THE VALUE OF CHILDREN: ALLOPARENTING IN SAMOA

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DEDICATION

For Dad, who would have loved this.

For Mum & Garry who kept asking *when* I would finish but never doubted that, eventually, I *would* finish.

And for Craig, who is unwaveringly supportive, constructively critical, and always my tama.

ABSTRACT

This thesis examines the impact of alloparenting by children in Samoa. Survey data was used to explore whether children's help in the household ("alloparental care") influenced female fertility. I showed that children's help had positive effects on both number of offspring and interbirth interval, but there was no influence of the sex of the first-born offspring; that is, having first-born daughters as potential helpers did not boost female reproduction compared to first-born sons. Building on this finding, I present ethological data on daily activities (including allocare) observed in twenty-five Samoan households in a single village. Contrary to received wisdom, these data showed that a division of labour by sex is not evident in children under the age of fifteen. I suggest this explains the lack of an effect of offspring sex. Finally, understanding the necessity of ecologically valid measures is explored through a series of open-ended interviews with Samoan women.

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CHAPTER ONE

FERTILITY, LIFE HISTORY, & KIN

Fa'amatagi – Samoan translation: From the direction of the wind
Meaning: Tell the story from the beginning

"The way to do fieldwork is never to come up for air until it is all over"

Margaret Mead Attributed in Simpson's Contemporary Quotations (1992)

1. Introduction

With fertility rates declining to levels below replacement (Myrskyla, Kohler, & Billari, 2009), several industrialized nations are now adapting to the consequences of an aging population: a fast-growing economy with declining fertility, leading to a severe labour shortage. (Castles, 2003). Numerous explanations have been put forward to explain this significant drop in fertility rates. Proximate determinants such as the costs and benefits of having children, lifestyle factors, and societal norms stress the importance of the cultural and institutional constraints on reproductive decision-making. More specifically, reproductive decisions are not only affected by individual preferences and values, but also by a range of factors outside the individual's control, such as public policy, the labour market, availability of affordable day-care, and the availability of social services (Bagavos & Martin, 2001).

Public policies designed to influence fertility can be broadly divided into two groups (Hugo, 2000). First, there are policies that attempt to stimulate fertility directly by offering financial incentives to individuals with children. These direct policies may manifest in terms of financial compensation for each child, supplementary tax deductions, and free or subsidized public housing, health care, and education. Second, there are public policies aimed at influencing fertility indirectly by changing the context in which fertility decisions are made. These indirect policies may promote gender equality, flexible working conditions, and incentives for young people to marry early.

Several industrialized countries have introduced policy measures intended to counter declining fertility, however, most of these policy changes (direct or indirect) have been only marginally successful. For example, with respect to the relationship between financial compensation and fertility, a weak (but positive) relationship was reported in Germany and in France (Buttner & Lutz, 1990). In Canada, Duclos, Lefebvre and Merrigan (2001), report that financial incentives result in only small increases in the probability of giving birth. Indeed, in most cases, the impact of financial incentive policies on fertility rates is minimal (Brouilette, Felteau, & Lefebvre, 1993; Blanchet & Ekert-Jaffe, 1994; Walker, 1995; and Gauthier & Hatzius, 1997). Using a cross-cultural analysis, Gauthier & Hatzius (1997), estimate that a 25% increase in financial incentives would only increase the total fertility rate of 0.07 children per woman.

Taxation incentives, however, have been shown to have a positive impact on fertility rates in the Canadian province of Quebec (Milligan, 2000). Nevertheless, despite the positive impact overall, fertility rates in Quebec have remained lower or on par with that of other Canadian provinces for which no such policy was introduced (Gauthier, 2001). In the United States, taxation incentives also appear to have a weak positive effect

on fertility rates (Georgellis & Wall, 1992). Similarly, 'family friendly' policies such as maternity or paternity leave, flexible working conditions, and childcare subsidies, in countries such as Canada, Hungary, Italy, Austria, Norway, Sweden, the Netherlands and the United States all report a positive, but again weak, effect on fertility rates (Hyatt & Milne, 1991; Buttner & Lutz, 1990; Gauthier & Hatzius, 1997; Castles, 2003; Del Boca, 2002).

Testa, Sobotka, and Morgan (2011), suggest that examining fertility making decisions from a 'macro-micro' approach may be more informative. Stressing the importance of the interactions between individual and aggregate-level factors, Testa et al. (2011) suggest fertility rates depend on the prevailing conditions in a society. Thus, a society's fertility rates are the aggregate-level result of a whole suite of reproductive decision-making making by individuals. As the authors point out, simply enacting a family-friendly policy to increase fertility may be ineffective if social norms run contra to that policy. Using data from Germany and France, Rossier, Brachet, and Salles (2011) demonstrate that, although women in the neighbouring countries have similar gender role perspectives, they experience differing nationally dominated models of child care that, in turn, have an impact on their reproductive decisions. The authors argue that the prominence of mother-provided childcare norms in Germany lead women, who need or want to work, to delay first-birth or subsequent births because they are hesitant to use external child care services. In contrast, women in France, where external child care is accepted, do not choose the same reproductive delays. This highlights the complicated nature of reproductive decision making and suggests that examining these decisions on a policy-by-policy basis may be inadequate.

Childcare is a factor that does seem to have a substantial impact on fertility rates in several industrialized countries (Blau & Robins, 1989; Kravdal, 1996; Del Boca, 2002; Castles, 2003). In particular, in the United States, parents report a stronger desire to have another child when childcare by a relative is present (e.g. grandmothers) (Lehrer & Kawasaki, 1985). These childcare considerations suggest that a broader perspective on reproductive decision-making, and speficially, the inclusion of evolutionary life history theory, may pay dividends in understanding fertility declines and the incentives to have children

2. Reproductive Decisions and Life History Theory

Broadly speaking, life history theory (LHT) is concerned with the allocation of energetic resources across the life-span of organisms, and the trade-offs made when organisms are forced to allocate finite resources to competing processes (e.g., growth versus reproduction) (Stearns, 1989). Life history strategies can differ both between and within species (Bielby, Mace, Bininda-Emonds, Cardillo, & Gittleman, et al. 2007), and can be applied at the level of the population, sub-population, or the individual. LHT applied to humans can provide a framework for understanding reproductive decision making, encompassing the decision of when to begin reproducing (the trade-off between present or future reproduction: growth vs reproduction); how often to reproduce (a trade-off between quality or quantity of offspring); and when to stop reproducing (a trade-off between reproductive effort and parenting effort). For instance, Migliano, Vinicius, and Lahr (2007) suggest that a trade-off between growth versus reproduction can be seen in Pygmy populations. Migliano et al. (2007) argue that traditional explanations for short stature (e.g., thermoregulation, locomotion in dense forests, lack of availability of food)

fall short because there are multiple populations worldwide, residing in varying ecologies that do not make demands on morphology in this way, but who also exhibit pygmy stature (i.e., males averaging less than 155cm tall). The authors therefore present evidence to suggest that pygmy-like short stature is the result of a life-history trade-off between the fertility benefits of a larger body size versus the costs of late growth cessation. That is, Migliano, Vinicius, and Lahr (2007) suggest that small stature is a by-product of selection for the early onset of reproduction.

Similarly, demographic models from other modern human populations demonstrate that individuals experiencing high mortality environments adopt traits that are characteristic of fast-life strategies. They marry and reproduce earlier, have shorter interbirth intervals, and engage in reduced parental investment (Nettle, 2010; Quinlan, 2006). At the individual level, Belsky, Steinberg, and Draper (1991), argue that plasticity in developmental processes early in life can also lead to different life strategies. Belsky et al., (1991) suggest that divergent developmental pathways encourage different reproductive strategies because of the contexts in which they have arisen. The first, characterized by a stressful rearing environment, inadequate resources, and insecure parental attachment, results in individuals developing fast life strategies, such as early pubertal development and limited investment in child rearing. The second developmental pathway is characterized by adequate resources, low stress, and spousal harmony, and results in a slower life history strategy including later pubertal development, later sexual activity, and greater parental investment. Using historical family data, reconstituted from church records and tax rolls, Störmer and Lummaa (2014) tested this hypothesis across German, Finnish, and Canadian populations at both the family and the individual level. Although no support at the individual level was found, there was evidence for the

adoption of fast life-history strategies (earlier marriage, earlier reproduction) at the family level in individuals exposed to high mortality environments.

2.1. The Demographic Transition

Although LHT accurately predicts many aspects of human reproduction across and within populations, it seemingly fails to account for the phenomenon of the demographic transition. Much of the world has now undergone a demographic transition—an event characterized by both decreased mortality rates and decreased fertility rates (Snopkowski, Towner, Shenk, & Colleran, 2016). Although researchers generally agree on the factors that lead to higher life expectancy, such as better access to reliable and effective health care, the factors that lead to the observed fertility decline are disputed (Snopkowski et al., 2016).

From an evolutionary perspective, this lack of consensus on the causes of fertility decline appears perplexing because as nations develop, and populations have improved access to resources, life history theory would predict a response of maximizing reproduction: the opposite of the pattern typically observed in a demographic transition. Additionally, with economic development, the first individuals to adopt a low-fertility strategy appear to be of high status or wealthy. This is the opposite of the behaviour observed in traditional hunter-gatherer and horticultural societies where a positive relationship between fertility and status is observed. (Hill & Kaplan, 1999; Snopkowski et al., 2016). Much of the existing literature examining the fertility decline that takes place during the demographic transition seems focused on economic resource explanations and fails to consider the decline of kin networks that often occurs during economic development. Traditional hunter-gatherer and horticulture societies maintained close kin-

networks and this may explain, in part, the positive correlation between status and reproduction observed in those groups, whereas the decrease of kin network availability in transitioned nations may explain the declining fertility observed. Turke (1989) suggested that the breakdown of kin networks lowers fertility because the costs of child rearing are paid directly by the parents. This implies that help from kin plays a role with respect to fertility.

Given that human mothers often care for multiple offspring at varying stages of development, each with differing needs, human mothers have always likely employed help from kin (Kramer, 2005, Hrdy, 2011). Hrdy (2009) suggests that human patterns of child rearing conform to the definition of cooperative breeding, and that alloparenting (i.e., parental or child rearing help from individuals other that the mother or the father) played a distinctive role in human evolution. Enlisting the help of an alloparent potentially increases women's fertility and child survivorship, enhances siblings' growth, and lowers morbidity and mortality risks (Kaplan et al., 2000). To date, the literature addressing allocare by kin has focused on the role of the father or the grandmother and much less attention has been directed towards the role of siblings.

The literature that has considered the impact of sibling alloparenting on reproductive success is inconsistent. In his formative time-allocation study among the Micronesian people of Ifaluk, Turke (1988) demonstrated that mothers with first-born daughters had higher fertility than mothers with first-born sons, and that women who bore a daughter first and then a son had higher fertility than women who had a son and then a daughter (Betzig, Harrigan, & Turke, 1989; Turke, 1988). In addition, the most fertile women were those whose first- and second-born children were female, while women with the lowest fertility had first- and second-born sons. This suggests that daughters are more

economically useful to the family (Hames & Draper, 2004). Similarly, Dunbar (2002) and Dunbar & Bereczkei (1997) found that women with first-born daughters had a reproductive advantage among Hungarian gypsies. Older children are the most common alloparents in traditional societies (Kramer & Veile, 2018; Weisner et al., 1977) and because of the availability of close kin networks, children may continue to provide alloparental help after forming families of their own (Hill et al., 2011).

Other studies have failed to replicate Turke's findings. In Dominica, Flinn (1989) found no effect of male-female birth order on fertility. He did, however, find that mothers who had non-reproductive females in their household had higher fertility, and that mothers with female helpers spent less time engaged in childcare than mothers without helpers. Similarly, Stieglitz, Gurven, Kaplan, and Hooper (2013) found that females were consistently more likely to be assigned domestic and alloparental tasks across all labour-demand contexts. In another recent study, Mattison and Neill (2013) found that, among Indo-Fijian mothers, only one category of children's work—childcare—had any impact on fertility.

3. The Case of Samoa

Much of the previous work addressing the impact of alloparenting on fertility has been conducted either in developing societies (with close kin networks where alloparental help from kin correlates with fertility) or in highly developed industrial nations with large, mobile populations (where childcare appears to be a factor in reproductive decision making and where we see the decline of kin networks). By contrast, Samoa, the location of the present study, is in a state of transition from developing to developed nation status.

According to The Committee for Development Policy (CDP) of the UN Economic and Social Council (ECOSOC), Samoa, a small island nation in the middle of the South Pacific graduated from Least Developed Country (LDC) status to Developing Nation status in 2014. Originally scheduled to graduate in 2010, this was postponed by the UN after a devastating tsunami hit the islands in 2009. In line with demographic transition trends observed in other economically developed or developing nations, life expectancy in Samoa has significantly increased, rising from an average of 54.97 years in to 72.41 years in 2010 (World Bank Data accessed January 2017). The most recent WHO data now indicate an overall life expectancy rate of 74.0 years. However, inconsistent with the demographic transition trends observed around the globe, Samoa's fertility rate continues to be holding steady and not declining in the way the demographic transition might predict. This is despite the Samoan government's attempts beginning in 2001 to reduce the fertility rate. Samoans live in large collectivist family groups and still rely on close kin networks. Within the family, Samoan children are given a large number of responsibilities, and it seems likely receiving help from one's older children, could offset the costs to the mother of childrearing and as a result, positively impact fertility. As such, Samoa is an ideal location to test whether the availability of kin and allocare from others is linked to fertility.

4. Outline of this Thesis

Following this introduction, in Chapter Two, I outline the methods that I used to conduct my studies. In Chapter Three, I present a general overview of fertility in Samoa, and demonstrate that factors typically associated with fertility decline during a demographic transition are operating in Samoa; elevated fertility rates cannot, therefore

be accounted for by the absence of those influences that generally drive down fertility. In Chapter Four, I consider the impact of children as allocare providers on two aspects of fertility (number of offspring and interbirth intervals) and present support for help from children having a positive impact on number of offspring and shorter interbirth intervals. In Chapter Five, I present ethological data on daily activities (including the allocare behaviours) observed in twenty-five Samoan households in a single village. This observational component provides evidence for both age and sex patterning in helping behaviours. Contrary to the current literature, the division of labour by sex does not emerge until young adulthood, and is not evident in children under the age of fifteen. Inconsistent with Chapter Four, no correlation with overall fertility is found. Chapter Six builds on the previous two chapters to offer a cautionary tale about the importance of proper operational definitions, ecologically valid measures, and important considerations for researchers conducting cross-cultural research. Finally, in Chapter Seven, I present a general discussion of my findings.

CHAPTER TWO

METHODS

1. Introduction

In this chapter, I provide a general overview of my sample, the locations I worked in Samoa, and general details of my survey methods and observational sampling. Further details regarding the specific nature of data collection and analysis are given in the relevant chapters that follow.

2. Sampling Population

The current project employed a mixed methods approach using both cross-sectional interview data from four sampling locations across the most populous island of Uplou and ethnogrpahic data collected from observing households in Lalomanu - a Samoan village on the southern tip of Upolu. In total, 223 Samoan mothers from independent households in each of four locations were interviewed in person by DLF and CAV. (See Tables 2.1, 2.2, 2.3, and 2.4 for complete descriptive statistcs). Participants were asked about their reproductive histories (e.g., how many times have you been pregnant? What are the birthdates and birth order of your children? Have you used birth control?), along with demographic and biographic information (e.g., what is your birthdate? What is your highest level of education achieved? What is your marital status? Is this your natal village?). See Appendix A for the complete survey. Participants who were unable to provide accurate birthdate information for their children or who reported any discrepancy with respect to birthdates of biological children were excluded from all analyses (n = 36),

along with women who had no biological children (n = 3), those who had adopted children prior to age 45 (i.e., while theoretically still able to reproduce) (n = 13), and those who had given birth to twins (having multiple births, sometimes multiple sexes, is a confound) (n = 12). We also excluded those whose children had died in childhood (n=6): a tsunami in 2009 killed more than 150 people from one of the sample locations. As we have no way of estimating the subsequent reproductive impact of this, these participants were excluded. This left us with a final sample of 153 participants. As some participants declined to answer some of the demographic and biographic information, sample sizes fluctuate slightly in my analysis.

2.1 Age

The mean age for all participants was 40.01 years (SD = 11.97) with a minimum age of 19 years and a maximum age of 71 years. The mean age for participants from Apia was 35.29 years (SD = 11.45); the mean age for participants from Solosolo/Anoama'a was 37.31 years (SD = 12.30); the mean age for participants from Lalomanu was 44.83 years (SD = 10.20); and the mean age for participnts from Falealili was 41.94 years (SD = 11.76).

