demographic and socioeconomic and cultural factors: Indonesia DHS 2017

Contraceptive intent

- Limiting: 27,76
- Spacing: 28,66

Internet use in the past year

- Never: 24,53
- Ever: 27,43

Mobile phone ownership

- Do not have: 22,58
- Have: 26,68

Work status

- Currently not employed: 24,45
- Currently employed: 27,12

Place of residence

- Rural: 24,66
- Urban: 27,11

Women's participation in decision making

- Do not participate: 24,18
- Partially participate: 25,75
- Fully participate: 26,22

Age at the start of the episode (years)

- 35 above: 25,55
- 25-34: 25,75
- 15-24: 30,48

Parity (living children at the end of the episode)

- 4+: 25,44
- 2-3: 27,21
- 0-1: 34,11

Education

- Higher: 25,81
- Secondary: 28,45
- Primary: 24,50
- No education/incomplete primary: 24,29

Household wealth index quintile

- Highest: 29,62
- Fourth: 24,79
- Middle: 28,38
- Second: 24,59
- Lowest: 23,57

3.3   Determinants of Contraceptive Discontinuation

Table 4 and Figure 5 show results of the Gompertz hazards model for the determinants of contraceptive discontinuation in Indonesia. All of the 11 independent variables have statistically significant effects on the risk of discontinuing contraception. The shape parameter is negative, -0.012, implying a decreasing hazard of discontinuing contraception over time.

The method-related factor—contraceptive method discontinued—strongly influences the contraceptive discontinuation risk in Indonesia. Compared with users of the pill, users of IUD, injectables, implants, male condom, and traditional methods (periodic abstinence and withdrawal) have lower risk of discontinuing contraception, at 80%, 37%, 69%, 47%, and 48% respectively.
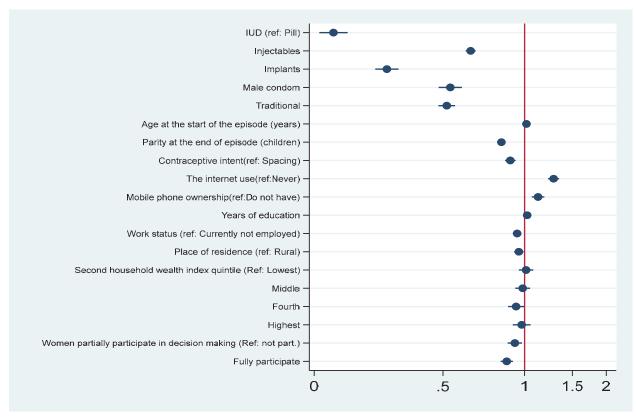
The demographic factors—women's age at the start of the episode, number of living children at the end of the episode, and contraceptive intent—determine the risk of discontinuing contraception. An increase of 1 year in women's age at the start of the episode will increase the risk of contraceptive discontinuation by 1.6%. An increase of one child in women's number of living children at the end of the episode will reduce the hazard of contraceptive discontinuation by 18%. Women who limit births have 11% lower hazard of ending a contraceptive episode than women who space births.

The risk of discontinuing a contraceptive episode is affected by socioeconomic and cultural factors. Women who used the internet in the past year have 28% higher hazard of discontinuing contraception than women who never used the internet in the past year. Women who have a mobile phone have 12% higher hazard of discontinuing contraception than women who do not have a mobile phone. An increase of 1 year in women's years of education will increase the hazard of contraceptive discontinuation by 2%. Women who are currently employed have 6% lower hazard of discontinuing contraception than women who are not currently employed. Urban women have 5% lower hazard of discontinuing a contraceptive episode than rural women. Women in the fourth household wealth quintile have 7% lower hazard of contraceptive discontinuation than women in the lowest wealth quintile. Women who partially participate or fully participate in household decision-making have, respectively, 8% and 14% lower hazard of abandoning a contraceptive episode than women who do not participate in household decision-making.

