**Women's Hypertension in Indonesia:**

**The Role of Religion, Trust, and Community Involvement**

By



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Abstract

Hypertension, or high blood pressure, is the leading cause of death worldwide and is a key risk factor for cardiovascular disease. Approximately three quarters of individuals living with hypertension reside in low- and middle-income countries (LMICs). In Indonesia – one of the largest LMICs – women's hypertension rates exceed men's despite less engagement in risky health behaviors such as tobacco and alcohol consumption. In this dissertation, I explore the relationship between women's social factors and hypertension because women's social determinants of health are often overlooked in hypertension research. Specifically, I examine women's religious involvement, feelings of trust, safety, and reciprocity, and involvement in community groups as potential social factors associated with hypertension. Using data from Wave 5 of the Indonesian Family Life Survey (IFLS), I found religious differences in the likelihood of hypertension. Muslim women – and particularly Muslim women who pray daily but do not engage in salat prayer – had the highest likelihood of hypertension overall, while Hindu women – and particularly women who either participate in daily yoga/meditation or refrain from red meat consumption – had the lowest likelihood of hypertension. I also found that women needing to be alert in the community was associated with lower likelihoods of hypertension compared to women who did not report a need to be alert. Measures of both individual- and community-level thick and thin trust were associated uniquely with likelihoods of hypertension. Finally, I found that women largely did not vary in likelihoods of hypertension by participation in community programs, and there were no significant differences in the relationship between participation and hypertension for mothers and non-mothers.

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# Chapter 1
# Introduction

Globally, hypertension, or high blood pressure, is the leading cause of death worldwide (Lim et al., 2012) and is a key risk factor for cardiovascular disease. Hypertension accounts for two-thirds of strokes and half of cases of ischemic heart disease (Lawes et al., 2006) as well as 14 percent of deaths globally (Lawes, Vander Hoorn, & Rodgers, 2008). In 2008, approximately one billion people worldwide were estimated to be hypertensive with three quarters residing in low- and middle-income countries (LMICs) (Kearney et al., 2008; Mendis, Puska, & Norrving, 2011). Although awareness, treatment, and control of hypertension have starkly increased in high-income countries, awareness and treatment have only *slightly* increased in LMICs, and control of hypertension in LMICs has *decreased* (Mills et al., 2016).

Cardiovascular disease is largely preventable by changing health behaviors (WHO, 2017), and many public health interventions address health behaviors such as alcohol and tobacco consumption as key issues in reducing hypertension rates. However, in many parts of the world, hypertension rates remain high despite low alcohol consumption and tobacco use. For example, women in Indonesia have significantly higher rates of hypertension than men; 35.4 percent of Indonesian women over the age of 18 have hypertension compared to 31.0 percent of men (Peltzer & Pengpid, 2018), evidence of a larger trend that Southeast Asia is one of few world regions where women have higher risks of hypertension than men (Mills et al., 2016). Additionally, while many parts of the world have seen overall declines in mean blood pressure, Southeast Asia has seen increases in mean blood pressure for women (Zhou et al., 2017). This disparity in hypertensive rates is prominent given men's disproportionate participation in unhealthy behaviors relative to women. More than 95 percent of women abstain from both alcohol and tobacco use (DHS, 2012), meaning that other social determinants of health may

provide important mechanisms through which hypertension rates may be lowered for women in Indonesia.

In this dissertation, I examine the relationship between social factors and hypertension, as women's social interactions within their living environments are often overlooked in hypertension research. Specifically, I examine women's religious involvement, feelings of trust, safety, and reciprocity, and involvement in community groups as potential social factors associated with hypertension. Hierarchical social structures paired with discourses of femininity that pressure women to care for others (Kawachi & Berkman, 2001) reinforce women's societal role as supporter and nurturer and largely dictate the social spaces women can occupy – highlighting the importance of gender-specific analyses of social factors and their relationship with hypertension.

Women's social relationships may have physiological consequences that may result in differences in hypertension outcomes. Possessing large amounts of social capital may provide women with outlets for stress reduction, increased social support that can improve psychological well-being, and accountability for uptake of positive health behaviors (McNeill, Kreuter, & Subramanian, 2006). More social support is associated with blunted physiological responses to stressful situations including lower blood pressure reactivity, lower cortisol activity, and increased heart rate variability (Cosley, McCoy, Saslow, & Epel, 2010). Social capital's relationship with hypertension, then, may help explain differences in likelihoods of hypertension for women in Indonesia.

Following in this chapter, I outline Indonesia as a setting, provide an overview of the framework underpinning each substantive chapter, and outline the significance of this dissertation. In Chapter 2, I relate religious practices and beliefs and hypertension. In Chapter 3,

I examine the relationship between cognitive social capital and hypertension. In Chapter 4, I assess structural social capital's relationship with hypertension. Finally, in Chapter 5, I provide conclusions, limitations, and future directions for research.

## Indonesia: Setting

Indonesia is an archipelago nation located in Southeast Asia and is comprised of more than 17,500 islands (of which about 6,000 are inhabited), 300 different ethnicities, and 580 different languages and dialects, though only 13 languages have more than one million speakers (Indonesian Embassy, 2016). The study site for the Indonesian Family Life Survey encompasses 13 of 26 of Indonesia's provinces (Figure 1). Indonesia is the fourth most populated country in


**Figure 1**: Provinces surveyed in the IFLS: Four Sumatran provinces (North Sumatra, West Sumatra, South Sumatra, and Lampung), all five Javanese provinces (DKI Jakarta, West Java, Central Java, DI Yogyakarta, and East Java), and four provinces sampling the remaining major island groups (Bali, West Nusa Tenggara, South Kalimantan, and South Sulawesi) (Strauss, Witoelar, & Sikoki, 2016).

the world following China, India, and the United States with a population exceeding 260 million (World Bank, 2016). Approximately 58 percent of Indonesia's inhabitants reside on the Javanese cluster of islands (Indonesian Embassy, 2016). Sample characteristics for this dissertation are provided in Table 1, and correlation coefficients amongst key predictors are provided in Appendix D, Table 1.

**Table 1**: Sample characteristics and hypertensive status for individual-level predictors and controls (given in percentages)

| | Overall | Percentages of group with hypertension |
|---|---|---|
| *Predictors* | | |
| Muslim (overall) | 90.40 | 38.61 |
| Christian (overall) | 4.64 | 41.35 |
| Hindu (overall) | 4.95 | 28.84 |
| Purse trust (ref) | 66.69 | 37.54 |
| No purse trust | 33.31 | 39.66 |
| Village is safe (ref) | 94.42 | 38.63 |
| Village is unsafe | 5.58 | 32.09 |
| No need to be alert (ref) | 14.14 | 45.10 |
| Need to be alert | 85.86 | 37.14 |
| House trust (ref) | 75.04 | 40.03 |
| No house trust | 24.96 | 32.97 |
| Child trust (ref) | 59.36 | 39.76 |
| No child trust | 40.64 | 33.04 |
| Does not participate in community programs | 34.52 | 37.03 |
| Participates in at least one program | 65.49 | 40.89 |
| Mean total program participation (0-13) | 1.98 (1.33) | - |
| | | |
| *Controls* | | |
| Age | 41.16 (15.05) | - |
| Married (ref) | 74.55 | 36.80 |
| Unmarried (divorced, widowed, single, or separated) | 25.45 | 42.27 |
| Elementary or less education (ref) | 46.82 | 51.63 |
| Junior high or more education | 53.18 | 26.37 |
| Employed (ref) | 59.34 | 36.77 |
| Unemployed | 40.66 | 40.27 |
| Does not own home (ref) | 16.76 | 29.93 |
| Partial or full ownership of home | 83.24 | 39.86 |
| Does not own vehicle (ref) | 27.11 | 45.95 |
| Partial or full ownership of vehicle | 72.89 | 35.31 |
| Body Mass Index (BMI) | | |
| Underweight | 9.33 | 27.67 |
| Normal weight | 49.30 | 31.23 |
| Overweight | 29.32 | 45.85 |
| Obese | 12.05 | 56.18 |
| Meets physical activity guidelines (ref) | 53.98 | 37.00 |
| Does not meet physical activity guidelines | 46.02 | 39.59 |
| Below average healthcare satisfaction (ref) | 21.07 | 46.46 |
| Average or better healthcare | 78.93 | 35.98 |

| | | |
|---|---|---|
| Does not use diabetes medication (ref) | 98.71 | 37.69 |
| Uses diabetes medication | 1.29 | 76.42 |
| Does not use cholesterol medication (ref) | 98.71 | 37.77 |
| Uses cholesterol medication | 1.29 | 70.73 |
| Parents are alive or died of unrelated causes (ref) | 85.65 | 36.23 |
| At least one parent died from hypertension-related causes | 14.35 | 49.89 |
| Urban (ref) | 54.26 | 37.83 |
| Rural | 45.74 | 38.62 |
| Total | | 38.19 |
| N | 9,528 | |

Unweighted sample characteristics for non-pregnant women aged 18 and older
*Source* Indonesian Family Life Survey, Wave 5

Indonesia is located within the Pacific Ring of Fire, an area highly prone to tectonic plate shifts and related natural disasters. Indonesia was devastated by an earthquake and tsunami in 2004 that killed approximately 230 thousand people (outside of the study sites surveyed in the Indonesian Family Life Survey). Most recently two earthquakes and one tsunami devastated Indonesia in August and September 2018 with more than 2,500 people dying and nearly 20,000 people being displaced from their homes.

Indonesia has long played an important role in global trade with a rich trade history dating back to the 1500s when Indonesia was colonized by the Portuguese for its spices. Although the Portuguese were largely unsuccessful, the Dutch established the Dutch East India Company in 1602 and maintained rule in Indonesia until the 1940s. Following a brief interlude in which the Japanese ruled during World War II, Indonesia formally established independence in 1949. Since achieving independence, Indonesia has been ruled by two dictators, Sukarno followed by Suharto. Suharto came to power after Sukarno in 1968 following an army-led anti-communist purge in 1965 in which over 500,000 people were killed. Indonesia was among the hardest hit by the Asian Financial Crisis in the late 1990s, and amidst the crisis protests led to Suharto's resignation in 1998. Following Suharto's resignation Indonesia has increasingly

democratized and has continued to operate under secular governance, with the exception of Aceh province (not included in the study setting) which operates under Sharia law. Given its efforts to maintain secular law, Indonesia is seen as being progressive with women's rights relative to most other Muslim-majority countries (Pringle, 2010).

Even so, women are often engrained in social structures that reinforce a subordinate status relative to men. For example, women in Indonesia are entrenched in belief systems that reinforce patriarchal structures and prevent them from holding positions of power and leadership. Women are may also be subjected to systems of kinship and property including patrilineal inheritance, household structures in which women are expected to perform childrearing and housework, and marriage practices such as polygyny. Laws reinforced in the 1990s promoted women's domestication and framed women as appendages to their husbands (Suryakusuma, 1996), a sentiment that is still engrained in Indonesia today. Despite a recent overhaul of the policies that were previously emphatically promoted in the 1990s, women still feel conflicted about their contested identities as mother and worker (Lindawati & Smark, 2010). Employed women overall focus their identities on being wives and mothers rather than on their status as workers (Ford & Parker, 2008), despite approximately 50 percent of Indonesian women participating in the labor force. Most women who are employed belong to the informal economy, and an additional large share of women works as unpaid household laborers.

Motherhood is promoted by the state as an integral element of womanhood, termed by many as *ibuism* (with *ibu* meaning mother) (Bennett, 2012). Women report that motherhood is an opportunity to confirm their destiny as women (Afiyanti & Solberg, 2015). Paired with a high value placed on religious devoutness and a dominant statewide Islamic ideology, the cultural

values that place women at the center of the home and family are inextricably intertwined with religion in Indonesia (Wiryomartono, 2014) regardless of the religion in which women belong.

### *Religion in Indonesia*

The Indonesian Constitution declares that all Indonesians must report membership in one of six monotheistic religions, and citizens are guaranteed freedom to practice any of these religions (Gudorf, 2012). Pancasila Law, the five-pillar system of governance in Indonesia, legally recognizes Islam, Hinduism, Catholicism, Protestantism, Buddhism, and Confucianism (An-Na-Im, 2008). Since the country's inception in the 1940s, citizens must claim one of these religions in order to acquire legal documents, obtain state-administered identification, and travel outside of the country (Seo, 2012). State-mandated religious education permeates primary school through college; children in Indonesia have two to three hours of compulsory religious classes each week (Smith-Hefner, 2007).

Approximately 87 percent of Indonesians identify as Muslim (Indonesian Census, 2010). Nearly ten percent of the population identifies as Christian (Protestant Christians and Catholics comprise seven percent and three percent, respectively), and approximately two percent identify as Hindu. Many of the minority religions are clustered geographically; for example, over 90 percent of Indonesian Hindus live on Bali, and large groups of Protestant Christians live in the provinces of Papua, West Papua, and North Sulawesi. Ninety three percent of Indonesians report that religion is very important to their lives (Pew, 2018), highlighting the importance of understanding religion's relationship with health outcomes.

Although social capital – a core focus of Chapters 3 and 4 – plays an important role in explaining differences in hypertension by religious affiliation and behaviors, I also explore the explanatory power of other elements of religious behavior including community surveillance,

physical activity associated with religious rituals, and differences in leisure time and financial freedom as a possible byproduct of being engrained in the tourist industry. I focus on women specifically because women on average are more religious than men and are situated within different social spaces in their religious communities (McFarland, 2009). For example, while men's practice of Islam is often centered around gathering at mosque, women's experience of religion is typically more community-focused (Adeney, 2003). Despite a diversity of religious beliefs and practices in Indonesia, Islam is inextricably linked to Indonesian women's experiences, including women who are not Muslim, particularly because Muslim women's groups are often centers for political activisim in the post-Suharto era and offer women platforms to address gender inequities in the public sphere (Rinaldo, 2008).

Past research that focuses on the relationship between religious affiliation and health neither discerns categories of minority religions nor focuses on gender-specific analyses of religion. In response to past research focusing on a minority-majority comparison, in Chapter 2, I distinguish between women who belong to Islam, Christianity, and Hinduism. Maintaining religious categories is an important step in hypertension research because clustering religions as "majority" versus "minority" overlooks potentially important sociohistorical factors that may underpin religions' relationship with risks of hypertension. While Indonesia has a majority Muslim population, the religious diversity of each island is unique, meaning that an overall religious minority in Indonesia may be the religious majority in certain parts of the country.

Hindus and Christians may differ in their risks of hypertension relative to Muslims despite their shared minority status. Indonesian Christians report significantly more perceived discrimination relative to Muslims (Kanas, Scheepers, & Sterkens, 2015), and in recent years, Indonesian churches have been subject to increasing amounts of terrorism – important because

individuals who have more perceived discrimination have raised hypertension risks (e.g., Dolezsar, McGrath, Herzig, & Miller, 2014). Hinduism and Islam coexist relatively more peacefully compared to Christianity and Islam's relationship, evidenced by both Muslims' incorporation of Hindu traditions into traditional Indonesian cultural practices and Hindus' efforts to redesign their religion with a monotheistic god to abide by Pancasila law (Suprato, 2016).

In addition to religion's sociohistorical roots that inform Islam's relationship with minority religions, religion permeates women's daily lives through encouraging different religious behaviors, providing religious communities that offer social support and resources, and offering women a sense of purpose – all of which may have implications for women's likelihoods of hypertension. For example, Islamic salat prayer has a physical – and public – component that may improve participants' health. Salat prayer consists of five daily recitations (Henkel, 2005), and each prayer is accompanied by physical movements (Haeri, 2013). Visible, simultaneous, and compulsory participation in prayer may provide Muslims with increased opportunities to form social connections and may expose participants to community resources (Maselko, Hughes, & Cheney, 2011). Hindus also engage in religiously endorsed behaviors that may improve health outcomes, such as yoga and meditation practice (Nicholson, 2013), which may denote women who have more leisure time or financial freedom. Although Christian women also tend to be actively involved in community networks through fellowship, prayer, and services, data limitations prevent examinations of Christian women's religious behaviors.

### *Social Capital*

Building on past conceptualizations that divide social capital into cognitive and structural social capital, I explore the unique relationship each type of social capital has with women's

likelihoods of hypertension in Chapters 3 and 4. Social capital includes features of social organization, including feelings of trust, safety, and reciprocity as well as group participation, all of which have the potential to enable collective action (Kawachi, Kennedy, & Glass, 1999). In Indonesia, social capital is contextualized within a longstanding and countrywide sentiment to engage neighbors and provide aid if necessary.

Indonesia is unified within the context of *gotong royong*, translated roughly to mutual and reciprocal assistance (Bowen, 1986). Perpetuated by government leadership in the 1960s, gotong royong was initially rooted in efforts to encourage community-level neighborhood watch programs that would be implemented, performed, and decided upon *by* neighbors *for* neighbors (Mardiasmo & Barnes, 2015). It was used as a means of filling within-community gaps that could not be filled by government intervention due to limited federal resources. *Gotong* means "many people carrying something together," while *royong* signifies an image of the shade from a tree used as a gathering place for people before and after a shared activity (Mardiasmo & Barnes, 2015).

State construction of the domestic domain across the New Order era from 1966-1998 reiterated that ideal women are devoted to their husbands and children (Blackwood, 2008), a notion that has reinforced women's role in perpetuating gotong royong via strengthened relationships within communities. Women's connections with friends, family, and neighbors are placed within a strong countrywide tradition of community and familial social networks (Sujarwoto & Tampubolon, 2013) that rely heavily on women's willingness to serve as husbands' companions and as mothers (Suryakusuma, 1996).

Women spend disproportionate amounts of time in their residential environments (Eriksson & Emmelin, 2013), meaning that integration with neighbors may have particular

significance for health outcomes. Given the potential link between gotong royong and health, especially for women, I frame women's interactions with their neighbors and communities as features of cognitive social capital, comprised in part by trust and reciprocity between individuals. In Chapter 3, I evaluate the relationship between different forms of cognitive social capital including feelings of safety, reciprocity, and trust in the community and likelihoods of hypertension.

Building on the strength of women's interactions with their communities, I also examine the relationship between structural social capital and women's hypertensive status in Chapter 4. Structural social capital measures formalized participation in the community through community program involvement (Murayama, Fujiwara, & Kawachi, 2012). Planning, implementation, and evaluation of community programs is instrumental to Indonesia's development and relies heavily on local female volunteers (Beard, 2007). Women are overwhelmingly responsible for village community programs (Molyneux, 2002) and are unduly burdened by expectations to take on additional voluntary labor. Indeed, women's voluntary labor can become a substitute to government action to alleviate poverty (O'Neill & Gidengil, 2006).

Gender differences in community participation may have health consequences resulting from the physical toll taken from unequal distribution of voluntary participation (Landstedt, Almquist, Eriksson, & Hammarström, 2016) that leaves women to endure more community work. Although men are more involved in leisure and sporting activities, women tend to be more heavily involved in health, youth, and community-oriented programming. Regardless of women's status as mother or non-mother, expectations about the *type* of programs in which women participate emphasizes women's role in child and youth development (Hodgkin, 2008). Given these expectations for women's community involvement, I compare likelihoods of

hypertension for women who do and do not have children. I do so because women report a desire to fulfill their destiny as a woman by performing well in their role as mother, and often this involves being heavily involved in youth programs (Afiyanti & Solberg, 2015). In addition to the potential that mothers may feel overwhelmed by responsibilities in their homes and communities that may lead to differences in hypertension compared to non-mothers, childless women are often involved in the same programs alongside mothers and may be subject to stigma, social isolation, or mistreatment resulting from their childlessness.

## Significance

I make three contributions to the literature. *First*, most hypertension literature examines physical and behavioral risk factors for hypertension including BMI, physical activity, eating habits, and tobacco and alcohol consumption while neglecting sociodemographic determinants of hypertension. I broaden the scope of understanding of social determinants of hypertension by focusing on women's sociodemographic characteristics. Several studies in Indonesia have explored hypertensive rates (e.g., Christiani, Byles, Tavener, & Dugdale, 2016; Hussain, Mamun, Reid, & Huxley, 2016; Peltzer & Pengpid, 2018; Rahajang & Tuminah, 2011), though few examine sociodemographic characteristics such as religion or social capital as possible determinants of hypertension. In this study I attempt to bridge literature examining health outcomes in Indonesia by contributing both to the religion and social capital and the hypertensive literature.

*Second*, most research tying religion and social capital to health outcomes is focused in high-income countries. Exploring social determinants of hypertension in LMICs, and particularly Indonesia, provides insight into the roles of religion and social capital in a country with a rich history of community and familial ties (Geertz, 1961). In this setting, understanding the many

elements of social capital including social trust, community participation, and religious participation is important because they each may play important roles in determining health behaviors and hypertensive risks, especially so for women whose access to formal networks may be limited. Particularly for religion and health research, most research documents within-religion differences among Christians in high-income countries but neglects the role of membership in other religions (e.g., Buck et al., 2009; Fitchett & Powell, 2009). However, most Indonesians are religiously involved to some extent and may derive many social connections through their religious participation.

*Third*, my dissertation focuses on the unique experiences of women in their social capital and religious connections. Recent scholarship has called for gender-specific analyses of social capital, important because women are often wholly involved in different networks centered within their residential environments. In addition to contributing to this gender-specific research more broadly, I also extend current structural social capital research by examining the interaction between structural social capital and motherhood status in Chapter 4. Maternal social capital research often revolves around children's health impacts as a result of mothers' behaviors. By focusing on the role of social capital for both mothers and non-mothers, I better discern how the interaction between motherhood status and social capital may uniquely affect women's own health.

# Chapter 2
# Religion and Hypertension

Hypertension (elevated blood pressure) is strongly associated with stroke, organ failure, and coronary heart disease and accounts for 13 percent of deaths globally (WHO, 2016). Hypertension is not evenly distributed geographically; an estimated 75 percent of hypertensive individuals live in low-middle income countries (LMICs) (Kearney et al., 2008). In LMICs, where over 80 percent of residents acknowledge religion's importance to daily life (Pew, 2015), understanding the complexities of religious involvement and its relationship with blood pressure is critical to reducing hypertension-related deaths.

Regular participation in religious activities is connected to lower rates of hypertension (e.g., Bell, Bowie, & Thorpe, 2012; Gillum & Ingram, 2006; Koenig, McCullough, & Larson, 2001; Lawler & Younger, 2002). However, most research examining the religion-hypertension connection relies on data from Christian and Catholic respondents in high-income countries. Indonesia serves as an ideal setting to explore the religion-hypertension relationship as it is both the largest LMIC with a population exceeding 260 million (World Bank, 2016) and the largest Muslim-majority country in the world with 87 percent of its residents affiliating with Islam (Pew, 2015). Additionally, despite its secular governance, citizens are mandated by the Indonesian government to claim one of six religions (Islam, Hinduism, Christianity, Catholocism, Buddhism, and Confucianism) in order to acquire government documents such as licenses and passports (Gudorf, 2012).

In this chapter, I explore the relationship between religion and hypertension for women in Indonesia. I extend current literature that emphasizes religion's relationship with hypertension as a product of its status as either a minority or majority religion. I compare likelihoods of hypertension for Hindu, Christian, and Muslim women, and I separate Islam and Hinduism by

women's participation in religious activities: salat prayer for Muslim women and yoga/meditation as well as red meat consumption for Hindu women. In doing so, I better evaluate the relationship between religious behaviors and hypertension. Although I include Protestants/Catholics (henceforth referred to simply as Christians), there is no comparable physical practice for Christian women.

I focus on women specifically because women both tend to be more religious overall and occupy different social spaces within religious communities (McFarland, 2009). Although Indonesia is secularly governed and is progressive toward women's rights relative to most other Muslim-majority countries (Pringle, 2010), societal gender norms regularly perpetuate women's exclusion from key social networks (Adeney, 2003). Perpetuation of established gender hierarchies affects the ways in which women participate in religion (Gross, 1996; Muñoz, 1993). For example, weekly Mosque is male-dominated, and women are relegated to a side or back room (Adeney, 2003). Muslim women also cite their domestic responsibilities as challenges to the demands of completing daily prayer (Winn, 2012). Women belonging to minority religions also hold a subordinate status; Christian Indonesian women are largely viewed as fulfillers of God's will to bear and raise children (Adeney, 2003), and a comparative analysis of Muslim and Hindu women in India suggests that both groups are subject to similar treatment in the private domain including limited household decision-making, gender segregation within households, and discrimination against daughters (Desai & Temsah, 2014).