2.2 Income

The overall average household income for all participants was $356.58 WST (Samoan Tala) per fortnight (SD = $446.91). Household income is highly variable in all locations with an overall range of $0.00 WST per week to $3600 WST per week. As a result, average weekly income may not be a very meanigful variable. Additionally, the Samoan economy relies heavily on remittances from overseas which are not necessarily

accounted for in average income. Samoans living overseas, primarily in the United States, Australia, and New Zealand contribute enormously to the economy by remitting funds to their families in Samoa. The World Bank estimated in 2017 that remittances accounted for approximately 17% of Samoa's Gross Domestic Product (GDP), however, a more recent figure from the Central Bank of Samoa, indicated that during the 2017/2018 fiscal year, remittances made up about 20% of the GDP. It is hard to say whether the World Bank figure is an underestimate or whether that figure is rising but, in either case, it is safe to say that for many Samoans, the primary source of household income is via overseas remittances. Of the 53 women from this sample who were asked if they receive overseas remittances, 87 % said, yes, of course they do, albeit with varying patterns of frequency ranging from biweekly to "whenever needed". As such, average income, in Samoa, may not be a meaningful measure of wealth. A better indicator of wealth in Samoa may be perceived socioeconomic status. When asked their perceived socioeconomic status, the majority of women (38%) said they felt that they were 'average', however, the frequency distribution is slightly skewed with 42% reporting that they were 'below average' or 'poor', and only 15% reporting that they felt 'above average' or 'wealthy'. See Table 2.2 for average income by location and Table 2.4 for complete perceived socioeconomic frequencies for the sample.

2.3 Education

Women in Samoa are now more educated than at any point in Samoa's history. The % distribution of educational achievement by Samoan women (aged 15 – 49) in the 2014 DHS is reported as follows: No formal education - .3 %; Primary education – 3.3 %; Secondary education – 76.1 %; and Tertiary education – 20.3 %. The current sample (n =

170) follows a similar trend with 2 % reporting that they have no formal education; 6 % reporting reaching a primary school education; 69 % reporting that they have reached a secondary school education; and 23 % reporting a tertiary education. See table 2.4 for the distribution of the current sample.

2.4 Village of Origin

There are no marrying rules in Samoa and the majority of individuals live on customary land (68.7 % reported in the 2011 census however, this overall figure may be deceiving because only 29.2 % of urban dwellers live on customary land however, 79.0 % or rural dwellers live on customary land.). As such, couples, once they marry, are free to live on customary land that is associated with either the wife's or the husband's family. Of participants in the current sample (n = 169), 56 % report living in the wife's village of origin, 29 % report living in the husband's village of origin, 14 % living in the village of origin for both the wife and the husband, and 1 % report living in a village that neither spouse originates from. See table 2.4.

3. Location

Four locations from the second largest yet most populous island of Upolu were selected as sampling locations. A number of variables were taken into consideration when choosing sampling locations: villages differ in distance to town and availability of services such as power and water and they differ in in size (land area and population) and access to services such as hospitals and police. In addition, the four sampling locations were selected based on previously established networks or associations with people in these locations.

3.1 Apia

Apia is the capital city of Samoa and has a population of approximately 35,000 people (Samoan Census, 2011). It is well developed and offers a variety of educational opportunities such as private and public primary schools and high schools as well as technical colleges and two universities. The capital city has a fully operational surgical hospital along with numerous private medical clinics. Apia is the home of the main police station and various victim support group offices, and as such; the police presence is strong in the capital city. Apia offers many employment opportunities ranging from selling fruits, vegetables, fish, or handicrafts at the various markets to entry-level service industry positions to senior-level positions within government. Movement around Apia is not difficult. Residents and visitors to the city may use any of the numerous busses that populate the city. Taxi cabs are in abundance and using a taxi to travel about the city is inexpensive (a few dollars more than bus fare). Throughout the week, Apia is a busy city with a movie theatre, a McDonald's, multiple grocery stores (including multiple wholesale food distributors) , four pharmacies, two department stores, various retail establishments (clothing, building supply, furniture, electronics, liquor, stationary and party supply). Apia has numerous restaurants (ranging from fast food to fine dining), bars (ranging from quiet lounges to dance clubs), hotels (hostels to five-star resorts), coffee shops (serving coffee from beans grown in Samoa), and bakeries (from fresh bread to wedding cakes). All four of the major banks in Samoa have their main branches in Apia and all four have ATMs scattered about town. Apia has tattoo shops and pool halls and

travel agents and internet cafes. It is, for all intents and purposes, no different than any city in any developed nation.

3.2 Solosolo/Anoama'a

Solosolo is a village on the northeast coast of Upolu and it is known for its excellent surfing. Solosolo is approximately a 20-minute drive (16 Km) along the east coast road from the capital city of Apia. It has the largest population in its electoral constituency with a little more than 1600 residents (Samoan Census, 2011). Typically, every Samoan village has a primary school and Solosolo is no exception. However, as is common in Samoa, secondary schools are limited to one per district. Thus, secondary school students from Solosolo must travel by foot or bus, four villages away (8.5 Km) to attend the district secondary school (Anoama'a College) or by bus to attend a high school in Apia. Since Solosolo is on the east coast road, busses from villages at the south end of the island travel through Solosolo to reach Apia. Therefore, residents of Solosolo have numerous bus options available to them to reach the capital city. There is no hospital or police station in Solosolo. For basic medical treatment, the closest rural hospital is one village away in Lufilufi (6.3 Km). The small rural hospitals are staffed primarily by nurse practitioners. A doctor is available one day every week, however for basic medical treatments and to dispense medication nurse practitioners at the rural hospitals are available 24 hours a day. If the patient's illness is too severe for the nurse practitioners to treat, then the patient will be sent to the main hospital in Apia. If the police are required, there is a small rural police station one village away in Lufilufi (6.3 Km). Most residents in Solosolo have a clean, metered, water supply available to them. Electricity in Samoa is

on a pre-pay system. Residents purchase ‘cash power’ at the Electric Company in Apia or at the small rural shops that are scattered throughout the villages. Almost all the homes in Solosolo/Anoama’a are equipped with a power meter and are wired for electricity. However, power is expensive, and residents typically use it sparingly.

3.3 Lalomanu

Lalomanu is located on the south tip of Upolu approximately 1 hour and 20 minutes (60.7 Km) from the capital city of Apia. Lalomanu is unique in that it has one of the most beautiful and popular beaches in Samoa. Thus, there is a small thriving tourism industry in the village. There are several locally owned and operated beach fale resorts in Lalomanu and these resorts employ many of the village residents. Lalomanu is an average sized village with a population of approximately 800 people (Samoan Census, 2011). Like Solosolo, Lalomanu has a primary school in the village but secondary school students must travel by foot or by bus to Aleipata College located three villages away (4.3 Km). Movement from Lalomanu to other parts of the island is challenging since the village is located on the south tip of Upolu. Therefore, fewer busses travel through the village en route to the capital city of Apia and as a result, residents of Lalomanu are reliant on the local bus that only travels to Apia twice a day. Because of the beach resorts, taxicabs are more frequently seen in Lalomanu than in other rural villages. Lalomanu is the location of the rural hospital for the district as well as the rural police station for the district. Many residents in Lalomanu have a clean, metered water supply and pre-pay metered power. But, because of the 2009 tsunami, many residents were forced to relocated to a part of the village that is not yet plumbed. These residents typically have water collection tanks and the Samoa Water Authority is supposed to deliver clean water

to these residents regularly, however, this delivery has been unreliable and therefore those without plumbed water often rely on rain water collection.

3.4 Falealili

Falealili is a small district that includes the villages of Sapo'e (population 105), Salesatele (population 330), and Salani (population 450) (Samoan Census, 2011). These villages are all located at the south end of Falealili and this district is located on the southwest coast of Upolu. Falealili is an approximately 55 minute drive (42.4 Km) from the capital city of Apia. This area has local village primary schools however secondary school students travel by foot or bus to either Lepa College (17.5 Km) or Poutasi College (10.5 Km). For access to medical care or police services residents of Falealili must travel to the rural hospital in Poutasi (10.5 Km). Movement from Falealili to the capital city Apia can be difficult as the bus service from this area is limited and taxicabs are rarely seen in this part of Upolu. Because Falealili is more isolated and there are fewer developed homes, not all the residents of Falealili have a metered water supply and pre-pay power. See Table 2.4 for respondents' descriptive statistics by sampling location and Figure 4.1 for a map of Upolu Island.

4. Materials and Procedure

4.1 Survey Data

Interviews were typically conducted either in the participants' homes or in a community *fale* such as a local *fale komiti* (women's committee *fale*) and conducted in the participants' language of choice (English or Samoan). Participants were paid $20

Samoan *Tala* for their time, and if the interviews were conducted at a community *fale*, a donation was made to the host to cover any expenses.

All interviews were conducted by a Samoan field-assistant, in the presence of the primary researcher. The interviews were conducted in either English or Samoan depending on the participant's preference. All questions had been piloted in a rural village in Samoa to ensure cultural sensitivity and to ensure that they were understandable to the Samoan research assistant and to the participants.

The questionnaire was comprised of four sections: 1) Demographic questions (e.g. age, marital status, average income, number of children); 2) Reproductive decision making and reproductive output questions (e.g. Why did you stop having children? Did you plan to have your first child? How many children do you have? With respect to child's sex, what is the birth order of your children?); 3) Household dynamics questions (e.g. How many people live in your house? Who are they? Do any of the people in the house help you look after your children? What appliances do you have in your house?); and 4) Sibling assistance questions (e.g. Do your children help you? Who helps you the most?. In addition, mothers were asked if they receive any financial assistance from kin or non-kin who live within the household or who live outside of the household, with particular attention being paid to older children no longer in school. See Appendix A for full complete survey.

4.2 Observational Data

The value of an ethological approach to understanding human life history cannot be overstated. Although survey data are highly informative, the addition of ethological methods provides insights that surveys cannot. Asking individuals what they 'prefer' or

'how they would behave' in any given situation may differ from what they actually do, and observations can both establish the veracity of self-report, and may also be more accurate as they do not rely on participant recall. Therefore, to gain a more thorough understanding of the role of children as alloparents, an observational study was conducted to complement the interview data. Following the in-person interviews, 25 households from one of the four sampling locations (Lalomanu) were selected for the observational component of this study.

Observations took place throughout the day. Using a method similar to Betzig and Turke (1988, 1989) on Ifaluk, each household was observed several times during the day at various time intervals across four months. During these focal household samples, all household activity, including instances of childcare and household chores by all household members present and visible were recorded. If no members of the household were in view, a notation was made. As such, all households were recorded during every observation period. Observations of helping activities made in Samoa during early field seasons made it apparent that, although Samoan mothers do not report receiving help from their children, the children are, in fact, performing multiple behaviours that may potentially reduce the amount of time Samoan mothers spend engaged in household duties and childrearing. Assistance with respect to direct childcare (i.e. feeding the baby, holding the baby, washing the baby) and indirect childcare (preparing and cooking food, washing clothes and bedding) were observed in every household. Often these helping behaviours were performed by children, as well as by both related and non-related adults. Typical villages in Samoa are small (the average population of a village is approximately 600 - 700 people), and Samoans live in open homes ("*fales*"), both of which mean that

activities are easy to monitor. Indeed, many of the daily activities take place outside of the home and are readily observable.

The largest obstacle I encountered was the tendency of the Samoan families to stop what they were doing, and attend to me. Even though the families were used to my presence in the village, often upon seeing me, typical behaviour would come to a halt and I would be offered food and drink, and the general hospitality of the household. In order to overcome this obstacle, I enlisted the help of a local Samoan research assistant whose presence did not result in any noticable change of behaviour. For complete household descriptive statistics see Table 4.1, for full ethogram of observed behaviours see Appendix C. Detailed data collection and data coding methods can be found in Chapter Five.

CHAPTER THREE

DETERMINANTS OF FERTILITY IN SAMOA

"as the traveler who has once been from home is wiser than he who has never left his own doorstep, so a knowledge of one other culture should sharpen our ability to scrutinize more steadily, to appreciate more lovingly, our own."

Margaret Mead – Coming of Age in Samoa

1. Introduction

My aim in this chapter is two-fold. First, to demonstrate that the sample of women who participated in this project is a representative sample of the overall population. To do so, I compare the demographic characteristics of my sample against data presented in the Comprehensive Samoan Demographic Health Survey and the Samoan census. Second, I show that traditional variables associated with a decline in fertility in economically developed countries, such as education and wealth, do not appear to influence fertility in the way that the Samoan NPP intended. This chapter thus forms the necessary foundation needed to support my own hypothesis that help from children offsets childrearing costs to mothers, and that this may explain why Samoan fertility is currently maintained at relatively high levels compared to other economically developed and transitional nations. In what follows, I provide a brief history of population policy in Samoa, and present DHS and census data on fertility patterns. I then present data from my own sample and provide an exploratory analysis of factors that appear to influence fertility.

1. 1. A Brief History of Samoan Fertility Policy

Samoa, formerly known as Western Samoa, is located roughly halfway between Hawai'i and New Zealand in the Polynesian region of the South Pacific. Data from the 2011 census indicates that the crude birth rate (CBR: number of births occurring per 1000 people) in Samoa sits at 30.4/1000. This number is higher than CBR for 2006 (27.3/1000), and higher than the CBR for 2001 (29.0/1000). The general fertility rate (GFR), defined as the total number of births in a given year per 1000 women aged 15 – 49 years, is a more refined measure of fertility that relates births directly to women of childbearing age. The 2011 census enumerated a total of 42,609 women in the reproductive ages of 15 – 49 years. The GFR for 2011 was calculated to be 134 births for every 1000 women in that age group. Like the CBR, the GFR of 2011 was higher than the GFR of 2006 (121/1000) and higher than the GFR of 2001 (130/1000) (Samoan Population and Housing Census 2011 Analytical Report). According to the 2014 Demographic Health Survey (DHS), Samoa's population is growing at an annual rate of 0.8 % and this is driven exclusively by the relatively high fertility rate.

Following the 1994 International Conference on Population held in Cairo, the Samoan government initiated the formation of a National Population Policy Council (NPPC). By 1998, the NPPC, with help from the Samoan Department of Health, developed the first National Population Policy (NPP). The NPP aimed to accelerate the rate of economic development and to improve the way of life for the Samoan people. At the time, population growth was considered too high to enable economic growth and, therefore, the policy focused on fertility reduction. The NPPC believed that a reduction in fertility and the slowing of population growth would hasten economic modernization, sustainable development, and eradicate poverty (MOH 2008a).

The NPP was revised in 2001 and again in 2008 to integrate population issues into a national strategy for development. On both occasions, the revisions placed the emphasis on fertility reduction. However, for the most part, the program has been unsuccessful and fertility rates have not fallen in the way the government expected. One of the specific targets of the revised National Population Policy was to reduce the Total Fertility Rate (TFR) from 4.4 in 2001 to 3.8 by the year 2011 (MOH 2008a). However, the 2009 Demographic and Health Survey reported a TFR of 4.6 (rising from 2001) while the most recent DHS data (from 2014), reported that, among women aged 15-49 (N = 1012), the overall TFR had risen to 5.1 (more specifically the TFR was reported as 4.4 in for women living in an urban residence and 5.2 in women living in a rural residence). In addition, the 2014 DHS revealed the GFR for Samoan women to be 163 births for every 1000 women. This number has increased from 130/1000 in 2001, i.e., by approximately 20%. Similarly, the 2014 Demographic and Health Survey gives a CBR for Samoan women to be 31.6 (the number of births occurring per 1000 people); this again represents an increase from 29.0 in 2001. Thus, Samoa's fertility rate has not declined substantially over the last fifteen years despite the ongoing transition to economically developed status and despite the efforts of the NPP to actively reduce fertility.

1.2. Factors Influencing Fertility

Family planning

One of the main objectives of the revised National Population Policy was to improve the family planning program in all areas of the country and among all age groups. The family planning program was primarily directed towards women and aimed at increasing awareness and use of modern contraceptive methods (versus traditional

methods such as the rhythm method or withdrawal). The program has proved successful in raising awareness: among all women surveyed in 2009, aged 15 - 49 (n = 2657), regardless of marital status, 70.7% report being aware of any contraceptive method (729/2657 women reported being aware of any traditional method: 27.0%; 1863/2657 women reported being aware of any modern method: 70.1%). By 2014, 82.5% of women surveyed, aged 15 -49 (n = 4805), regardless of marital status, reported having knowledge of any contraceptive method (traditional method: 34.4 %; modern method: 82.0 %). Increasing awareness did not, however, increase usage. When these same women were asked if they had ever used any form of contraception, only 31.5% of women in 2009 reported doing so, (traditional methods used by only 5.3 % and modern methods used by 29.6 %), and there was no change in this number by 2014, with only 30.9 % reporting that they had ever used any contraception method (any traditional method: 5.6 %; any modern method: 29.5 %). Additionally, in 2009, only 17.8 % said that they were currently using some form of contraception, while in 2014 that number had declined to 16.7 %.