Table 4   Hazard ratio for Gompertz hazards model of the determinants of contraceptive discontinuation: Indonesia DHS 2017

Covariate	Hazard ratio	*p*-value
Method-related factor		
Contraceptive method discontinued (reference=Pill)		
IUD	0.20 [0.18-0.22]	<0.001
Injectables	0.63 [0.61-0.66]	<0.001
Implants	0.31 [0.28-0.34]	<0.001
Male condom	0.53 [0.48-0.59]	<0.001
Traditional	0.52 [0.48-0.55]	<0.001
Demographic factors		
Age at the start of episode (years)	1.02 [1.01-1.02]	<0.001
Parity at the end of episode (children)	0.82 [0.80-0.84]	<0.001
Contraceptive intent (reference=Spacing)		
Limiting	0.89 [0.85-0.93]	<0.001
Socioeconomic factors		
Internet use (reference=Never)		
Ever	1.28 [1.22-1.34]	<0.001
Mobile phone ownership (reference=Do not have)		
Have	1.12 [1.06-1.18]	<0.001
Years of education	1.02 [1.02-1.03]	<0.001
Work status (reference=Currently not employed)		
Currently employed	0.94 [0.90-0.97]	<0.001
Place of residence (reference=Rural)		
Urban	0.95 [0.91-0.99]	0.016
Household wealth index quintile (reference=Lowest)		
Second	1.01 [0.95-1.08]	0.688
Middle	0.98 [0.92-1.05]	0.609
Fourth	0.93 [0.87-1.00]	0.036
Highest	0.98 [0.90-1.05]	0.518
Cultural factor		
Women's participation in decision-making (reference=Do not participate)		
Partially participate	0.92 [0.87-0.98]	0.008
Fully participate	0.86 [0.82-0.90]	<0.001
Constant	0.03 [0.03-0.04]	<0.001
Gamma	-0.012 [-0.014-0.011]	<0.001

Figure 5   Hazard ratio for Gompertz hazards model of the determinants of contraceptive discontinuation: Indonesia DHS 2017

4   DISCUSSION

The results of this study show that contraceptive discontinuation due to reduced need (desire to become pregnant and other fertility-related reasons) is much higher among the users of short-term contraceptive methods (injectables, pill, and male condom) and traditional family planning methods (periodic abstinence and withdrawal) than among users of long-term contraceptive methods (IUD and implants). This indicates that short-term modern methods and traditional methods of family planning are preferred when women perceive less of a need to avoid pregnancy. It might be that some women have chosen short-term methods in anticipation of a change in their need for contraception over a short or medium period of time. It might also be that some women who use short-term methods found it complicated to maintain use of a long-term method and discontinued contraception in anticipation of switching to a short-term method. In addition, contraceptive discontinuation due to side effects/health concerns is highest for the pill, followed by injectables. This result suggests lower client satisfaction and poor counseling on the side effects/health problem management for these two most favored methods.

By demographic factors, contraceptive discontinuation is higher among younger women, women with no living children or just one child, and women who space births. This might be because older women have used their contraceptive method for a longer period and are more familiar with the method and hence more likely continue its use compared with younger women. Regarding the number of living children, women with more children might be more likely to limit births and to realize that they are at higher risk of unwanted pregnancy than women with lower parity, and hence more likely continue their use of contraception. Concerning contraceptive intent, women who limit births might have lower discontinuation rates because they feel more pressure to prevent unintended pregnancy compared with women who are spacing births and expect to have another child in the future.

By socioeconomic and cultural factors, higher rates of contraceptive discontinuation are associated with ever use of the internet, having a mobile phone, having higher education, being currently employed, living in an urban area, being in a wealthier household, and fully participating in household decision-making. These results could reflect better access to family planning information and services, such as the availability of a range of family planning methods, among women who ever use the internet and who have a mobile phone, so that they are more likely to discontinue one method and switch to another when their needs change. Similarly, more educated, currently employed, urban, wealthier, and more empowered women might have better access to family planning information and services, including various methods of contraception, than other women so that they are more likely to discontinue use either to switch to a more suitable method or to have more children.

After controlling for other factors, the type of contraceptive method is strongly associated with discontinuation risk in Indonesia. The risk of discontinuing the pill is higher than for other methods. It might be because the pill is much easier than other methods to abandon when women experience side effects and have health concerns—and in particular compared with long-term methods such as the IUD and implants, which need trained medical personnel to perform the removal. This finding is consistent with the results of the studies by Arifin (2003), Bradley, Schwandt, and Khan (2009), and Curtis and Blanc (1997), which found highest risk of contraceptive discontinuation for the pill in Indonesia.

In Indonesia, higher risk of discontinuing contraception is strongly associated with older age. This result is consistent with the results of the study in Senegal by Barden-O'Fallen et al. (2018), but inconsistent with the results of the study in Indonesia by Bradley, Schwandt, and Khan (2009) and in Ghana by Parr (2003). It might be because older women in Indonesia today are less willing to continue the use of a contraception when encountering problems than younger women.