I found significant differences in the likelihood of measured hypertension across religions. Muslim women – and particularly Muslim women who pray daily but do not engage in salat prayer – had the highest likelihood of hypertension overall, while Hindu women – and

particularly those women who either participate in daily yoga/meditation or refrain from red meat consumption – had the lowest likelihood of hypertension.

## Background

Research from developing contexts suggests hypertension risks vary by religious beliefs. Most existing research in LMICs either separates religions by whether they belong to the majority or a minority religion or aggregates all religions that are neither Hindu nor Muslim as "other." Current religion-hypertension research is inconclusive as to who is at the highest risk of having hypertension. On one hand, evidence from rural India suggests that individuals belonging to minority religions have higher risks of hypertension compared to Hindus (e.g., Banerjee, Mukherjee, & Basu, 2016; Jindal, Jindal, & Dass, 2016). In an analysis of women in India, non-Hindu women were found to have higher hypertension risks than Hindu women, significantly so for religious women belonging to the "other" category comprised of Buddhists, Sikhs, Jains, and Christians (e.g., Anand & Singh, 2017; Moser, Agrawal, Smith, & Ebrahim, 2014). On the other hand, research also finds that those belonging to a *minority* religion have lower risks of hypertension. For example, in India Kanungo et al. (2016) found that Hindu participants had significantly higher likelihoods of hypertension relative to Muslims. In Bangladesh, a Muslim-majority country, non-Muslims had a 22 percent lower likelihood of hypertension compared to Muslims, which was hypothesized to result from dietary differences (Al Nahian et al., 2018).

Nuance surrounding religions' relationship with hypertension may be lost by clustering minority religions; none of the aforementioned research includes Christianity as its own religious category. However, Christianity is the second largest religion in Indonesia after Islam, and its unique history and social position in contrast with Hinduism may have meaningful implications for health outcomes. Indonesian Christians report significantly higher levels of perceived

discrimination relative to Muslims (Kanas, Scheepers, & Sterkens, 2015), and some argue that many policies implemented through the state's management of religion (e.g., requiring intra-religion marriages, restricting construction of houses of worship, and limiting which religions are considered legitimate (Seo, 2012)) are discriminatory measures against Christians (e.g., Jones, 2005). In recent years, Indonesian churches have been subject to increasing amounts of terrorism perpetrated by radicalized Islamists, with the most recent attack on three churches occurring in May 2018. Many scholars characterize a discordance between Islam and Christianity grounded in a race for religious, economic, and political expansion in Southeast Asia that has spanned hundreds of years (e.g., Schrieke, 1955). One source of this dissonance stems from Christianity's evangelical leanings: All three major threads of Indonesia's Christianity encourage evangelism and conversion (Hoon, 2013), which may explain why Indonesian Muslims perceive their religion to be threatened by Christians (Kanas, Scheepers, & Sterkens, 2015) and have responded to impending competition for converts by preaching (Azra, 2008; Hefner, 1993).

Individuals who have higher levels of perceived discrimination (e.g., Dolezsar et al., 2014) and those who are stigmatized (e.g., Link & Phelan, 2006) have increased hypertension risks. Perceived or objective social exclusion, stigma, and discrimination may be more overt for Christian women and may translate to worse cardiovascular health. In contrast, Hinduism and Islam coexist peacefully despite Hinduism's similar minority status to Christianity (Suprato, 2016). The rich, longstanding history of Hinduism in Indonesia dates to the sixth century and has heavily influenced Indonesian culture (Pringle, 2010). Indonesian Hindus established mores, customs, and myths that persist in today's Indonesian culture. Muslim-majority villages across Indonesia celebrate Hindu holidays, and markets sell Hindu-inspired batiks (Adeney, 2003). To adhere to the federal mandate to follow a monotheistic religion, many Indonesian Hindus have

integrated their beliefs and practices with indigenous and Muslim teachings to reflect a monotheistic form of Hinduism (McDaniel, 2010). Additionally, Hinduism and Islam both have religiously endorsed behaviors that are explicitly physical and may have added health advantages when compared to Christian women.

Belonging to a religion that encourages positive behaviors may confer health advantages to worshippers, particularly because physical activity and dietary patterns are two health-compromising behaviors that are particularly difficult to overcome (Schwarzer, 2008). Little research examines religious differences in hypertensive status through the lenses of health lifestyles and health behavior promotion (Cockerham, 2005). However, the teachings, beliefs, and values of a religious group directly influence health outcomes (Ha, Salama, Gwavuya, & Kanjala, 2014), and religions may promote health behaviors that can influence hypertension likelihoods. Adherence to behaviors promoted through religion is deeply grounded in fulfilling God's wishes and consequently is a powerful tool to encourage believers' actions. Qualitative research assessing health behaviors for Indonesian Muslims showed that religious beliefs and support, including feelings derived from fulfilling an obligation to God as well as drawing support from God, are essential components that shape behaviors (Mizutani, Tashiro, Sugiarto, Yulaikhah, & Carbun, 2015).

Islamic salat prayer has a physical – and public – component that may encourage better cardiovascular health. Salat, the call to pray five times per day (Henkel, 2005), is integral to relinquishing life to a higher authority (Winchester, 2008) and consistently reminds individuals of their relationship with a divine figure (Harvey & Silverman, 2007). There are five daily recitations: at dawn, noon, afternoon, evening, and night. Each prayer has a series of accompanying physical movements (standing, prostrating, kneeling, sitting) in the direction of

Mecca (Haeri, 2013). Salat movements can improve physical fitness (e.g., Ibrahim, Sian, Shanggar, & Razack, 2013; Reza, Urakami, & Mano, 2001; Alabdulwahab, Kachanathu, & Oluseye, 2013), psychological well-being (e.g., Doufesh, Faisal, Lim, & Ibrahim, 2012), cognitive functioning (e.g., Bai, Ye, Zhu, & Zhang, 2012), and cardiac blood flow (e.g., Doufesh, Ibrahim, Ismail, & Ahmad, 2013), all of which may reduce hypertensive risks. Additionally, participation in salat burns approximately 340 calories per day (Athgar, 1993). Individuals who engage in salat also must be adept at self-regulation, time management, and compliance (Doufesh et al., 2013; McCullough & Willoughby, 2009) which may provide discipline that translates into healthier decision-making.

Visible, simultaneous, and compulsory participation in salat prayer may reduce hypertension likelihoods for Muslims (Koenig, et al., 2001). Religious activities provide spaces where individuals can interact with others who hold comparable social and political values (Ellison & Levin, 1998), and Muslim individuals may have increased opportunities to form social connections. In Indonesia, increased community cohesion decreases risks of poor health (e.g., Saint Onge, Jansen, & Ice, 2018). Religious communities are often homogenous in ways that neighborhood or community ties may not be and may be a potentially powerful source of both tangible and intangible community resources (Maselko, Hughes, & Cheney, 2011).

During the call to prayer, which plays aloud on speakers in urban areas, Muslims are expected to stop their activities to complete prayer cycles. The call to prayer fosters an inclusive environment for those Indonesians who participate; participation facilitates inclusion in a religious structure (Oxoby, 2009) and solidifies community inclusiveness that could lead to lower hypertensive risks (e.g., Koenig et al., 2001). For example, Al-Kandari (2003) found that more devout Kuwaiti Muslims have lower blood pressure. Muslims are expected to participate in

all prayers and movements with few exceptions (Bowen, 1989), offering an additional mechanism for behavioral reinforcement imposed by fellow Muslims. Social sanctions reinforce publicly enacted behaviors (Byron et al., 2016), and individuals who refrain from salat defy normative social behavior and are excluded from social benefits associated with participating. Individuals who choose not to engage in salat may not only cede physical and mental health benefits, but they may also experience social sanctions including stigmatization or exclusion that negatively affect blood pressure.

Hindus also engage in religiously endorsed behaviors that may improve health outcomes. Many Hindus regularly engage in yoga and meditation practice (Nicholson, 2013), which is associated with lower risks of hypertension (e.g., Khobragade, Khobragade, & bin Lutfi Abbas, 2016; Wachholtz & Pargament, 2005). In addition to yoga's physical activity-associated benefits, yoga practice itself may serve as a proxy for other factors that provide protective advantages, such as having more leisure time. For example, women who are financially advantaged may have more time for yoga practice, as time and costs associated with yoga practice have been shown to be barriers to participation for women in the US (Atkinson & Permuth-Levine, 2009). Research from neighboring Vietnam also shows that women who are reported to be rich or average income have lower prevalence of hypertension than women who are poor (Van Minh, Bypass, Chuc, & Wall, 2006). Most of Indonesia's Hindu population is concentrated on Bali, a highly profitable tourist hub of Indonesia. Proximity and participation in Bali's tourist trade may provide access to resources such as money, knowledge, and social connections that can help women to avoid health risks and adopt protective strategies (Link & Phelan, 2000; Phelan, Link, & Tehranifar, 2010). When compared to women of other religions, Hindu women, and particularly those who can afford to engage in regular yoga and meditation practice, may have lower hypertension risks.

Yet, Hindu women may also be exposed to potential negative ramifications of the tourist industry including pollution, disruption to local cultures, and devaluation of women's communities (Shaw & Williams, 1994).

Additionally, many Hindus are vegetarians or refrain from consuming red meat (Eliasi & Dwyer, 2002). Red meat consumption is associated with higher risks of hypertension (Pan et al., 2012; Tzoulaki et al., 2008), and religious individuals who maintain vegetarian diets have lower blood pressures than their meat-eating counterparts (Rouse, Armstrong, & Beilin, 1982). Red meat has higher concentrations of cholesterol and saturated fats, both shown to increase risks of hypertension in Indonesian adults (Kamso, Rumawas, Lukito, & Purwantyastuti, 2007). As with regular yoga and meditation practice, women who have more wealth may be more likely to refrain from consuming red meat. Although most Hindus on Bali belong to lower castes, women belonging to higher castes specifically are forbidden from touching or consuming beef products (Covarrubias, 1937/2015). Additionally, like Muslims who fulfill their daily prayer call, Hindus with restricted diets and/or daily yoga and meditation practice may be skilled at time management and self-control, both of which may facilitate healthy choices.

## Hypotheses

Aligned with previous research, I examine the relationship between belonging to a majority religion (Islam) and minority religion (Christianity or Hinduism) and hypertension (Hypotheses 1a and 1b). I do not hypothesize which group will have lower likelihoods, again aligned with past conflicting research as to who is less likely to be hypertensive:

> *Hypothesis 1a: Belonging to the majority religion may be related to lower likelihoods of hypertension.*
>
> *Hypothesis 1b: Belonging to a minority religion may be related to lower likelihoods of hypertension.*

Second, I disaggregate minority religions into Hinduism and Christianity to compare their likelihoods of hypertension with Islam's relationship with hypertension:

> *Hypothesis 2: Muslims and Hindus will have lower likelihoods of hypertension relative to Christians.*

Both Muslims and Hindus engage in physically demanding religious behaviors – salat and yoga, respectively – that encourage affiliated women to engage in physical activity. Christians, however, do not have a comparable physical religious behavior that may confer health benefits. Additionally, Hinduism and Islam coexist while animosity between the Muslim majority and Christian minority may leave Christians discriminated against, stigmatized, and stressed, all of which may translate to poorer health.

Finally, I further disaggregate Muslims and Hindus by their respective health behaviors in order to better establish whether specific religious behaviors may confer health benefits:

> *Hypothesis 3: Muslim women who pray more will have lower likelihoods of hypertension than Muslim women who do not pray or pray infrequently .*

> *Hypothesis 4a: Hindu women who engage in yoga/meditation will have lower likelihoods of hypertension than all other religious groups.*

> *Hypothesis 4b: Hindu women who refrain from red meat consumption will have lower likelihoods of hypertension than all other religious groups.*

In addition to the inherent health benefits accrued through regular yoga and meditation as well as through refraining from eating red meat, Hindus who are able to regularly engage in these health behaviors may also be of higher caste or social status as well as have more leisure time, both of which may confer health benefits.

## Data and Method

### *Data*

The data came from Wave 5 of the Indonesian Family Life Survey (IFLS5), a survey collected in 2014-2015 in 13 of Indonesia's 26 provinces. The IFLS5 interviewed nearly 31,000 adults and represents 83 percent of Indonesia's population (Strauss, Witoelar, & Sikoki, 2016). The data for my analysis came from individual-level surveys as well as community-level data collected from interviews with local community leaders. Starting with a sample of 30,872, I excluded respondents with missing community-level information (i.e., moved outside of the surveyed communities), reducing the sample to approximately 20,000. I also excluded individuals who are missing anthropometric data, are under the age of 18, or whose reported religion is not Muslim, Christian, or Hindu resulting in a sample size of 17,852. Limiting the sample to women resulted in 9,923 women. Finally, I removed 325 women who reported being pregnant at the time of data collection, as pregnant women may experience pregnancy-related changes in blood pressure (James & Nelson-Piercy, 2004). Removing women who had incomplete data for the variables in the final models resulted in a sample size of 9,528 women nested in 285 communities. Although citizens can affiliate with six different religions, Buddhists and Confucianists combined comprise less than one percent of the population (UN, 2018) and an even smaller proportion of the sample measured in this chapter. I excluded women belonging to these religions from my analysis.

### *Method*

The outcome was a dichotomous measure of hypertensive status (reference=not hypertensive). In the IFLS5, regular interviewers took three blood pressure (BP) measurements on alternating arms. Hypertensive status is defined by having either (1) a mean systolic BP

(amount of artery pressure during heart muscle contraction) above the threshold, (2) a mean diastolic BP (amount of artery pressure when the heart is between beats) above the threshold, or (3) self-reported current use of prescribed hypertension medication. I used at-home BP thresholds; at-home measurement lowers the hypertension threshold from 140/90 mm Hg to 135/85 mm Hg (Joint National Commission, 2003; Parati, 2008). At-home measurements improve the accuracy of BP readings due to the absence of the "white coat effect," that is, having a higher BP during a doctor's visit (Fuchs, de Mello, & Fuchs, 2013) and better predict organ damage (Chobanian et al., 2003), cardiovascular events (Niiranen, Hanninen, Johansson, Reunanen, & Jula, 2010), and hypertension (Pickering et al., 2008; Stergiou & Bliziotis, 2011; Ward, Takahashi, Stevens, & Heneghan, 2012). For individuals who did not have their BP measurements taken three times (less than 1 percent of the sample), I controlled for being measured three times (reference) versus being measured once or twice.

I included several measures of religious affiliation. First, I compared those belonging to the majority religion (reference) to those in minority religions. I also subdivided minority religions into Christian and Hindu compared to Muslims (reference). To evaluate the role of prayer on Muslim women's health, I included an additional religion variable for which I disaggregated Muslim respondents by daily prayers and compared them to Christian and Hindu individuals: I compare Muslim women who pray 5 times daily (salat prayer, reference) to Muslim women who do not pray or pray infrequently, Muslim women who pray 1-4 times daily, Muslim women who pray 6 or more times daily, Christian, and Hindu. To explore within-Hindu differences in hypertensive rates, I separated Hindu women first by whether they participate in daily yoga or meditation as well as by whether they "observe a certain diet for spiritual reasons." I compared Hindu women who do and do not observe a particular diet (defined as those who are

vegetarian, pescatarian, or those who do not eat red meat or beef) to Muslim (reference) and Christian respondents. Individual-level religious affiliation also had a corresponding contextual-level effect. Contextual-level religious affiliation was measured as the proportion of individuals in each community belonging to each of the three religions. This variable was constructed using data from both men and women to better account for community religious composition. These effects represent a 10 percent increase in the proportion of respondents in a community who are Christian relative to other religions and who are Hindu relative to other religions.

I included several sociodemographic and health characteristics as controls. Age was continuous and was zeroed at the sample's minimum age of 18 because older age is associated with higher odds of being hypertensive (Bateman et al., 2012). I also included age-squared as a covariate to account for the possibility that there is selection bias as to which women survive into older age. Marital status may affect hypertensive risks (Basu & Millett, 2013), and to control for this possibility I included a binary marital status variable to compare those who are married (reference) to those who are not yet married, separated or divorced, and widowed. Lower educational attainment is associated with hypertension risks (Abdul-Razak et al., 2016). I included a binary measure for educational attainment, comparing respondents with elementary school or less education (reference) to those who have junior high or more education. Additionally, I included employment status (0=employed, 1=unemployed) due to a demonstrated relationship between employment status and hypertension (Khan et al., 2013; Rose et al., 1999). I also included two measures of household assets given because having fewer household assets is associated with higher risks of hypertension (Khan et al., 2013). First, I accounted for whether women or other members of their household have partial or full ownership of their home compared to women who do not own a home (reference). Second, I controlled for whether a

respondent reported that she or someone else in her household having partial or full ownership of a vehicle (reference = no car ownership), which in addition to serving as a measure of assets also served as a proxy for whether a woman can access transportation.

I controlled for several health-related measures. Given a strong link between obesity and hypertension (Kayima et al., 2015), I constructed a categorical body mass index (BMI) variable calculated using the formula: weight(in kg)/(height(in m)$^2$). Per CDC guidelines, those whose BMI fell below 18.5 were categorized as "underweight" (reference), BMIs between 18.5 and 24.99 were "normal weight", BMIs between 25 and 29.99 were "overweight", and BMIs of 30 or greater were "obese". As lack of regular physical activity predicts hypertension (Dietz, Douglas, & Brownson, 2016), I included a binary variable for whether the respondent met guidelines for adequate physical activity, defined as participating in at least 25 minutes of vigorous activity 3 days a week or 30 or more minutes of moderate activity 5 days a week (AHA, 2018). Women were instructed only to include activities in their calculations that lasted at least 10 consecutive minutes. Respondents who did not meet these cutoffs were categorized as "physically inactive" (reference), while those who met the cutoffs were categorized as "physically active."

Research shows an inverse relationship between healthcare satisfaction and hypertension (Harris, Luft, Rudy, & Tierney, 1995). I included a categorical measure of self-reported healthcare satisfaction. Those with below average healthcare (reference) were compared to women who have average or above average healthcare. Diabetes and high cholesterol strongly predict hypertension (Halperin et al., 2006; Sowers, Epstein, & Frohlich, 2001). I included separate measures for whether a respondent reported use of diabetes or cholesterol medication. Women who did not report using medication (reference) were compared to women who reported using medication. To control for familial predispositions to hypertension, I included a

dichotomous variable for whether the respondent had one or both parents die of hypertension-related causes (heart attack, heart problems, stroke, kidney disease, or co-morbidities including one of these causes). Those women whose parents are alive or have died of unrelated causes were coded as "0"; individuals who have had one or both parents die of hypertension-related causes were coded as "1".

I included several community-level measures. First, I included a measure of whether the respondent's community is urban (reference) or rural. I also included contextual-level effects for all level-1 predictors. Binary and categorical measures represented a 10 percent increase in the proportion of respondents in a community who belonged to the comparison group relative to the reference group. Contextual-level continuous measures represented the mean for the community. As with the variables for the contextual-level effects of religion, these measures were calculated using the total available sample of men and women from each community (N=17,852). The exponentiated coefficients for contextual-level effects are not reported in the tables although they were included in the models. Results of contextual-level effects can be seen in Appendix A.

At the exploratory stage, I tested various alternative specifications of the dependent variable and the analytic sample, but the results were largely unaffected across the different specifications. For example, I replaced home-based BP with an office-based BP threshold (140/90mm Hg). I also re-categorized individuals who have controlled hypertension (e.g., those who take hypertensive medication but are not hypertensive according to their BP readings) as "not hypertensive." I estimated models using robust as well as clustered variance-covariance matrices, neither of which affected the coefficients significantly. I controlled for past and current tobacco use given some sources reporting that smoking tobacco is a risk factor for hypertension (WHO, 2016). However, less than 3 percent of the survey sample reports regular tobacco use, in

line with the broader women's prevalence of tobacco use in the country (DHS, 2012). I excluded individuals who did not have their blood pressure readings taken three times. These individuals comprised about 1 percent of the sample, and their exclusion did not significantly affect results. Finally, out of concern for the possibility that women who moved out of a survey community may be healthier than those who did not move, I estimated models predicting hypertensive status by whether respondents were excluded because they moved outside of a surveyed community. Having moved out of a surveyed community did not predict hypertensive status.

All the models were estimated as multilevel logistic regressions using Stata Statistical Software 14 (StataCorp 2015). Respondents were nested within their community of residence at the time of Wave 5 data collection. I examined tetrachoric, polychoric, or Pearson correlations among individual- and contextual-level predictors across the variables to guide the elimination of redundant covariates. I also examined bivariate correlations between hypertensive status and the covariates.

Missing data were removed through listwise deletion, and missing cases were checked to ensure that the missing data were ignorable. Through this process, I removed a community-level control of the number of health posts within the community. Two communities had missing data for their health posts, and their exclusion via listwise deletion would reduce the sample by approximately 70 women. Exclusion of these women from the models violated the missing completely at random (MCAR) assumption, as evidenced by Little's MCAR test (mcartest in Stata), which tests whether significant differences are present between the means of missing-value patterns (Li, 2013) ($\chi^2$ distance(20)=206.65, $p<0.001$). By removing health posts as a predictor and reinstating the women in the models, the MCAR test was no longer violated ($\chi^2$ distance(12)=19.33, $p>0.05$).

I acknowledge four limitations. First, it is impossible to assess causality between the predictor and outcome. However, unlike most health outcomes, hypertension is largely asymptomatic (WHO, 2016), and most hypertensive individuals in LMICs are unaware of their hypertensive status (Hussain, Mamun, Reid, & Huxley, 2016). There is no reason to suspect that hypertensive status would guide an individual's religious affiliation or that this selection would differ by religions. Furthermore, hypertensive status should not affect Muslims' prayer engagement; Muslim individuals are expected to adapt their daily prayer to accommodate physical limitations. Second, BP measurements were a mean of three measurements taken on a single day. A more accurate BP screening would occur over several days or weeks. However, there is no reason to believe that more accurate BP readings would be reflected differently for respondents belonging to different religions. Third, although individuals self-report religious affiliation, all Indonesians are required to declare a religion. A simple measure of religious affiliation does not consider an individual's devotion or whether he or she declares a religion but otherwise does not practice; the survey also does not provide an option for respondents to report being nonreligious or atheist. However, 93 percent of Indonesians state that religion is "very important" to daily life (Pew, 2015), providing at least some evidence that respondents are engaged to an extent in their reported religion. In the IFLS, individuals are asked about their level of religiosity, and two percent report that they are not religious. Including a measure of whether respondents are "very religious," "somewhat religious," "rather religious," or "not religious" does not affect model results. Finally, my measure of hypertension was binary and relied on systolic and diastolic blood pressures. Future research may benefit from accounting for differences in isolated systolic hypertension and isolated diastolic hypertension by estimating each as a separate continuous measure.

## Results

Table 1 presents the distribution of respondents who are hypertensive by religious affiliation. Overall, 38 percent of women were hypertensive and approximately 9.4 percent of the variance across likelihoods of hypertension was accounted for by the community in which women lived (95% CI: 0.06-0.14). Approximately 90 percent of the sample was Muslim, and 5 percent each were Hindu and Christian. Relative to Muslims, Christians had higher percentages of hypertension (41 percent) and Hindus had lower percentages of hypertension (29 percent) compared to 39 percent of Muslims. A $X^2$ test of independence indicated a significant difference in hypertension likelihoods for majority and minority religions ($X^2=2.21$, $p<0.05$). After disaggregating religious minorities into Christians and Hindus, there was a nonsignificant difference in hypertension likelihoods between Christians and Muslims ($X^2=1.16$, $p=0.247$) and a statistically significant difference in hypertension likelihoods between Hindus and Muslims ($X^2=4.27$, $p<0.001$) and Hindus and Christians ($X^2=4.01$, $p<0.001$).

**Table 1**: Religious sample characteristics (given in percentages)

| | Overall | Percentages of group with hypertension |
|---|---|---|
| Muslim (overall) | 90.40 | 38.61 |
| Prays infrequently or does not pray | 3.72 | 31.99 |
| Prays 1-4 times daily | 14.53 | 29.86 |
| Prays 5 times daily | 62.79 | 38.59 |
| Prays 6+ times daily | 18.85 | 46.63 |
| Christian (overall) | 4.64 | 41.35 |
| Hindu (overall) | 4.95 | 28.84 |
| Daily yoga/meditation | 2.53 | 23.05 |
| No red meat consumption | 1.20 | 26.09 |
| Total | | 38.19 |
| N | 9,528 | |

Unweighted sample characteristics for non-pregnant women aged 18 and older
*Source* Indonesian Family Life Survey, Wave 5

Within Islam, the largest proportion of women reported engaging in prayer 5 times per day (62.79 percent). A minority of Muslim women reported praying infrequently or not praying at all (3.72 percent). The number of reported prayers per day ranged from 0 to 15 (not shown) with 97 percent of Muslim women praying 10 or fewer times per day. Approximately half of Hindu women reported engaging in daily yoga/meditation, while nearly 25 percent of Hindu women reported refraining from red meat consumption.