When asked their reasons for not using contraception, the most common response was that they were was opposed to family planning (2014: 61.5 % of women aged 15 – 29 and 64.4 % of women aged 30 – 49); an increase from 2009, when 56.9 % of respondents indicated that the reason for not using contraception was respondent opposed. The second most common reason for not using contraceptives was method-related reasons (e.g. health concerns, fear of side effects, lack of access, interfere with the body's normal process) (18.4% of 15 – 29-year-old women and 15.6 % of 30 – 49-year-old women). With respect to future intended usage of contraception, in 2014, only 19.7 % of current non-users (n = 2100) reported an intention to use contraception in the future (27.2 % were unsure and 51.2 % reported no intention to use any contraception in the future). Similar figures can

be seen in men: in both 2009 and 2014, only 15 %of all men aged 15 -49, regardless of marital status (2009: n = 1307; 2014: n = 1669) reported ever having used a condom. Reasons for non-use, then, are largely personal and socio-cultural and not due to a lack of access.

Access to modern and reliable contraceptive methods is thought to drive global fertility declines and provides the rationalization for global investments in family planning programs (Mace & Colleran, 2009). However, the precise way in which contraceptive uptake is transmitted and spreads within populations is still unclear (Colleran & Mace 2015). In Samoa, awareness about and access to contraception does not appear to result in contraceptive uptake and, as such, the NPP has not been effective at reducing fertility. Mace and Colleran (2009) propose that, because contraceptive uptake is often seen among women of lower wealth and educational levels than might be expected, social interactions within networks and communities may exert more influence on women's decisions to begin using contraception use than political or economic factors. More specifically, Mace and Colleran (2009) suggest that, when information concerning a behaviour is either costly to acquire or uncertain, individuals who are viewed as prestigious, knowledgeable or successful may disproportionately influence reproductive decision-making. In populations that face constraints on the number of individuals with whom it is possible to interact, information diffusion and resulting behavioural change can be slow. Mace and Colleran (2009) therefore argue that, when women rely on social networks for information, the particular methods that communities adopt are likely to be path-dependent and may not be the most effective. Additionally, in populations where high fertility is valued or where economic development is slow, contraceptive use does

not appear to spread at all. Thus, "Diffusion of information is therefore not equivalent to diffusion of behaviour" (Colleran & Mace 2015, pp 2).

Taking a historical perspective, Kaplan and Lancaster (2000) argue that the emergence of competitive labour markets in industrialising societies significantly increased the economic payoff of investing in the skills and formal education of children. The resources that parents needed to successfully invest in their children demanded a lower fertility. This led people in Europe and in North America initially to reduce their family sizes through behavioural methods (e.g. abstinence, rhythm method) and this, predictably, generated an increase in demand for reliable and efficient contraceptive methods. In other words, their argument is that modern contraception represents a response to increased demand for reliable family planning, and is not the cause of lowered fertility. (Also see Barkow and Burley 1980; Perusse, 1993). All of this helps make sense of the Samoan context, where personal opposition to, and hence lack of demand for, contraceptives (which may stem from entrenched pro-natal values, particularly among men) combined with limited female mobility (movement around the islands can be difficult, and social interactions of women may be constrained and often limited to neighboring villages) may inhibit contraceptive uptake despite its widespread availability and the encouragement of Government programs.

Education

Along with contraceptive use, level of education is a well-established predictor of fertility (Snopkowski, Towner, Shenk, & Colleran, 2016; Basu, 2002; Lutz & Samir, 2011). From the 1980s onward, reliable data are available from the World Fertility Survey (WFS), and empirical studies examining the relationship between education and fertility increased in frequency (Martin, 1995). Cross-national research based on the WFS

data has confirmed that, in general, education has a negative influence on fertility (Martin, 1995). The strength of this relationship, however, was found to be contingent on both social structure and levels of economic development (Bongaarts, 1978; Cochrane, 1983; Weinberger, 1987; Martin, 1995). This led to a growing awareness of the complexity of the fertility-education relationship and resulted in a shift in the focus of research to the proximate determinants of fertility (Bongaarts, 1978; Martin, 1995). This demonstrated that education affects numerous behaviours that, in turn, have a depressing effect on fertility. However, the complexity of this relationship can be observed during the early stages of a demographic transition. Here, education appears to increase rather than decrease fertility. Factors associated with education such as improved maternal health, reduced risk of fetal death, and a decrease of traditional practices such as extended breastfeeding and post-partum abstinence, seem to accelerate the pace of childbearing and result in a positive fertility-education relationship (Lesthaeghe et al., 1981: Martin 1995). Nevertheless, this positive relationship does not appear to be long lived and, eventually, the fertility enhancing benefits of education are eventually replaced by fertility reducing behaviours such as an increase in contraceptive use, delayed marriage, and later age at first birth (Nag et al., 1980; Martin 1995; Snopkowski, Towner, Shenk, & Colleran, 2016).

Recognizing the existence of the fertility-education relationship, in addition to highlighting contraceptive use, the Samoan NPP attempted to reduce fertility rates by emphasizing the importance of education and implemented strategies to make formal education more accessible to all members of the population. Specifically, payment schemes were introduced whereby the government would reimburse the cost of public school fees, and laws were enacted that required children to attend school, with fines were

imposed for truancy. The formal education structure in Samoa is based on a three-tier system: eight years of primary education (Grades 1 through 8), followed by five years of secondary education (Grades 9 through 13), and then tertiary education (either university, vocational, or professional training). In the 2014 DHS, the median number of years in school declines with increasing age (median number of years of schooling: women aged 20 - 24 = 12.4 years; women aged 30-34 = 12.1 years; women aged 40-44 = 11.6 years; women aged 60-64 = 9.1 years; women over the age of 65 = 7.5 years). In addition, of the women over the age of 65 (N = 769) surveyed in the 2014 DHS, only 11.4 % had completed secondary school (completed all five years). In contrast, 51.2% of women aged 30–34 (N = 662) reported completing secondary school, and 63.9 % of women aged 20-24 (N=922) indicated that they had completed all five years of secondary school. Thus, educational attainment has, indeed, improved over the years and students remain in school longer. Although the NPP has proved unable to reduce fertility rates, the goal of making education more accessible to Samoans of all income brackets has proved remarkably successful. Interestingly, the impact of education is not as strong for men. Only 16.5% of men over the age of 65 (N=625) had completed all five years of secondary school, along with 43.1% of men aged 30-34 (N=749) and 45.8% of men 20-24 (N= 1068).

Both the 2009 and the 2014 DHS examined the total fertility rates in Samoan women by educational achievement and reported no clear pattern or significant difference between groups. However, in women aged 40–49 (assumed to be at the end of their reproductive period), the mean number of children ever born does suggest a possible influence of education on fertility. In 2009, the mean number of children ever born was 5.4 for a woman with a primary education level or less, 4.7 for women with secondary

level education, and 3.7 for those with tertiary education. The 2014 DHS reported similar findings (5.1, 4.6 and 3.4 for women with primary, secondary and tertiary schooling respectively). There is thus some hint that education drives down fertility. However, the disproportionate distribution within educational categories should be considered: because the participants are consistent throughout the DHS, the distribution of educational achievement reported in the DHS indicates a disproportionate distribution across categories in that very few women fall in the primary education and tertiary education categories, so their impact on overall fertility level calculations is probably minimal. This is probably the reason that the DHS reports no significant difference between groups (the DHS does not report the sample size per category).

Kaplan (1996) has argued that fertility rates in developing nations may reflect the payoffs to education and that, in many situations, the payoffs are likely to be low as a result of poor-quality schooling or the low educational achievements of parents. It is possible that, in line with Kaplan's argument, pay-offs to education in Samoa are low due to a lack of economic opportunities post-education. It is apparent that employment has not risen in line with increased education attainment. Indeed, Samoa has a high rate of unemployment, particularly among women. The 2009 DHS reports that 71% of women were not employed in the 12 months preceding the survey (9 % were employed at some point throughout the preceding 12 months but are currently unemployed and 20 % are currently employed) and 48 % of men (10 % report being employed at some point during the preceding 12 months but are currently unemployed and 42 % are currently employed). Numbers from the 2014 DHS indicate that, for women, the unemployment rate has risen slightly with 74 % reporting that they have been unemployed for the 12 months preceding the survey (8 % report being employed at some point during the 12 months but are

currently unemployed and 19 % report being currently employed). Among men, 48 % report being unemployed for the 12 months preceding the survey (15 % report that they were employed at some point during the preceding 12 months but are currently unemployed, and 37 % report being currently employed). It is also worth noting that of the 37 % of men who report currently being employed in 2014, 42.9 % work in the agriculture sector or as unskilled manual labour and 76 % of those men report being paid not in cash but in the way of compensation; most often, in the form of shares of produce. These figures suggest that, although the NPP has seen success in encouraging educational achievement, the government has failed to stimulate economic opportunities for the nation's educated citizens. Thus, although educational achievement has increased in Samoa, fertility rates are also still rising.

Age at First Birth

The age at which childbearing begins has important demographic consequences for society as a whole, as well as for the health and well-being of mothers and their offspring. Women who marry early are typically exposed to the risk of pregnancy for a longer time, particularly when there are low rates of contraceptive usage. Thus, early childbearing generally leads to higher overall fertility than delayed childbearing. An increase in the median age at first birth is typically an indicator of a population transitioning from high to low fertility. In many western populations, later age at first birth—which may reflect an increase in the age at marriage and an increase in educational and economic opportunities for women—has contributed to the overall fertility decline. The NPPC's strategy of promoting contraceptive awareness and encouraging educational achievement was aimed at increasing the age at first birth and thereby lowering the overall fertility rate. The 2014 DHS findings indicate that the median age at first birth was

23.0 years for women aged 25–49 at the time of the survey (n = 2914), which is only slightly lower than the median age of 23.4 years (for the same age group) in 2009.

Wealth

The relationship between wealth and fertility varies with economic development. In small scale societies, increased access to resources often translates into higher fertility. Among industrial nations, however, as individuals become wealthier, fertility declines (Kaplan & Lancaster, 2000). In Samoa, the wealth index (Rutstein, 2008) is used to assess wealth inequities. Information is collected on household ownership of consumer items ranging from a kettle to a television to a car, as well as information about dwelling characteristics, such as source of drinking water, sanitation facilities, and type of flooring material. Each asset is assigned a weight or a factor score which is generated through principle components analysis. The resulting scores are standardized in relation to a normal distribution with a mean of 0 and a standard deviation of 1. Each household is subsequently assigned a score for each asset, with the scores summed for each household and individuals are ranked according to the total score of the household in which they reside. The sample is then divided into quintiles from one (lowest) to five (highest). Wealth quintiles provide a standardized measure of the combined indicators of household income and expenditures.

Data from the DHS for Samoa suggests some relationship between wealth and fertility. In 2009, women living in the poorest households (based on the wealth index) reported the highest total fertility rate (5.9 births per woman) while women in the wealthiest households reported the lowest total fertility rate (4.0 births per woman). This trend is consistent with data collected in 2014, where again, women living in the poorest households reported the highest total fertility rate (6.7 births per woman) and women

living in the wealthiest households reported the lowest total fertility rate (3.7 births per woman). However, these data must be treated cautiously as relationships at the group level may not hold at the individual level (the "ecological fallacy", i.e., the relationship within each wealth category may differ from that between categories": Pollet et al. 2014) and other mitigating factors, such as urban versus rural dwelling may be relevant. Women living in rural areas are more likely to fall into the lower quintiles of the wealth index and have a higher overall fertility than their urban dwelling counterparts (2014 Rural TFR: 5.2 births per woman, Urban TFR: 4.4 births per woman).

Women living in rural areas experience limited access to resources (employment, post-secondary education, family planning and health services, building materials for homes, sanitation services, and availability of clean drinking water) and, as such, are more likely to be over-represented in the lower wealth quintiles while women residing in urban dwellings are more likely to be over-represented in the upper wealth quintiles. Consequently, the elevated birth rate in low-wealth index women may be a function of a mediating variable not considered by the DHS.

In Samoa, estimating an individual's wealth status based on income alone also may not be appropriate. The Samoan economy relies heavily on remittances from overseas. Samoans living abroad, primarily in the United States, Australia, and New Zealand, contribute enormously to the Samoan economy by remitting funds to their families. According to the World Bank (2017), remittances make up about 16.7 % of the Gross Domestic Product (GDP). Of the total number of remittances sent to Samoa each year, in 2009 the United States accounted for 21 % of the total, Australia accounted for 27 % of the total and New Zealand accounted for 31 % of the total (DHS, 2014). These remittances are essential to families living in Samoa but they are often unpredictable and

unreliable. Brown (1998) notes that the informal nature of money transfer, often taking many forms such as informal transfers in cash or in kind and passing through many channels, make it difficult to acquire information pertaining to remittance behaviour. As such, the World Bank estimate of 16.7 % of the GDP may, in fact, be a gross underestimate. Samoan families rely heavily on overseas remittances, which are highly variable in amount and frequency (Brown, 1998), and asking them to report income estimates with any expectation of accuracy is unsuitable. Instead, calculating wealth or perceptions of wealth using alternative metrics is likely more accurate.

Fertility Intentions and Reproductive Decision-Making

Understanding fertility intentions and reproductive decision-making is fundamentally important for population and family planning policymakers. This is particularly so in a population like Samoa, where government-instituted polices attempting to lower the fertility rate have been largely unsuccessful. Gaining insight about the fertility desires of the population can aid policymakers in assessing the effectiveness of current policies and programs and help to modify these in future.

Although female fertility preferences may not necessarily predict reproductive behaviour, they may still serve as a guide to likely patterns of future fertility. The desire to limit family size in Samoa appears to be related to level of education, but not in the anticipated direction. Rather, when comparing women with the same number of living children, the percentage of currently married women (age 15-49) who do not wish for more children is highest among the least educated: 71.0 % of women with only a primary school education report wanting no more children, compared to 55.4 % of those with a secondary school education and 44.9 % of those with tertiary education. Of course, these figures may be misleading because women of all ages are included in the analysis and

educational achievement has been steadily increasing; older women may therefore be over-represented in the "primary school only" category and younger women may be included in the "secondary school and beyond" category. However, it is worth noting the large disparity.

Additionally, the same data indicate an apparent relationship between wealth and the desire to limit reproduction: 59.8 % of married women (aged 15-49) who score in the lowest quintile of the wealth index report wanting to have no more children compared with 46.7% of women in the highest wealth quintile (regardless of the number of living children they currently have). Again, because all ages have been collapsed into one variable, it is difficult to say if there is an overrepresentation of a particular age group in any of the wealth quintiles. Interestingly, among currently married women aged 15-49, there is virtually no difference in the desire for more children based on area of residence: 55.3 % of women in urban areas report wanting to have no more children compared to 53.6 % report in rural areas. These data are particularly interesting when compared to the actual fertility numbers. In 2014, the total wanted fertility rate was 4.0 with an actual fertility rate of 5.1, compared to a total wanted fertility rate was 3.5 with an actual fertility rate was 4.6 in 2009. This suggests that the wanted fertility rate is increasing, as well as TFR.

It is also worthwhile to note that Samoa is a patriarchal society and women may be constrained in their ability to make an autonomous choice about reproduction. In 2014, 30.3 % of men age 15-49 (n = 1576) and 36.5 % of women, age 15- 49 (n = 4905) believe that a husband is justified in hitting or beating his wife for at least one of the following reasons: she burns the food; she argues with him; she goes out without telling him; she neglects the children; she refuses to have sex with him. Additionally, in 2014, only 26.7

% of women aged 15-49, (n = 4805) believed it was permissible to refuse sex with their husband if he had a sexually transmitted infection. This may help explain lower rates of wanted versus actual fertility.

2. The Current Sample: Representativeness and Fertility Correlates

Having presented a general picture of fertility in Samoa, in this section I present data from my own sample. I first demonstrate that my sample is in line with data available in the DHS and Census samples, and then present an analysis of correlates of fertility in my sample.

2.1. Descriptive Statistics

Descriptive statistics were calculated in order to demonstrate that my sample was ecologically valid and does not differ meaningfully from the much larger cross-sections of the population utilized by the Samoan census and the Samoan Demographic and Health Survey. Tables 2.1. and 2.3. demonstrate that the patterns seen in the current sample are consistent with similar published data, with one notable exception. The current sample has a much larger proportion of women who reported ever using birth control (50% of currently married women report ever using birth control) than similar reports in the 2009 (29% of currently married women report ever using birth control) and 2014 (27% of currently married women report ever using birth control) DHS.