Women's parity is negatively associated with the risk of discontinuing contraception in Indonesia. It is as expected, as women with more children have more motivation to avoid unwanted pregnancy in order to maintain their wanted number of children. This finding is consistent with the results of the study in Senegal by Barden-O'Fallen et al. (2018), in Ghana by Parr (2003), and in Indonesia by Curtis and Blanc (2003). However, it is inconsistent with the results of the study by Bradley, Schwandt, and Khan (2009) that found the highest risk of contraceptive discontinuation among women with more children in Indonesia, which can be caused by the decline in family planning program efforts in the early 2000s.

Using contraception to limit births is associated with lower hazard of contraceptive discontinuation in Indonesia. As mentioned earlier in discussing contraceptive intent, women who limit births feel more pressure to avoid unwanted pregnancy than women who space births, and consequently are less likely to discontinue contraceptive use. This finding supports the studies by Arifin (2003) and Curtis and Blanc (1997) that found lower hazard of contraceptive discontinuation among women who limit births.

In Indonesia, ever-use of the internet and ownership of a mobile phone are associated with higher risk of discontinuing a contraceptive use episode. It might be because women who ever use the internet and women who have a mobile phone can find more information on family planning services through these two social media instruments that can help them to handle problems in using contraception. However, this result is not consistent with the results of the study by Bradley, Schwandt, and Khan (2009) that found an insignificant effect of media exposure on the risk of contraceptive discontinuation in Indonesia.

Higher risk of contraceptive discontinuation is associated with higher levels of women's education in Indonesia. It is not as expected, but might be because more educated women have better knowledge and access to family planning information and services, enabling them to switch methods more easily. This result is inconsistent with the results of the study in Senegal by Barden-O'Fallen et al. (2018) and in Ghana by Parr (2003) that found that more educated women have lower risk of discontinuing contraception, and also inconsistent with the studies in Indonesia by Bradley, Schwandt, and Khan (2009) and Curtis and Blanc (1997) that found an insignificant effect of education on the risk of abandoning contraception.

In Indonesia, higher risk of discontinuing contraceptive use is associated with women being unemployed. Unemployed women might be less motivated to prevent unwanted pregnancy than women who are currently employed. However, this finding is inconsistent with the results of the study in Indonesia by Bradley, Schwandt, and Khan (2009) that found higher risk of discontinuing contraception among women who worked in the past year.

Living in urban areas and being wealthier are associated with lower hazard of contraceptive discontinuation in Indonesia. It might be because urban and wealthier women have better access to family planning services and information, in particular family planning counseling services, to support and maintain their use of contraception. This finding supports the results of the study in Indonesia by Bradley, Schwandt, and Khan (2009) that found lower risk of discontinuing contraception among women in urban areas. But the finding

is inconsistent with the results of the study in Indonesia by Curtis and Blanc (1997) that found higher hazard of contraceptive discontinuation in rural areas. In addition, Curtis and Blanc (1997) also found that women in wealthier households are less likely to discontinue contraception.

In Indonesia, women who are more empowered—fully participating in household decision-making—have lower hazard of discontinuing contraception. More empowered women might have a better understanding about how to maintain contraception, including when encountering side effects or health concerns. This finding supports the results of the studies by Ahmed et al. (2010), Corroon et al. (2014), and Sebayang, Efendi, and Astutik (2017) showing the importance of women's empowerment for the use of maternal and child health services.

5   CONCLUSIONS

The results of our study show that discontinuing use of a contraceptive method is relatively common in Indonesia. Nearly 3 of every 10 contraceptive use episodes are discontinued within 12 months of beginning an interval of use. The 12-month contraceptive discontinuation rate is highest for the pill, followed by injectables. The main reason for contraceptive discontinuation is side effects/health concerns, followed by desire to become pregnant. The 12-month contraceptive discontinuation rate due to side effects/health concerns is highest for the pill, followed by injectables.

The 12-month contraceptive discontinuation rate varies across demographic and socioeconomic and cultural factors. It is higher among women who are older, have no children or one child, want to space births, ever used the internet in the past year, have a mobile phone, have higher education, are currently employed, live in urban areas, are in wealthier households, and fully participate in decision-making.