Table 2 provides the multivariable results. Results are reported as odds ratios; odds ratios above one indicate an increase in the likelihood of hypertensive status, and odds ratios below one indicate a decrease. Individual-level religious affiliation was tested as a random slope for minority versus majority religions, but did not improve model fit relative to a fixed effects model ($X^2(1)=0.21$, $p=0.64$) and was not included in the models. In Model 1, I tested Hypotheses 1a and 1b; that is, whether there is a significant difference in hypertension likelihoods between minority and majority religions. The results showed that women who are *not* in the majority religion, compared to those in the majority, had a 35 percent lower likelihood of being hypertensive, all else equal. This finding lends support to Hypothesis 1b: Women belonging to minority religions were less likely to have hypertension than women in the majority religion.

**Table 2**: Multilevel binomial logistic regression models of hypertension on religion (odds ratios; standard errors given in parentheses)

| | Model 1 | Model 2 | Model 3 | Model 4 | Model 5 |
|---|---|---|---|---|---|
| *Predictors* | | | | | |
| Muslim (ref) | | | | | |
| Not Muslim | 0.65 (0.12) * | | | | |
| Christian | | 0.70 (0.13) * | | | |
| Hindu | | 0.42 (0.11) * | | | |
| Muslim, prays 5 times daily (ref) | | | | | |
| Muslim, does not pray or prays infrequently | | | 1.22 (0.18) | | |
| Muslim, prays 1-4 times daily | | | 1.19 (0.10) * | | |

| | | | | | |
|---|---|---|---|---|---|
| Muslim, prays 6+ times daily | | | 0.97 (0.07) | | |
| Christian | | | 0.72 (0.14) † | | |
| Hindu | | | 0.44 (0.12) ** | | |
| Muslim (ref) | | | | | |
| Christian | | | | 0.70 (0.13) * | 0.70 (0.13) † |
| Hindu, no daily yoga/meditation | | | | 0.52 (0.15) * | |
| Hindu, daily yoga/meditation | | | | 0.33 (0.10) *** | |
| Hindu, consumes red meat | | | | | 0.47 (0.13) ** |
| Hindu, does not consume red meat | | | | | 0.32 (0.11) ** |
| *Controls* | | | | | |
| Age (zeroed at 18) | 1.07 (0.01) *** | 1.07 (0.01) *** | 1.08 (0.01) *** | 1.07 (0.01) *** | 1.07 (0.01) *** |
| Age squared | 1.00 (0.00) | 1.00 (0.00) | 1.00 (0.00) | 1.00 (0.00) | 1.00 (0.00) |
| Not married (ref=married) | 1.02 (0.07) | 1.02 (0.07) | 1.03 (0.07) | 1.03 (0.07) | 1.02 (0.07) |
| Junior high or more education (ref=elementary or less) | 0.79 (0.05) *** | 0.80 (0.05) *** | 0.80 (0.05) *** | 0.80 (0.05) *** | 0.79 (0.05) *** |
| Employed (ref=unemployed) | 0.80 (0.04) *** | 0.80 (0.04) *** | 0.80 (0.04) *** | 0.80 (0.04) *** | 0.80 (0.04) *** |
| Partial or full ownership of home (ref=does not own home) | 1.08 (0.08) | 1.09 (0.08) | 1.10 (0.08) | 1.08 (0.08) | 1.09 (0.08) |
| Partial or full ownership of car (ref=no car) | 0.90 (0.06) | 0.90 (0.05) | 0.90 (0.06) | 0.90 (0.06) | 0.90 (0.06) |
| BMI (ref=underweight) | | | | | |
| Normal weight | 1.76 (0.18) *** | 1.75 (0.18) *** | 1.76 (0.18) *** | 1.75 (0.18) *** | 1.75 (0.18) *** |
| Overweight | 3.35 (0.36) *** | 3.33 (0.36) *** | 3.37 (0.36) *** | 3.34 (0.36) *** | 3.34 (0.36) *** |
| Obese | 6.02 (0.74) *** | 6.00 (0.73) *** | 6.06 (0.74) *** | 6.00 (0.73) *** | 6.00 (0.73) *** |
| Physically active (ref=not physically active) | 1.01 (0.05) | 1.01 (0.05) | 1.02 (0.05) | 1.01 (0.05) | 1.01 (0.05) |
| Average or above average healthcare (ref=below average healthcare) | 0.94 (0.06) | 0.94 (0.06) | 0.95 (0.06) | 0.95 (0.06) | 0.95 (0.06) |
| Blood pressure measured once or twice (ref=three times) | 0.86 (0.17) | 0.86 (0.17) | 0.86 (0.17) | 0.86 (0.17) | 0.86 (0.17) |
| Diabetes medication (ref=no medication) | 2.39 (0.56) *** | 2.39 (0.56) *** | 2.39 (0.56) *** | 2.40 (0.56) *** | 2.39 (0.56) *** |
| Cholesterol medication (ref=no medication) | 1.60 (0.37) * | 1.59 (0.36) * | 1.59 (0.36) * | 1.58 (0.36) * | 1.59 (0.36) * |
| One or both parents died of HBP-related causes (ref=no parents died of HBP-related causes) | 1.33 (0.09) *** | 1.32 (0.09) *** | 1.34 (0.09) *** | 1.33 (0.09) *** | 1.33 (0.09) *** |
| Rural community (ref=urban) | 1.10 (0.09) | 1.09 (0.09) | 1.08 (0.09) | 1.09 (0.09) | 1.09 (0.09) |
| Fixed effect intercept | 0.07 (0.06) | 0.10 (0.09) | 0.10 (0.09) | 0.10 (0.09) | 0.10 (0.09) |

| | | | | | |
|---|---|---|---|---|---|
| $\sigma^2$ estimate | 0.07 (0.02) | 0.07 (0.02) | 0.07 (0.02) | 0.07 (0.02) | 0.07 (0.02) |
| N | 9,528 | 9,528 | 9,518 | 9,528 | 9,528 |

All models control for contextual-level effects that correspond with individual-level predictors. Results of contextual-level effects are given in Appendix A.
*Source* Indonesian Family Life Survey, Wave 5
Significance levels: †p≤0.10; *p≤0.05; **p≤0.01; ***p≤0.001

Disaggregating the minority religion into Christians and Hindus significantly improved model fit ($X^2(1)=4.68$, $p<0.05$). Both minority groups had significantly lower likelihoods of hypertension than Muslim women, although the difference was starker for Hindu women (OR=0.70, $p<0.05$ and OR=0.43, $p<0.05$, respectively). Pairwise comparisons of Christian and Hindu women showed that Hindu women also had significantly lower likelihoods of hypertension compared to Christian women (OR=0.61, $p<0.05$). This finding lends some support to Hypothesis 2; although I initially hypothesized that both Muslim and Hindu women would have lower likelihoods of hypertension than Christian women, Muslim women had higher likelihoods of hypertension than Christian women while Hindu women had lower likelihoods of hypertension than Christians.

In Model 3, I examined whether Muslim women who reported praying more have a lower likelihood of being hypertensive compared to Muslim women who do not pray or pray infrequently (Hypothesis 3). Model 3 did not significantly improve model fit relative to Model 2 ($X^2(3)=6.36$, $p=0.100$). I found that although the results of the model were statistically nonsignificant, the likelihood of being hypertensive gradually declined for women who pray more. Interestingly, this pattern was reversed in Table 1's unadjusted values, as well as in a model with daily prayer as the only predictor. Including age in the model was responsible for this reversal, suggesting that after controlling for age, prayer was associated with increasingly lower likelihoods of hypertension.

Pairwise comparisons from Model 3 for all categories of prayer as well as Christians and Hindus are provided in Table 3. Notably, post hoc analysis showed that women who engage in salat prayer (5 prayers daily) or who pray 6 or more times per day had significantly lower likelihoods of hypertension compared to women who pray 1-4 times daily (OR=0.84, $p<0.05$ and OR=0.81, $p<0.05$, respectively), although this difference was not significant when compared to women who do not pray or pray infrequently. This finding lends some support to Hypothesis 3.

**Table 3:** Pairwise comparisons for religion predictor on hypertension in Table 2, Model 3 (predicted probabilities; standard errors in parentheses)

| *Predictor* | |
|---|---|
| 1-4 prayers daily vs does not pray/prays infrequently | −0.02 (0.16) |
| 5 prayers daily vs does not pray/prays infrequently | −0.19 (0.15) |
| 5 prayers daily vs 1-4 prayers daily | −0.17 (0.08) * |
| 6+ prayers daily vs does not pray/prays infrequently | −0.24 (0.16) |
| 6+ prayers daily vs 1-4 prayers daily | −0.21 (0.10) * |
| 6+ prayers daily vs 5 prayers daily | −0.04 (0.07) |
| Christian vs does not pray/prays infrequently | −0.53 (0.23) * |
| Christian vs 1-4 prayers daily | −0.51 (0.20) ** |
| Christian vs 5 prayers daily | −0.33 (0.19) † |
| Christian vs 6+ prayers daily | −0.29 (0.20) |
| Hindu vs does not pray/prays infrequently | −0.99 (0.30) *** |
| Hindu vs 1-4 prayers daily | −0.99 (0.28) *** |
| Hindu vs 5 prayers daily | −0.82 (0.27) ** |
| Hindu vs 6+ prayers daily | −0.78 (0.28) ** |
| Hindu vs Christian | −0.48 (0.23) * |

Significance levels: †p≤0.10; *p≤0.05; **p≤0.01; ***p≤0.001

Christian women had significantly lower likelihoods of hypertension compared to Muslim women who engage in fewer than 5 prayers per day, but this relationship was approaching statistical significance and statistically nonsignificant, respectively, for Christian women compared to Muslim women who pray 5 (OR=0.72, p=0.083) and 6 or more times per day (OR=0.75, p=0.141). This finding indicates that there was no difference in likelihoods of hypertension for Christian women when compared to Muslim women who pray at least five

times per day. Hindu women, however, had significantly lower likelihoods of hypertension compared to Muslim women regardless of daily prayer habits.

In Models 4 and 5, I divided Hindu women by their daily yoga/meditation participation and their red meat consumption. Neither Model 4 nor Model 5 statistically significantly improved model fit relative to Model 2 ($X^2(1)=3.21$, $p=0.073$ and $X^2(1)=1.17$, $p=0.280$, respectively). Compared to Muslim women, both Hindu women who do and do not engage in daily yoga/meditation had significantly lower likelihoods of hypertension. This difference was starker for women who participate in daily yoga/meditation, lending support to Hypothesis 4a. Pairwise comparisons indicated a lower likelihood of hypertension for Hindu women who participate in daily yoga/meditation compared to Hindu women who do not, although this difference was approaching statistical significance (OR=0.64, p=0.075; not shown).

Model 5 lends support to Hypothesis 4b; Hindu women who do not consume red meat had lower likelihoods of hypertension than all other religious groups. However, this difference was statistically nonsignificant when compared to Hindu women who do eat red meat (OR=0.73, p=0.283; not shown). In supplementary analyses, I estimated an additional model comparing Hindu women who both engage in daily yoga/meditation *and* refrain from red meat consumption. This model provided additional evidence that both yoga/meditation and refraining from eating red meat were related to lower likelihoods of hypertension; however, cell sizes were greatly reduced for Hindu women (not shown).

I note several controls that were significant across models. Age significantly increased the likelihood of being hypertensive; a one-year increase in age resulted in a 7 percent higher likelihood of being hypertensive across the models. Additionally, women who have more education and who are employed both had approximately 20 percent lower likelihoods of being

hypertensive compared to women who have elementary school or less education or who are unemployed, respectively. Increasingly higher BMI was also significantly associated with a higher likelihood of being hypertensive, as was reported cholesterol or diabetes medication use and having one or both parents die of hypertension-related causes.

## Discussion and Conclusion

My study offers unique insight into the relationship between religious affiliation and behaviors and likelihoods of hypertension. Prior research on religious affiliation and hypertension, however limited, typically relied on a distinction between minority and majority religions without exploring possible between-religion differences that contribute to these differences. Aligned with past research, I found significant differences in likelihoods of hypertension for women belonging to the majority and minority religions. However, I also found significant between-religion differences in likelihoods of hypertension after disaggregating women by religious affiliation and religious behaviors. To capture the complexities of religious identity and its potential differences in predicting hypertensive status, I disaggregated minority religions into Hindus and Christians as well as disaggregated Muslims by prayer behavior and Hindus by yoga and red meat consumption habits. The results showed that women belonging to minority religious groups in Indonesia have lower likelihoods of hypertension compared to Muslim women and is most pronounced for Hindu women. This difference was most evident when comparing Hindu women to Muslim women who do not pray or pray infrequently. For Muslim women who reported praying daily, those who pray at least 5 times per day had significantly lower likelihoods of hypertension than Muslim women who pray a reported 1-4 times per day. Finally, Hindu women who reported engaging in daily yoga or meditation or

refraining from red meat consumption had particularly lower likelihoods of hypertension when compared with other groups.

My finding that Christian and Hindu women had lower likelihoods of hypertension than Muslims could be explained partially by differences in micro-interactions experienced by women of different religions. Although evidence suggests that women of all three religions occupy subordinate spaces that favor men's needs over women's (e.g., Adeney, 2003; Desai & Temsah, 2014; Winn, 2012), Islam is broadly practiced across Indonesia, and social norms that perpetuate the lower status of women within the religion may be more prominent or more strictly upheld. In the process of democratizing in the early 2000s, a resurgence of traditional Islamic ideals (van Bruinessen, 2013) has called for Indonesian Muslims to embrace traditional views of gender and to defend morality through intensified state regulation (Rinaldo, 2013).

An increase in Islamic observance and piety is diffusing through society, particularly among those who are more educated and socioeconomically advantaged (Schwarz, 2018). Many point to a recent influx of Indonesian Muslim women participating in veiling as evidence of a shift toward conservatism. Paradoxically, however, Muslim women are simultaneously gaining increased access to the public sphere. State-sanctioned gender ideologies promote the viewpoint that women's "natural" role is as mother and caretaker of the household domain (Tickamyer & Kusujiarti, 2012) and conflict with women's increasing visibility in the public domain. With Muslim women's growing public visibility throughout Indonesia, Muslim women may be subject to increasingly unwanted criticism, judgment, and mistreatment, which could translate to worse health outcomes.

This explanation is further evidenced by separating Muslim women by prayer habits. Doing so showed that (1) Muslim women who reported praying at least 5 times daily had

significantly lower likelihoods of hypertension when compared to Muslim women who reported praying daily but did not engage in salat and (2) Muslim women who reported praying at least 5 times daily did not differ in their likelihoods of hypertension when compared to Christian women. Muslim women who fall short of engagement in salat prayer may be particularly susceptible to the negative ramifications associated with increased visibility in the public sphere. Salat prayer is a highly visible act of religiosity, and devout Muslims are expected to stop all activities when the call to prayer happens (Bowen, 1989). Women who pray at least 5 times per day may benefit from solidified community inclusiveness and inclusion in a religious structure (Koenig et al., 2001; Oxoby, 2009), but women who do not pray the expected number of times may experience criticism or judgment, which, again, may negatively impact their health.

The action of salat prayer itself may also confer some health advantages, as salat prayer is a highly physical, spiritual practice that improves cardiac blood flow, burns calories, and encourages physical movement (e.g., Ibrahim, Sian, Shanggar, & Razack, 2013). My findings showed that Muslim women who pray more have lower likelihoods of hypertension compared to Muslim women who pray less. This finding is contrasted with some research suggesting that individuals may pray more as a response to worse health (e.g., McCaffrey, Eisenberg, Legedza, Davis, & Phillips, 2004). In supplementary models, I included prayer as a continuous measure to evaluate possible quadratic effects of prayer (not shown). In these models, increasing amounts of daily prayer were significantly associated with decreased likelihoods of hypertension with a turning point far beyond the upper limits of the total number of daily prayers within the sample. This finding provides additional support that the physical benefits of salat prayer may play a role in differences in hypertensive status for Muslim women who engage in varying amounts of daily prayer. Additionally, salat prayer requires strong time management skills as well as self-control

(e.g., Doufesh et al., 2013). An additional possible explanation for the relationship between prayer and hypertension is that higher likelihoods of hypertension associated with less prayer do not result from the prayer itself but rather are a product of decreased time management or self-control skills.

In terms of health behaviors conferring benefits to women, both Hindu women who engage in daily yoga or meditation and women who refrain from red meat consumption experienced lower likelihoods of hypertension relative to other religious groups. Although these models cannot determine causality, this finding provides some evidence that daily yoga or meditation as well as limiting red meat consumption may reduce hypertension risks. However, Hindu women who do and do not participate in the health behavior did not vary significantly in their hypertensive rates; engagement in the health behavior merely widened the gap between Hindu women and Christian and Muslim women. Engagement in these health behaviors cannot fully account for the decreased likelihoods of hypertension seen in the Hindu women in the sample.

Physical activity's limited explanatory power is also evidenced by additional models in which I disaggregated Muslim women by reported prayer and compared them to Hindu women separated by yoga/meditation habits (not shown). In these models, Hindu women who both do and do not report participation in daily yoga/meditation had lower likelihoods of hypertension than Muslim women of every prayer category. However, if salat prayer's physical attributes were largely responsible for associated lower hypertension likelihoods, Muslim and Hindu women engaged in physically rigorous health behaviors would have similar hypertensive risks. In order to better understand the health benefits of prayer, future research should address Hindu prayer in Indonesia. In recent years, Indonesian Hindus have started to incorporate a twice daily call to

prayer that is played over loudspeakers in many villages and are reminiscent of Islam's call to prayer (McDaniel, 2017). Future research may incorporate questions specifically for Hindu women regarding their participation in the daily call to prayer. Comparing Hindu and Muslim women who engage in daily prayer may further highlight similarities and differences in hypertension likelihoods based on prayer practices.

Hindu women's concentration on Bali, the tourist hub of Indonesia, may confer health advantages that promote better cardiovascular health, providing one possible explanation for my finding that Hindu women consistently had lower likelihoods of hypertension across all models. For example, women who rely on a tourist industry may have a more predictable income pattern that provides women with increased financial stability and potentially decreased stress and better health. However, supplementary models indicated that hypertension advantages held by Hindu women persisted even after controlling for subjective measures of economic status (not shown). Future research should probe women living in highly trafficked tourist areas of Indonesia to better parse the role financial stability may play on Hindu women's lives compared to women from other religious backgrounds as well as to better understand the potential negative ramifications of tourism (e.g., Shaw & Williams, 1994) on women's health. Finally, regular engagement with an international and broad-based group of tourists may expose Hindu women to an amalgam of health behaviors, ideas, or resources that may be less accessible to more remote Indonesian women.

Although I initially hypothesized that Christian women would have the highest likelihoods of hypertension compared to Muslim and Hindu women, Christian women were located squarely between the two groups. Despite hostility toward Christianity as well as an uptick in threats and perpetrations of violence against Christians overall, Christian women may

not experience these broader instances of aggression within the micro-interactions of their daily lives and may not have resultant poorer health outcomes. In comparison to Hindu women, Christian women do not have comparable religious behaviors that reinforce healthier decision-making, and Christian women do not have the same breadth of access to financial and social resources afforded to Hindu women living on Bali. Future research should qualitatively examine the daily experiences of women of the different religions to better understand the role discrimination, microaggressions, and public pressure to behave in a specific manner may play for women's health outcomes.

Indonesia's backdrop for a study of the relationship between religion and hypertension poses unique challenges because its approximately 17,500 islands are ethnically, religiously, and linguistically heterogeneous. There is broad diversity in the extent to which policies are guided by religious doctrine across the country. Although at a country level Islam is the majority religion, different communities may be dominated by individuals from other religions. In exploratory analyses I included cross-level interactions with each community's religious composition by the individual-level reported religion of women in the sample (not shown). These analyses do not point to significant variations in hypertension rates for women living in communities with variations in their religious composition, again providing additional evidence that the relationship between religion and hypertension should not be viewed within a static majority-minority framework.

Finally, although determining causality between religious affiliation/behavior and hypertension is impossible to determine, hypertension is asymptomatic in most adults and likely does not determine religious participation. Most Indonesians belong to their religion from birth and have their values reinforced through state-compulsory religious education throughout

childhood (McDaniel, 2017). Future research should focus on the role of religion and religious behaviors across the life course to more fully illuminate religion's relationship with hypertensive status.

# Chapter 3
# Social Trust and Hypertension

Globally, hypertension (high blood pressure), is a leading risk factor for cardiovascular disease (CVD) and accounts for two-thirds of strokes and half of cases of ischemic heart disease (IHD) (Lawes et al., 2006). CVD is the leading cause of death for women globally (WHO, 2018), attributed in part to a later onset compared to men, an underestimation of the risks of heart disease in women, and under-recognition of symptoms of cardiovascular events (Maas & Appelman, 2010). Hypertension disproportionately affects residents of low-middle-income countries (LMICs) (Mendis, Puska, & Norrving, 2011). In Indonesia, one of the largest LMICs with 260 million residents, approximately 35 percent of adults are hypertensive (Peltzer & Pengpid, 2018) with gender disparities in hypertension widening as Indonesians age (52 percent of women over age 40 compared to 43 percent of men (Hussain et al., 2016)). In LMICs, where women's access to formalized networks may be limited, examining the relationship between social trust, reciprocity, and safety in women's residential environments and their likelihoods of having hypertension is an important step in establishing potential mechanisms through which hypertension rates may be lowered.

A key principle of Indonesian society, gotong royong (roughly translated to mutual and reciprocal assistance), encourages social trust by implying both a responsibility to support others within the community as well as an unspoken understanding that favors will be returned (Bowen, 1986). Trust and reciprocity, two components of cognitive social capital, are crucial to gotong royong. Trust and reciprocity operate at both the individual and community levels (Murayama et al., 2012; Musalia, 2016; Zarychta, 2015) and may be related to health. Having a network of trusted neighbors may reduce stress, provide accountability for uptake of positive health

behaviors, offer resources for coping, and provide both material and immaterial support (McNeill, Kreuter, & Subramanian, 2006).

Social trust may provide mechanisms to offset gender disparities in resource-challenged LMICs such as Indonesia. Societal gender norms regularly perpetuate women's exclusion from key social networks (Adeney, 2003), highlighting a need to better understand social trust's role as a component of social capital that may affect women's health. By focusing on multiple dimensions of social trust (*thick* and *thin*), I examine how trust may be uniquely associated with women's hypertensive risks.

Focusing on the relationship between social trust and hypertension is an important next step in understanding social capital's relationship with women's health in Indonesia. Women who have chronic illnesses vary significantly in subjective measures of health (i.e., self-rated health) by reported social capital (Waverijn, Heijmans, & Groenewegen, 2017), marking the importance of using a more objective health outcome measure. In this chapter, I extend current research that focuses on subjective and self-reported measures of health by examining social capital's relationship with measured blood pressure. While past research relating mothers' social trust and health in Indonesia suggests that thick and thin trust benefit women's self-rated health differently at the individual and community levels (Saint Onge, Jansen, & Ice, 2018), objective measures of health such as hypertensive status are often excluded from analyses. This is particularly important because two thirds of Indonesians are unaware of their hypertensive status (Hussain et al., 2016).

Using data from Wave 5 of the Indonesian Family Life Survey (IFLS), I found that women who report a need to be alert or risk being taken advantage of had lower likelihoods of hypertension compared to women who did not report a need to be alert (*individual-level thin*

*trust)*. I also found that living in a community with less reported community-level thin trust was associated with decreased likelihoods of hypertension. Finally, I found that lacking individual-level thick trust (trust in neighbors to watch children) was also associated with decreased likelihoods of hypertension compared to women who had child trust. I situate these findings within a broader literature suggesting that the relationship between cognitive social capital and women's health may be complex and context-dependent.