It is also worth noting that there was very little variance in educational achievement, with more than 70% of the current sample reporting a completion of secondary education. With respect to income, responses were so variable (e.g., in one village, Falealili, the average income in tala is $368.97 with a standard deviation of

$627.04) that it was necessary to standardize this variable for analysis (See Table 3.2.). Additionally, because asking about income does not necessarily capture resources such as payments 'in kind' and excludes participants with zero income, participants were also asked about their perceived socioeconomic status. In the current study, all indications are that income and perceived socioeconomic status are measuring different things. Additionally, it is with caution that we offer a comparison of perceived socioeconomic status to the wealth quintiles that are used in the Samoan DHS. Wealth quintiles are calculated using a rubric of multiple variables that were not considered in the current study (e.g. type of flooring in a fale – dirt, cement, wood, tile, etc.). Therefore, although we have included them for comparison's sake, perceived socioeconomic status is not an identical measure.

With respect to village of residence, in Samoa, there are no post-marital residence rules to which young couples must abide. When couples wed, they are welcome to choose their village of residence. However, since most land in Samoa is customary land (81%) (AusAid, 2009), many couples will live either with the bride's family or the groom's family. A very small majority may purchase free-hold land and live with independent of either family, but this is rare as only 4% of the total land in Samoa is free-hold (AusAid, 2009). The positive effects of maternal grandparental investment are well established within the literature (Hawkes, O'Connell, & Blurton Jones, 1997; Sear, Mace, & McGregor, 2000; Gibson & Mace, 2005; Pollet, Nettle, & Nelissen, 2007), as such, Samoan women who choose to live in their own natal village, in close proximity to maternal kin, may have a reproductive advantage over Samoan women who choose to live in their spouse's natal village. Additionally, paternity uncertainty may lead men who are in situations of high uncertainty to preferentially insist on post-marital residence in

their natal village so that they are potentially in close proximity to their sister's offspring and are afforded the opportunity to maximize inclusive fitness benefits by increasing investment in their nieces and nephews (Moravec et al., 2018). Some villages have rules that do not permit marriage between men and women from the same village, however, that is not the case for every village in Samoa. In my sample, most participants resided in their natal village.

Table 3.1 *Number of offspring – overall and by independent variables ($n_{respondents}$ = 142)*

	N	Mean # Children	SD	Median	Total Fertility Rate (TFR) for women aged 15-49 years reported by the 2014 Samoan DHS	Mean number of children born to women age 40-49 reported by the 2014 Samoan DHS
Location						
Apia	21	3.14	2.14	2.00	Urban = 4.4	Urban = 4.2
Anoama'a	51	4.16	2.19	4.00	Rural = 5.2	Rural = 4.5
Lalomanu	35	5.24	2.24	5.00		
Falealili	35	3.78	2.29	3.00		
Education Level						
Primary or Less	11	4.2	2.48	3.00	5.1	5.1
Secondary	100	4.5	2.36	4.00	5.4	4.6
Tertiary	31	3.2	1.98	3.00	4.0	3.4
Ever used birth control						
No	80	3.66	2.27	3.00		
Yes	62	4.82	2.26	5.00		
Marital Status						
Married/Common Law	117	4.26	2.45	4.00		4.88
Divorced	7	3.29	0.76	3.00		
Single	7	2.57	1.39	3.00		
Widowed	11	4.82	1.66	5.00		
Perceived SES						
Wealthy	7	2.86	0.99	3.00	Wealth Q5 = 3.7	Wealth Q5 = 3.5
Above Average	14	3.43	2.32	2.50	Wealth Q4 = 4.3	Wealth Q4 = 4.5
Average	54	4.37	2.52	4.00	Wealth Q3 = 5.4	Wealth Q3 = 4.4
Below Average	39	4.72	1.74	5.00	Wealth Q2 = 5.3	Wealth Q2 = 4.8
Poor	21	3.33	2.46	2.00	Wealth Q1 = 6.7	Wealth Q1 = 5.3
Missing	7					
Natal Village						
Participant's village	77	4.06	2.03	4.00		
Spouse's village	43	4.28	2.55	4.00		
Participant & Spouse	20	4.55	2.95	4.00		
Neither	2	2.00	0	2.00		
Overall	142	4.17	2.33	4.00	5.1	4.5

Table 3.2. *Average income by location in Samoan tala per fortnight (n = 131)*

Location	N	Mean	SD	Median
Apia	21	612.14	574.68	400.00
Anoama'a	44	225.57	170.04	150.00
Lalomanu	31	354.97	268.26	250.00
Falealili	35	368.97	627.04	175.00
Total	131	356.58	446.91	200.00

**Missing values (Anoama'a = 7, Lalomanu = 4)*

Table 3.3. *Age at first birth - overall, and by independent variables (n = 142*)

	N	Mean	SD	Median	Median age at first birth for women aged 25-49 years 2014 Samoan DHS
Location					
Apia	21	22.92	5.27	22.24	Urban = 23.20
Anoama'a	51	22.28	3.20	22.14	Rural = 22.90
Lalomanu	35	20.99	3.06	20.88	
Falealili	35	23.65	3.46	22.74	
Education Level					
Primary or Less	11	21.02	3.38	20.44	22.10
Secondary	100	21.97	3.50	21.74	22.70
Tertiary	31	24.25	3.90	24.48	24.70
Ever used birth control					
No	80	22.71	3.98	22.28	
Yes	62	21.99	3.28	21.50	
Marital Status					
Married/Common Law	117	22.32	3.73	21.77	
Divorced	7	23.93	1.66	24.45	
Single	7	24.04	4.17	22.68	
Widowed	11	21.20	3.06	21.48	
Perceived SES					
Wealthy	7	21.70	3.42	23.70	Wealth Q5 = 24.50
Above Average	14	23.24	4.98	21.95	Wealth Q4 = 23.20
Average	54	23.09	4.01	22.40	Wealth Q3 = 22.70
Below Average	39	21.86	2.49	21.49	Wealth Q2 = 22.50
Poor	21	21.17	2.99	21.28	Wealth Q1 = 22.30
Missing	7				
Natal Village					
Participant's village	77	22.50	3.58	21.93	
Spouse's village	43	22.54	3.34	22.45	
Participant & Spouse	20	20.86	3.44	20.66	
Neither	2	30.71	4.13	30.71	
Overall	142	22.46	3.69	21.9	23.0

2.2. Analysis of Fertility Correlates

2.2.1. Methods

Participants

My sample consists of 223 Samoan women from four different locations on the main island of Upolu. Participants were interviewed by CAV and DLF, in-person, in the language of their choice (for location distribution see Table 3.4). Participants were asked about their reproductive histories (e.g., how many times have you been pregnant? What are the birthdates and birth order of your children? Have you used birth control?), along with demographic and biographic information (e.g., what is your birthdate? What is your highest level of education achieved? What is your marital status? Is this your natal village?). See Appendix A for the complete survey.

For the present analyses, women who were unable to provide accurate birthdate information for their children or who reported any discrepancy with respect to birthdates of biological children were excluded from analysis (n = 36), along with women who had no biological children (n = 3), those who had adopted children prior to age 45 (i.e., while theoretically still able to reproduce) (n = 13), and those who had given birth to twins (having multiple births, sometimes multiple sexes, is a confound) (n = 12). We also excluded those who had children that had died in childhood (n=6): a tsunami in 2009 killed more than 150 people from one of the sample locations. As we have no way of estimating the subsequent reproductive impact of this, these participants were excluded. In addition, only participants who completed all the fields of interest (marital status, education level, average income, socioeconomic status, natal village, and use of birth control) in the biographic survey were included in the model. This left us with a final sample size of 142 participants for analysis.

Table 3.4. *Descriptive statistics indicating the frequency of the categorical fixed effects overall and by location (n = 142)*

	Apia		Anoama'a		Lalomanu		Falealili		Total	
Variable	N	%	N	%	N	%	N	%	N	%
Education Level										
Primary or Less	0	0	7	13.73	2	5.71	2	5.71	11	7.75
Secondary	10	47.62	34	66.67	32	91.43	24	68.57	100	70.42
Tertiary	11	52.38	10	19.61	1	2.86	9	25.71	31	21.83
Used birth control										
Yes	12	57.14	19	37.25	16	45.71	15	42.86	62	43.66
No	9	42.86	32	62.75	19	54.29	20	57.14	80	56.34
Marital Status										
Married/Relationship	16	76.19	46	90.20	24	68.57	31	88.57	117	82.39
Divorced	0	0	2	3.92	3	8.57	2	5.71	7	4.93
Single	4	19.05	1	1.96	1	2.86	1	2.86	7	4.93
Widowed	1	4.76	2	3.92	7	20.0	1	2.86	11	7.75
Perceived SES										
Wealthy	1	4.76	4	7.84	0	0	2	5.71	7	4.93
Above Average	7	33.33	2	3.92	4	11.43	1	2.86	14	9.86
Average	12	57.14	16	31.37	11	31.43	15	42.86	54	38.03
Below Average	1	4.76	18	35.29	11	31.43	9	25.71	39	27.46
Poor	0	0	7	13.73	6	17.14	8	22.86	21	14.79
Missing	0	0	4	7.85	3	8.57	0	0	7	4.93
Natal Village										
Participant's village	12	57.14	29	56.86	19	54.29	17	48.57	77	54.23
Spouse's village	5	23.81	14	27.45	10	28.57	14	40.0	43	30.28
Participant & Spouse	2	9.52	8	15.69	6	17.14	4	11.43	20	14.08
Neither	2	9.52	0	0	0	0	0	0	2	1.41
Total	**21**	**100**	**51**	**100**	**35**	**100**	**35**	**100**	**142**	**100**

Ethical clearance for the project and informed consent

Ethical clearance was granted by the University of Lethbridge Human Research Ethics committee, protocol number 2014010. Written informed consent was obtained from all individual participants included in the study.

Locations

Four regions from the island of Upolu were selected for sampling. Several variables were taken into consideration when choosing villages: distance to town and availability of services such as power and water; size (land area and population), and access to services

such as police and hospitals. For a full description of each location see Appendix A. The villages in each region were selected based on previously established networks or associations with people in these locations.

Statistical Analysis: Model Variables

In all models, number of biological offspring was the dependent variable.

Marital Status – Participants were asked their current marital status. In Samoa, couples are considered married if they are living in the same residence, whether they have been legally or formally married or not. As such, women were asked to choose from four options: Married/committed relationship; Single; Divorced; Widowed.

Education – Participants were asked their highest level of completed education and were provided three options to choose from: Primary or less; Secondary; Tertiary (including Professional, Trade, or University). As such, women who may have completed three years at university but did not obtain a degree would have selected Secondary. This methodology was used to remain consistent with the methodology in the Samoan census and the Demographic Health Survey.

Average household income - For inclusion in the model, the variable "Average Income" was scaled, or standardized. In the questionnaire participants were asked "What is your average household income every two weeks? (Tala per fortnight?)".

Perceived Wealth (*Socioeconomic status)* – Socioeconomic status was ascertained by asking participants which one of the options provided, best described their living situation. Possible response options available to select were as follows: wealthy; above average; average; below average; or poor.

Natal village -. We included three levels for this variable: wife's natal village (maternal); spouse's natal village (paternal); or both wife and spouse's natal village (mat&pat). Two

participants reported living in a village that neither had a natal association with and they were excluded from all analyses including natal village as a variable.

Help from children – To measure help from children, participants were asked "do you receive help from your children?" As such, this measure is reflective of the participant's perception of help and is not observed help. Responses were limited to "yes" or "no".

Ever use of birth control – Participants were asked if they had ever used any form of birth control (including if they were currently using birth control), yes or no.

Data Analysis

Due to small sample size and the skewed number of responses within some categories (See Table 2.4.), we used a Bayesian multilevel Poisson regression model with a weak non-informative prior, centered on zero, to investigate the possible effects of marital status, level of education, average income (scaled), perceived socioeconomic status, natal village, usage of birth control, and help from children on overall fertility. The four regions from which the sample was drawn were included as a group-level effect.

2.2.2. Results

There was no clear effect of any of our predictor variables on fertility, with the exception of help from children ($\beta = 0.55$) and use of birth control ($\beta = 0.23$). Women who reported help from children and said they had used birth control had more children. Overall, the model explained approximately 38% of the variance in number of offspring (see Table 3.5. for full model results, Figure 3.1. for posterior density plot and Figure 3.2. for distribution of predictor variables).

Table 3.5. *Full Bayesian multilevel Poisson regression model with a weak non-informative prior, centered on zero. Dependent variable – number of children, independent variables – Marital Status, highest level of education, average income (scaled), perceived socioeconomic status, help from children, natal village, ever used birth control (chains = 4, cores = 4, iterations = 4000, number of observations = 127)*

Group-Level Effects

~District (number of levels: 4)						
	Estimate	Est. Error	L=95% CI	u-95%CI	Eff. Sample	Rhat
sd (Intercept)	0.12	0.15	0.00	0.54	883	1.01
Population-Level Effects						
	Estimate	Est. Error	L=95% CI	u-95%CI	Eff. Sample	Rhat
Intercept	.75	.0.31	0.12	1.36	4102	1.00
MARSTATMARRIEDCR	0.31	0.24	-0.15	0.82	4784	1.00
MARSTATSINGLE	0.11	0.33	-0.54	0.74	4479	1.00
MARSTATWIDOWED	0.34	0.27	-0.18	0.89	5117	1.00
EDUCATIONPRIMARYLESS	-0.10	0.17	=0.43	0.22	8000	1.00
EDUCATIONTERTIARY	-0.22	0.12	-0.46	0.02	8000	1.00
AVGINCOME.s	-0.06	0.05	-0.16	0.03	8000	1.00
SOCIOECOSTATAVERAGE	0.06	0.17	-0.24	0.40	4267	1.00
SOCIOECOSTATBELOWAVG	0.08	0.17	-0.26	0.44	4279	1.00
SOCIOECOSTATPOOR	-0.13	0.20	-0.52	0.26	4750	1.00
SOCIOECOSTATWEALTHY	-0.29	0.31	-0.93	0.29	6854	1.00
CHILDRENHELPYES	0.55	0.12	0.32	0.77	8000	1.00
VILLAGEMATERNAL	-0.14	0.13	-0.39	0.12	6812	1.00
VILLAGEPATERNAL	-0.10	0.13	-0.36	0.15	7160	1.00
USEDBCYES	0.23	0.10	0.03	0.42	8000	1.00
Marginal R^2 with random effects						
	Estimate	Est. Error	Q2.5	Q97.5		
R2	0.375	0.060	0.244	0.483		

Figure 3.1. Posterior density plot for Bayesian multilevel Poisson regression model with a weak non-informative prior, centered on zero.