The contraceptive method used, age, parity, contraceptive intent, internet use, mobile phone ownership, education, work status, place of residence, wealth status, and women's participation in decision-making have statistically significant effects on the risk of abandoning an episode of contraceptive use. Higher hazard of discontinuing contraception is associated with the use of the pill, older women, having fewer children, spacing births, ever use of the internet, having a mobile phone, having more education, being currently unemployed, living in a rural area, being in poorer households, and not participating in household decision-making.

The findings from this study reveal important determinants of contraceptive discontinuation and present guidance crucial for improving family planning services in Indonesia in order to reduce unnecessary and unintentional contraceptive discontinuation. The finding of higher contraceptive discontinuation due to side effects/health problems and for the two most favored methods, pill and injectables, could suggest the need for counseling improvement, more effective communication about the methods, and contraceptive technology improvement. Women should be enabled to discuss potential side effects/health problems of using a contraceptive method. Women who suffer prolonged amenorrhea should be given counseling on how to treat this side effect of practicing contraception. The number of contraceptive methods available should be increased to allow women to switch promptly to suitable methods.

Higher risk of discontinuing contraception among women who are older, have fewer children, space births, ever use the internet, have a mobile phone, have more education, are currently unemployed, live in rural areas, are in poorer households, and do not participate in household decision-making implies the need for family planning counseling on contraceptive discontinuation management among women in these groups in order to avoid unwanted pregnancy. Government stakeholders (the National Population and Family Planning Coordinating Board, Ministry of Health, National Development Planning Ministry/Agency, and Ministry of Women Empowerment and Child Protection) and nongovernment stakeholders (United Nations Population Fund, World Health Organization, and Family Planning 2020) should formulate policies targeting these groups of women in order to reduce contraceptive discontinuation and achieve the RPJMN 2020-2025 contraceptive discontinuation target in Indonesia.

Some suggestions are proposed for further study of contraceptive discontinuation in Indonesia. First is a study of the determinants of contraceptive use failure and switching in the current socioeconomic setting

of Indonesia that have not been examined in this study. Second is using more suitable statistical methods that account for proportionality assumptions and dependent outcomes for women who have more than one contraceptive use episode, which can be a multilevel analysis. Third is increasing the availability of time-varying socioeconomic variables in DHS data.

REFERENCES

Ahmed, S., A. A. Creanga, D. G. Gillespie, and A. O. Tsui. 2010. "Economic Status, Education and Empowerment: Implications for Maternal Health Service Utilization in Developing Countries." *PloS One* 5 (6): e11190. https://doi.org/10.1371/journal.pone.0011190.

Ali, M. M., J. Cleland, and I. H. Shah. 2012. *Causes and Consequences of Contraceptive Discontinuation: Evidence from 60 Demographic and Health Surveys*. Geneva, Switzerland: World Health Organization.

Alihonou, E., N. Carre, V. Capochichi, and P. Thonneau. 1997. "Contraceptive Continuation and Its Determinants in Benin." *Contraception 55* (2): 97-101.

Allison, P. D. 1995. *Survival Analysis Using SAS: A Practical Guide*. 10th printing ed. Cary, North Carolina, USA: SAS Institute Inc.

Alvergne, A., R. Stevens, and E. Gurmu. 2017. "Side Effects and the Need for Secrecy: Characterising Discontinuation of Modern Contraception and Its Causes in Ethiopia Using Mixed Methods." *Contraception and Reproductive Medicine* 2: 24. https://dx.doi.org/10.1186%2Fs40834-017-0052-7.

Arifin, E. N. 2003. *Factors Associated with Contraceptive Discontinuation in Bali, Indonesia: A Multilevel Discrete-time Competing Risks Hazard Model*. Asian Meta Centre for Population and Sustainable Development Analysis. Singapore: Asian Meta Centre.

Badan Kependudukan dan Keluarga Berencana Nasional (National Population and Family Planning Coordinating Board/BKKBN), Badan Pusat Statistik, Kementerian Kesehatan, and USAID. 2018. *Survei Demografi dan Kesehatan Indonesia (Indonesia Demographic and Health Survey) 2017*. Jakarta, Indonesia: BKKBN.

Barden-O'Fallen, J., I. S. Speizer, L. M. Calhoun, and M. Corroon. 2018. "Women's Contraceptive Discontinuation and Switching Behavior in Urban Senegal, 2010-2015." *BMC Women's Health* 18 (35). https://doi.org/10.1186/s12905-018-0529-9.