## Background

Social capital, in general, entails the use of social ties for productive action (e.g., Bourdieu, 1977; Coleman, 1988; Portes, 1998). Social capital can facilitate collective problem solving, enforce health-promoting norms, and encourage mutually beneficial social ties (Kawachi & Berkman, 2000), in addition to increasing access to health promoting material resources. Social capital has been conceptualized as both an individual-level resource garnered from personal connections (Bourdieu, 1984) as well as a community-level resource that depends partially on trust and reciprocity to build and reinforce social cohesion (Coleman, 1988; Kawachi & Berkman, 2000; Putnam, 2000). Social capital is often subdivided into structural or cognitive social capital: Structural social capital is defined by participation in social groups or activities, while cognitive social capital's components include perceived trust and reciprocity (Agampodi, Agampodi, Glozier, & Siribaddana, 2015).

In disadvantaged, inegalitarian contexts such as Indonesia, increased cognitive social capital, and more specifically trust and reciprocity, may have important implications for cardiovascular health because women may be less involved in formalized social networks through employment, religious meetings, or advanced education (Landstedt et al., 2016; Quetulio-Navarra, Znidarsic, & Niehof, 2017). For example, polygynous marriage practices,

patrilineal inheritance and kinship systems, household structures and roles in which women by default perform childrearing and housework, and belief systems that reinforce patriarchal structures and prevent women from holding positions of power and leadership all contribute to women's omission from key social networks. Relatively few women engage in formalized employment, and weekly Mosque is male-dominated (Adeney, 2003). Although nearly 90 percent of Indonesia's population identifies as Muslim, religious norms and doctrines further limit women's access to formal religious networks. These structures, in addition to discourses of femininity that pressure women to care for others (Kawachi & Berkman, 2001), limit women's participation in non-domestic social networks (e.g., Schaner & Das, 2016; Wieringa, 2015).

The strength and type of interactions women have with friends, family, and neighbors (O'neill & Gidengil, 2006) are contextualized within Indonesia's rich tradition of engrained community and familial social networks (Sujarwoto & Tampubolon, 2013; Beard, 2007; Miller, Scheffler, Lam, Rosenberg, & Rupp, 2006; Geertz, 1961; Jay, 1969). Reinforced notions of women's social roles in Indonesia emphasize the importance of caregiving and domestic work that result in women spending most of their time in their residential environments (Eriksson & Emmelin, 2013). Although trust and reciprocity have largely been examined as determinants of improved health (e.g., Musalia, 2016), recent research has explored the potential negative ramifications of being ingrained in trusting and reciprocal relationships (e.g., Landstedt et al., 2016). Expectations to fulfill requests made by friends and family can offer sources of stress that may harm women's health (Neff & Karney, 2005). For example, women may feel burdened by requests or commitments from friends and family (Portes, 2014). Women being overloaded by demands by friends and family paired with heightened responsiveness to those needs (e.g., van Kleef et al., 2008) may more noticeably result in negative health consequences for women (e.g.,

Eriksson & Emmelin, 2013).

Two possible mechanisms may explain the negative physiological effects of burdensome reciprocity with friends and family. First, women who are over-involved in reciprocal ties or who have increased negative social interactions may be more likely to engage in harmful coping behaviors such as tobacco use, alcohol consumption, physical inactivity, or unhealthy dietary decisions (e.g., Cohen, 2004). However, in the Indonesian context, dependence on tobacco or alcohol as coping mechanisms is unlikely given that over 95 percent of women abstain from substance use (DHS, 2012). Second, women who feel burdened by others' requests may have increased psychological distress including depressed mood (Ingram et al., 1999) and decreased psychological well-being (Rook, 1998), both of which have been connected to increased risks of hypertension through physical dysregulation (e.g., Rutledge & Hogan, 2002). For women who are on the other side of the reciprocal transaction (i.e., women seeking favors from others), disappointment in friends and family who cannot meet expectations for trust and reciprocity have also been hypothesized to be related to increased risks of hypertension for women (Sneed & Cohen, 2014).

Women may instead benefit from increased social trust and reciprocity. In Columbia, higher levels of interpersonal trust and reciprocity were consistently associated with better self-rated health while participation in community groups had mixed effects on health (Hurtado, Kawachi, & Sudarsky, 2011). Karhina, Ng, Ghazinour, and Eriksson (2016) found that women in Ukraine and Sweden with low amounts of social trust had higher likelihoods of poor self-rated health. Similarly, in Kenya, increased amounts of trust consistently benefitted health (Musalia, 2016). A relationship may also exist between acute negative social interactions and both short- and long-term alterations in blood pressure; for example, Sneed and Cohen (2014) found that

negative social interactions were associated with higher risks of hypertension for older US women over a 4-year follow up. Possible mechanisms through which large amounts of trust and reciprocity may be associated with better health include stress reduction, improvements to psychological well-being, accountability for uptake of positive health behaviors, resources for coping, and both material and immaterial support (McNeill, Kreuter, & Subramanian, 2006).

Beyond its individual benefits, trust and reciprocity can potentially provide advantages to individuals who are surrounded by a trusting and highly linked community; social capital's benefits are experienced by all individuals within the social structure – not only those who have invested in it (Coleman, 1988). Trust is integral to neighborhood- and community-level networks, and distrust is associated with decreased social cohesion (e.g., Ross, 2011). For example, research from rural Honduras showed that high-trusting individuals living in high-trusting environments more readily seek assistance in times of need than low-trusting individuals in low-trusting environments (Zarychta, 2015). Women in England residing in low-trusting neighborhoods also experienced worse health than women living in high-trusting neighborhoods (Stafford et al., 2005). In a study of adults' blood pressure in rural Japan, living in a community with a larger proportion of respondents who believe others will take advantage of them resulted in modest but significantly higher systolic blood pressures for individuals in that community (Hamano et al., 2011).

Most research connecting social capital and health does not discriminate between thick and thin trust (Abbott & Freeth, 2008; Wang, Schlesinger, Wang, & Hsiao, 2009). In a review of 14 studies linking social capital to chronic diseases, mortality, and cardiovascular events, Choi et al. (2014) found limited evidence for effects of most social capital dimensions on chronic health outcomes; however, Choi et al. reported that ambiguity in social capital measurements and

incomparability of studies made it difficult to draw conclusions, and none of the studies included in the review distinguished between thick and thin trust. *Thick* trust, or particularized trust (Uslaner, 2002), is found in intensely cohesive relationships formed through recurring experiences (Putnam, 2000) and involves both personal familiarity between two individuals and a strong commitment to the relationship (Khodyakov, 2007). Having thick trust could indicate previous positive experiences with trusting someone, longitudinal social interactions, mutual network ties that can reaffirm an individual's reputation, or similar group membership (e.g., Delhey & Newton, 2005). Women could gain thick trust, for example, by socializing and building relationships with neighbors.

Conversely, *thin* trust, or generalized trust (Uslaner, 2002), is trust between acquaintances or strangers. Thin trust generally arises when a community has shared moral values that set behavioral expectations (Fukuyama, 1995). Thin trust relies on weak ties (Granovetter, 1973) and functions on an assumption of reciprocity as well as an assumption that individuals will comply with certain behavioral expectations (Khodyakov, 2007). Thin trust may foster connectedness to the community because "it extends the radius of trust beyond the roster of people whom [one] can know personally" (Putnam, 2000, p. 136) and expands individuals' access to information and ideas beyond their immediate social connections (Granovetter, 1983).

Whereas thick trust may encourage women to cultivate enduring and mutually beneficial relationships, thin trust may facilitate women's feelings of safety, security, and decreased anxiety in their community more broadly, and both types of trust may reinforce or be interrelated with one another. In the US context, Ahern and Hendryx (2005) predicted self-reported hypertension status and found that individuals who reported having social support (i.e., individual-level thick trust) had lower likelihoods of self-reported hypertension. Riumallo-Herl, Kawachi, and

Avendano (2014) found that neither individual-level thin trust (measured by whether the respondent thought trusting others was safe) nor individual-level thick trust was associated with increased likelihood of hypertension for women in Chile. Alternatively, research from Albania showed that having increased perceived neighborhood safety was associated with decreased likelihoods of both uncontrolled hypertension and undiagnosed hypertension (Pirkle, Ylli, Burazeri, & Sentell, 2018).

In the Indonesian context, Saint Onge, Jansen, and Ice (2018) found that at the individual level, thin trust benefited mothers' self-rated health while individual-level thick trust nonsignificantly affected likelihoods of poor self-rated health. Specifically, they found that perceptions of community safety (thin trust) and living in a community with more women who trusted neighbors to watch children (thick trust) were consistently related to better health. However, there are unsettled debates regarding the relationship between thick and thin trust and health outcomes in Indonesia. Regarding trust's relationship with hypertension, Cao and Rammohan (2016) used a sub-sample of the Indonesian Family Life Survey and found that individual-level thin trust did not affect the likelihood of self-reported hypertensive status for adults aged 50 and older. However, Cao and Rammohan reported a hypertension prevalence of 23 percent – significantly underestimating recent estimates that up to 50 percent of Indonesians over the age of 40 have hypertension (Hussain et al., 2016). I expand on this study by broadening the included measures of trust and adopting a calculated measure of blood pressure based on objective readings rather than self-reported hypertensive status.

## Hypotheses

The first aim of this study is to determine how social trust may be related to women's hypertensive status in Indonesia, net of individual and community factors. Specifically, I am

interested in discerning between thick and thin trust to better assess how different forms of trust are related to hypertension. Regarding thin trust, I hypothesize that:

> *Hypothesis 1: Women who lack individual-level thin trust will have increased likelihoods of hypertension compared to women who have individual-level thin trust.*
>
> *Hypothesis 2: Women who have less community-level thick trust will have increased likelihoods of hypertension compared to women who have more community-level thin trust.*

Although ample research suggests that increased feelings of social support are related to better health, the potential relationship between thick trust – one element of feeling socially supported – and health outcomes is less clear. Juxtaposing research suggesting that social relationships may be burdensome for women who are overcommitted to helping those around them with research suggesting that reciprocity in trusting relationships improves women's health by making them feel less stressed and more supported, I do not hypothesize a direction:

> *Hypothesis 3a: Women who lack individual-level thick trust will have increased likelihoods of hypertension compared to women who have individual-level thick trust.*
>
> *Hypothesis 3b: Women who lack individual-level thick trust will have decreased likelihoods of hypertension compared to women who have individual-level thick trust.*
>
> *Hypothesis 4a: Women who lack community-level thick trust will have increased likelihoods of hypertension compared to women who have community-level thick trust.*
>
> *Hypothesis 4b: Women who lack community-level thick trust will have decreased likelihoods of hypertension compared to women who have community-level thick trust.*

## Data and Method

### *Data*

The data for analysis came from the fifth wave of the Indonesian Family Life Survey (IFLS5), collected in 2014-2015. The IFLS5 is representative of 83 percent of Indonesia's population and was collected in 13 of Indonesia's 26 provinces (Strauss, Witoelar, & Sikoki, 2016). The survey collects information at the individual and household levels as well as from

community leaders and social service providers. This analysis includes both individual- and community-level data. Starting with 30,872 respondents, I excluded respondents who are missing community-level information (i.e., moved outside of the surveyed communities), reducing the sample to approximately 20,000. I also excluded individuals who did not have their blood pressure (BP) taken or are under the age of 18, resulting in a sample reduction to 17,852. Pregnancy-related changes in BP may affect BP readings, so I also excluded 325 pregnant women from the sample (James & Nelson-Piercy, 2004). After limiting the sample to women and excluding women who had missing information, the resulting final sample size was 9,528.

***Method***

Outcome: The outcome was a dichotomous measure of hypertensive status, calculated using mean systolic and diastolic blood pressure measurements and self-reported hypertension medication use. In the IFLS5, interviewers took blood pressure readings three times on alternating arms. I used these readings to assign hypertensive status (reference=not hypertensive); being hypertensive denotes having a mean systolic blood pressure (the amount of pressure in the arteries during heart muscle contraction) above the threshold, a mean diastolic blood pressure (the amount of pressure in the arteries when the heart is between beats) above the threshold, or self-reported use of hypertension medication.

I used "at-home" blood pressure thresholds, which lowers the hypertension threshold from 140/90 mm Hg (office-based) to 135/85 mm Hg (Joint National Commission, 2003). At-home measurements improve the accuracy of BP readings resulting from the absence of the "white coat effect," that is, having an increased blood pressure resulting from the stress or anxiety associated with a doctor's visit (Fuchs, de Mello, & Fuchs, 2013). At-home readings are also better predictors of organ damage (Chobanian et al., 2003), cardiovascular events (Niiranen,

Hanninen, Johansson, Reunanen, & Jula, 2010), and hypertension (Pickering et al., 2008; Stergiou & Bliziotis, 2011; Ward et al., 2012). For individuals in the sample who had 1 or 2 blood pressure readings taken but did not have their measurements taken the full three times (approximately 1 percent of the sample), I controlled for being measured three times (reference) versus being measured once or twice.

Predictors: I included three thin trust predictors. Respondents were told, "Say you lost a wallet or a purse that contained 200.000 rupiah (approximately USD $15) and your identity card. I'd like you to think about how likely it is that it will be returned with the money if it were found by someone else." My measure of *purse trust* measured the likelihood that the purse would be returned if it were found by someone who lives close by. Answers were coded dichotomously; I compared women who think it is likely their purse would be returned (reference) to women who think it is unlikely that their purse would be returned. Second, respondents were asked how safe they consider the village (*safety*). I compared those who say the village is safe (reference) to women who said the village is unsafe. Finally, I included a dichotomous measure of alertness based on whether women thought they must be alert or risk being taken advantage of by someone in their community (*alertness*). Women who did not think they need to be alert (reference) were compared to women who did think they need to be alert.

I also included two measures of thick trust. *House trust* denoted women's response to the statement, "I would be willing to ask my neighbors to look after my house if I have to leave for a few days." I compared women who trusted their neighbors to watch their house (reference) to women who did not trust their neighbors to watch their house. Second, respondents with children were asked if they would be willing to leave their children with neighbors for a few hours if they

had to go somewhere that children were not allowed (*child trust*). I compared women who trust their neighbors (reference) to women who did not trust their neighbors to watch their children.

I include positive values (i.e., *possessing* trust) as the reference group because strong sociohistorical forces in Indonesia encourage women to build ties within their communities, making *having* trust a more typical response, which I then compare to women who *do not have* trust. Each individual-level thick and thin trust measure also had a corresponding contextual-level effect. Contextual-level effects of trust were aggregated individual-level trust measures. Level-2 effects represented a 10 percent increase in the proportion of women in a community who lack trust.

Controls: I included several sociodemographic and health characteristics as controls. Older age is associated with increased risks of hypertension (e.g., Bateman et al., 2012). I included age both as a continuous predictor zeroed at the minimum age in the sample (18) and as age squared to address potential bias that older women in the sample have lived longer because they have better health. I also included marital status as a binary measure of married (reference) compared to unmarried because a link has been found between marital status and hypertension (e.g., Basu & Millett, 2013). I compared respondents with elementary school or less education (reference) to those with junior high or more education, given an established relationship between less educational attainment and hypertension (Abdul-Razak et al., 2016). Employment status has been associated with hypertension (Khan et al., 2013), so I included a dichotomous measure of employment status (0=employed, 1=unemployed). I also incorporated two separate measures of household assets, which have been shown to reduce risks of hypertension (Khan et al., 2013). I included a dichotomous measure of respondents who did or did not (reference) have partial or full ownership of their home. I also controlled for whether respondents had partial or full

ownership of a vehicle (reference = no car ownership). In addition to serving as a proxy for household assets, vehicle ownership also at least partially accounted for access to transportation and mobility.

In addition to sociodemographic characteristics, I accounted for multiple measures of health. I included a categorical measure for body mass index (BMI) given a strong, negative relationship between increased BMI and hypertension (Kayima et al., 2015). I calculated BMI using the formula: weight(in kg)/(height(in m)$^2$). I compared those whose BMI falls below 18.5 who are underweight (reference) to those whose BMIs fall between 18.5 and 24.99 (normal weight), BMIs between 25 and 29.99 (overweight), and BMIs of 30 or greater (obese). Lack of regular physical activity also predicts hypertension (Dietz, Douglas, & Brownson, 2016). Using American Heart Association (2016) guidelines, I constructed a binary variable for whether women in the sample met weekly guidelines for physical activity. Women who met physical activity guidelines (defined as self-reported participation in 25 or more minutes of vigorous activity 3 days a week or 30 or more minutes of moderate activity 5 days a week) were the reference group compared to women who did not meet physical activity thresholds.

I included a binary measure of self-reported healthcare satisfaction, which is inversely related to hypertensive status (Harris et al., 1995). I compared women who had below average healthcare (reference) to women who had average or better healthcare. Multiple comorbidities are associated with concurrent hypertension including diabetes and hyperlipidemia (high cholesterol) (Halperin et al., 2006, Sowers, Epstein, & Frohlich, 2001). Although biomarker data were unavailable for categorizing women based on blood glucose or cholesterol readings, I included separate measures for whether women reported use of diabetes or cholesterol medication (reference= no medication use). Family history of hypertension is related to increased

risks of hypertension due to both genetic and environmental factors (CDC, 2018). I included a binary variable for whether one or both parents died of hypertension-related causes (defined as cause of death reported as heart attack, heart problems, stroke, kidney disease, or co-morbidities including one of these causes). I compared women whose parents were alive or had died of unrelated causes (reference) to women who had one or both parents die of hypertension-related causes.

Finally, I included multiple community-level measures. I included a dichotomous measure of urban (reference) or rural. I also included community-level effects for all level-1 predictors. Nominal and dichotomous variables were calculated as proportions and represented a 10 percent increase in the proportion of respondents in a community who belong to the comparison group relative to the reference group. Continuous individual-level predictors were calculated as the mean for the community. Community-level controls were calculated using available data from both men and women from each community (N=17,852).

Models were estimated as multilevel logistic regressions using Stata Statistical Software 14 with respondents nested within their community of residence at the time of Wave 5 data collection (StataCorp, 2015). I examined tetrachoric, polychoric, or Pearson correlations among individual- and contextual-level predictors across the variables to eliminate redundant covariates. I also examined bivariate correlations between hypertensive status and the covariates. In estimating the models, I used likelihood ratio tests to test for significant improvement in model fit resulting from the addition of thick and thin trust predictors relative to a model that included controls only. To better understand whether various measures of thin trust related differently to likelihoods of hypertension, I examined three thin trust measures in subsequent models (Models 1-3). Following these models, I included all measures of thin trust together to assess the unique

contributions of each measure of thin trust (Model 4). In Models 5 and 6, I individually included both thick trust predictors at both the individual and community levels. Model 7 included both thick trust predictors at individual and community levels to understand how thick trust may be uniquely related to hypertensive status. Finally, in Model 8 I included all individual- and community-level thick and thin trust predictors to assess each social trust measure's relationship with hypertension.

Before arriving at the presented models, I examined multiple specifications of the outcome variable and analytic sample, and the results largely did not change. I replaced home-based blood pressure with an office-based blood pressure threshold of 140/90mm Hg (15 percent of women in the sample fit the criteria for home-based hypertension but not office-based hypertension). I also re-categorized women who have well-controlled hypertension via antihypertensive medication as not hypertensive. I included a measure of whether women have *ever* been told they have hypertension. However, self-reported hypertensive status may be unreliable. I included tobacco use as a control given research showing that smoking tobacco is a risk factor for hypertension (WHO, 2016). However, a lack of a relationship may be due to gender dynamics in Indonesia that dictate extremely limited tobacco consumption for women, and a small minority of women in the sample use tobacco Finally, I excluded individuals who did not have their blood pressure readings taken three times.

For each model, I examined whether random slopes for thick and thin trust with unstructured covariances significantly improve model fit relative to fixed effect models using likelihood ratio tests. Missing data were removed through listwise deletion, and missing cases were checked to ensure that the missing data were ignorable. Two communities were missing health post data, and excluding these communities reduced the sample by approximately 70

women and violated the MCAR assumption, as evidenced by Little's MCAR test (mcartest in Stata) ($\chi^2$ distance(20)=206.65, p<0.001). I removed health posts as a control and replaced the women, which revalidated the MCAR test ($\chi^2$ distance(12)=19.33, p>0.05).

## Results

Table 1 presents the distribution of respondents who are hypertensive across cognitive social capital predictors. Overall, 38 percent of women in the sample were hypertensive. Thin trust predictors were related to hypertensive status in the opposite direction than expected, except for purse trust (see Table 1). To examine whether controls may have been obscuring the effects of trust, I proceeded with regression models (results described below and in Table 2). Approximately 67 percent of respondents thought a purse would likely be returned by someone who lives nearby. Forty percent of women lacking purse trust were hypertensive compared to 38 percent of women who had purse trust. $X^2$ tests of independence indicated significant differences in hypertensive status for *purse trust* ($X^2$=−2.03, p=0.04). Ninety four percent of women reported their village as safe, and differences in hypertension rates for *safety* were significant ($X^2$=3.03, p<0.05), with a higher proportion of women who say their village is safe having hypertension (39 percent). Regarding *alertness*, 14 percent of women reported no need to be alert at the risk of be taken advantage of. The difference in hypertensive rates for *alertness* was statistically significant ($X^2$=5.60, p<0.05); 45 percent of women who reported no need to be alert were hypertensive compared to 37 percent who reported a need to be alert.

Regarding the thick trust predictors, three quarters of the sample reported being willing to trust a neighbor to watch their house, while only 59 percent of women who have children reported trusting a neighbor to watch their children. Women's rates of hypertension varied statistically significantly by both *house trust* ($X^2$=6.17, p<0.05) and *child trust* ($X^2$=5.86,

p<0.05), but in the opposite direction than expected; 40 percent of women who had either form of trust were hypertensive compared to 33 percent of women who lacked either form of trust.

**Table 1**: Sample characteristics and hypertensive status for individual-level predictors of cognitive social capital

| | Overall | Percentage of Community (CI) | Percent with hypertension | Significance level[a] |
|---|---|---|---|---|
| Individual-level thin trust | | | | |
| Purse trust (ref) | 66.69 | | 37.54 | 0.04 |
| No purse trust | 33.31 | 34.36 (0.00-81.82) | 39.66 | |
| Village is safe (ref) | 94.42 | | 38.63 | 0.00 |
| Village is unsafe | 5.58 | 5.58 (0.00-44.12) | 32.09 | |
| No need to be alert (ref) | 14.14 | | 45.10 | 0.00 |
| Need to be alert | 85.86 | 85.86 (44.44-100) | 37.14 | |
| Individual-level thick trust | | | | |
| House trust (ref) | 75.04 | | 40.03 | 0.00 |
| No house trust | 24.96 | 24.96 (0.00-70.00) | 32.97 | |
| Child trust (ref) | 59.36 | | 39.76 | 0.00 |
| No child trust | 40.64 | 40.53 (0.00-94.44) | 33.04 | |
| Overall | | | 38.27 | |

Unweighted sample characteristics for non-pregnant women aged 18 and older, N=9,528

[a] $\chi 2$ levels of significance

*Source*, Indonesian Family Life Survey, Wave 5

Table 2 provides the multivariable results. These results are reported as odds ratios. An odds ratio above one indicates an increase in the likelihood an individual is hypertensive relative to the reference group whereas an odds ratio below one indicates a decrease in the likelihood of being hypertensive. Table 2 does not include individual- and community-level controls that were also included in each model (see Appendix B). In each of the models, including the relevant predictors as random effects did not statistically significantly improve model fit; results are presented as fixed effects models.

In Models 1 through 4, I examined whether individual- and community-level *thin trust* were associated with hypertensive status (*Hypotheses 1 and 2*). In Model 1, lacking individual-level purse trust was related to a non-statistically significant decrease in the likelihood of hypertension (OR=0.99, CI 0.89-1.10). Living in a community with an increasingly larger

proportion of women who lacked purse trust was related to a statistically significant decrease in the likelihood of hypertension. Each additional 10 percent of women in a community who lacked purse trust was associated with a 5 percent decrease in the likelihood of a woman in that community having hypertension (OR=0.95, CI 0.90-0.99), beyond individual-level purse trust. The proportion of communities lacking purse trust ranged from 0 to 82 percent, meaning that the difference in likelihoods of hypertension for women living in the lowest and highest proportions of communities having purse trust was over 40 percent.