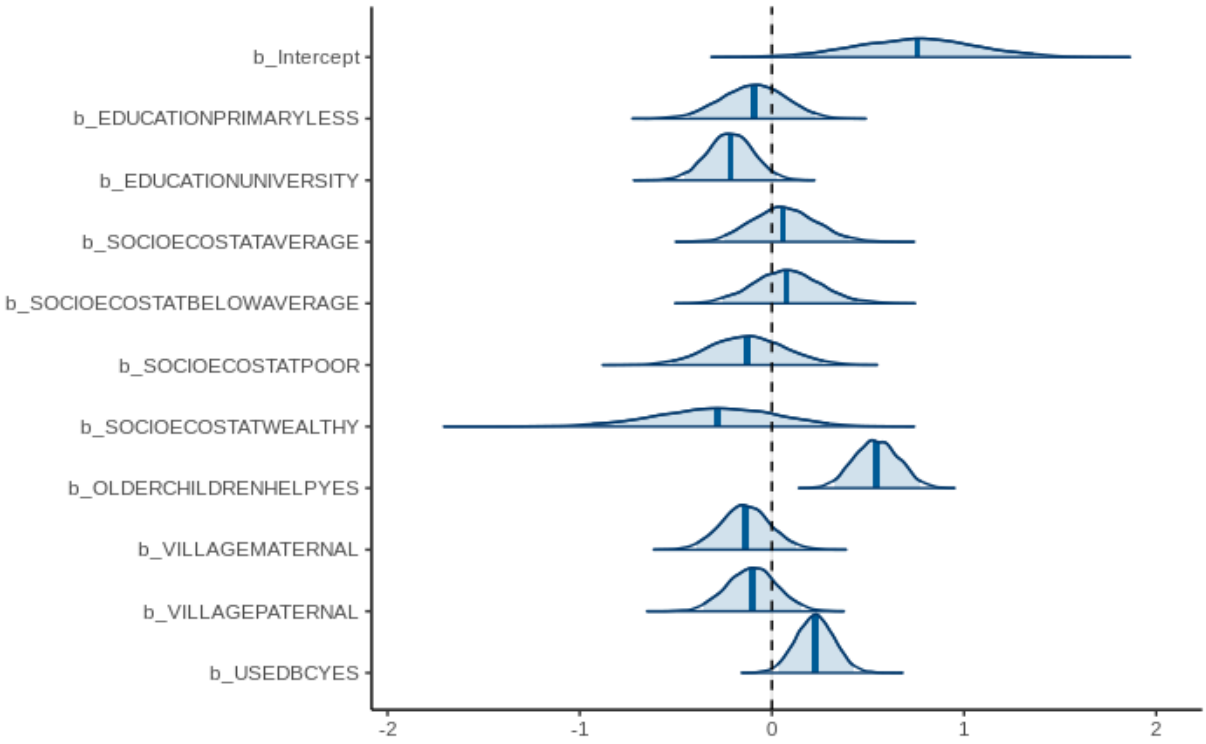
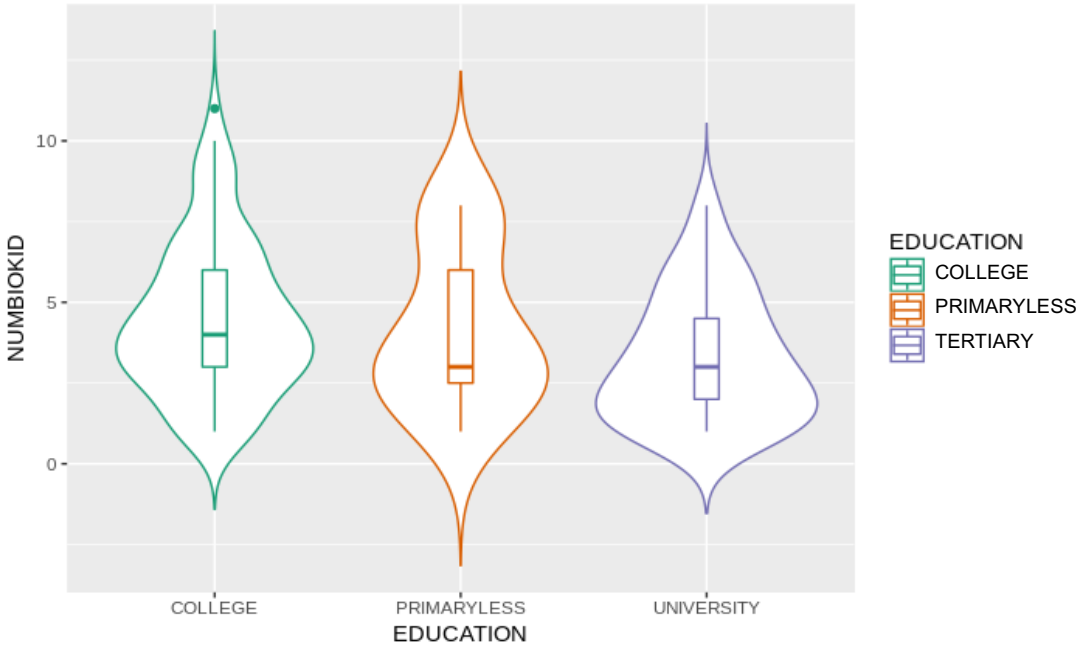
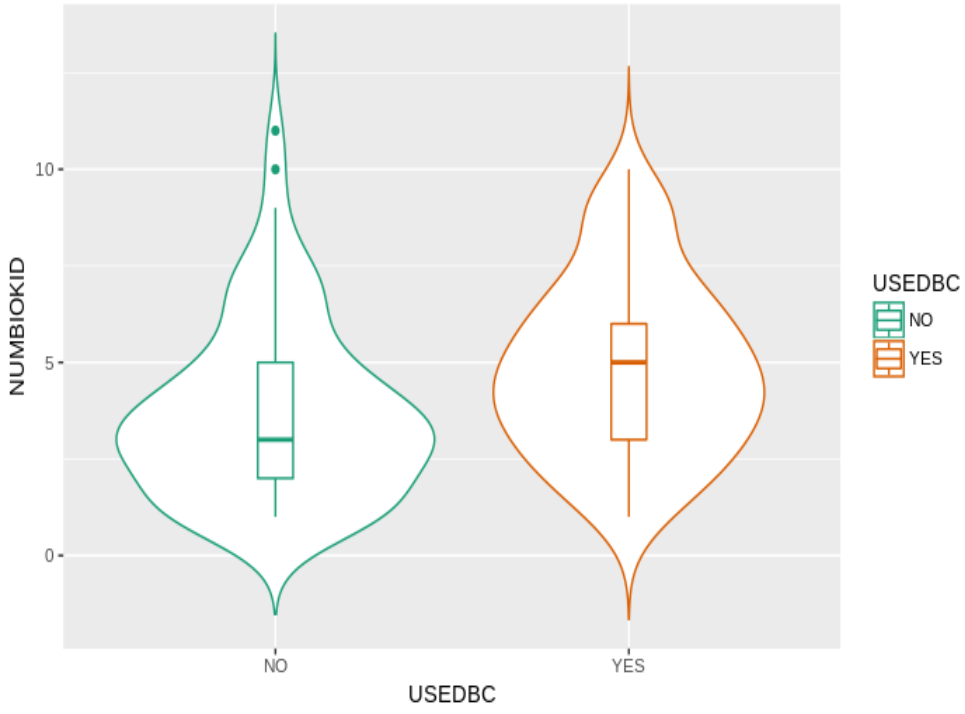


Figure 3. 2. Violin plots demonstrating the distribution of the number of children by predictor variable.

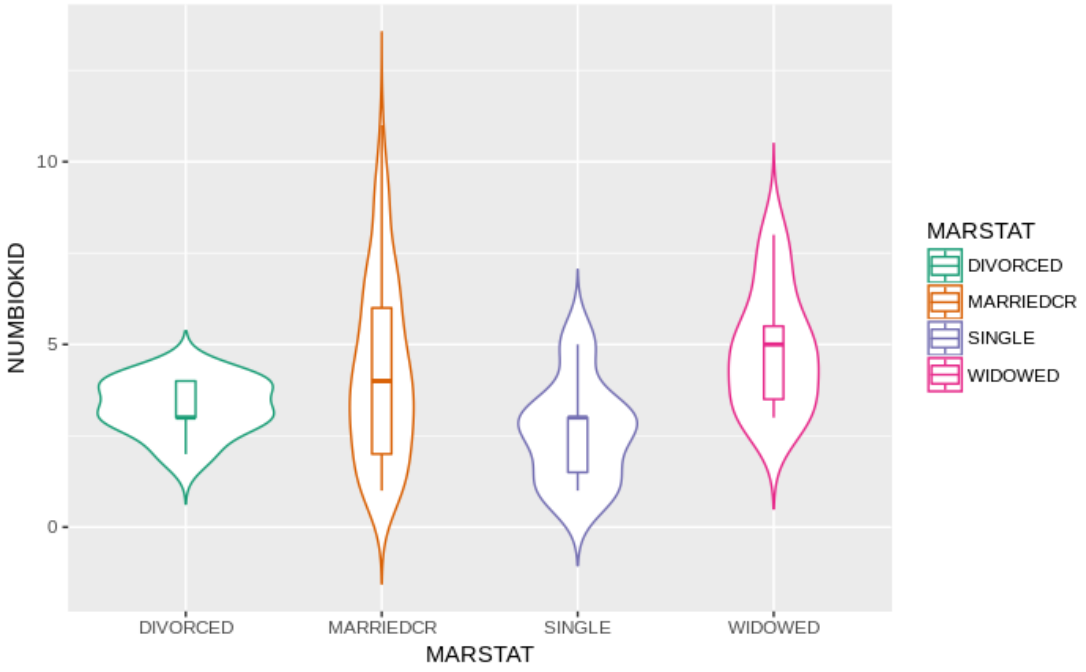
a) Highest level of education achieved (n = 142)



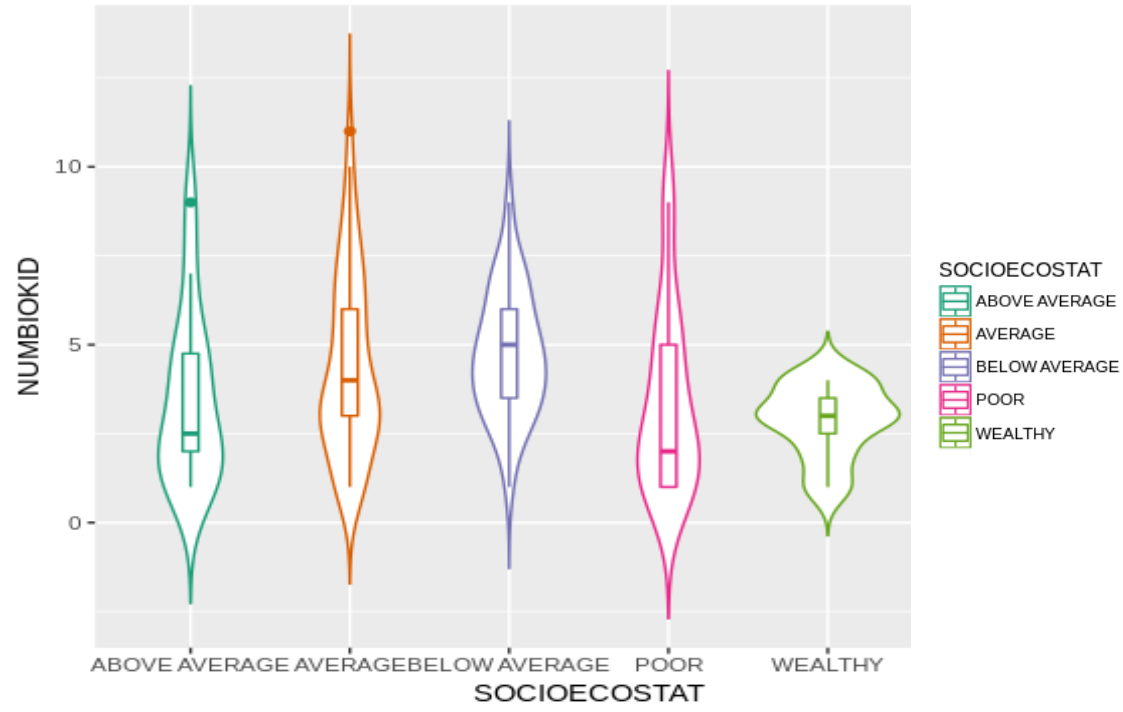
b) Ever used birth control (any method) (n = 142)



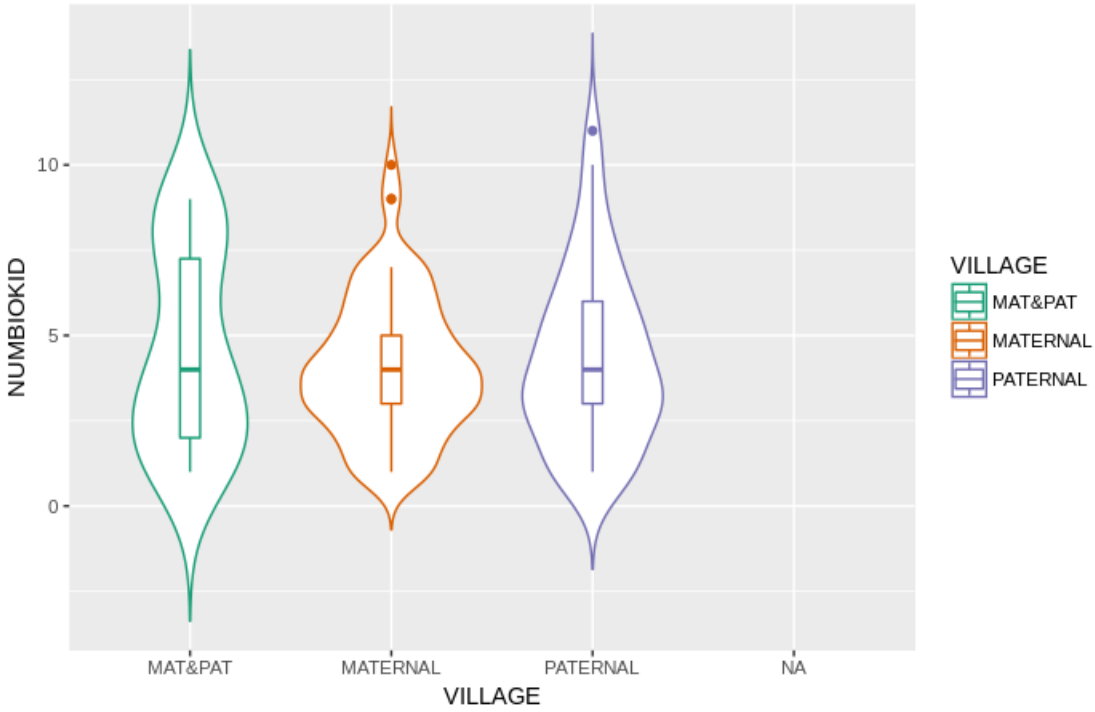
c) Marital status at time of interview (n = 142)



d) Perceived Socioeconomic status at time of interview (n = 142, 7 missing)



e) Village of residence at time of interview (Maternal = participant's village, Paternal = participant's spouse's village, Mat&Pat = both participant and spouse from same village) (n = 142)



In order to follow up on these effects and test for interaction effects, help from children and use of birth control were tested independently. Again. we conducted Bayesian multilevel Poisson regression models with a weak non-informative prior, centered on zero, (random effect = location, four levels) with either help from children or use of birth control as our only independent variable. For help from children, the model explained approximately 19% of the variance in number of offspring (Marginal $R^2 = 0.19$; $\beta = 0.56$). Women who reported receiving help from their children had more offspring overall (Table 3.6.). For birth control, the model explained approximately 7% of the variance in number of offspring ($\beta = 0.29$; Marginal $R^2 = 0.07$). Women who reported using birth control had more offspring overall (Table 3.7.).

As a measure of sensitivity, all models were also run including the participants with twins (n = 12). We found the effects persisted, and the model explained 39% of the variance (Marginal $R^2 = 0.39$) (full model - help from children ($\beta = 0.57$), and use of birth control ($\beta = 0.24$). When tested alone, help from children ($\beta = 0.68$; Marginal $R^2 = 0.26$) and birth control($\beta = 0.36$; Marginal $R^2 = 0.10$), again explain a meaningful amount of the variance we observe in overall fertility.

Table 3.6. *Help from children Bayesian multilevel Poisson regression model with a weak non-informative prior, centered on zero. Dependent variable – number of children, independent variable – help from children (chains = 4, cores = 4, iterations = 4000, number of observations = 141)*

Group-Level Effects

~District (number of levels: 4)

	Estimate	Est. Error	L=95% CI	u-95%CI	Eff. Sample	Rhat
sd (Intercept)	0.16	0.18	0.01	0.60	780	1.01

Population-Level Effects

	Estimate	Est. Error	L=95% CI	u-95%CI	Eff. Sample	Rhat
Intercept	1.02	0.12	0.76	1.26	1362	1.00
CHIDRENHELPYES	0.56	0.10	0.37	0.76	4738	1.00

Marginal R^2 with random effects

	Estimate	Est. Error	Q2.5	Q97.5
R2	0.192	0.057	0.084	0.307

Table 3.7. *Use of birth control Bayesian multilevel Poisson regression model with a weak non-informative prior, centered on zero. Dependent variable – number of children, independent variable – Used birth control (chains = 4, cores = 4, iterations = 4000, number of observations = 142)*

Group-Level Effects

~District (number of levels: 4)

	Estimate	Est. Error	L=95% CI	u-95%CI	Eff. Sample	Rhat
sd (Intercept)	0.38	0.29	0.09	1.24	1334	1.00

Population-Level Effects

	Estimate	Est. Error	L=95% CI	u-95%CI	Eff. Sample	Rhat
Intercept	1.24	0.21	0.76	1.68	1771	1.00
USEDBCYES	0.29	0.08	0.12	0.45	4762	1.00

Marginal R^2 with random

	Estimate	Est. Error	Q2.5	Q97.5
R2	0.067	0.043	0.009	0.174

Table 3.8. *Respondents descriptive statistics by reported help (yes/no), including chi-square tests of independence of all categorical factors (Respondents from Table 3.6)*

	N		Relative Frequency		Chi-square	p-value
Reported help from children	Yes	No	Yes	No		
Location					14.49	.002
Apia	10	10	7%	7%		
Anoama'a	32	19	23%	13%		
Lalomanu	31	4	22%	3%		
Falealili	17	18	12%	13%		
Education Level					3.24	.20
Primary or Less	7	4	5%	3%		
Secondary	68	32	48%	23%		
Tertiary	15	15	11%	11%		
Ever used birth control					6.25	.01
No	44	36	31%	26%		
Yes	46	15	33%	11%		
Marital Status					5.16	.16
Married/Common Law	72	44	51%	31%		
Divorced	5	2	4%	1%		
Single	3	4	2%	3%		
Widowed	10	1	7%	1%		
Perceived SES					4.69	.32
Wealthy	4	3	3%	2%		
Above Average	6	7	4%	5%		
Average	37	17	28%	13%		
Below Average	28	11	21%	8%		
Poor	11	10	8%	7%		
Natal Village					.03	.98
Participant's village	49	28	35%	20%		
Spouse's village	28	15	20%	11%		
Participant & Spouse	13	7	9%	5%		

Table 3.9. *Respondents average number of IBI days, number of offspring, age at interview, age at first birth, and average income by reported help from children (yes/no)(respondents from Table 3.6)*

	N	Mean	SD	Median
Reported Help from Children (Yes/No)				
Average IBI in Days				
Yes	90	1123.39	510.02	1025.50
No	51	1390.97	1394.67	903.00
Number of Offspring				
Yes	90	4.99	2.12	5.00
No	51	2.76	2.01	2.00
Age at Interview				
Yes	90	42.11	10.83	42.00
No	51	36.49	13.16	31.00
Age at First Birth				
Yes	90	21.81	3.39	21.72
No	51	23.34	4.02	22.64
Average Income				
Yes	84	372.90	470.95	200.00
No	46	308.43	386/30	200.00

3. Discussion

My results demonstrate that our sample appears to be consistent descriptively with the Samoan DHS and the Samoan census and additionally, our findings are consistent with the patterns seen and conclusions drawn in these publications.