Bradley, S. E. K., H. M. Schwandt, and S. Kan. 2009. *Levels, Trends, and Reasons for Contraceptive Discontinuation*. DHS Analytical Studies No. 20. Calverton, Maryland, USA: ICF Macro.

Castle, S. and I. Askew. 2015. *Contraceptive Discontinuation: Reasons, Challenges, and Solutions*. USA: Population Council.

Central Bureau of Statistics, National Family Planning Coordinating Board, Ministry of Health, and Macro International Inc. 1992. *Indonesia Demographic and Health Survey 1991*. Jakarta, Indonesia: BPS.

Central Bureau of Statistics, State Ministry of Population/National Family Planning Coordinating Board, Ministry of Health, and Macro International Inc. 1995. *Indonesia Demographic and Health Survey 1994*. Jakarta, Indonesia: BPS.

Central Bureau of Statistics, State Ministry of Population/National Family Planning Coordinating Board, Ministry of Health, and Macro International Inc. 1998. *Indonesia Demographic and Health Survey 1997*. Jakarta, Indonesia: BPS.

Cleves, M., R. G. Gutierrez, W. Gould, and Y. V. Marchenko. 2010. *An Introduction to Survival Analysis Using Stata*. Third ed. College Station, Texas, USA: Stata Press.

Corroon, M., I. S. Speizer, J. Fotso, A. Akiode, A. Saad, L. Calhoun, and L. Irani. 2014. "The Role of Gender Empowerment on Reproductive Health Outcomes in Urban Nigeria." *Maternal and Child Health Journal* 18 (1): 307-315. https://doi.org/10.1007/s10995-013-1266-1.

Curtis, S. L. and A. K. Blanc. 1997. *Determinants of Contraceptive Failure, Switching, and Discontinuation: An Analysis of DHS Contraceptive Histories*. DHS Analytical Report No. 6. Calverton, Maryland: Macro International Inc.

Davis, K. and J. Blake. 1956. "Social Structure and Fertility. An Analytic Framework." *Economic Development and Cultural Change* 4 (3): 211-235. https://doi.org/10.1086/449714.

Fathonah, S. 2000. *Patterns of Contraceptive Use in Indonesia*. Calverton, Maryland: State Ministry/National Family Coordinating Board and Macro International Inc.

General Directorate of Statistics (GDS), Ministry of Health and ICF. 2018. *Timor-Leste Demographic and Health Survey 2016*. Dili, Timor-Leste and Rockville, Maryland, USA: GDS and ICF.

Gerber, W. 2011. *The Use of Information and Communication Technology in Family Planning, Reproductive Health, and Other Health Programs: A Review of Trends and Evidence*. The AIDSTAR-Two Project. Cambridge: Management Sciences for Health.

Grady, W. R., M. D. Hayward, and F. A. Florey. 1988. "Contraceptive Discontinuation among Married Women in the United States." *Studies in Family Planning* 19 (4): 227-237.

Greenleaf, A. R., S. Ahmed, C. Moreau, G. Guiella, and Y. Choi. 2019. "Cell Phone Ownership and Modern Contraceptive Use in Burkina Faso: Implications for Research and Interventions Using Mobile Technology." *Contraception* 99: 170-174. https://doi.org/10.1016/j.contraception.2018.11.006.

Kementerian Perencanaan Pembangunan Nasional/Badan Perencanaan Pembangunan Nasional (National Development Planning Ministry/ Agency /BAPPENAS). 2014. *Rencana Pembangunan Jangka Menengah Nasional (National Midterm Development Plan) 2015-2019. Buku II Agenda Pembangunan Bidang (Book II Sector Development Agenda)*. Jakarta, Indonesia: BAPPENAS.

Kementerian Perencanaan Pembangunan Nasional/Badan Perencanaan Pembangunan Nasional (National Development Planning Ministry/Agency/BAPPENAS), Badan Pusat Statistik and United Nations Population Fund. 2018. *The 2015-2045 Indonesia Population Projection*. Jakarta, Indonesia: BAPPENAS.

Khalifa, M., W. Abdelaziz, and E. Sakr. 2017. *Changes in Contraceptive Use Dynamics in Egypt: Analysis of the 2008 and 2014 Demographic and Health Surveys*. DHS Working Papers No. 132. Rockville, Maryland, USA: ICF.