Models 2 and 3 provide coefficients for two other forms of thin trust: village safety and alertness, respectively. Neither reporting the village as unsafe nor reporting a need to be alert were statistically significantly associated with hypertension at either the individual or community levels and failed to improve model fit. In Model 4, I included all thin trust predictors at both the individual and community levels. Women living in a community with a higher proportion of respondents who lacked purse trust were statistically significantly related to an increased likelihood of hypertension. For each additional 10 percent of a community who lacked purse trust, women's likelihoods of hypertension decreased by five percent (CI 0.90-1.00). Community-level safety and alertness predictors as well as all individual-level thin trust predictors were nonsignificantly associated with hypertension. These findings do not support *Hypothesis 1;* individual-level thin trust was not associated with hypertension. These findings were opposite to the predicted findings in *Hypothesis 2*; although the hypothesis was that lacking community-level thin trust would be associated with increased likelihoods of hypertension, community-level lack of purse trust was consistently associated with *decreased* hypertension likelihoods, even after controlling for other thin trust measures.

**Table 2:** Multilevel binomial logistic regression models of hypertensive status on individual- and community-level thin trust (odds ratios; 95% confidence intervals)

| Predictors | Model 1 | Model 2 | Model 3 | Model 4 |
|---|---|---|---|---|
| Individual-level thin trust | | | | |
| No purse trust (ref = purse trust) | 0.99 (0.89-1.10) | | | 0.98 (0.88-1.09) |
| Village is unsafe (ref = safe) | | 1.01 (0.80-1.26) | | 1.01 (0.80-1.27) |
| Need to be alert (ref = no need to be alert) | | | 0.92 (0.80-1.05) | 0.92 (0.80-1.05) |
| Community-level thin trust* | | | | |
| No purse trust | 0.95 (0.90-0.99)* | | | 0.95 (0.90-1.00)* |
| Village is unsafe | | 0.96 (0.87-1.06) | | 0.99 (0.90-1.09) |
| Need to be alert | | | 1.04 (0.96-1.12) | 1.03 (0.96-1.12) |
| Fixed effect intercept | 0.16 (0.02-0.89)* | 0.11 (0.02-0.62)** | 0.10 (0.02-0.55) | 0.17 (0.03-0.93)* |
| σ2 estimate | 0.06 | 0.07 | 0.07 | 0.06 |
| N | 9,528 | 9,528 | 9,528 | 9,528 |

**Table 2 (cont.):** Multilevel binomial logistic regression models of hypertensive status on individual- and community-level thin trust (odds ratios; 95% confidence intervals)

| Predictors | Model 5 | Model 6 | Model 7 | Model 8 |
|---|---|---|---|---|
| Individual-level thin trust | | | | |
| No purse trust (ref = purse trust) | | | | 0.97 (0.85-1.09) |
| Village is unsafe (ref = safe) | | | | 1.05 (0.81-1.36) |
| Need to be alert (ref = no need to be alert) | | | | 0.85 (0.73-1.00)* |
| Community-level thin trust* | | | | |
| No purse trust | | | | 0.94 (0.88-0.99)* |
| Village is unsafe | | | | 0.97 (0.87-1.08) |
| Need to be alert | | | | 1.02 (0.94-1.11) |
| Individual-level thick trust | | | | |
| No house trust (ref = trust) | 0.94 (0.84-1.06) | | 1.04 (0.90-1.20) | 1.03 (0.89-1.19) |
| No child trust (ref = trust) | | 0.90 (0.79-1.01)† | 0.89 (0.78-1.01)† | 0.88 (0.77-1.00)† |
| Community-level thick trust* | | | | |
| No house trust | 0.98 (0.93-1.04) | | 0.99 (0.92-1.07) | 1.01 (0.94-1.09) |
| No child trust | | 1.00 (0.95-1.05) | 1.00 (0.94-1.06) | 1.02 (0.96-1.09) |
| Fixed effect intercept | 0.09 (0.02-0.49)** | 0.15 (0.02-1.02) | 0.15 (0.02-1.04) | 0.41 (0.05-3.04) |
| σ2 estimate | 0.07 | 0.07 | 0.07 | 0.06 |
| N | 9,528 | 7,269 | 7,269 | 7,269 |

All models control for individual- and community-level variables. Full models provided in Appendix B.
*Source,* Indonesian Family Life Survey, Wave 5
Significance levels: † p ≤0.10; * p ≤0.05; ** p ≤0.01; *** p ≤0.001
*Included as percentage agreement in 10% increments

In Models 5, 6, and 7, I examined the relationship between individual- and community-level thick trust predictors and likelihoods of hypertension (*Hypotheses 3a, 3b, 4a, and 4b*).

Model 5 included individual- and community-level *house trust.* Lacking house trust was nonsignificantly associated with decreased likelihoods of hypertension at both the individual and community level (OR=0.94, CI 0.84-1.06; OR=0.98, CI 0.93-1.04, respectively). Model 6 only included women who have children in the household (women who do not have children were not asked about their willingness to ask neighbors to watch children). Lacking individual-level *child trust* was associated with a lower (p=0.08) likelihood of hypertension; women lacking child trust had a 10 percent lower likelihood of hypertension compared to women who had child trust. In Model 7, I included both forms of thick trust at both the individual and community levels to assess whether each form of trust uniquely contributed to likelihoods of hypertension. Lacking *child trust* at the individual level was associated with decreased likelihood of hypertension compared to women who had child trust (p=0.07). These models lend some support to *Hypothesis 3b;* that is, lacking individual-level thick trust is related to decreased likelihoods of hypertension for Indonesian women. Living in a community with less overall child trust was not associated with changes in the likelihood of hypertension for women in that community, however. Community-level thick trust was not associated with likelihoods of hypertension and supported neither *Hypothesis 4a* nor *Hypothesis 4b.*

Finally, in Model 8 I included all thick and thin trust predictors, both individual- and community-level, to explore which predictors' statistical significance persisted after controlling for all thick and thin trust variables. An individual-level need to be alert was associated with a 15 percent lower likelihood of hypertension compared to women who did not think they needed to be alert (OR=0.85, CI 0.73-1.00). Lacking purse trust at the community level was associated with a 6 percent lower likelihood of hypertension for every additional 10 percent of a community that reported distrusting a neighbor to return a purse. Finally, lacking individual-level child trust

was associated with decreased likelihoods of hypertension for women compared to women who had child trust (OR=0.88, CI 0.77-1.00; p=0.06). All other individual- and community-level thick and thin trust predictors were not associated with statistically significant changes in the likelihood of hypertension.

## Discussion and Conclusion

In this chapter I examined the relationship between individual- and community-level social trust and hypertension among women in Indonesia. While past research largely focuses on overall trust and self-reported measures of health and well-being, I highlight that different forms of social trust are uniquely related to women's likelihoods of hypertension. I examined two forms of social trust—*thick* and *thin*—and found that thick and thin trust were differently related to hypertension at the individual and community levels. Past research is inconclusive regarding cognitive social capital's relationship with health for women, and my findings lend support to a growing body of literature suggesting that context is closely intertwined with the potential health consequences or benefits of social capital.

Although I initially hypothesized that lacking thin trust would be associated with increased likelihoods of hypertension (*Hypotheses 1 and 2)*, I found evidence supporting the converse in Model 8; individual-level thin trust, measured as whether women report that it is necessary to be alert in the community or risk being taken advantage of, was significantly associated with a 15 percent lower likelihood of hypertension for women who felt they need to be alert compared to women who did not report needing to be alert. Whereas perceived community safety may be a more objective assessment of actual threats in the village (and in this case was associated with nonsignificantly increased likelihoods of hypertension for women who feel their village is unsafe), feelings of alertness may more accurately serve as a proxy to assess

the proactive role a woman is taking within her community to feel safer. A broad psychology research suggests that individuals who are conscientious – defined by the presence of deliberate, self-controlled, and goal-directed behaviors including planning and delayed gratification (e.g., Roberts, Lejuez, Krueger, Richards, & Hill, 2014) – have lower risks of mortality and are healthier overall (e.g., Shanahan, Hill, Roberts, Eccles, & Friedman, 2014). Women who report alertness may be intentional in their awareness and responsiveness to community surroundings, which may translate to lower likelihoods of hypertension via healthier decision making and better self-control.

To test whether the potential relationship between being alert and having hypertension was concealed by women who receive more formal education, I examined whether the relationship between alertness and hypertensive status varied by educational attainment via interaction terms in an additional model (not shown). I did so because higher amounts of education are associated with increased sense of self-control and better problem-solving skills (Mirowsky & Ross, 2003) which may obscure potential advantages of alertness for women who are less educated. Women who had lower education who reported a need to be alert in their communities had significantly lower likelihoods of hypertension compared to women who had lower education who did not feel a need to be alert, while alertness was not associated with hypertension for women who had at least junior high education. Having “street smarts” allows individuals to better maneuver social structures and increases social agency (Hatt, 2007), whereas women who had higher levels of formal education may not benefit as much from the advantages of experience gained in the lived environment.

Alternatively, women who are healthier overall may spend more time in their communities and may have a better sense of real or perceived community dangers. Although

hypertension is largely asymptomatic, women who have hypertension may also have other comorbidities or health problems that cause them to become more socially isolated (e.g., Kvaal, Halding, & Kvigne, 2013) and spend more time in their homes.

Community-level thin trust, as measured by trust in a neighbor to return a lost purse, was also consistently associated with decreased likelihoods of hypertension for women living in communities with increasingly less trust. Decreased community-level trust could signify less social pressure to engage in gotong royong (Bowen, 1986). Gotong royong was solidified by government leadership in the 1960s in an attempt to circumvent shortcomings in national security programming (Mardiasmo & Barnes, 2015), and as Indonesia continues to democratize and urbanize, citizens may feel less impelled to engage in gotong royong. Less community-level thin trust could may be symptomatic of strong in- and out-group categorizations, fragmented communities, and reciprocal relations that are relegated to the in-group (Smith, 2010; Uslaner, 2002). However, women may have strengthened relationships with friends and family members as a result of living in a less trusting community, which may offset the detrimental effects of fragmented communities. Other community-level thin trust predictors were nonsignificantly related to likelihoods of hypertension (i.e., *safety* and *alertness*), in line with past research showing that neighborhood safety was only related to decreased likelihoods of hypertension before controlling for education, income, and race/ethnicity (Mujahid et al., 2008).

Lacking individual-level thick trust (measured as *child trust*) was related to a 10-12 percent lower likelihood of hypertension compared to women who reported having child trust, lending some support to *Hypothesis 3b*, though this sample was restricted only to women who have children (who, on average, had slightly higher unadjusted rates of hypertension compared to women who do not have children (42 percent of mothers compared to 37 percent of non-

mothers). As van Kleef et al. (2008) described, individuals in positions of decreased social power are acutely aware and responsive to the needs and suffering of those around them. In Indonesia, acuity for other's needs may result in women feeling burdened by excessive requests from friends and neighbors that may negatively affect health (e.g., Portes, 2014). Although recent research has not found a relationship between psychosocial stress itself and hypertension (Agyei et al., 2014; Sparrenberger, Fuchs, Moreira, & Fuchs, 2008), women who feel obligated and burdened in responding to requests from others may cope by engaging in unhealthy behaviors such as disengagement in physical activity or eating unhealthier meals, which could result in both increased short- and long-term risks of hypertension (Graudal, Hubeck-Graudal, & Jurgens, 2017). Women who are involved in unbalanced reciprocal relationships may also experience worse psychological wellbeing, which has also been tied to increased risks of hypertension (Trudel-Fitzgerald, Boehm, Kivimaki, & Kubzansky, 2014).

Helping others care for their children entails additional commitments when compared to watching their house, and the implied reciprocity associated with asking a neighbor to watch children may be responsible for the significant increases in hypertensive likelihoods for those with *child trust* but not *house trust.* Thick trust may not confer individual-level health benefits and could become costly if women feel obligated to aid their neighbors, especially if they themselves have limited time or resources to help.

Alternatively, women who report having more child trust could be sicker. Chronically ill women are more likely to receive social support from neighbors if they have more individual-level connections to others in the neighborhood, especially so for women who have children (Waverijn, Heijmans, & Groenewegen, 2017). If sicker women have had more positive experiences with receiving assistance from community members, their experiences may provide

freedom or a general sense of "being taken care of" (Coleman, 1988). Women who may be less likely to report having child trust may also be women who are healthier, are more independent, and have needed to rely on neighbors less for support.

Possessing individual- and community-level thick and thin trust increases likelihoods of good self-rated health (Saint Onge, Jansen, & Ice, 2018). Specifically, Saint Onge et al. found that increased amounts of community-level thick trust (measured as *child trust*) and individual-level thin trust (measured as *safety*) were associated with better self-rated health. Juxtaposing the findings presented in this chapter with past findings highlights a need to approach health in a more holistic way that entails both subjective and objective measures of well-being. Other recent research has shown that stressful life events are significantly related to self-reported hypertension but are not associated with objective measures of hypertension (Sparrenberger et al., 2008), again providing evidence that subjective measures of health, including self-reported hypertensive status, are heavily influenced by non-biological factors.

Self-rated "health" carries an array of definitions (e.g., Blaxter, 1990) and its reach extends far beyond clinical measures of health. With this, women's self-rated health is typically a measure either of health relative to those around them or relative to their own health in the past and may not successfully capture long-term health complications they are affected by. In the sample in this chapter, only 30 percent of women in the sample who had hypertension also reported that they were "unhealthy" when asked about self-rated health, suggesting that measured blood pressure is accessing a unique feature of health not captured by self-reported status. Future research could incorporate a combination of biomarker data, measures of psychological well-being, activities of daily living, and self-reported health status to more fully understand social capital's relationship with facets of health.

Future research may also incorporate other dimensions of trust, such as institutional trust (Khodyakov, 2007). Given Indonesia's tumultuous political history that has oscillated between democratic and dictatorial processes, understanding the possible effects of women's changing relationships with the political structures in Indonesia may be an important facet of women's health. Trust between women and their religious institutions may be an additional angle through which to explore the relationship between institutional trust and women's health.

I acknowledge three limitations. First, while this study emphasizes the relationships women have with others in their community, future research may consider the potential health consequences of bridging ties, i.e., the role of trusting and building relationships with those in other communities. Limitations to the IFLS prevent analysis of this kind, but most Indonesian women spend much of their time in their own communities (Adeney, 2003), providing some evidence that bridging social capital may be less important to health than other forms of cognitive social capital. Second, I focus on perceptions of social trust rather than examining more objective measures of social capital such as social network ties. Although past research suggests that perceptions may be more relevant to health than objective measures (Weden, Carpiano, & Robert, 2008), women's relationships with their communities are evolving, and the role social capital may have in predicting health outcomes may be captured differently via social network analysis. Third, my analysis is cross-sectional and neither shows causality between cognitive social capital and hypertension nor evaluates longer-term relationships with lacking or possessing trust and how that may predict chronic and acute hypertension. Examining social trust and its relationship with health outcomes over time would provide additional insight into the mechanisms through which individual- and community-level trust operate. However, the IFLS

does not provide trust questions prior to Wave 4, meaning that longitudinal analysis will not be possible until future waves are collected.

Theoretical and methodological links between trust and social capital should continue to be pursued and developed. In this chapter I neither address the distinction of trust and reciprocity (Torche & Valenzuela, 2011) nor the "contested concepts" (Woolcock, 2010) of social trust from social capital (e.g., Carpiano & Fitterer, 2014). Rather, I adopted the approach that trust and reciprocity are closely intertwined and difficult to disentangle given limitations to the questions asked by the IFLS, and I contextualize trust as a facet of social capital without conflating the two. I do so by incorporating social trust at both the individual- and community-levels and considering the ways in which trust may uniquely be constructed given the social context of the sample.

My findings add to a broader literature that recognizes the potential negative relationship social capital has with health. Increasingly so, scholars are skeptical of explanations of the social capital−health relationship that overstate social capital's role in improving health (e.g., Portes, 2014). Current research in social capital is ambiguous in social capital measurements, making incomparability between studies difficult to draw conclusions (Choi et al., 2014), and limited evidence from multilevel studies makes developing interventions to address social capital's relationship with health – whether good or bad – particularly difficult (Murayama, Fujiwara, & Kawachi, 2012). To overcome this ambiguity, I examined two specific forms of social capital using multiple measures at both the individual and community levels. However, additional studies examining the relationship between specific forms of social capital and more holistic measures of health are needed in order to effectively translate findings into practical interventions.

# Chapter 4
# Structural Social Capital and Hypertension

Hypertension is the leading risk factor for cardiovascular disease and accounts for approximately half of cases of ischemic heart disease and stroke (Lawes et al., 2006; WHO, 2017). Hypertension disproportionately affects residents of low- and middle-income countries (LMICs). Approximately 1 billion of the world's 1.3 billion hypertensive individuals live in LMICs (Mills et al., 2016), and while prevalence of hypertension is declining in high-income countries, prevalence increased by 7.7 percent between 2000 and 2010 in LMICs (Mills et al., 2016). In LMICs, where social capital is crucial to acquiring both material and immaterial resources, understanding the complexities of social capital and its relationship with hypertension is an important step in addressing hypertension-related deaths.

Broadly, social capital entails investment in social relationships with expected returns (Lin, 1999). Social capital may provide individuals with opportunities for civic engagement, learning a new skill, and accessing social support (Berkman & Glass, 2000; Landstedt et al., 2016). One form of social capital, structural social capital, can compensate for a lack of economic or cultural capital (e.g., Bourdieu, 1984; 1986; Murayama et al., 2012) and may provide individuals with both material and immaterial support (Berkman & Glass, 2000; Landstedt et al., 2016). Social capital covers the extent and diversity of involvement in community programs and organizations (Agampodi et al., 2015; Murayama et al., 2012). Due to lack of questions for respondents regarding their informal social participation, I solely evaluate the relationship between formalized community participation and hypertension.

Regular participation in community organizations has been connected to improved cardiovascular health (e.g., Kamiya, 2010; Shankar, McMunn, Banks, & Steptoe, 2011). However, most research focuses on structural social capital within high-income countries. For

example, Kamiya et al. (2011) found that risks of hypertension for respondents in England were significantly reduced for those who reported more social participation. Shankar et al. (2010) also found that increases in social isolation (measured by community participation, marital status, and friend and kinship ties) were related to modest but significant increases in both systolic and diastolic blood pressure. Other research, also from high-income countries, indicates that involvement in social organizations decreases risks of mortality (e.g., Nyqvist, Forsman, Giuntoli, & Cattan, 2013), risks of heart attacks (Ali, Merlo, Rosvall, Lithman, & Lindstrom, 2006), and risks of death post-heart attack (e.g., Chaix, Lindstrom, Rosvall, & Merlo, 2008).

A paucity of research discerns participation in different types of community programs and focuses instead on simpler, binary measures of whether individuals participate regularly in community groups. Indonesia – one of the most populated LMICs with 260 million residents – serves as an ideal setting to understand the relationship between structural social capital and hypertension using both measures of overall participation and type of participation; over 80 percent of Indonesian adults report regular community participation (e.g., Cao & Rammohan, 2016). Additionally, approximately one third of Indonesians are hypertensive, and less than half of Indonesians who have hypertension are aware of their hypertensive status (Peltzer & Pengpid, 2018).

In this chapter, I examine the relationship between structural social capital and hypertension for women in Indonesia. I focus on women specifically because men and women are involved in different types of community groups, leading recent scholars to call for gender-specific analyses of social capital and its relation to health outcomes (e.g., Hodgkin, 2008). While men partake more in organizations centered around education, sports, and leisure activities (Matud, 2017), women are more involved in organizations with a group or community focus as

well as organizations that focus on youth and children (Hodgkin, 2008).

I compare women who do and do not have children to better understand how structural social capital's relationship with hypertension may differ for mothers and non-mothers. Women's community involvement tends to be contextualized within expectations of motherhood and maternal social responsibility and often revolves around child and youth programs and community improvement projects – regardless of whether women are mothers (Hodgkin, 2008). Yet, recent gender-specific analyses of social capital preferentially examine the role of maternal social capital while overlooking the experiences of childless women (e.g., Saint Onge, Jansen, & Ice, 2018), and maternal social capital is typically viewed as a mechanism through which children may accrue health advantages (e.g., De Silva & Harpham, 2007; Harpham, De Silva, & Tuan, 2006; Turney, 2013). However, social capital may relate differently to health for women who have and do not have children even after controlling for age and marital status, as motherhood status as well as stigma associated with childlessness may significantly shape the community networks women belong to.

I include multiple measures of structural social capital, including number of programs women are involved in and type of programs women in which women are involved. I found that there was no statistically significant relationship between binary measures of community participation and hypertensive status, but women living in communities with higher amounts of participation on average had lower likelihoods of hypertension compared to women in communities with less program participation. Mothers and non-mothers did not differ significantly in their likelihoods of hypertension. I also found that women, regardless of motherhood status, who reported participation in more community programs did not differ in their likelihoods of hypertension relative to women who participated in fewer community

programs. Finally, I found that women largely did not vary in likelihoods of hypertension by participation in specific program types with the exceptions of involvement in political parties, religious organizations, voluntary labor organizations, and health care centers. There were not statistically significant differences in the relationship between participation in specific programs and hypertension for mothers and non-mothers.

## Background

Particularly in LMIC settings such as Indonesia, structural social capital provides an effective channel for women to access and utilize community resources (Grootaert, 1999). Community participation may encourage women to feel empowered within their communities (Wallerstein & Bernstein, 1994), important because women have limited participation in formalized religion or employment social networks (e.g., Schaner & Das, 2016; Wieringa, 2015). In Indonesia, Mosque attendance is male-dominated (Adeney, 2003), and women are often restricted to self-employment or employment in the informal sector. Yet, women find ways to diversify and expand their social networks via community involvement (Stalker, 2008).

Women are typically responsible for health, education, food, and housing programs in their villages (Molyneux, 2002). Women both organize and hold neighborhood gatherings and coordinate common neighborhood tasks such as payment of dues, communal workdays, and holiday festivities. Despite husbands regularly taking credit for wives' work in the community (Adeney, 2003), direct connections within the lived environment may be related to better health for women. For example, Strange, Bremner, Fisher, Howat, and Wood (2016) found that women who are involved within their communities of residence scored significantly higher on mental well-being than women who were equally involved in groups outside of their communities.

Multiple studies find a positive relationship between women's community participation and improved health (e.g., Gregson et al., 2011). One suggested pathway through which community participation may improve cardiovascular health is by facilitating transfer of health information and advice amongst group members (e.g., Walter, Robbins, Murphy, & Ball-Rokeach, 2017). Active involvement in community groups may allow for more rapid diffusion of health information and increased health awareness (Valente, 2012). Structural social capital may also help nurture friendships, facilitate a sense of belonging, and provide group members with confidantes who can offer support, encouragement, exchange of resources, and advice (Thoits, 2011). For example, Pirkle et al. (2018) found that individuals who reported a high level of support from friends experienced significantly decreased odds of both uncontrolled and undiagnosed hypertension in Albania. Fellow community group members may also encourage individuals experiencing cardiovascular symptoms to more actively seek medical care (Allan & Scheidt, 1996).

Structural social capital may also have physiological consequences that can positively affect cardiovascular health. For example, being able to effectively and healthfully cope with stress is significantly associated with mitigated hypertensive risks (Lindquist et al., 1997). Cosley, McCoy, Saslow, and Epel (2010) found that higher levels of social support, which could be accrued through active participation alongside others in community organizations, were associated with blunted physiological responses to stressful situations including lower blood pressure reactivity, lower cortisol activity, and increased heart rate variability and its heart frequency component (HRV-HF). Organizational participation also may increase levels of self-control, self-efficacy, or self-esteem (e.g., Piliavin & Siegl, 2007), which may equip women with the necessary tools for healthier decision-making.

Although ample research suggests pathways to improved cardiovascular health for women engaged in their communities, recently scholars are also acknowledging the possible negative ramifications of structural social capital (e.g., Portes, 2014). Women's disproportionate participation in community tasks and projects compounded with household responsibilities may be difficult for women (Osborne, Baum, & Ziersch, 2008) and may negatively impact health (Landstedt et al., 2016) or have a null relationship with health outcomes (e.g., Ellaway & Macintyre, 2007; Muennig, Cohen, Palmer, & Zhu, 2013; Yip et al., 2009). Individuals who have less perceived control, agency, and freedom are more likely to respond to the needs of others (van Kleef et al., 2008), making women particularly susceptible to the potential negative consequences of structural social capital. For example, women may experience additional stress from excessive obligations and requests by others (Portes, 2014).