More specifically, my results are consistent with the 2009 and 2014 Samoan DHS in that I find no evidence of a relationship between fertility and education. My results also demonstrate no relationship between fertility and socioeconomic status and fertility and income, although neither the 2009 nor 2014 Samoan DHS tested socioeconomic status or income, they found no evidence of a relationship between fertility and wealth quintile. Additionally, the distribution of variables such as education and marital status in our sample mirrored the distribution in both the 2009 and 2014 Samoan DHS. Despite using socioeconomic status as a measure of wealth, I found that the distribution of wealth (measured by SES) was similar to the distribution of wealth (measured by wealth quintile) in the Samoan DHS.

Importantly, our model highlights that help from children is an important variable that requires further attention. The Samoan NPP did not take into consideration help from family members as a factor that could be driving or maintaining fertility in Samoa. My work demonstrates that, more than any other variable that we considered, help appears to be important. I asked women if they received help from their children, which captured the participants' perception of help, in further chapters, I also observed whether help was occurring within households. These two measures of help may be capturing two different things, and could potentially, impact fertility in different ways. However, in the current chapter reported help, help that the mother perceives to be happening, appears to have some relationship with fertility. Importantly, this study cannot address the directionality

of the relationship between number of children and help from children. We must consider whether help from children is the consequence of higher fertility or the cause of higher fertility. In order to address the directionality of this relationship, longitudinal data is necessary. Additionally, number of children is not the only way to measure fertility. Perhaps investigating the duration of time between births, interbirth interval, would be a more nuanced measure and provide further insight into the positive impact on fertility that help from children appears to have.

The Samoan NPP relied on the idea that making birth control more accessible, increasing the availability of contraception, and increasing understanding of how contraception physically affects the body, would all combine to reduce the fertility rate and encourage women to space births. However, our results show that women who report using birth control actually have more children those who report never using birth control. This suggests that women may be using contraception as a consequence of having many children, to limit further reproduction rather than to delay reproduction or to space their births. Indeed, with respect to the number of children at first use of contraception, the 2014 Samoan DHS reports the highest proportion of women (in ages 35-49 years) saying they initiated contraception usage after 4 or more children. This finding is consistent with Alvergne, Lawson, Clarke, Gurmu, and Mace (2013), and Alvergne, Gibson, Gurmu, and Mace (2011) who found the same effect. Further support for this can be seen within DHS respondents who claimed to have never used birth control. More than 99% of women aged 15-19 years claimed to have never used contraception compared to 55% of women aged 45-49. This also helps to explain the patterns in my own sample, where the overall mean age is 40 years old, and 56% of our sample report having never used birth control.

In this context, the proportion of non-users in our sample is consistent with the Samoan DHS.

In line with Kaplan and Lancaster's (1999) argument that the emergence of competitive labour markets reconfigures payoffs to parental investment, it appears that the Samoan economy—which remains in the early stages of development, is highly unstable, and still reliant on global funding—has not yet reached the point where there is an active demand for contraception in order to post-pone or space births and ensure sufficient investment in more costly children.

To expand on this a little. Kaplan and Lancaster (1999) suggested that parents who are more educated, and earn more, are likely more efficient at educating their children. As a result, optimal levels of investment increase with the increasing educational level of the parents. Fertility and income eventually become decoupled as increases in income are compensated for by increased investment. Similarly, Colleran (2016) proposes that in all species, the energetics of reproduction are linked to resource accumulation, but that humans have evolved a particular "skill-intensive" foraging niche, which requires investment in embodied capital to attain resources (or other types of wealth). Addressing fertility decline in developed nations, Colleran, Jasienska, Nenko, Galbarczyk, and Mace (2015) and Colleran (2016) suggest that one of its causes may be that the developed market economies increase parental investment returns via embodied capital, in the form of education, which in return, generate quality versus quantity trade-offs in offspring. In Samoa, post-education employment is less likely than post-education unemployment. Wages are still low when measured against the cost of living (For example, the cost of taking the bus, round trip, to the capital city of Apia to work is approximately $10 WST, and the minimum wage is $2.20 WST/hour). Going to work

outside of the home is costly unless one can ensure a high paying position. As a result, investing in the education for oneself or of one's offspring is risky. This, Samoa appers not to have reached the stage where parental investment returns via embodied capital offset the cost to delaying or limiting reproduction.

Finally, studies that investigate the causes of changing fertility rates often focus on measuring the direct impact of socioeconomic factors on fertility (Bongaarts, 1978; Martin, 1995). For example, the level of education in women is a socioeconomic indicator typically found to be negatively related to fertility, however, this indicator may be more useful if examined by the age at which women marry or by contraceptive use *within* educated women. Within group analyses may be a more meaningful approach and may better explain the relationship between education and other socioeconomic factors and fertility (Mace, 2008).

In the current study, one factor emerged as having a particular impact across categories – help from children. As such, it is worth further investigating the role of children as helpers and the impact those helpers may have on their mother's fertility.

CHAPTER FOUR

EFFECTS OF OFFSPRING SEX AND REPORTED HELP ON REPRODUCTION

"I have tried to answer the question which sent me to Samoa: Are the disturbances which vex our adolescents due to the nature of adolescence itself or to the civilization? Under different conditions does adolescence present a different picture?"

Margaret Mead – Coming of Age in Samoa

1. Introduction

Human life history is marked by extremely long lifespans, an extended juvenile period, and high rates of both fertility (Kramer, 2005; Stieglitz, Gurven, Kaplan, & Hooper, 2013) and offspring survivorship (Kaplan, Hill, Lancaster, & Hurtado, 2000). This combination gives rise to high levels of offspring dependency: children remain energetically dependent on their parents long after weaning and do not produce more food than they consume until they reach their mid to late teens (Kaplan 1994; Kramer 2005). As a result, human mothers often face a time- and resource-allocation problem: they find themselves simultaneously caring for multiple offspring at various stages of development, each of which has different needs (Kramer, 2005; Mace, 2000). One way for mothers to attend effectively to these contrasting needs is to enlist the help of others in childcare and household labour. This potentially increases women's fertility and child survivorship, enhances siblings' growth, and lowers morbidity and mortality risks (Kaplan et al., 2000). Most of the literature on this issue focuses either on the role of grandmothers as helpers

(Alvarez, 2000; Hawkes, O'Connell, & Blurton Jones, 1989; Hawkes, O'Connell, Jones, Alvarez, & Charnov, 1998; O'Connell, Hawkes, & Blurton Jones, 1999) or on patterns of paternal investment. Much less attention has been paid to the role of offspring as potential "helpers at the nest" (Kramer, 2005), although there are some suggestive findings.

In a time-allocation study among the Micronesian people of Ifaluk, Turke (1988) demonstrated that mothers with first-born daughters had higher fertility than mothers with first-born sons, and that women who bore a daughter first and then a son had higher fertility than women who bore a son and then a daughter (Betzig, Harrigan, & Turke, 1989; Turke, 1988). In addition, the most fertile women were those whose first- and second-born children were female, while women with the lowest fertility had first- and second-born sons. Although the sample sizes were small, (women with first- and second-born daughters n = 11, women with first- and second-born sons = 7), this suggests that daughters may be more economically useful to the family (Hames & Draper, 2004).

Similarly, Bereczkei and Dunbar (2002) and Bereczkei and Dunbar (1997) found that, among Hungarian gypsies, women with first-born daughters displayed a reproductive advantage. Specifically, Bereczkei and Dunbar found that women with first-born daughters experienced shorter inter-birth intervals, a longer reproductive span, and higher fertility. Their time allocation data suggested that the underlying mechanism for this reproductive pattern was an elevated rate of helping with housework and childcare by daughters.

Other studies have failed to replicate such findings, however. Flinn (1989) found no effect of male-female birth order on fertility in Dominica. He did find, however, that mothers with non-reproductive females in their household had higher fertility, and that mothers with female helpers spent less time engaged in childcare than mothers without

helpers. More recently, Stieglitz, Gurven, Kaplan, and Hooper (2013) found that, among Tsimane forager-horticulturalists in Bolivia, women were consistently more likely to be assigned domestic and alloparental tasks across all labour-demand contexts. In another recent study, Mattison and Neill (2013) found that, among Indo-Fijian mothers, only one category of children's work—childcare—had any impact on fertility: children's direct contributions to childcare were positively associated with their mother's reproductive success.

Older children are the most common alloparents in traditional societies (Weisner et al., 1977) and children may continue to provide alloparental help after forming families of their own (Hill et al., 2011). In Aymara women, overall reproductive success (fertility and offspring survivorship) increases with the presence of offspring helpers of either sex who are over the age of five (Crognier, Villena, & Vargas, 2002). Sear, Mace, and McGregor (2003) found no effect of offspring help on overall fertility in Gambian mothers, although Sear et al., (2002) did find that Gambian children aged two to five, with at least one sister that was ten or more years their senior, experienced higher survivorship than Gambian children without an older sister. Taken together, this suggests there is some relationship between help from siblings and the mother's reproductive success within natural or high fertility populations, although it seems to be highly context-specific. In addition, the relationship between specific types of help (i.e., general household help versus direct help with childcare) is often not differentiated.

Not all populations keep detailed records of birth dates, so many studies investigating the relationship between help and fertility use only one measure: total reproductive output (e.g. Turke 1988). However, the length of the interbirth interval (i.e., the interval between the births of surviving offspring) is both a reliable predictor for

determining rates of fertility in high fertility populations and an indicator of parental investment (Mace & Sear, 1997). Children born after a short interbirth interval appear to suffer detrimental effects, with higher rates of morbidity and mortality (Blurton Jones, 1986; Mace & Sear, 1997; Norton, 2005; Blurton Jones 2016). Short interbirth intervals have been linked to increased risk for preterm birth, low birth weight, and being small for gestational age (Blurton Jones, 1986; Norton, 2005). Additionally, in some populations, women who experience multiple successive births in a short time period may suffer from maternal depletion syndrome, a condition that is associated with a number of difficulties such as edema, anemia, inadequate pregnancy weight gain, and osteomalacia (Winkvist, Rasmussen, & Habicht, 1992; Blurton Jones, 2016).

Due to competition between siblings for access to parental resources (e.g. food, care, attention), smaller families are associated with lower rates of mortality, and children born before or after a long interbirth interval may fair better in the competition for parental resources particularly during critical developmental periods. As a result, longer birth intervals may contribute to the improved health status of both mother and child (Mace & Sear, 1997; Flinn, 1988; Lawson & Mace, 2011; Blurton Jones, 2016).

One explanation for relatively short interbirth intervals in humans, despite the potential negative health implications for mother and offspring, is the presence of cooperative breeding—defined here as non-parental individuals who assist in rearing offspring who are not their own. By ameliorating maternal energy burdens, assistance from others may help offset the costs of shorter inter-birth intervals, and can explain why higher levels of help, from offspring and others, contributes to higher overall levels of fertility. Borgin, Bragg, and Kuzawa (2014) argue that the term ‘cooperative breeding’ may be inappropriate to use in human contexts. They point to a definition of ‘cooperative

breeding' put forth by Lukas and Clutton-Brock (2012) who suggest that, one of the criterion essential to 'cooperative breeding' are females who do not breed regularly but rather provide alloparental care to the genetically related offspring of a breeding female. Since women in traditional societies reproduce regularly if fertile, this is not a criterion that humans meet (Bogin, Bragg, & Kuzawa, 2014). Borgin, Bragg, and Kuzawa (2014) stress that humans undoubtedly demonstrate cooperative assistance, support, and mutual aid with respect to the rearing of offspring, however, they argue that the human style of cooperative breeding is not the equivalent of cooperative breeding observed in non-human animals, and thusly they recommend the term biocultural reproduction. For the current study, I have used the term cooperative breeding, and by this, I mean exactly as Bogin, Bragg, and, Kuzawa (2014) have re-termed 'biocultural reproduction'.

The sex of offspring may also contribute to variation in inter-birth interval length. For example, Low (1991) found that, in a sample of births from 19th century Sweden, birth intervals that ended in the birth of a boy were significantly longer than intervals that ended with the birth of a girl. Mace and Sear (1997), investigating birth spacing in a population of Gabbra pastoralists from Northern Kenya, found similar results: birth intervals ending in the birth of a son resulted in longer birth intervals than those ended by the birth of a daughter, although the effect was not statistically significant. Both sets of authors argue that maternal depletion might explain this phenomenon. Male offspring are often considered the costly sex (Trivers & Willard, 1973): evidence from rhesus macaques show that males are larger at birth, they nurse for longer and more frequently than female offspring and the composition of the mother's milk is richer, and more energetically demanding to produce, for male offspring (Hinde, 2009). Low (1991) also distinguished between the cost imposed on mothers with respect to nursing (which she

argues would increase the time after a birth of a costly sex), and the cost imposed on mothers with respect to gestation (which she argues, may increase the time before the conception of the costly sex).

Here, we investigate (i) whether reported help from offspring predicts the length of inter-birth intervals and overall fertility, and (ii) whether offspring sex has any influence on inter-birth interval length in a sample of women from Independent Samoa. In contrast to other industrialized and industrializing nations, Samoa's fertility rate has slightly increased over the last ten years despite ongoing economic development (2014 Samoan Census). Along with economic and social development, parents are being encouraged by churches and the government to prioritize their children's education. Despite this, the fertility rate has not been negatively affected. One explanation for Samoa's continued high fertility rate may be that mothers receive high levels of alloparental help.

Anecdotally at least, it appears that helping behaviour is expected of Samoan children (Fanene, 2007; D Forrester, pers. Obs.). Accordingly, Samoan mothers who report receiving household help from their offspring are predicted to reproduce more frequently (i.e. have shorter interbirth intervals), and reproduce more overall (higher total fertility) than Samoan mothers who report receiving no help from their offspring.

Consistent with the division of labour reported by Turke on the Pacific Island of Ifaluk (1988), the division of labour by sex in Samoa suggests that women (and girls) are responsible for the majority of childcare and household maintenance (Meleisea, 1985; Schoeffel, 1978; Schoeffel, 1983). As a consequence, Samoan mothers with first-born daughters are predicted to reproduce more frequently (shorter interbirth intervals) and reproduce more overall (higher total fertility) than Samoan mothers with first-born sons.

Accordingly, interbirth intervals that occur after the birth of a daughter are predicted to be shorter than interbirth intervals following the birth of a son. In addition, interbirth intervals that are closed by the birth of a son are predicted to be longer than interbirth intervals that are closed by the birth of a daughter. Consequently, therefore, birth intervals that are both opened by a daughter and closed by a daughter should be shorter than interbirth intervals that are both opened by a son and closed by a son.

2. Methods

Participants

The sample consists of 223 Samoan women from four different locations on the main island of Upolu. Participants were interviewed by CAV and DLF, in-person, in the language of their choice (for location distribution see Table 3.4). Participants were asked about their reproductive histories (e.g., how many times have you been pregnant? What are the birthdates and birth order of your children? Have you had any miscarriages?), demographic information (e.g., what is your birthdate? What is your highest level of education achieved? What is your marital status?), and questions about general help they receive from their older children in looking after their younger children (e.g., do your children help you?). An attempt was made to differentiate the type of help that women received (e.g. do your children help with the wash? Do your children help with cooking?) However, because these questions were not structured by child, and were about children's help in general, most women who stated they received help from their children also answered "yes" to every type of helping behavior. This led to little or no variation in response, and precluded an examination of the impact of help by category or type.