Kleinbaum, D. G. and M. Klein. 2005. *Survival Analysis: A Self-Learning Text: Statistics for Biology and Health*. Second Edition. New York, United States of America: Springer. https://doi.org/10.1007/978-1-4419-6646-9.

Lou, C., Q. Zhao, E. Gao, and I. Shah. 2006. "Can the Internet Be an Effective Way to Conduct Sex Education for Young People in China?" *Journal of Adolescent Health* 39: 720-728. https://doi.org/10.1016/j.jadohealth.2006.04.003.

MacQuarrie, K. L. D., S. E. K. Bradley, A. Gemmill, and S. Staveteig. 2014. *Contraceptive Dynamics Following HIV Testing*. DHS Analytical Studies No. 47. Rockville, Maryland, USA: ICF International.

Mahumud, R. A., M. G. Hossain, A. R. Sarker, M. N. Islam, M. R. Hossain, and J. A. M. Khan. 2015. "Prevalence and Associated Factors of Contraceptive Discontinuation and Switching among Bangladeshi Married Women of Reproductive Age." *Open Access Journal of Contraception* 6: 13-19. https://dx.doi.org/10.2147%2FOAJC.S76070.

Modey, E. J., R. Aryeetey, and R. Adanu. 2014. "Contraceptive Discontinuation and Switching Among Ghanaian Women: Evidence from the Ghana Demographic and Health Survey." *African Journal of Reproductive Health* 18 (1): 8402.

Nulhakim, I. and O. B. Samosir. 2017. "The Effects of Internet Access on Contraceptive Use in Indonesia (Intercensal Population Survey Data Analysis of 2015)." *Advances in Social Science, Education, and Humanities Research (ASSEHR)* 126. https://dx.doi.org/10.2991/icied-17.2018.13.

Parr, N. J. 2003. "Discontinuation of Contraceptive Use in Ghana." *Journal of Health, Population and Nutrition* 21 (2): 150-157.

Ramstrom, K. C., A. E. Barón, L. A. Crane, and J. V. Shlay. 2002. "Predictors of Contraceptive Discontinuation in a Sexually Transmitted Disease Clinic Population." *Perspectives on Sexual and Reproductive Health* 34 (3): 146-153. https://doi.org/10.2307/3097713.

Sebayang, S. K., F. Efendi, and E. Astutik. 2017. *Women's Empowerment and the Use of Antenatal Care Services in Southeast Asian Countries*. DHS Working Paper No. 129. Rockville, Maryland, USA: ICF.

Simmons, R. G., J. N. Sanders, C. Geist, L. Gawron, K. Myers, and D. K. Turok. 2019. "Predictors of Contraceptive Switching and Discontinuation within the First 6 Months of Use among Highly Effective Reversible Contraceptive Initiative Salt Lake Study Participants." *American Journal of Obstetrics & Gynecology* 220 (4): 1-12. https://doi.org/10.1016/j.ajog.2018.12.022.

Singh, K. K., T. K. Roy, and B. P. Singh. 2010. "Contraceptive Discontinuation and Switching Patterns." *Genus* 66 (1): 63-88.

Statistics Indonesia, National Family Planning Coordinating Board, Ministry of Health, and ORC Macro. 2003. *Indonesia Demographic and Health Survey 2002-2003*. Jakarta, Indonesia: BPS.

Statistics Indonesia, National Family Planning Coordinating Board, Ministry of Health, and Macro International. 2008. *Indonesia Demographic and Health Survey 2007*. Jakarta, Indonesia: BPS.

Statistics Indonesia, National Population and Family Planning Board, Ministry of Health, and ICF International. 2013. *Indonesia Demographic and Health Survey 2012*. Jakarta, Indonesia: BPS.

United Nations Development Programme. 2014. *Human Development Report 2014: Sustaining Human Progress: Reducing Vulnerabilities and Building Resilience*. New York, USA: UNDP.

United Nations Development Programme. 2018. *Human Development Indices and Indicators 2018 Statistical Update*. New York, USA: UNDP.

Wang, W. and R. Hong. 2017. *Contraceptive Discontinuation, Failure, and Switching in Cambodia. Further Analysis of the 2014 Cambodia Demographic and Health Survey*. DHS Further Analysis Reports No. 105. Rockville, Maryland, USA: ICF.

Yamaguchi, K. 1991. *Event History Analysis*. Applied Social Research Method Series 28. London: SAGE Publications.