Expectations of maintaining relationships may unduly burden women (Landstedt et al., 2016; Silvey & Elmhirst, 2003), and uneven gender roles that emphasize selflessness and caregiving may pressure women into over-participation in programs that give rise to worse health outcomes (Eriksson & Ng, 2015). Additionally, community organizational participation may be used as an alternative to government or international aid in LMICs (O'Neill & Gidengill, 2006), placing additional pressure on women to facilitate community growth and development. Research from the US shows that individuals who volunteer in low or moderate amounts had lower hypertension likelihoods than individuals who volunteered large amounts of time (Burr, Tavares, & Mutchler, 2011; Tavares, Burr, & Mutchler, 2013), suggesting that moderate community participation may benefit cardiovascular health while excessive volunteering may have health consequences.

For women balancing familial responsibilities with community group involvement, particularly those women who have children, the increased burden of social participation may contribute to worse health outcomes. Mothers who become involved in community groups may be subject to judgment and reproduction of dominant ideologies that dictate how women, and particularly mothers, *should* be spending their time (Mulcahy, Parry, & Glover, 2010). Women's identities as mothers are particularly important in shaping community participation (Osborne, Baum, & Ziersch, 2008). Women often tolerate participation in social activities regardless of their own personal interests for the sake of their children (Hodgkin, 2008), one possible explanation for Kroll's (2010) finding that mothers who volunteered more had significantly lower life satisfaction compared to mothers who volunteered less. Women also may feel overburdened by motherhood and its associated responsibilities but want to fulfill societal notions of what it means to be a "good mother" by maintaining involvement in community programs (Hodgkin, 2008).

For women who are childless, community participation may be negatively associated with hypertensive risks if they are exposed to stigma associated with childlessness, especially if their community participation is centered around youth or child activities. Womanhood is often synonymous with motherhood (Ferland & Caron, 2013; Lindsey & Driskill, 2013; Miles, Keitel, Jackson, Harris, & Licciardi, 2009), and women who are childless may be subject to social isolation (Miles et al., 2009). Increased participation in community programs may also make childless women's deviation from the norm of having children more noticeable.

Type of organization may meaningfully affect participants' health outcomes. For example, some organizations – such as health and wellness programs or community improvement programs – may directly encourage health-promoting behaviors (McNeill, Kreuter,

& Subramanian, 2006). In health-oriented programs, structural social capital may expose women to like-minded individuals who can reinforce positive health behaviors and socially sanction women who choose to engage in discouraged health behaviors such as smoking, physical inactivity, or unhealthy eating (Byron et al., 2016). Women who are mothers may uniquely benefit from participation in youth organizations where they can exchange information and build networks with other mothers (Hodgkin, 2008). The unique role of motherhood may also prove advantageous for mothers; Boneham and Sixsmith (2006) found that mothers identified closely with the roles of care and health provider, and consequently, they were more accustomed to sharing health experiences and information reciprocally with others.

Non-mothers who may not have the freedom to choose the social programs they belong to may benefit from inclusion in groups that do not focus on children or youth. Structural social capital may help to engrain childless women in a social network and overcome potential social isolation associated with childlessness. In the only known study of its kind, Kroll (2010) found that volunteering in social organizations was related to increased odds of higher life satisfaction for childless mothers when compared to both men and women who had children. Alternatively, participation in health and wellness programs also expose childless women to reinforcement of stigmatizing attitudes (Hampshire, Blell, & Simpson, 2012). Participation in programs with a heavy concentration of women who are mothers (e.g., child and youth programs) may also serve to socially isolate women who are childless and contribute to poor health outcomes.

## Hypotheses

I first examine the relationship between structural social capital and hypertension for women. Given structural social capital's general net positive effect on women's health outcomes, I hypothesize that:

*Hypothesis 1: Women who are involved in community organizations will experience lower likelihoods of hypertension than women who are not involved.*

Second, I examine the relationship between community organizations and likelihoods of hypertension for mothers and non-mothers. I contribute uniquely to the structural social capital literature by examining the specific relationship between community program participation and cardiovascular health for women who are childless. I do not hypothesize a direction of the relationship, given evidence that both mothers and non-mothers may experience both beneficial and detrimental effects of program participation.

*Hypothesis 2a: Participation in community programs will be related to decreased likelihoods of hypertension for non-mothers compared to mothers.*

*Hypothesis 2b: Participation in community programs will be related to increased likelihoods of hypertension for non-mothers compared to mothers.*

Finally, given limited research examining differences in hypertensive rates by *type* of program rather than magnitude of participation, I include an exploratory hypothesis connecting mothers and non-mothers to the type of programs in which they participate. I broadly hypothesize that mothers and non-mothers will differ in their likelihoods of hypertension by the types of programs in which they are involved.

## Data and Method

### *Data*

The data came from the 2014-2015 wave (Wave 5) of the Indonesian Family Life Survey (IFLS5), a longitudinal survey of over 30,000 individuals collected in 13 of Indonesia's 26 provinces. It has been collected since 1993 and represents 83 percent of Indonesia's population (Strauss, Witoelar, & Sikoki, 2016). The IFLS includes both individual- and community-level data, both of which I used in this analysis. Initially starting with a sample of 30,872, I limited the sample to individuals who still lived within the approximately 310 surveyed communities, which

reduced the sample size to approximately 20,000. I excluded approximately 325 pregnant women from the sample because pregnant women may experience pregnancy-related changes in blood pressure (BP) (James & Nelson-Piercy, 2004). I also removed individuals who were missing BP readings, were under the age of 18, or who lacked community organization participation information resulting in a sample size of 17,672. Finally, limiting the sample to women and removing individuals who had missing information resulted in a final sample size of 9,528.

***Method***

My outcome variable was hypertensive status. I calculated hypertensive status using average systolic and diastolic blood pressure measurements over three same-day readings as well as self-reported hypertensive medication use. Regular interviewers took BP readings as the first of several anthropometric measurements, and they took readings three times on alternating arms. I used the at-home BP threshold for hypertension; individuals who had a mean home-measured BP greater than 135/85 mm Hg were classified as hypertensive (Joint National Committee, 2003). At-home measurements improve the accuracy of BP readings because participants are less likely to have a higher BP caused by anxiety or stress associated with doctor visits (Fuchs, de Mello, & Fuchs, 2013). At-home BP readings are demonstrated as an acceptable threshold in bother younger and older adults (Parati et al., 2008) and better predict and hypertension (Stergiou & Bliziotis, 2011; Ward et al., 2012).

I constructed a dichotomous measure of hypertension status with the reference group being “not hypertensive.” Women who have a systolic BP greater than 135, a diastolic BP greater than 85, or women whose mean BP fell below the threshold but reported taking hypertensive medication were included in the “hypertensive” group. For those individuals in the

sample who did not have their measurements taken three times, I included a control to account for being measured three times (reference) versus being measured once or twice.

I included several individual- and contextual-level measures of structural social capital to assess its potential relationship with hypertensive status. At the individual level, I included a dichotomous measure for whether women reported participation over the last 12 months in at least one of 14 programs: village cooperatives, village improvement programs, youth groups, village library, religious activities, health funds, village savings and loan program, PNPM (National Program for Community Empowerment), community meetings, voluntary labor, women's associations, health posts, health posts for the elderly, and political parties. I also examined continuous and quadratic measures of program involvement, ranging from 0 to 13. To measure whether type of program significantly predicts hypertensive status, I included binary variables for whether women participated in each of the 14 programs (reference=does not participate in the program). For models in which I examined the relationship between participation in different program types and hypertension, I restricted the sample to women who reported that the program was available to them in their community. I did not include women who reported the program was unavailable to them, even if their community leader reported the program as available, given that subjective measures of community characteristics may have more meaningful health implications than objective measures of health (e.g., Weden et al., 2008).

At the community level, I included a variable for the proportion of women in the sample who reported participation in at least one program. Contextual-level participation was scaled to reflect a 10 percent increase in the proportion of women who report participating. I also included a continuous measure for the average number of community programs in which women in each

community participated. I also examined the role of overall participation in each type of program. I included 14 separate variables to measure the proportion of women (in 10 percent increments) in each community who participated in each type of program.

I included several sociodemographic and health characteristics as controls. I included a continuous measure of age that was zeroed at 18, the minimum age in the sample, as well as quadratic age because although older age is associated with increased hypertensive risks (e.g., Bateman et al., 2012), older women in the sample may be healthier and thus have decreased hypertensive risks. I also compared women who were married (reference) to women who were unmarried (divorced, widowed, single, or separated) given an established link between marital status and hypertension (e.g., Basu & Millett, 2013). Due to an established relationship between lower educational attainment and hypertension (Abdul-Razak et al., 2016), I compared respondents who had elementary school or less education (reference) to those who had junior high or more education. I also included a dichotomous measure of employment status (0=employed, 1=unemployed), which has been shown to be related to hypertension (Khan et al., 2013). I incorporated two different household asset measures given research showing that assets are inversely related to hypertensive risks (Khan et al., 2013). First, I compared women who did not have partial or full ownership of their home (reference) to those who did. Second, I compared women who did not have at least partial ownership of a vehicle (reference) to women who did. In addition to measuring household assets, vehicle ownership may also signify ease of access to transportation and mobility.

I also accounted for several health- and health-behavior-related characteristics. There is a strong direct relationship between body mass index (BMI) and hypertension (Kayima et al., 2015). Using the formula [weight(in kg)/(height(in m)$^2$)] to calculate BMI (CDC, 2018), I

compared underweight women (reference) to normal weight, overweight, and obese women. I also included a variable to measure whether women met weekly physical activity guidelines published by the American Heart Association (2018); lack of regular physical activity predicts hypertension (Dietz, Douglas, & Brownson, 2016). Women who self-reported participation in at least 25 minutes of vigorous activity 3 days a week or at least 30 minutes of moderate activity 5 days a week (reference) were compared to women who did not meet physical activity thresholds.

Healthcare satisfaction is inversely related to hypertensive status (Harris et al., 1995). I compared women who reported having below average healthcare (reference) to women who had average or better healthcare. Concurrent diabetes and high cholesterol are associated with hypertension (Halperin et al., 2006; Sowers, Epstein, & Frohlich, 2001). Although the IFLS did not include biomarker data that could be used to categorize women by diabetes or hypercholesterolemia status based on laboratory blood glucose or cholesterol readings, I included separate measures for whether women reported being prescribed diabetes or cholesterol medication (reference= no medication use). Family history of hypertension is related to increased risks of hypertension and is associated with both genetic and environmental predispositions (CDC, 2018). I compared women who had one or both parents die of hypertension-related causes (defined as cause of death reported as heart attack, heart problems, stroke, kidney disease, or co-morbidities including one of these causes) to women whose parents were alive or had died of unrelated causes (reference).

Finally, I included several community-level measures. I accounted for whether the woman's community of reference is reported by community leadership as urban (reference) or rural. I also included contextual-level effects for all level-1 predictors. I calculated nominal and dichotomous variables as proportions. Nominal and dichotomous contextual-level variables

represent a 10 percent increase in the proportion of respondents in each community who belonged to the comparison group relative to the reference group. Continuous measures represented the mean for the community. I calculated contextual-level variables using all available data from both men and women in each community (N=17,852).

In additional analyses, I examined several alternative outcome variables, and the results did not change. For example, I replaced home-based blood pressure with an office-based blood pressure threshold of 140/90mm Hg (15 percent of women in the sample fit the criteria for home-based hypertension but not office-based hypertension). I also re-categorized women whose hypertension was being controlled with medication as not hypertensive. I included a measure of whether women had *ever* been told they had hypertension. However, self-reported hypertensive status in Indonesia grossly underestimates prevalence of hypertension (Hussain, Reid, & Huxley, 2016), and most individuals who are hypertensive are unaware of their status (Peltzer &Pengpid, 2018). Finally, I excluded individuals who did not have their blood pressure readings taken three times, a group of women comprising 1.5 percent of the sample population.

I estimated the models using multilevel logistic regressions using Stata 14.2 (StataCorp, 2015). Respondents were nested within their community of residence. In preliminary analyses, I examined tetrachoric, polychoric, or Pearson correlations among individual-level predictors across the variables to guide the elimination of redundant covariates. I also examined bivariate correlations between hypertensive status and the covariates. For each model, I examined whether random slopes for community program participation significantly improve model fit relative to fixed effect models using likelihood ratio tests. I removed missing data through listwise deletion, and I checked missing cases using Little's MCAR test (mcartest in Stata) to ensure that missing data could be ignored. Two communities did not have available health post data. Excluding these

communities reduced the sample by approximately 70 women and violated the MCAR assumption. Removing health posts as a control re-introduced the women to the sample and revalidated the MCAR assumption.

## Results

Table 1 presents the sample characteristics and hypertensive status for individual-level predictors of structural social capital by motherhood status. Overall, 76 percent of women in the sample were mothers. Mothers were slightly more involved in community programs than non-mothers; 68 percent of mothers compared to 63 percent of non-mothers reported participation in at least one community program in the last 12 months. However, mothers and non-mothers who reported community participation were similar in the total number of programs in which they participated, with all women overall averaging participation in about two programs in the last 12 months.

**Table 1**: Sample characteristics and hypertensive status for individual-level predictors of structural social capital by motherhood status

| | Overall | | Percent with Hypertension | | Significance level[a] |
|---|---|---|---|---|---|
| | Mothers | Non-mothers | Mothers | Non-mothers | |
| Does not participate in community programs | 31.88 | 37.15 | 36.98 | 38.06 | 0.58 |
| Participates in at least one program | 68.12 | 62.85 | 37.06 | 44.72 | 0.00 |
| Mean total program participation (0-13) | 1.97 (1.34) | 1.99 (1.32) | - | - | - |
| Participates in: | | | | | |
| Village cooperative | 2.01 | 1.62 | 46.26 | 56.76 | 0.26 |
| Village improvement program | 7.43 | 7.29 | 38.60 | 48.19 | 0.03 |
| Youth group | 1.50 | 5.58 | 30.91 | 14.17 | 0.00 |
| Library | 0.66 | 0.66 | 33.33 | 26.67 | 0.63 |
| Religious activities | 48.45 | 52.13 | 40.20 | 47.43 | 0.00 |
| Health fund | 1.39 | 1.49 | 43.14 | 55.88 | 0.20 |
| Village savings/loan | 1.83 | 1.32 | 32.84 | 53.33 | 0.04 |
| PNPM | 2.88 | 1.67 | 35.07 | 39.47 | 0.60 |
| Community meeting | 11.67 | 5.58 | 30.91 | 14.17 | 0.00 |

| | | | | | |
|---|---|---|---|---|---|
| Voluntary labor | 12.13 | 12.25 | 36.49 | 45.52 | 0.01 |
| Women's association | 11.09 | 11.02 | 38.18 | 52.19 | 0.00 |
| Health post | 22.02 | 4.87 | 25.87 | 49.55 | 0.00 |
| Health post for elderly | 4.36 | 7.16 | 57.68 | 65.64 | 0.09 |
| Political party | 7.03 | 3.69 | 36.31 | 25.00 | 0.04 |
| Overall | 76.28 | 23.72 | 37.03 | 42.25 | 0.00 |

Unweighted sample characteristics for non-pregnant women aged 18 and older, N=9,528

[a] $\chi 2$ levels of significance; significance level indicates differences in hypertension percentages by motherhood status.

*Source,* Indonesian Family Life Survey, Wave 5. (std. dev.)

Table 1 also provides a breakdown of proportions of mothers and non-mothers who participated in each of 14 different types of programs. Unadjusted values suggest variation in the types of programs in which mothers and non-mothers participated. Overall, both mothers and non-mothers reported the highest proportion of involvement in religious activities. However, non-mothers had a slightly higher proportion involved in religious groups with 52 percent of non-mothers participating compared to 48 percent of mothers. Significantly higher proportions of mothers were involved in health posts: 22 percent of mothers compared to five percent of non-mothers. Mothers were also significantly more involved in community meetings (12 percent) and political parties (seven percent) than non-mothers (six percent and four percent, respectively). Non-mothers were more involved in youth groups (six percent) compared to mothers (two percent) as well as health posts for the elderly (seven percent compared to four percent). Eight programs had proportions of mothers and non-mothers that fell within approximately one percentage point of each other: village cooperatives, village improvement programs, library, health fund, village savings/loan, PNPM, voluntary labor, and women's association.

Thirty seven percent of mothers were hypertensive compared to 42 percent of non-mothers ($\chi^2$=−4.48, p<0.001). Non-mothers who reported participation in at least one program had statistically significantly higher proportions of hypertension compared to mothers who participated in at least one program ($\chi^2$=−5.26, p<0.001). Regarding participation in different

types of programs, several programs were associated with statistically significant differences in proportions of hypertensive mothers and non-mothers. Participation in two programs was related to mothers having statistically significantly higher proportions of hypertension than non-mothers: youth groups and political parties. Six programs had statistically significantly more non-mothers with hypertension than mothers: village improvement programs, religious activities, voluntary labor, women's associations, health posts and health posts for elderly. However, after adjusting for age, these relationships lost statistical significance. Programs with no statistically significant differences in proportions of hypertension for mothers and non-mothers included: village cooperatives, library, health fund, and PNPM. An additional 2 programs had cell sizes too small to include in adjusted models: health fund and village savings/loan.

Results are reported as odds ratios; odds ratios above one indicate an increase in the likelihood of hypertensive status, and odds ratios below one indicate a decrease. Including whether women report participation in at least one program in the last 12 months as a random effect did not improve model fit relative to a fixed effect model ($X^2(1)=0.66$, $p=0.42$) and is not included. In models in which binary and continuous measures of program participation were included sequentially and without controls (not shown), women's reported participation in at least one program was not significantly associated with likelihoods of hypertension (OR=1.07, p=0.154), while quantity of participation was significantly associated with a three percent higher likelihood of hypertension for each additional program a woman reported (OR=1.03, p=0.046). However, the significant relationship between quantity of participation and hypertension became nonsignificant after controlling for age.

Table 2 shows estimates for full models with controls to examine the relationship between program participation, magnitude of participation, and motherhood status to test

*Hypotheses 1, 2a,* and *2b.* Women who participated in at least one program had nonsignificantly lower likelihoods of hypertension (OR=0.91, p=0.11) relative to women who did not participate, and living in a community with a larger proportion of women who participated in community groups was not associated with likelihoods of hypertension (Model 1). In additional models where I controlled for the number of programs a woman reported being available to her in her community as well as the average number of reported available programs in the community, the likelihood of having hypertension did not change (not shown).

**Table 2**: Multilevel binomial logistic regression models of hypertension on structural social capital (odds ratios; 95% confidence intervals given in parentheses)

| | Model 1 | Model 2 | Model 3 |
|---|---|---|---|
| *Predictors* | | | |
| Participates in at least one program (ref=does not participate) | 0.91 (0.81−1.02) | | |
| Number of programs participated in (0-13) | | 0.99 (0.95−1.03) | |
| Mother who does not participate in at least one program (ref) | | | |
| Mother who participates in at least one program | | | 1.02 (0.84−1.25) |
| Non-mother who does not participate in at least one program | | | 1.04 (0.64−1.68) |
| Non-mother who participates in at least one program | | | 0.89 (0.66−1.21) |
| Community-level average number of programs in which female community members participated* | | 0.89 (0.80−1.00) * | |

All models include contextual-level effects that correspond with individual-level predictors and controls as well as individual-level controls. Complete results are given in Appendix 1.
*Source* Indonesian Family Life Survey, Wave 5
Significance levels: †p≤0.10; *p≤0.05; **p≤0.01; ***p≤0.001
*Included as proportion of non-reference category in 10% increments

Total number of programs in which women participated was also nonsignificantly associated with decreased likelihoods of hypertension (Model 2). For each additional program in which a woman reported participating, there was a 1 percent lower likelihood of hypertension. Living in a community with women who participated in more programs was statistically significantly associated with an eleven percent lower likelihood of hypertension for each additional program in which women on average in the community participated (OR=0.89,

p=0.049). The range of average number of programs in which women participated in a community was from 0 to 4.5 (not shown), meaning that women's likelihood of hypertension was reduced nearly 50 percent for those women living in the most highly involved communities relative to women living in the lowest involved communities. The relationship between individual-level hypertension and community-level program participation was strengthened after controlling for reported available programs and average reported programs available in the community; for each additional program in which the women in a community participated, individual women in that community had a 15 percent lower likelihood of having hypertension (OR=0.85, p=0.017, not shown). Quadratic effects of program participation were nonsignificant, suggesting that there is no peak number of programs after which the beneficial relationship declines (not shown). These findings do not support *Hypothesis 1;* women who participated in community programs did not have significantly different likelihoods of hypertension compared to women who did not participate. However, living in a community with an increased number of programs in which women participated on average was associated with decreased likelihoods of hypertension for women living in that community.

Interaction effects indicated that relative to mothers who did not report participation in programs, neither mothers nor non-mothers varied significantly in their likelihoods of hypertension regardless of program involvement (Model 3). Non-mothers, regardless of program participation, had non-significantly lower likelihoods of hypertension compared to both mothers who participated and those who did not. Additional interaction models did not indicate a significant variation in the relationship between total programs, motherhood status, and likelihoods of hypertension (not shown), and living in a community with a higher number of average programs in which women participated was not related with statistically significant

variation in likelihoods of hypertension by motherhood status (not shown). Accounting for total reported available programs was also unrelated to significant changes in the relationship between hypertension, program participation, and motherhood status. These findings do not provide support for *Hypotheses 2a* or *2b;* participation in community programs was not statistically significantly associated with likelihoods of hypertension for either mothers or non-mothers.

In Tables 3 and 4, I show relationships between participation in different program types for women (Table 3) and mothers and non-mothers (Table 4) and hypertensive status in conjunction with my exploratory *Hypothesis 3* – that women will vary in their likelihoods of hypertension by program *type* and motherhood status. I restricted models to women who report the listed program is available in their community (models including all women, regardless of reported program availability, are provided in Appendix C). In Table 3, program type was not related to different likelihoods of hypertension, with the exception of participation in a political party, which was related to a 21 percent lower likelihood of hypertension for women who were involved (OR=0.79, p=0.063). These findings were consistent in additional models including all women, regardless of whether they reported a program was available in their community (see Table 1, Appendix C). Finally, in Table 4, I show select program types and their interactions with motherhood status. The results showed that program type by motherhood status was largely nonsignificant in predicting hypertension.