For the present analyses, women who were unable to provide accurate birthdate information for their children or who reported any discrepancy with respect to birthdates

of biological children were excluded from analysis (n = 36), along with women who had no biological children (n = 3), those who had adopted children prior to age 45 (i.e., while theoretically still able to reproduce) (n = 13), and those who had given birth to twins (having multiple births, sometimes multiple sexes, per interval is a confound) (n = 12). We also excluded those who had children that had died in childhood (n=6): a tsunami in 2009 killed more than 150 people from one of the sample locations. As we have no way of estimating the subsequent reproductive impact of this, all participants with children that died in childhood were excluded. This left us with a final sample size of 153 participants for analysis, comprising 593 interbirth intervals, 482 of which were naturally completed. We did, however, run all analyses on the full sample (i.e., including twins, adopted children and women who had lost children) as a form of "sensitivity analysis" to assess whether these unusual cases influenced the patterns found.

Ethical clearance for the project and informed consent

Ethical clearance was granted by the University of Lethbridge Human Research Ethics committee, protocol number 2014010. Written informed consent was obtained from all individual participants included in the study.

Locations

Four regions from the island of Upolu were selected for sampling. A number of variables were taken into consideration when choosing villages: distance to town and availability of services such as power and water; size (land area and population), and access to services such as police and hospitals. Taken together, the final sample is an ecologically valid representation of the population. For a full description of each location see Appendix A. The particular villages in each region were selected based on previously established networks or associations with people in these locations.

Calculation of interbirth intervals

For each participant, interbirth intervals were calculated by counting the number of days between the birth of each child. For women of childbearing age, censored interbirth intervals (i.e., intervals that were 'opened' by the birth of one child but not closed by the birth of a subsequent child), the number of days at risk was calculated by counting the number of days between their last birth and the date of the interview.

Methods of analysis

For all analyses investigating overall fertility, a Poisson regression was used. In order to control for mild violation of the assumption that the variance equals the mean, the R package 'sandwich' was used to obtain robust standard errors and calculate p-values accordingly. Additionally, the 95% confidence intervals were calculated using parameter estimates and their robust standard errors.

For analyses investigating the length of the interbirth interval, a Cox proportional hazards mixed effects regression was used, as this enabled the use of right-censored data (i.e., open inter-birth intervals) and allowed us to use the entire data set. These models provide a hazard rate, or the chance of an event of interest occurring in a particular period of time. Here, the event of interest was the birth of a child. The Cox model assumes that the hazard rate for an individual can be factored into a baseline hazard rate that is common to all the individuals in the sample. When the hazard ratio is greater than one, the covariate of interest is associated with an increased hazard of the event of interest occurring (i.e., closing of the interval due to a birth). When the hazard ratio is less than one, the covariate is associated with a decreased hazard of the event of interest occurring. A hazard ratio of one suggests that there is no relationship between the covariate and the event of interest.

Prediction 1: Reported help from children will lead to shorter interbirth intervals and more surviving offspring

In addition to the participant exclusions outlined earlier, further exclusions were required for this particular analysis. From a sample of 153 participants, participants were excluded if their first-born child was under the age of five years (n = 28) and/or if the participant did not provide a yes or no response to the question about receiving help during the interview (n = 1). This leaves us with a final sample size of 124 participants.

A general linear model (GLM) was used to investigate the effect, if any, of reported help by older children on the average length, in days, of interbirth intervals. To calculate average interbirth interval, each participant's closed interbirth intervals were summed then divided by the total number of intervals. For example, a woman who had three children had two closed interbirth intervals; those two intervals were summed, and divided by the number of intervals, i.e., two. The age of the participant at the time of her first birth (M = 22.25) and the age of the participant at the time of the interview (M = 42.77) were both included as covariates in the model.

To examine the effect of reported help on length of interbirth interval, a Cox proportional hazards mixed effects regression model was used. We included age of the participant at opening birth, the number of children present in the home (equivalent to birth order -1) and reported help from children as fixed effects. Participant ID was included as a random effect.

Prediction 2: First-born daughters will predict shorter interbirth intervals and higher overall fertility

A Cox proportional hazards mixed effects regression model was used to examine the influence of first-born sex on interbirth interval length. The model included age of the

participant at opening birth, number of children present in the home, and sex of the first-born child as fixed effects. Participant ID was included as a random effect.

Prediction 3: The sex of the child that opens the interval and the sex of the child that closes the interval will predict of the length of the interbirth interval

A Cox proportional hazards model was used to examine the impact of the sex that opens and the sex that closes an interval on interbirth interval length. The model included age of the participant at opening birth, number of children present in the home at the time of the opening birth, sex of the child that opened the interval, and sex of the child that closed the interval as fixed effects. Participant ID was included as a random effect.

Prediction 4: The category of interval will impact interbirth interval length with intervals opened by a daughter and closed by a daughter being shorted than those opened and closed by sons.

A GLM was used to investigate the impact of category of interbirth interval on interbirth interval length. The length of interbirth intervals in days was the response variable and interbirth interval category was the predictor variable, with age of mother at first birth included as a covariate.

Following Colquhoun (2018), we describe outcomes as indicating weak ($P \sim 0.05$), moderate ($P \sim 0.01$) or strong ($P \sim 0.001$) evidence for effects.

3. Results

For all intervals ($n = 593$), the overall mean interbirth interval length was 1096.83 days ($SD = 963.67$). The Samoan 2014 Demographic and Health Survey (DHS) gives an overall median of non-first births as 27.9 months (approximately 837 days). For non-first births in the current sample, the overall median of interbirth intervals was 817 days (approximately 27.2 months). Additionally, the 2014 Samoan DHS gives an overall

median of age at first birth as 23.0 years. In the current sample (n = 153), the overall mean age at first birth is 22.52 years (SD = 3.78), and the median is 22.10. The mean age at the time of interview for the current sample is 39.79 years (SD = 11.60) (See Table 3.1 for descriptive statistics). The Samoan Census (2001, 2006, 2011) and Samoan Demographic Health Surveys (2009, 2014) report total fertility rates (TFR) ranging from 4.4 in 2001, to 5.1 in 2014, the current sample reports a mean of 4.18 with respect to total number of surviving offspring, slightly lower than the current TFR. Taken together, this suggests that the current sample data is representative of the national survey (see Table 4.1 for descriptive statistics).

Table 4.1. *Overall descriptive statistics for final sample*

	N	Mean$_{(Full\ Dataset)}$	SD	Min	Max
All Women					
# of Surviving Offspring	153	4.18 (4.34)	2.29	1	11
Age at time of interview	153	39.79 (40.24)	11.60	19	70
Age at time of first birth	153	22.52 (22.37)	3.78	15	35
Interbirth interval length $_{(days)}$	153	1096.8 (1257)	963.67	40	7009
Women aged over 45					
# of Surviving Offspring	49	5.27	2.27	2	10
Age at time of interview	49	54.55	5.71	46	70
Age at time of first birth	49	22.65	3.54	17	35
Interbirth interval length $_{(days)}$	49	1171	624.63	207	2258

Prediction 1: Reported help from children will lead to shorter interbirth intervals and more surviving offspring

As one might expect, there was strong evidence for an effect of age of first birth on fertility: women with an earlier age at first birth report higher levels of fertility (Table 4.2). Again, as expected, there was strong evidence for an effect of mother's age at the time interview, with older women experiencing higher fertility (Table 4.2). As predicted we also found strong evidence for a positive effect of reported help on fertility (Figure 4.2; Table 4.2), although the directionality of this relationship cannot be inferred (i.e., there may be reverse causality: the more children present in the household, the more help a mother receives).

There was strong evidence for a relationship between reported help and average interbirth interval length: women who reported receiving help from their children had shorter interbirth intervals (M_{help} = 1154.19, SE = 94.23, n = 94) than those who did not (M_{nohelp} = 1917.18, SE = 169.50, n = 30; $F(1,120) = 15.14$, $p < 0.0001$, $\eta^2 = 0.11$). (Figure 3.1). Repeating the analysis including women with children of all ages (i.e., no age restriction of over five years, n = 153), we found a moderate evidence and a smaller effect of reported help ($F(1,150) = 3.60$, $p = 0.05$, $\eta^2 = 0.02$). When the analysis was conducted including women with twins and children of all ages (no restrictions, n = 165), we found no evidence for an effect ($F(1,162) = 2.63$, $p = 0.11$, $\eta^2 = 0.01$).

We also found a weak effect of the number of children present in the home (i.e., birth order -1) on interbirth interval length. As birth order increased, so too did the length of the interbirth interval, with a hazard ratio of 0.91 ($p = 0.03$). There was no effect of mother's age on IBI. There was also moderate evidence for an effect of reported help from children on IBI (Table 4.3). Women who reported receiving help from their children

experienced shorter inter-birth intervals (hazard ratio of 1.47, $p = 0.01$).

Table 4.2. *Poisson Regression examining relationship between reported help and overall fertility (age of the mother at the time of her first birth and age of the mother at the time of the interview included as covariates), n = 153*

Coefficients	Estimate	Robust SE	Pr(>|z|)	LL	UL
(Intercept)	1.30	0.23	< 0.0001	0.84	1.75
OLDERCHILDRENHELPYES	0.43	0.09	< 0.0001	0.24	0.62
AGEOFMOTHERATFIRSTBIRTH	-0.04	0.01	< 0.0001	-0.06	-0.03
AGEOFMOTHERATINTERVIEW	0.02	0.00	< 0.0001	0.01	0.03

Null deviance: 195.54 on 151 degrees of freedom
Residual deviance: 112.28 on 148 degrees of freedom
AIC: 599.51

Table 4.3. *Cox proportional hazards mixed effects model on effect of reported help from children on the length of IBI. Fixed effects: Age of mother at opening birth, number of children present in the home at the time of the opening birth, and reported help from children. Random effects: Participant ID. (N_{IBI} = 590, 3 observations deleted due to missing values)*

Fixed Coefficient	coef (β)	exp(coef) (hazard ratio)	se(coef)	z	p
AGEOFMOTHERATOPENBIRTH	-0.02	0.98	0.02	-1.11	0.270
CHILDRENPRESENT	-0.09	0.91	0.04	-2.16	0.031
Factor (HELP)YES	0.38	1.47	0.15	2.52	0.012

Random effects

Group	Variable	Std Dev	Variance
ID	Intercept	0.46	0.21

	NULL	Integrated	Fitted
Log-likelihood	-2622.94	-2609.51	-2545.29

	X^2	df	p	AIC	BIC
Integrated loglik	26.85	4.00	< 0.000	18.85	2.14
Penalized loglik	155.29	57.39	< 0.000	40.51	-199.26

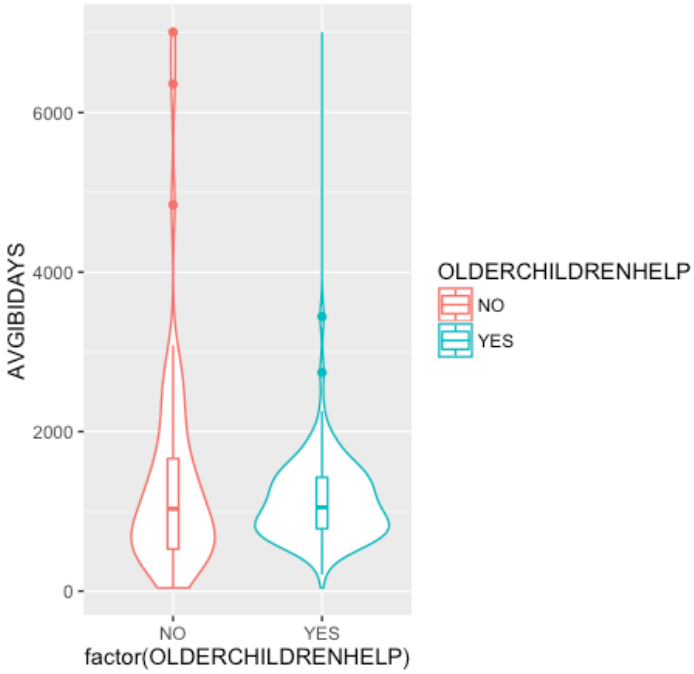


Figure 4.1. Distribution of mean interbirth intervals by reported help (n = 153). A general linear model was used to demonstrate that women who report receiving help from their children experience shorter, on average, interbirth intervals than do women who report receiving no help ($p < 0.000$).

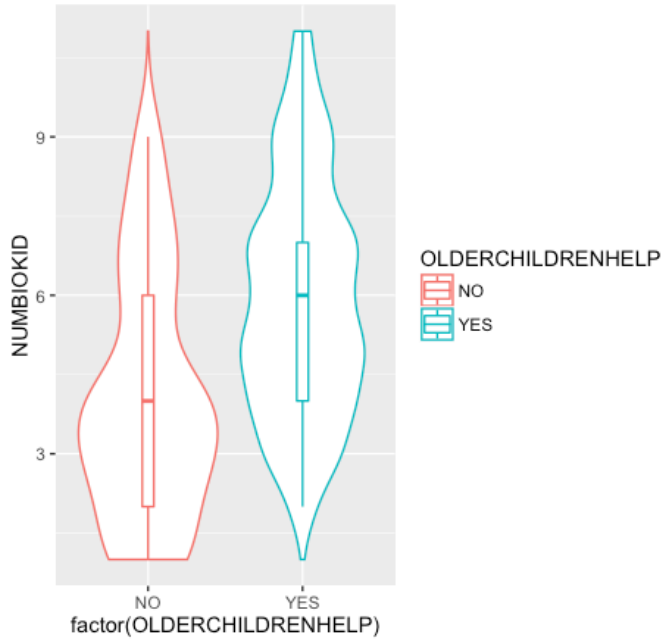


Figure 3.2. Distribution of number of surviving offspring by reported help (n = 153). A Poisson regression was conducted to demonstrate that women who report receiving help from their children experience a higher overall fertility than do women who report receiving no help ($p < 0.000$).

As a measure of sensitivity, we re-ran the analysis using the full sample of participants. For both overall fertility and IBI, we obtained the same effects as for the restricted sample (Table B.1 & B.2: Appendix B.), although hazard ratios were slightly lower than for the full sample (0.88 for children in household and 1.45 for reported help).

Prediction 2: First-born daughters will predict shorter interbirth intervals and higher overall fertility

As above, we found effects of age of mother at interview and age at first birth on overall fertility. For our sub-sample of women who had completed reproduction (> 45 years old, N=49), we also found an effect of age at first birth, but no effect of age at interview (as one would expect for this sub-sample) (Table 4.5; Table 4.6). However, there was no effect of the sex of the first-born child on the length of interbirth intervals (Hazard ratio of 0.85, $p = 0.21$, Table 4.4). Against prediction, having a first-born daughter did not shorten the interval between births. (Figures 4.3-4.4; Table 4.4).

Additionally, there was no effect of sex of first-born child on overall fertility (Table 4.5). There was also no effect for the post-reproductive sub-sample (Figure 4.5; Table 4.6). Taken together, we found no evidence to support the prediction that Samoan mothers with first-born daughters are likely to reproduce more frequently (shorter interbirth intervals) and or reproduce more overall (higher total fertility) than Samoan mothers with first-born sons.