**Table 3:** Multilevel binomial logistic regression models of hypertension on structural social capital by program type (odds ratios; 95% confidence intervals given in parentheses)

| *Models* | *Predictors* | OR (CI) | N |
|---|---|---|---|
| | *Participated in the last 12 months (ref=does not participate)* | | |
| Model 1 | Village cooperative | 1.18 (0.81−1.73) | 2,112 |
| Model 2 | Village improvement program | 1.03 (0.83−1.27) | 4,243 |
| Model 3 | Youth group | 1.24 (0.83−1.86) | 3,382 |
| Model 4 | Library | 0.74 (0.36−1.52) | 772 |

| | | | |
|---|---|---|---|
| Model 5 | Religious activities | 0.98 (0.87−1.12) | 7,456 |
| Model 6 | Health fund | 1.27 (0.80−2.01) | 1,373 |
| Model 7 | Village savings/loan | 1.08 (0.72−1.62) | 2,707 |
| Model 8 | PNPM | 0.97 (0.71−1.34) | 3,097 |
| Model 9 | Community meeting | 0.92 (0.77−1.10) | 4,519 |
| Model 10 | Voluntary labor | 0.97 (0.81−1.17) | 3,870 |
| Model 11 | Women's association | 1.05 (0.87−1.27) | 4,976 |
| Model 12 | Health post | 1.07 (0.93−1.24) | 7,885 |
| Model 13 | Health post for elderly | 1.13 (0.87−1.46) | 2,758 |
| Model 14 | Political party | 0.79 (0.61−1.01)† | 2,761 |

Each model controls for all individual- and community-level controls. Models do not account for participation in other program types. Models are restricted to women who report program availability in their community. Differences in N sizes for these models reflect the sample restriction.
*Source* Indonesian Family Life Survey, Wave 5
Significance levels: †p≤0.10; *p≤0.05; **p≤0.01; ***p≤0.001

**Table 4:** Select Multilevel binomial logistic regression models of hypertension on structural social capital by program type and motherhood status interaction (odds ratios; 95% confidence intervals given in parentheses)

| *Models* | *Predictors* | OR (CI) | N |
|---|---|---|---|
| | *Participated in the last 12 months (ref=does not participate)* | | |
| Model 1 | Village improvement program | | 4,243 |
| | Mother who does not participate (ref) | | |
| | Mother who participates | 1.00 (0.64−1.57) | |
| | Non-mother who does not participate | 0.86 (0.53−1.39) | |
| | Non-mother who participates | 1.20 (0.69−2.09) | |
| Model 2 | Religious activities | | 7,456 |
| | Mother who does not participate (ref) | | |
| | Mother who participates | 0.75 (0.53−1.05)† | |
| | Non-mother who does not participate | 1.18 (0.75−1.86) | |
| | Non-mother who participates | 0.87 (0.62−1.23) | |
| Model 3 | Community meeting | | 4,519 |
| | Mother who does not participate (ref) | | |
| | Mother who participates | 1.28 (0.90−1.82) | |
| | Non-mother who does not participate | 0.98 (0.63−1.53) | |
| | Non-mother who participates | 1.29 (0.85−1.97) | |
| Model 4 | Voluntary labor | | 3,870 |
| | Mother who does not participate (ref) | | |
| | Mother who participates | 1.04 (0.72−1.51) | |
| | Non-mother who does not participate | 0.93 (0.57−1.52) | |
| | Non-mother who participates | 1.78 (1.09−2.92)* | |
| Model 5 | Women's association | | 4,976 |
| | Mother who does not participate (ref) | | |
| | Mother who participates | 1.09 (0.74−1.61) | |
| | Non-mother who does not participate | 1.36 (0.89−2.08) | |
| | Non-mother who participates | 1.08 (0.68−1.72) | |
| Model 6 | Health post | | 7,885 |

| | | |
|---|---|---|
| | Mother who does not participate (ref) | |
| | Mother who participates | 1.54 (0.98−2.42)† |
| | Non-mother who does not participate | 1.08 (0.68−1.73) |
| | Non-mother who participates | 1.59 (0.94−2.67)† |

Select likelihoods of hypertension by program type*motherhood status interaction. Program types that are not included in Table 4 have insufficient cell sizes to include model results. Each model includes individual- and community-level controls. Models are restricted to women who report program availability in their community. Differences in N sizes for these models reflect the sample restriction.
*Source* Indonesian Family Life Survey, Wave 5
Significance levels: †p≤0.10; *p≤0.05; **p≤0.01; ***p≤0.001

Mothers who participated in religious activities (Table 4, Model 2) had slightly lower likelihoods of hypertension compared to mothers who did not participate (OR=0.75, p=0.085) and non-mothers who did not participate (OR=0.75, p=0.095). Non-mothers who participated in voluntary labor (Table 4, Model 4) had higher likelihoods of hypertension compared to mothers who did not participate (OR=1.78, p=0.021). Finally, both mothers and non-mothers who participated in health posts (OR=1.54, p=0.061 and OR=1.59, p=0.079, respectively) had higher likelihoods of hypertension compared to mothers who did not participate (Table 4, Model 6). These findings were consistent in additional models including all women, regardless of whether they reported a program was available in their community (see Table 2, Appendix C).

Taken together, findings from Tables 3 and 4 indicate that the relationship between participation in specific program types and likelihoods of hypertension was largely nonsignificant, with the exception of reported involvement in health posts for both mothers and non-mothers. These findings largely disprove my exploratory hypothesis that participation in specific types of programs would be related to varying likelihoods of hypertension for mothers and non-mothers.

## Discussion and Conclusion

My study offers unique insight into the complexity of the role of structural social capital in women's lives and its relationship with hypertensive status. Prior research on structural social

capital and hypertension has relied on individual-level measures of community participation from Western and high-income settings. For example, in a review of social capital and its relationship with non-communicable diseases, 13 of the 14 included studies were from Western countries, highlighting a need for research in LMICs (Choi et al., 2014).

I situate this study in a non-Western low-middle income country with above average hypertensive rates and examined dichotomous program participation, a continuous measure of program participation, and individual-level program participation in 14 different types of programs. I also included interaction effects between measures of structural social capital and motherhood status to offer a more complete view of the role structural social capital may play in predicting hypertension. Although it is impossible to assess causality between structural social capital and hypertensive status using cross-sectional data, unlike other health outcomes with symptoms that may deter individuals from community participation, most hypertensive individuals are asymptomatic or have acute symptoms such as occasional nausea or headaches (WHO, 2016). Most hypertensive individuals in LMICs are unaware of their hypertensive status (Hussain, Mamun, Reid, & Huxley, 2016), suggesting there is no reason to suspect that hypertensive status would result in respondents falling into specific social capital patterns that could affect results.

I found that overall, individual-level community participation – regardless of how it was measured – was unrelated to hypertensive status for both mothers and non-mothers. Binary measures of community participation, as well as number of programs, were nonsignificantly associated with slightly lower likelihoods of hypertension. After including an interaction for motherhood status, non-mothers who participated in programs had a slightly lower likelihood of hypertension compared to mothers who participated, though these differences were

nonsignificant. Quadratic effects of community participation were also nonsignificant, suggesting that there is not a curvilinear relationship between participation and hypertension. Interestingly, women living in a community with a higher average number of programs in which women participated had lower likelihoods of hypertension, though this relationship did not vary by motherhood status.

In high-income settings, structural social capital may not be linked to objective measures of health status such as blood pressure (Ellaway & Macintyre, 2007; Muennig et al., 2013). I contribute to this literature by focusing on women and further disaggregating by motherhood status. A wide range of social capital and health literature focuses on the relationship between women's community participation and health outcomes while overlooking women who are childless (e.g., Saint Onge, Jansen, & Ice, 2018). Current research does not assess cardiovascular health by motherhood status, but my findings suggest that neither mothers nor non-mothers have differences in hypertensive status by community participation after adjusting for sociodemographic characteristics.

One possible explanation for a lack of relationship between structural social capital and hypertensive status is that structural social capital may improve morbidity and mortality outcomes through slight changes in numerous measures of biological risk factors rather than through large changes in any one measure. Modest, short-term changes in blood pressure may not be evident for women who have varying levels of community participation, but community participation may better predict long-term morbidity and mortality. For example, in a study of US adults, structural social capital was not significantly associated with biomarker data including changes in blood pressure but was significantly associated with reduced all-cause mortality (Muennig et al., 2013).

Additionally, health effects associated with community participation may take longer than the time frame provided in the IFLS. Individuals in the IFLS were reporting on whether they volunteered with an organization in the past 12 months, but respondents were not asked about the frequency by which they engage in each program, the expected time commitments associated with each organization, or the length of time they have been involved in each program. Although my findings suggest that short-term participation in community participation is not related to likelihoods of hypertension, future research may explore the long-term effects of community participation on hypertensive status. One additional benefit of a longer timeline for program participation is that it provides a more complete picture of involvement, and respondents are more likely to report participation in groups that occur more regularly, recently, or are more meaningful to their lives (Hall, 2001). Additionally, long-term participation in community programs has been associated with better self-rated health and well-being (Piliavan & Siegl, 2007), and past community program participation has been associated with predicting better future cardiovascular health (Han, Tavares, Evans, Saczynski, & Burr, 2017) in high-income populations.

An additional possible explanation for the lack of relationship between community participation and hypertension is that the potential benefits of organizational participation are counterbalanced by the consequences of women overextending themselves. Women are often the cornerstones of community organizing in Indonesia (Adeney, 2003) and are often involved in coordinating neighborhood events, meetings, and programs. Organizational participation can offer material and non-material benefits that can compensate for limited economic or cultural capital, therefore mitigating the negative effects of living in resource-poor settings. For example, women who otherwise may be closed off from formalized social networks through employment,

education, or religion (Adeney, 2003) may have increased opportunities to extend their social network, engage with like-minded individuals, take ownership of their communities, and feel pride in their neighborhood (Hibbert, Piacentini, & Al Dajani, 2003; Ohmer, Meadowcroft, Freed, & Lewis, 2009). However, most women participate in community groups in addition to multiple other responsibilities including being married, having children, and working.

Over-commitment to multiple groups may cause tension for individuals as they navigate their responsibilities. Involvement with several groups may interfere with family, work, or voluntary obligations if one or more groups require large time commitments, excessive material resources to engage, or is physically or psychologically demanding (Creary & Gordon, 2016). Specifically, women who have familial and organizational obligations may have difficulty balancing their commitments (Osborne, Baum, & Ziersch, 2008). Although community participation for women in low-resource settings may provide an effective channel to access and utilize community resources (Grootaert, 1999), role strain – difficulties resulting from trying to fulfill obligations (Goode, 1960; Pearlin, 1989) – may cause participants to feel anxiety or stress over their duties and may neutralize potential positive benefits.

Participants who have competing time commitments may also have less time to devote to individual organizations or programs and do not build meaningful connections to the organization or its participants. Although having more time to engage in meaningful activities may empower participants and foster inclusiveness in the community by facilitating decision-making, building self-esteem, or encouraging prosocial behaviors (e.g., Laverack, 2006), as shown in additional models where I examine the relationship between individual program types and hypertension, participation in individual programs was largely unrelated to hypertension for both mothers and non-mothers. Future research should consider the potential role of household-

or family-level structural social capital. With this, future research may consider structural social capital within marital dyads and the potential role a partner's community involvement may have on cardiovascular health. Men and women generally participate in different types of social activities (Matud, 2017), and spouses may benefit from additional community ties accrued by family members.

Structural social capital may help women feel connected to their communities via strengthened friendships, increased sense of belonging, enhancing access to resources and information, and through connecting supportive and encouraging women (Thoits, 2011), all of which may affect subjective measures of health but may not be related to acute changes in likelihoods of chronic and non-communicable diseases. Participation in individual programs has been strongly associated with improved subjective measures of health and well-being such as self-rated health (Lee et al., 2008), mental health (Roh et al., 2015), life satisfaction (Li, Chen, & Chen, 2013) and depression (Morrow-Howell, Hinterlong, Rozario, & Tang, 2003). However, the relationship between community participation and presence of non-communicable diseases and more objective measures of health is less evident (Choi et al., 2014). My finding that living in a community with women who are involved in more community programs is associated with lower likelihoods of hypertension may suggest that community-level program participation can potentially provide advantages to individuals who are surrounded by women who are more involved; social capital's benefits are experienced by all individuals within the social structure – not only those who have invested in it (Coleman, 1988). Living in a community with more involved women could also be indicative of communities that have more community efficacy, a powerful mechanism for improving residents' health (Teig et al., 2009).

With regard to involvement in specific programs, my findings suggest a potential detrimental relationship between assisting at a health post and likelihoods of hypertension. Assisting at a health post may expose volunteers to individuals who have severe or prolonged illnesses or disabilities which may be particularly debilitating and physically and emotionally taxing to organizational volunteers (e.g., Gandoy-Crego, Clemente, Mayán-Santos, & Espinosa, 2009). The potential benefits of exposure to civically-minded individuals and the subsequent accrual of social capital may be outweighed by the stress of participating. Alternatively, there may be selection effects regarding who donates time or labor to a health care post; individuals who are familiar with the facilities or its needs after using its services or having had a parent use the services may be more likely to participate.

I found that women who reported participating in political activism had a 21 percent lower likelihood of hypertension compared to women who did not report participating. Political party participation may denote women who have more autonomy in other arenas of their lives, an important determinant of women's improved health (Sherwin, 1998). Political party involvement may also connect women to broader political structures that can improve health by providing increased access to information and decision-making opportunities.

I also found that women who are engaged in religious organizations, regardless of motherhood status, have slightly lower likelihoods of hypertension compared to women who are not involved. This finding reinforces findings discussed in Chapter 2; in Chapter 2 I showed that Muslim women who were more devout in daily prayer as well as Hindu women who engaged in daily yoga and meditation and abstained from red meat consumption had lower likelihoods of hypertension compared to their less religiously engaged counterparts. Religion is central to many

women's lives in Indonesia and exposes them to other women with whom they can interact, share information, and form friendships (Adeney, 2003), all of which may result in better health.

Future research should address possible structural differences in the organizations of these programs in addition to understanding their role in community empowerment as potential points of departure for improving health outcomes. Doing so would complement past research demonstrating that involvement in hierarchically based organizations affects health differently than participation in egalitarian ones (Yamaza et al., 2016) as well as offer a more complete picture of types of structural social capital and their functions.

In the presented models, I included a measure of the number of programs women perceive are available to them in their communities, despite having access to more objective measures of program availability as supplied in additional interviews with community leaders. Although I relied on women's perceptions of available community programs as a measure of their options for community participation, future research may examine more objective measures. Combining perceived and objective neighborhood measures has not been applied to availability of community programs. However, neighborhood violence and perceptions of neighborhood safety have been shown to relate differently to adult mental health (e.g., Wilson-Genderson & Pruchno, 2013) and smoking habits (e.g., Shareck & Ellaway, 2011). Perceived community characteristics also more significantly predict physical activity (e.g., Ma, Dill, & Mohr, 2014). Some research also suggests that perceived neighborhood quality is more closely associated with adult health than objective neighborhood quality (e.g., Weden et al., 2008).

Given the unique sampling frame of the IFLS, both individuals and community leaders were asked about available programs, making it possible to compare subjective and objective measures of available programs. Most past research does not distinguish between self-reported

available community programs and objective reporting by community leaders. For example, Saint Onge, Jansen, and Ice (2018) found using the Indonesian Family Life Survey that living in a community with more perceived available community programs was significantly related to decreased likelihoods of poor self-rated health for mothers. However, perceived and objective measures of community characteristics differently predict health outcomes.

I acknowledge several limitations. Women who have problems with infertility may be more likely to score poorly on other measures of health (Verit, Yildiz Zeyrek, Zebitay, & Akyol, 2017), such as subjective measures of health and wellbeing (e.g., Hansen, Slagsvold, & Moum, 2009). Thus, women who do not have children may be more likely to have hypertension. However, no past associations have been found between infertility and hypertension (e.g., Farland et al., 2015), providing some evidence that biological factors associated with infertility do not contribute to potential differences in hypertensive status. Second, I separated women by whether they have children. However, in doing so, I do not account for potential variation in community participation by number of children. In Indonesia, where the average woman has one to two children (DHS, 2012), having three or more children may create barriers to access to community participation. Future research should incorporate number of children to examine potential relationships between number of children, community participation, and hypertension. Third, women in the study are not necessarily involuntarily childless. Women who are choosing to live childfree may not experience or acknowledge the same extent of stigma for their childlessness as those who are involuntarily childless and may not have health outcomes tied to their community participation. However, in Indonesia only 0.5 percent of women report that they do not want children (DHS, 2012), providing some evidence that many of the women in the sample who are childless are not childless by choice.

Overall, given the large proportion of Indonesian adults involved in community programs (Cao & Rammohan, 2016) as well as the lack of negative associations between community involvement and likelihoods of hypertension, providing support to grassroots organizations that seek to improve their living environment may work to both improve communities and facilitate better cardiovascular health for participants in those organizations. For example, incorporation of hypertension management programs into existing organizational structures may increase access to cardiovascular care (e.g., Neupane et al., 2016; Nguyen et al., 2011) and provide opportunities for future interventions.

# Chapter 5
# Conclusion

In this dissertation, I sought to explore the relationship between different elements of women's social environment and their relationship with hypertension. By focusing on social capital and religious behaviors, I wanted to understand how the depth and breadth of social ties serve as a potential mechanism in mitigating hypertensive risks for women in Indonesia. The hypotheses posed in this dissertation were written in response to recent public health efforts to reduce hypertensive risks by altering health behaviors. Globally, alcohol and tobacco consumption are key health behaviors targeted by public health campaigns. However, in many parts of the world – especially so for women and for individuals living in Muslim-majority countries – hypertension rates remain high despite limited tobacco and alcohol use.

Other public health interventions target increased fruit and vegetable intake to alleviate hypertensive risks. However, financial insecurity that prevents Indonesians from affording fresh produce has been pinpointed as a key barrier in implementing successful programs founded on encouraging dietary changes (Dewi, Stenlund, Marlinawati, Ohman, & Weinehall, 2013). Therefore, understanding alternative social factors that may affect women's risks of hypertension may be useful to help guide public health interventions in LMIC settings like Indonesia where access to resources may be limited.

Aligned with past research largely from India, I found that Muslim women had higher likelihoods of hypertension compared to women belonging to other religions. In disaggregating minority religions into Hinduism and Christianity, I found that Hindu women had the lowest likelihoods of hypertension, and Hindu women who reported partaking in daily yoga or meditation practice or refraining from red meat consumption had particularly lower likelihoods of hypertension when compared with other groups. For Muslim women, I found that women who

engaged in salat by praying at least five times daily had lower likelihoods of hypertension compared to Muslim women who prayed daily but prayed fewer than five times per day.

More research is needed to ascertain possible health policy implications related to religious behaviors. My findings suggest that Muslim women may have higher likelihoods of hypertension relative to women of other religions in Indonesia, suggesting that efficiency and efficacy of programs aimed at reducing hypertension rates could be improved upon by focusing on Muslim women. Given religion's importance to daily life for Indonesian women, as well as their overwhelming participation in religiously oriented community organizations relative to other types of community groups, disseminating health programming through formalized religious networks could connect women to broader health organizations, or at a minimum, impart educational materials aimed at reducing risks of hypertension.

For example, government and international agencies could collaborate with mosques (but also with temples and churches) to disperse health information. Women's religious groups could help lead programs that provide information to women about both preventative measures such as healthier eating and engagement in physical activity and more acute education about recognizing symptoms of cardiovascular events that could reduce both morbidity and mortality related to cardiovascular disease. Church-based interventions in the US context have been successful in helping participants manage other long-term chronic illnesses (e.g., Samuel-Hodge et al., 2009) and could potentially be extended to diagnosis and management of hypertension. Regardless of whether public health interventions arise internally within a faith-based organization, come from external sources, or are a collaboration between faith-based groups and outside organizations, overall participants experience significant health improvements (Campbell et al., 2007).

Barriers to implementing interventions that improve long-term health outcomes in LMICs include low amounts of capacity-building, minimal opportunities for political change, and health systems that may not be responsive to change (van de Vijver, Oti, Addo, de Graft-Aikins, & Agyemang, 2012). However, interventions in Indonesia that include community-based programs play an important role in circumventing lack of economic and government resources because they provide access and opportunities to women where they already gather. Even in settings where large-scale policy changes are difficult to accomplish, well-constructed interventions that entail dissemination of health information can make a difference (Fuster & Kelly, 2010). A comprehensive and integrated approach includes community-based programs (Fuster & Kelly, 2010), is widely significant with a clear rationale (Jean & St-Pierre, 2009), and is minimally invasive to women's daily lives while still communicating the necessary information. Indeed, prevention of risks associated with cardiovascular disease is both scalable and cost-effective in LMICs like Indonesia (WHO, 2007).

With regard to cognitive social capital, I found that women who said they needed to be alert or risk being taken advantage of by others in their community had lower likelihoods of hypertension when compared to women who did not need to be alert. I also found that women who lived in communities with less thin trust had lower likelihoods of hypertension. Less individual-level thick trust (measured as trust in a neighbor to watch children) was also associated with decreased likelihoods of hypertension. These findings add to a growing body of literature that suggest that the relationship between social capital and health outcomes is complex and context-specific. Although I initially framed *alertness* as a quality of the communities in which women live, alertness may alternatively indicate women's sense of awareness, preparedness, and responsiveness to potential threats in their communities. Arming women with

knowledge and a stronger understanding of threats in their communities may empower women to feel safer and more in-control, which may have positive long-term benefits. Future research should assess alertness as an outcome to better understand why women report a need to feel alert.

Although research demonstrates the important of trust in public health interventions that entail relationship-building between community members and community-based participatory research investigators (Christopher, Watts, McCormick, & Young, 2008), less research examines the role of individual- and community-level trust amongst members within the community. Some literature suggests that individuals should engage in "trust building, getting to know neighbors, and watching out for each other's children" (Wallerstein, 2002, pp. 74) and that community associations may serve as a vessel through which community members can work together to make neighborhood improvements, the idea being that individuals invested in the community will feel empowered and will resultantly have better health. The results of my dissertation suggest that more research needs to be done to examine the associations between different forms of trust and a range of health outcomes. Women are often the purveyors of trust and reciprocity in their residential environments, and the increased burden of forging relationships with neighbors typically falls on women (Landstedt et al., 2016). Public health interventions should take care to ensure that health programming is not unduly relying on women's relationships with others in their community.

Regarding participation in community programs, I did not find any statistically relationships between community participation and hypertensive status. I also did not find any differences in likelihoods of hypertension for mothers and non-mothers by program participation, and there was no relationship between hypertension likelihoods and types of community programs in which women participated. Community organizational participation may not

inherently result in better health, though public health interventions often use organizations' existing frameworks to quickly and efficiently incorporate public health programming. Yet, the relationship between intervention programs that utilize community organizations have mixed results on the effect of noncommunicable diseases (e.g., Cutter, Tan, & Chew, 2001). Despite a lack of research indicating significant impacts on reducing noncommunicable disease rates, at a minimum, incorporation of hypertension management programs into existing organizational structures may increase access to cardiovascular care (e.g., Neupane et al., 2016; Nguyen et al., 2011) and provide opportunities for future interventions.

It is important to note that there is currently a lack of research assessing implementation and evaluation of community-based models in LMICs, as well as research addressing sustainability of community programming in LMICs (Fuster & Kelly, 2010). Therefore, working on a global scale to establish standardized evaluations of health interventions may ensure efficacy of implemented programs. Although my dissertation offers some insight into factors that may be related to women's likelihoods of hypertension, both future hypertension research and evaluations of interventions should consider multiple measures of cardiovascular health. For example, my measure of hypertension is binary and reliant on a ratio between systolic and diastolic blood pressures. Future research may benefit from accounting for differences in isolated systolic hypertension and isolated diastolic hypertension by estimating each as separate continuous measures.

Although I address several limitations in each chapter, being unable to ascertain causality in this project specifically provides an opportunity for future research. It is impossible to assess causality between the predictors and hypertensive status. For the analyses presented in this dissertation, it is unlikely that hypertensive status significantly affected either the social capital

patterns women fall into or the religious affiliations women claim. However, future research should investigate the long-term relationships between religious affiliation and cognitive and structural social capital and hypertension. The IFLS currently has two waves of data probing religion and cognitive and structural social capital, meaning that the future release of Wave 6 will provide new opportunities for longitudinal analysis of religion and social capital.

Importantly, Indonesia's heterogeneity makes it a unique setting for a study of social determinants of health. Thousands of inhabited islands paired with nearly 600 different spoken languages and countless cultural ideologies suggest that a universal approach to improving hypertension rates will not be effective uniformly countrywide. Although I point to large overarching trends that are grounded in Indonesia's unique political and religious history, recognizing the unique context of each surveyed community by overlaying quantitative research with qualitative inquiry is also a crucial next step in better understanding how to implement community health projects.

Finally, women provide a powerful driver for community mobilization and are heavily involved community members. Increasingly so, women have become involved in conversations about how power is distributed along gendered lines (Burn, 2011), and women in Indonesia are working diligently to strengthen their political voices. On a national scale, women are crucial agents of change and are invaluable members and leaders of social movements. Both future community development projects and research inquiries should preferentially examine the impacts such programming will have on the lives of women in the community, as they are often key stakeholders and managers of the implemented programs. Although women are often the cornerstones of their communities and engender change on a local scale, realizing that women's commitments to their residential environments may be used to offset lack of government or

international aid in LMICs (O'Neill & Gidengill, 2006) is an important step in ensuring that women are benefiting from the social institutions in which they invest.

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# APPENDIX A

**Table 1**: Multilevel binomial logistic regression models of hypertension on religion (odds ratios; standard errors given in parentheses)

| | Model 1 | Model 2 | Model 3 | Model 4 | Model 5 |
|---|---|---|---|---|---|
| *Predictors* | | | | | |
| Muslim (ref) | | | | | |
| Not Muslim | 0.65 (0.12) * | | | | |
| Christian | | 0.70 (0.13) * | | | |
| Hindu | | 0.42 (0.11) * | | | |
| Muslim, prays 5 times daily (ref) | | | | | |
| Muslim, does not pray or prays infrequently | | | 1.22 (0.18) | | |
| Muslim, prays 1-4 times daily | | | 1.19 (0.10) * | | |
| Muslim, prays 6+ times daily | | | 0.97 (0.07) | | |
| Christian | | | 0.72 (0.14) † | | |
| Hindu | | | 0.44 (0.12) ** | | |
| Muslim (ref) | | | | | |
| Christian | | | | 0.70 (0.13) * | 0.70 (0.13) † |
| Hindu, no daily yoga/meditation | | | | 0.52 (0.15) * | |
| Hindu, daily yoga/meditation | | | | 0.33 (0.10) *** | |
| Hindu, consumes red meat | | | | | 0.47 (0.13) ** |
| Hindu, does not consume red meat | | | | | 0.32 (0.11) ** |
| *Controls* | | | | | |
| Age (zeroed at 18) | 1.07 (0.01) *** | 1.07 (0.01) *** | 1.08 (0.01) *** | 1.07 (0.01) *** | 1.07 (0.01) *** |
| Age squared | 1.00 (0.00) | 1.00 (0.00) | 1.00 (0.00) | 1.00 (0.00) | 1.00 (0.00) |
| Not married (ref=married) | 1.02 (0.07) | 1.02 (0.07) | 1.03 (0.07) | 1.03 (0.07) | 1.02 (0.07) |
| Junior high or more education (ref=elementary or less) | 0.79 (0.05) *** | 0.80 (0.05) *** | 0.80 (0.05) *** | 0.80 (0.05) *** | 0.79 (0.05) *** |
| Employed (ref=unemployed) | 0.80 (0.04) *** | 0.80 (0.04) *** | 0.80 (0.04) *** | 0.80 (0.04) *** | 0.80 (0.04) *** |
| Partial or full ownership of home (ref=does not own home) | 1.08 (0.08) | 1.09 (0.08) | 1.10 (0.08) | 1.08 (0.08) | 1.09 (0.08) |
| Partial or full ownership of car (ref=no car) | 0.90 (0.06) | 0.90 (0.05) | 0.90 (0.06) | 0.90 (0.06) | 0.90 (0.06) |
| BMI (ref=underweight) | | | | | |
| Normal weight | 1.76 (0.18) *** | 1.75 (0.18) *** | 1.76 (0.18) *** | 1.75 (0.18) *** | 1.75 (0.18) *** |
| Overweight | 3.35 (0.36) *** | 3.33 (0.36) *** | 3.37 (0.36) *** | 3.34 (0.36) *** | 3.34 (0.36) *** |

| | | | | | |
|---|---|---|---|---|---|
| Obese | 6.02 (0.74) *** | 6.00 (0.73) *** | 6.06 (0.74) *** | 6.00 (0.73) *** | 6.00 (0.73) *** |
| Physically active (ref=not physically active) | 1.01 (0.05) | 1.01 (0.05) | 1.02 (0.05) | 1.01 (0.05) | 1.01 (0.05) |
| Average or above average healthcare (ref=below average healthcare) | 0.94 (0.06) | 0.94 (0.06) | 0.95 (0.06) | 0.95 (0.06) | 0.95 (0.06) |
| Blood pressure measured once or twice (ref=three times) | 0.86 (0.17) | 0.86 (0.17) | 0.86 (0.17) | 0.86 (0.17) | 0.86 (0.17) |
| Diabetes medication (ref=no medication) | 2.39 (0.56) *** | 2.39 (0.56) *** | 2.39 (0.56) *** | 2.40 (0.56) *** | 2.39 (0.56) *** |
| Cholesterol medication (ref=no medication) | 1.60 (0.37) * | 1.59 (0.36) * | 1.59 (0.36) * | 1.58 (0.36) * | 1.59 (0.36) * |
| One or both parents died of HBP-related causes (ref=no parents died of HBP-related causes) | 1.33 (0.09) *** | 1.32 (0.09) *** | 1.34 (0.09) *** | 1.33 (0.09) *** | 1.33 (0.09) *** |
| Rural community (ref=urban) | 1.10 (0.09) | 1.09 (0.09) | 1.08 (0.09) | 1.09 (0.09) | 1.09 (0.09) |
| Community proportion not Muslim | 1.00 (0.02) | 0.98 (0.02) | 0.98 (0.02) | 0.98 (0.02) | 0.98 (0.02) |
| Community mean age | 1.01 (0.01) | 1.00 (0.01) | 1.00 (0.01) | 1.00 (0.01 | 1.00 (0.01) |
| Community proportion unmarried | 1.02 (0.04) | 1.02 (0.04) | 1.02 (0.04) | 1.01 (0.04) | 1.02 (0.04) |
| Community proportion junior high or more education | 1.01 (0.02) | 1.00 (0.02) | 1.01 (0.02) | 1.00 (0.02) | 1.00 (0.02) |
| Community proportion employed | 0.98 (0.03) | 0.97 (0.03) | 0.97 (0.03) | 0.98 (0.02) | 0.97 (0.03) |
| Community proportion who owns a house | 1.03 (0.03) | 1.03 (0.03) | 1.02 (0.03) | 1.02 (0.03) | 1.03 (0.03) |
| Community proportion who owns a car | 0.99 (0.01) | 0.99 (0.01) | 0.99 (0.01) | 0.99 (0.01) | 0.99 (0.01) |
| Community proportion undernourished | 1.03 (0.04) | 1.04 (0.04) | 1.04 (0.04) | 1.04 (0.04) | 1.04 (0.04) |
| Community proportion physically active | 1.00 (0.00) | 1.00 (0.00) | 1.00 (0.00) | 1.00 (0.00) | 1.00 (0.00) |
| Community proportion average or above average healthcare | 0.95 (0.04) | 0.95 (0.04) | 0.96 (0.04) | 0.96 (0.04) | 0.95 (0.04) |
| Community proportion with blood pressure measured once or twice | 0.87 (0.17) | 0.84 (0.16) | 0.94 (0.16) | 0.85 (0.16) | 0.85 (0.16) |
| Community proportion with diabetes medication | 1.00 (0.02) | 1.00 (0.02) | 1.00 (0.02) | 1.00 (0.02) | 1.00 (0.02) |
| Community proportion with cholesterol medication | 0.98 (0.02) | 0.98 (0.02) | 0.98 (0.02) | 0.98 (0.02) | 0.98 (0.02) |
| Community proportion family history of HBP | 1.00 (0.01) | 1.00 (0.01) | 1.00 (0.01) | 1.00 (0.01) | 1.00 (0.01) |
| Fixed effect intercept | 0.07 (0.06) | 0.10 (0.09) | 0.10 (0.09) | 0.10 (0.09) | 0.10 (0.09) |
| $\sigma^2$ estimate | 0.07 (0.02) | 0.07 (0.02) | 0.07 (0.02) | 0.07 (0.02) | 0.07 (0.02) |
| N | 9,528 | 9,528 | 9,518 | 9,528 | 9,528 |

All models control for contextual-level effects that correspond with individual-level predictors. Results of contextual-level effects are scaled as a 10 percent increase in the proportion of respondents in the community who belong to the non-reference category.
*Source* Indonesian Family Life Survey, Wave 5
Significance levels: †p≤0.10; *p≤0.05; **p≤0.01; ***p≤0.001

# APPENDIX B

**Table 1:** Multilevel binomial logistic regression models of hypertensive status on trust (odds ratios; 95% confidence intervals)

| *Predictors* | Model 1 | Model 2 | Model 3 | Model 4 |
|---|---|---|---|---|
| Individual-level thin trust | | | | |
| No purse trust (ref = purse trust) | 0.99 (0.05) | | | 0.98 (0.05) |
| Village is unsafe (ref = safe) | | 1.01 (0.12) | | 1.01 (0.12) |
| Need to be alert (ref = no need to be alert) | | | 0.92 (0.08) | 0.92 (0.08) |
| Community-level thin trust* | | | | |
| No purse trust | 0.95 (0.02)* | | | 0.95 (0.02)* |
| Village is unsafe | | 0.96 (0.05) | | 0.99 (0.05) |
| Need to be alert | | | 1.04 (0.04) | 1.03 (0.04) |
| *Controls* | | | | |
| Age (zeroed at 18) | 1.07 (0.01) *** | 1.07 (0.01) *** | 1.07 (0.01) *** | 1.07 (0.01) *** |
| Age squared | 1.00 (0.00) | 1.00 (0.00) | 1.00 (0.00) | 1.00 (0.00) |
| Not married (ref=married) | 1.03 (0.07) | 1.02 (0.07) | 1.02 (0.07) | 1.03 (0.07) |
| Junior high or more education (ref=elementary or less) | 0.79 (0.05) *** | 0.79 (0.05) *** | 0.79 (0.05) *** | 0.79 (0.05) *** |
| Employed (ref=unemployed) | 0.80 (0.04) *** | 0.80 (0.04) *** | 0.80 (0.04) *** | 0.80 (0.04) *** |
| Partial or full ownership of home (ref=does not own home) | 1.04 (0.08) | 1.06 (0.08) | 1.06 (0.08) | 1.04 (0.08) |
| Partial or full ownership of car (ref=no car) | 0.90 (0.06) | 0.90 (0.06) | 0.90 (0.06) | 0.90 (0.06) |
| BMI (ref=underweight) | | | | |
| Normal weight | 1.76 (0.18) *** | 1.75 (0.18) *** | 1.75 (0.18) *** | 1.76 (0.18) *** |
| Overweight | 3.33 (0.36) *** | 3.32 (0.35) *** | 3.31 (0.35) *** | 3.32 (0.36) *** |
| Obese | 6.07 (0.73) *** | 6.02 (0.72) *** | 6.02 (0.72) *** | 6.01 (0.73) *** |
| Physically active (ref=not physically active) | 1.01 (0.05) | 1.01 (0.05) | 1.01 (0.05) | 1.01 (0.05) |
| Average or above average healthcare (ref=below average healthcare) | 0.95 (0.06) | 0.95 (0.06) | 0.95 (0.06) | 0.95 (0.06) |
| Blood pressure measured once or twice (ref=three times) | 0.84 (0.17) | 0.85 (0.17) | 0.85 (0.17) | 0.85 (0.17) |
| Diabetes medication (ref=no medication) | 2.30 (0.53) *** | 2.31 (0.53) *** | 2.29 (0.53) *** | 2.29 (0.53) *** |
| Cholesterol medication (ref=no medication) | 1.62 (0.37) * | 1.62 (0.37) * | 1.62 (0.37) * | 1.63 (0.37) * |
| One or both parents died of HBP-related causes (ref=no parents died of HBP-related causes) | 1.32 (0.09) *** | 1.32 (0.09) *** | 1.32 (0.09) *** | 1.32 (0.09) *** |
| Rural community (ref=urban) | 1.06 (0.08) | 1.09 (0.09) | 1.07 (0.08) | 1.06 (0.08) |
| Community mean age | 1.00 (0.01) | 1.00 (0.01) | 1.00 (0.01) | 1.00 (0.01) |
| Community proportion unmarried | 1.00 (0.04) | 1.01 (0.04) | 1.01 (0.04) | 1.00 (0.04) |
| Community proportion junior high or more education | 1.00 (0.02) | 1.00 (0.02) | 1.00 (0.02) | 0.99 (0.02) |
| Community proportion employed | 0.96 (0.03) | 0.96 (0.03) | 0.97 (0.03) | 0.96 (0.03) |

| | | | | |
|---|---|---|---|---|
| Community proportion who owns a house | 1.01 (0.03) | 1.02 (0.03) | 1.02 (0.03) | 1.00 (0.03) |
| Community proportion who owns a car | 0.99 (0.01) | 0.99 (0.01) | 0.99 (0.01) | 0.99 (0.01) |
| Community proportion undernourished | 1.06 (0.04) | 1.04 (0.04) | 1.04 (0.04) | 1.06 (0.04) |
| Community proportion physically active | 1.00 (0.00) | 1.00 (0.00) | 1.00 (0.00) | 1.00 (0.00) |
| Community proportion average or above average healthcare | 0.95 (0.04) | 0.97 (0.04) | 0.97 (0.04) | 0.95 (0.04) |
| Community proportion with blood pressure measured once or twice | 0.84 (0.16) | 0.83 (0.16) | 0.82 (0.16) | 0.83 (0.16) |
| Community proportion with diabetes medication | 1.00 (0.02) | 1.00 (0.02) | 1.00 (0.02) | 1.00 (0.02) |
| Community proportion with cholesterol medication | 0.98 (0.02) | 0.98 (0.02) | 0.98 (0.02) | 0.98 (0.02) |
| Community proportion family history of HBP | 1.00 (0.01) | 1.00 (0.01) | 1.00 (0.01) | 1.00 (0.01) |
| Fixed effect intercept | 0.16 (0.06) * | 0.11 (0.09) ** | 0.10 (0.09) | 0.17 (0.09) * |
| $\sigma^2$ estimate | 0.06 (0.02) | 0.07 (0.02) | 0.07 (0.02) | 0.06 (0.02) |
| N | 9,528 | 9,528 | 9,528 | 9,528 |

All models control for contextual-level effects that correspond with individual-level predictors. Results of contextual-level effects are scaled as a 10 percent increase in the proportion of respondents in the community who belong to the non-reference category.
*Source*, Indonesian Family Life Survey, Wave 5
Significance levels: ŧ p ≤0.10; * p ≤0.05; ** p ≤0.01; *** p ≤0.001

**Table 1 (cont.)** Multilevel binomial logistic regression models of hypertensive status on trust (odds ratios; 95% confidence intervals)

| | Model 5 | Model 6 | Model 7 | Model 8 |
|---|---|---|---|---|
| *Predictors* | | | | |
| Individual-level thin trust | | | | |
| No purse trust (ref = purse trust) | | | | 0.97 (0.06) |
| Village is unsafe (ref = safe) | | | | 1.05 (0.12) |
| Need to be alert (ref = no need to be alert) | | | | 0.85 (0.10) * |
| Community-level thin trust* | | | | |
| No purse trust | | | | 0.94 (0.02) * |
| Village is unsafe | | | | 0.97 (0.06) |
| Need to be alert | | | | 1.02 (0.04) |
| Individual-level thick trust | | | | |
| No house trust (ref = trust) | 0.94 (0.06) | | 1.04 (0.07) | 1.03 (0.15) |
| No child trust (ref = trust) | | 0.90 (0.07) ŧ | 0.89 (0.08) ŧ | 0.88 (0.07) ŧ |
| Community-level thick trust* | | | | |
| No house trust | 0.98 (0.03) | | 0.99 (0.04) | 1.01 (0.04) |
| No child trust | | 1.00 (0.03) | 1.00 (0.03) | 1.02 (0.03) |
| *Controls* | | | | |
| Age (zeroed at 18) | 1.07 (0.01) *** | 1.08 (0.01) *** | 1.08 (0.01) *** | 1.07 (0.01) *** |
| Age squared | 1.00 (0.00) | 1.00 (0.00) | 1.00 (0.00) | 1.00 (0.00) |
| Not married (ref=married) | 1.02 (0.07) | 1.00 (0.09) | 1.00 (0.09) | 1.01 (0.09) |
| Junior high or more education (ref=elementary or less) | 0.79 (0.05) *** | 0.79 (0.06) *** | 0.79 (0.06) *** | 0.80 (0.06) *** |

| | | | | |
|---|---|---|---|---|
| Employed (ref=unemployed) | 0.80 (0.04) *** | 0.82 (0.05) *** | 0.82 (0.05) *** | 0.82 (0.05) *** |
| Partial or full ownership of home (ref=does not own home) | 1.06 (0.08) | 1.02 (0.08) | 1.03 (0.08) | 1.00 (0.08) |
| Partial or full ownership of car (ref=no car) | 0.90 (0.06) | 0.89 (0.06) | 0.89 (0.06) | 0.90 (0.06) |
| BMI (ref=underweight) | | | | |
| Normal weight | 1.75 (0.18) *** | 1.74 (0.21) *** | 1.74 (0.21) *** | 1.73 (0.21) *** |
| Overweight | 3.31 (0.35) *** | 3.24 (0.42) *** | 3.24 (0.42) *** | 3.23 (0.41) *** |
| Obese | 6.02 (0.72) *** | 5.74 (0.81) *** | 5.74 (0.81) *** | 5.75 (0.82) *** |
| Physically active (ref=not physically active) | 1.01 (0.05) | 1.01 (0.06) | 1.01 (0.06) | 1.01 (0.06) |
| Average or above average healthcare (ref=below average healthcare) | 0.94 (0.06) | 0.92 (0.07) | 0.92 (0.07) | 0.92 (0.07) |
| Blood pressure measured once or twice (ref=three times) | 0.84 (0.17) | 0.95 (0.22) | 0.95 (0.22) | 0.96 (0.22) |
| Diabetes medication (ref=no medication) | 2.31 (0.54) *** | 2.39 (0.65) *** | 2.39 (0.65) *** | 2.37 (0.65) *** |
| Cholesterol medication (ref=no medication) | 1.61 (0.37) * | 1.66 (0.45) * | 1.66 (0.45) * | 1.67 (0.45) * |
| One or both parents died of HBP-related causes (ref=no parents died of HBP-related causes) | 1.32 (0.09) *** | 1.40 (0.11) *** | 1.40 (0.11) *** | 1.40 (0.11) *** |
| Rural community (ref=urban) | 1.07 (0.08) | 1.10 (0.10) | 1.10 (0.10) | 1.10 (0.09) |
| Community mean age | 1.00 (0.01) | 1.00 (0.01) | 1.00 (0.01) | 0.99 (0.01) |
| Community proportion unmarried | 1.01 (0.04) | 1.05 (0.05) | 1.05 (0.05) | 1.03 (0.05) |
| Community proportion junior high or more education | 1.00 (0.02) | 1.00 (0.02) | 1.00 (0.02) | 0.99 (0.02) |
| Community proportion employed | 0.96 (0.03) | 0.96 (0.04) | 0.96 (0.04) | 0.96 (0.04) |
| Community proportion who owns a house | 1.00 (0.03) | 1.00 (0.04) | 1.00 (0.03) | 1.00 (0.03) |
| Community proportion who owns a car | 0.99 (0.01) | 1.00 (0.01) | 1.00 (0.01) | 1.00 (0.01) |
| Community proportion undernourished | 1.04 (0.04) | 1.10 (0.05) * | 1.10 (0.05) * | 1.10 (0.05) |
| Community proportion physically active | 1.00 (0.00) | 1.00 (0.00) | 1.00 (0.00) | 1.00 (0.00) |
| Community proportion average or above average healthcare | 0.97 (0.04) | 0.95 (0.04) | 0.95 (0.04) | 0.93 (0.04) |
| Community proportion with blood pressure measured once or twice | 0.83 (0.16) | 0.80 (0.17) | 0.80 (0.17) | 0.82 (0.17) |
| Community proportion with diabetes medication | 1.00 (0.02) | 0.99 (0.02) | 0.99 (0.02) | 0.99 (0.02) |
| Community proportion with cholesterol medication | 0.98 (0.02) | 0.98 (0.02) | 0.98 (0.02) | 0.98 (0.02) |
| Community proportion family history of HBP | 1.00 (0.01) | 1.00 (0.01) | 1.00 (0.01) | 1.00 (0.01) |
| Fixed effect intercept | 0.09 (0.06) | 0.15 (0.09) | 0.15 (0.09) | 0.41 (0.09) |
| $\sigma^2$ estimate | 0.07 (0.02) | 0.07 (0.02) | 0.07 (0.02) | 0.06 (0.02) |
| N | 9,528 | 7,269 | 7,269 | 7,269 |

All models control for contextual-level effects that correspond with individual-level predictors. Results of contextual-level effects are scaled as a 10 percent increase in the proportion of respondents in the community who belong to the non-reference category.
*Source*, Indonesian Family Life Survey, Wave 5
Significance levels: † $p \leq 0.10$; * $p \leq 0.05$; ** $p \leq 0.01$; *** $p \leq 0.001$

# APPENDIX C

**Table 1:** Multilevel binomial logistic regression models of hypertension on structural social capital by program type; not restricted to women who report program availability in their communities (odds ratios; confidence intervals given in parentheses)

| *Models* | *Predictors* | OR (CI) |
|---|---|---|
| | *Participated in the last 12 months (ref=does not participate)* | |
| Model 1 | Village cooperative | 1.22 (0.86−1.73) |
| Model 2 | Village improvement program | 0.98 (0.81−1.19) |
| Model 3 | Youth group | 1.34 (0.93−1.95) |
| Model 4 | Library | 0.78 (0.42−1.44) |
| Model 5 | Religious activities | 0.95 (0.85−1.06) |
| Model 6 | Health fund | 1.26 (0.83−1.89) |
| Model 7 | Village savings/loan | 1.07 (0.74−1.55) |
| Model 8 | PNPM | 0.97 (0.72−1.31) |
| Model 9 | Community meeting | 0.91 (0.78−1.07) |
| Model 10 | Voluntary labor | 0.98 (0.84−1.16) |
| Model 11 | Women's association | 1.06 (0.89−1.26) |
| Model 12 | Health post | 1.09 (0.95−1.25) |
| Model 13 | Health post for elderly | 1.08 (0.86−1.37) |
| Model 14 | Political party | 0.87 (0.71−1.08) |

Each model controls for all individual- and community-level controls. Models do not account for participation in other program types. Models include all women regardless of whether they report program availability in their community.
*Source* Indonesian Family Life Survey, Wave 5; N=9,528
Significance levels: †p≤0.10; *p≤0.05; **p≤0.01; ***p≤0.001

**Table 2:** Select Multilevel binomial logistic regression models of hypertension on structural social capital by program type and motherhood status interaction; not restricted to women who report program availability in their communities (odds ratios; confidence intervals given in parentheses)

| *Models* | *Predictors* | OR (CI) |
|---|---|---|
| | *Participated in the last 12 months (ref=does not participate)* | |
| Model 1 | Village improvement program | |
| | Mother who does not participate (ref) | |
| | Mother who participates | 0.91 (0.61−1.36) |
| | Non-mother who does not participate | 1.00 (0.74−1.37) |
| | Non-mother who participates | 1.01 (0.61−1.66) |
| Model 2 | Religious activities | |
| | Mother who does not participate (ref) | |
| | Mother who participates | 0.78 (0.57−1.06) |
| | Non-mother who does not participate | 1.14 (0.78−1.67) |
| | Non-mother who participates | 0.87 (0.65−1.16) |
| Model 3 | Community meeting | |
| | Mother who does not participate (ref) | |
| | Mother who participates | 1.29 (0.92−1.79) |
| | Non-mother who does not participate | 1.06 (0.78−1.45) |

| | | |
|---|---|---|
| | Non-mother who participates | 1.23 (0.83−1.81) |
| Model 4 | Voluntary labor | |
| | Mother who does not participate (ref) | |
| | Mother who participates | 1.08 (0.78−1.50) |
| | Non-mother who does not participate | 1.01 (0.74−1.37) |
| | Non-mother who participates | 1.48 (0.96−2.27) |
| Model 5 | Women's association | |
| | Mother who does not participate (ref) | |
| | Mother who participates | 1.12 (0.77−1.62) |
| | Non-mother who does not participate | 1.09 (0.80−1.47) |
| | Non-mother who participates | 1.10 (0.71−1.72) |
| Model 6 | Health post | |
| | Mother who does not participate (ref) | |
| | Mother who participates | 1.60 (1.04−2.46)* |
| | Non-mother who does not participate | 1.13 (0.75−1.71) |
| | Non-mother who participates | 1.57 (0.94−2.60)† |
| Model 7 | Health post for elderly | |
| | Mother who does not participate (ref) | |
| | Mother who participates | 1.26 (0.76−2.07) |
| | Non-mother who does not participate | 1.07 (0.79−1.46) |
| | Non-mother who participates | 1.29 (0.74−2.24) |

Select likelihoods of hypertension by program type*motherhood status interaction. Program types that are not included in Table 4 have insufficient cell sizes to include model results. Each model includes individual- and community-level controls. Models include all women regardless of whether they report program availability in their community.

*Source* Indonesian Family Life Survey, Wave 5; N=9,528

Significance levels: †p≤0.10; *p≤0.05; **p≤0.01; ***p≤0.001

# APPENDIX D

Table 1: Pairwise Correlation Coefficients Amongst Key Predictors

| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|---|
| | Not Muslim (ref=Muslim) | 1.00 | | | | | | |
| 2 | Has purse trust (ref=lacks trust) | 0.04*** | 1.00 | | | | | |
| 3 | Safe (ref=not safe) | 0.01 | −0.12*** | 1.00 | | | | |
| 4 | Alert (ref=not alert) | −0.01 | 0.07*** | −0.02 | 1.00 | | | |
| 5 | House trust (ref=no trust) | 0.02 | −0.14*** | 0.11*** | −0.05*** | 1.00 | | |
| 6 | Child trust (ref=no trust) | 0.04*** | −0.12*** | 0.10*** | −0.04*** | 0.41*** | 1.00 | |
| 7 | Participates in programs (ref=no participation) | 0.07*** | −0.04*** | 0.02* | −0.03*** | 0.04*** | 0.02 | 1.00 |

*Source* Indonesian Family Life Survey, Wave 5; N=9,528
Significance levels: †p≤0.10; *p≤0.05; **p≤0.01; ***p≤0.001