Table 4.4. *Cox proportional hazards mixed effects model on effect of the sex of the first-born child on the length of IBI. Fixed effects: Age of mother at opening birth, number of children present in the home at the time of the opening birth, sex of the first born child. Random effects: Participant ID. (N_{IBI} = 593)*

Fixed Coefficient	coef (β)	exp(coef) (hazard ratio)	se(coef)	z	p
AGEOFMOTHERATOPENBIRTH	-0.02	0.98	0.02	-1.48	0.140
CHILDRENPRESENT	-0.07	0.93	0.04	-1.73	0.083
Factor (SEXFIRSTBORN)GIRL	0.16	0.85	0.13	-1.24	0.210

Random effects

Group	Variable	Std Dev	Variance
ID	Intercept	0.46	0.21

	NULL	Integrated	Fitted
Log-likelihood	-2622.94	-2609.51	-2545.29

	X^2	df	p	AIC	BIC
Integrated loglik	21.59	4.00	< 0.000	13.59	-3.14
Penalized loglik	151.04	57.88	< 0.000	35.28	-206.77

Table 4.5. *Poisson Regression examining effect of sex of first-born child on overall fertility* (including age of the mother at the time of her first birth and age of the mother at the time of the interview as covariates) n = 153

Coefficients	Estimate	Robust SE	Pr(>|z|)	LL	UL
(Intercept)	1.78	0.24	< 0.000	1.30	2.25
SEXOFFIRSTBORN	-0.02	0.08	0.81	-0.17	0.13
AGEOFMOTHERATFIRSTBIRTH	-0.05	0.01	< 0.000	-0.07	-0.03
AGEOFMOTHERATINTERVIEW	0.02	0.00	< 0.000	0.01	0.03

Null deviance: 196.96 on 152 degrees of freedom
Residual deviance: 133.70 on 149 degrees of freedom
AIC: 623.55

Table 4.6. *Poisson Regression examining relationship between sex of first-born child and overall fertility (including age of the mother at the time of her first birth as a covariate) in women over the age of 45* (n = 49)

Coefficients	Estimate	Robust SE	Pr(>|z|)	LL	UL
(Intercept)	2.75	0.32	< 0.000	2.12	3.37
SEXOFFIRSTBORN	0.17	0.11	0.13	-0.05	0.38
AGEOFMOTHERATFIRSTBIRTH	-0.06	0.01	< 0.000	-0.09	-0.03

Null deviance: 44.653 on 47 degrees of freedom
Residual deviance: 36.417 on 45 degrees of freedom
AIC: 207.08

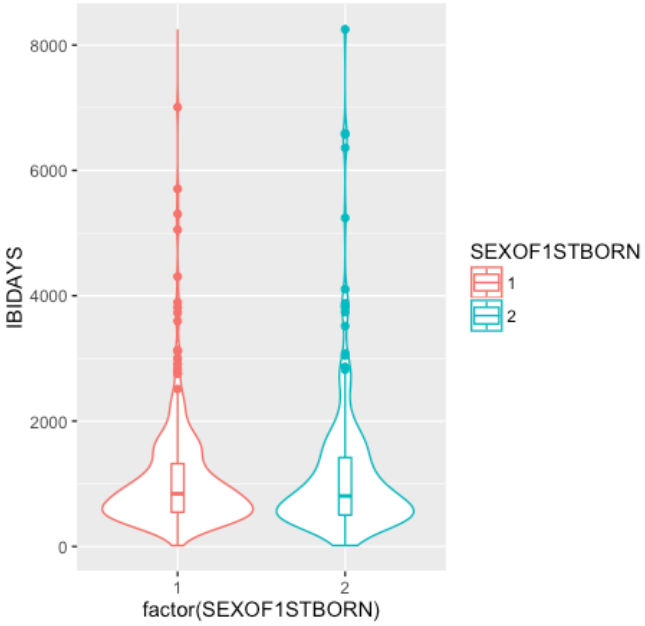


Figure 4.3. Distribution of interbirth interval by the sex of the first-born offspring (1 = male, 2 = female). A Cox mixed effects regression demonstrated no significant difference of interbirth interval length in women with first-born daughters compared to first-born sons ($p = 0.21$).

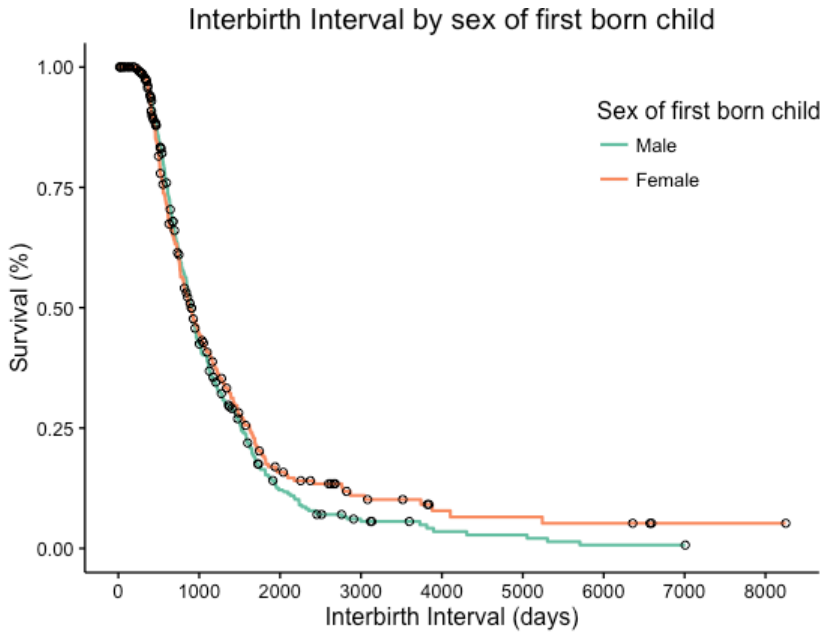


Figure 4.4. Kaplan-Meier survival plot. Probability of closing an interbirth interval (by the birth of another offspring) by sex of first-born child. Having a first-born daughter (versus first-born son, does not result in the likelihood of a shorter interbirth interval as predicted *(p* = 0.21)

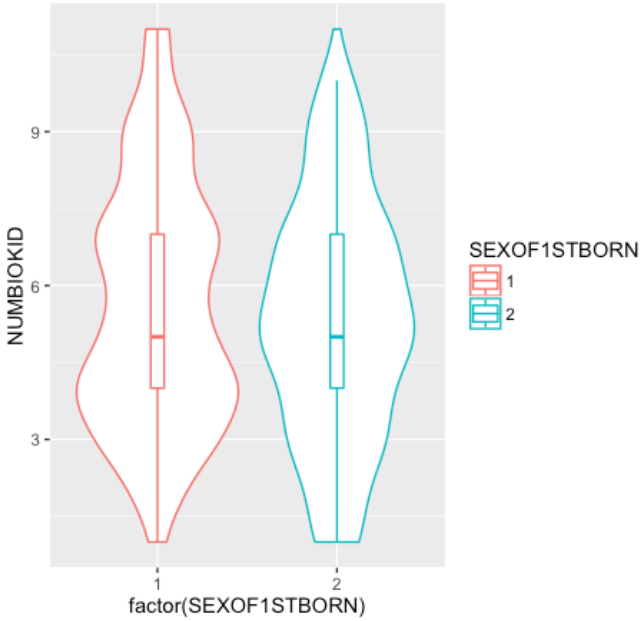


Figure 4.5. Distribution of number of surviving offspring by sex of first-born. A Poisson regression demonstrated that women with first-born daughters do not experience a higher overall fertility than do women with first-born sons ($p = 0.82$).

Prediction 3: The sex of the child that opens the interval and the sex of the child that closes the interval will predict of the length of the interbirth interval.

There was no evidence to suggest the sex of the child that opened an interbirth interval had an effect on interbirth interval length (Figures 4.6a-b; Table 4.7). There was, however, weak evidence for an effect of the sex that closed the interval (Hazard ratio of 1.22, $p = 0.05$), i.e., intervals that were closed by the birth of a son were longer than those closed by a daughter (Figures 4.6a-b, Table 4.7).

Table 4.7. *Cox proportional hazard mixed effects regression model with fixed effects: Age of mother at opening birth, number of children present in the home at the time of the opening birth, sex of the child that opened the interval, and sex of the child that closed the interval. Random effects: Participant ID. (n=482, 111 observations deleted due to missingness – sex of closing child)*

Fixed Coefficient	coef (β)	exp(coef) (hazard ratio)	se(coef)	z	p
AGEOFMOTHERATOPENBIRTH	0.01	1.01	0.02	0.95	0.34
CHILDRENPRESENTINHOME	-0.09	0.91	0.04	-2.19	0.03
Factor (SEXOPENEDINTERVAL)GIRL	-0.08	0.92	0.10	-0.84	0.40
Factor (SEXCLOSEDINTERVAL)GIRL	0.20	1.22	0.10	1.99	0.05

Random effects

Group	Variable	Std Dev	Variance
ID	Intercept	0.35	0.12

	NULL	Integrated	Fitted
Log-likelihood	-2494.32	-2489.60	-2447.72

	X^2	df	p	AIC	BIC
Integrated loglik	9.44	5.00	0.093	-0.56	-21.44
Penalized loglik	93.21	40.88	< 0.000	11.46	-159.23

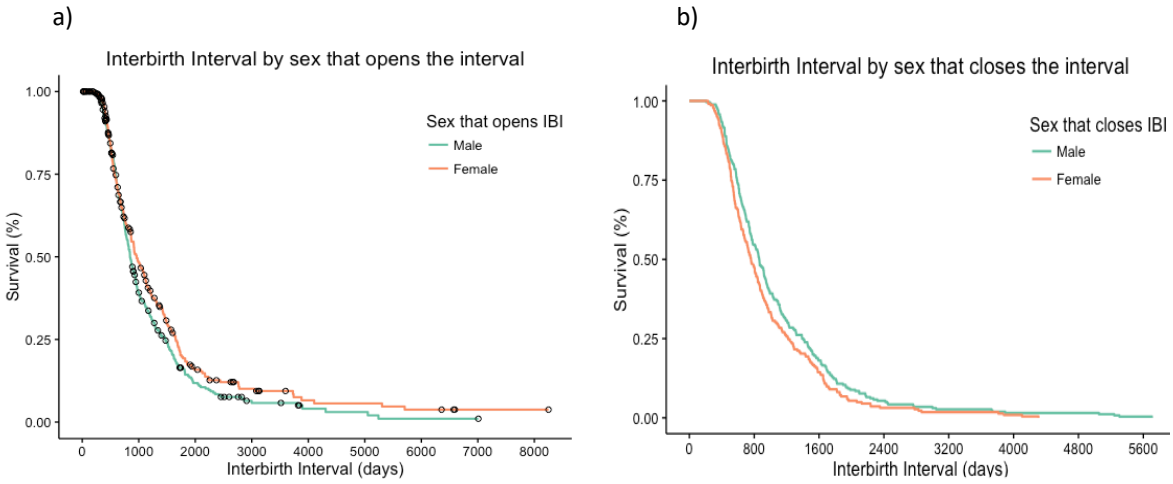


Figure 4.6. Kaplan-Meier survival plots. (a) The probability of the survival of an interbirth interval by the sex of the child that opens the interval – hazard ratio 0.9186 (p = 0.40). (b) The probability of the survival of an interbirth interval by the sex of the child that closes the interval – hazard ratio = 1.22 (p = 0.05)

Prediction 4: The category of interval will impact interbirth interval length

Against prediction, there was no evidence that intervals opened and closed by a daughter were shorter than those opened and closed by a son ($F(3,477) = 1.76$, $p = 0.15$. There was also no effect of mother's age (Figure 4.7, Table 4.8).

Table 4.8. *General linear model examining the impact of the category of interbirth interval on interbirth interval length (in days).*

Interval Category	N	Mean interval in days	SE	95% CI	
Boy_{open} - Boy_{close}	140	1034.99	63.74	909.75	1160.23
Boy_{open} - $Girl_{close}$	128	968.31	66.61	837.42	1099.20
$Girl_{open}$ - $Girl_{close}$	94	974.17	77.64	821.62	1126.73
$Girl_{open}$ - Boy_{close}	120	1164.81	68.72	1029.77	1299.85

Category Comparison	Difference interval in days	Lower	Upper	p (adj)
Boy_{open} - $Girl_{close}$ Vs. Boy_{open} - Boy_{close}	82.98	-321.10	155.13	0.81
$Girl_{open}$ - $Girl_{close}$ Vs. Boy_{open} - Boy_{close}	70.12	-329.76	189.52	0.90
$Girl_{open}$ - Boy_{close} Vs. Boy_{open} - Boy_{close}	118.65	-123.58	360.88	0.59
$Girl_{open}$ - $Girl_{close}$ Vs. Boy_{open} - $Girl_{close}$	12.87	-251.62	277.35	0.99
$Girl_{open}$ - Boy_{close} Vs. Boy_{open} - $Girl_{close}$	201.64	-45.76	449.05	0.15
$Girl_{open}$ - Boy_{close} Vs. $Girl_{open}$ - $Girl_{close}$	188.77	-79.42	456.96	0.27

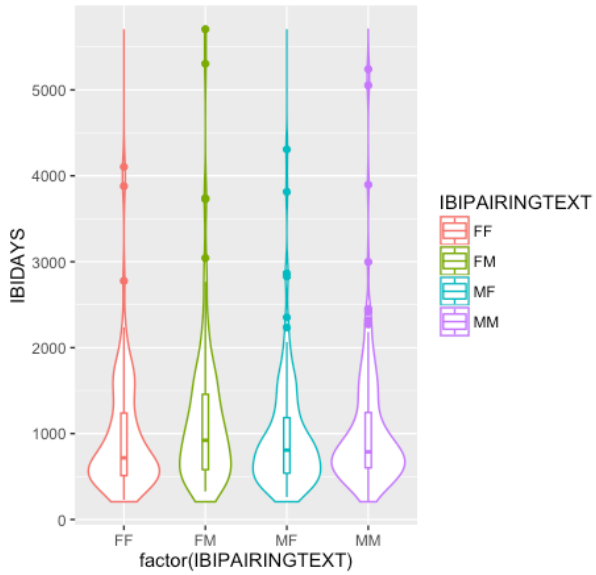


Figure 4.7. Distribution of IBI length by IBI type. A GLM was conducted to examine if length of interbirth interval could be predicted by type of interbirth interval. No effect was found.

4. **Discussion**

Samoan mothers in our sample who reported receiving help from their children experienced shorter inter-birth intervals and had more surviving offspring overall. Controlling for both age at first birth and age at the time of interview, women who reported receiving help from their children experienced interbirth intervals that were, on average, more than two years shorter than women who reported receiving no help (Mean difference = 762.99 days), and had at least one more surviving child on average (Mean difference = 1.4 children). In contrast, there was no evidence to show that the sex of the first-born offspring influenced fertility or interbirth interval, nor was there any evidence to suggest that IBI was influenced by the sex of the child that opened the interval, although we did find an effect with respect to the sex that closed the interval: there was moderate evidence to suggest that IBI was shorter when a girl closed the interval.

It is important to bear in mind that this study used only cross-sectional data, so we can neither assess causality nor can we know whether help was consistent across a mother's reproductive lifespan. Although a mother may report receiving help now, at her current reproductive stage, it is possible that she would report differently either earlier or later in her reproductive lifespan. Blurton Jones (2016) makes a similar point highlighting issues of endogeneity, or intrinsic difference, between women. For example, does one observe higher fertility because older children really are helpful, or is it because the most fertile women continue to have surviving children into their later 30s? We addressed this general concern to some extent by controlling for maternal age but also, more importantly, by including only mothers without deceased children in the analysis.

Helping behaviour is expected from children as a part of growing up as a child in Samoa, and the overwhelming majority of our participants report that they received help from their children (76%, compared to only 24% who said they receive no help). It is possible that cultural expectations and reputational concerns led some women to report help even if they did not actually receive any. We cannot determine whether all women that reported receiving help actually did so, or whether their responses reflect an acquiescence bias. However, if some cases of reported help are false positives, we should be less likely to observe the effects that we do.

During in-person interviews, women were asked about the help they received from their children overall. However, they were not asked about help per child. As almost all of our participants reported receiving help (76%), it might be beneficial to attempt to quantify the amount of help they receive per child, to determine whether the magnitude of help they receive has an impact on overall fertility or interbirth interval. It would also be

beneficial to differentiate between activities directly related to allocare (e.g. feeding younger siblings) and help indirectly related to allocare (e.g. serving food to the parents).

The current study also investigated the impact of the sex of the first-born child on length of interbirth interval, predicting that women with first-born daughters would experience shorter interbirth intervals and a higher overall fertility than women with first-born sons. We failed to find any evidence to support this prediction. Consistent with the division of labour reported by Turke (1988), tasks in Samoa are, indeed, allocated by sex. However, it may be that these are not set 'rules' and instead, tasks can be gender fluid. It became apparent, during fieldwork, that if a woman has no daughters who are at an age capable of helping, her sons will assume the responsibility for helping with the mother with her chores. This task fluidity may be age specific and possibly arises because of the physical maturity that is required to complete typically male-associated tasks, such as working in the plantation, catching a pig, gathering water, or carrying a bushel of coconuts. As a result, we may not see an effect of the sex of the first-born because, by the time a son is old enough to move away from doing tasks that directly offset costs to his mother, he likely has multiple younger siblings who can take his place. As a result, mothers may receive help from children of both sexes equally until such time that male children are physically capable of handling male-typical tasks; by this point help from male offspring may shift from helping mothers to helping fathers. In Samoa, the important variable thus appears to be the provision of help, and not the sex of the child providing the help. One way to test this gender-fluid predication would be to observe the specific tasks that offspring are engaged in across development.

Although we found no effect of length of interbirth interval based on the sex that opened an interval, if boys are more costly to gestate, then it is possible that a woman's

body is more likely to reject a male fetus if interbirth intervals are short (and the mother hasn't fully recovered from her previous birth) (Mace & Sear, 1997). This may explain our finding that interbirth intervals are significantly shorter when the sex of the closing child is female.

If we are to invoke the maternal depletion hypothesis as an explanation for these findings as Low (1991) and Mace and Sear (1997) suggest, then we would also expect to see a difference in the length of interbirth interval based on the type of interval, with daughter-daughter intervals being shorter than son-son intervals. We found no support for a difference of interbirth interval length by type. This however, may reflect the relatively small sample size in this study

Overall, the results of the current study provide support for the existing literature on cooperative breeding, which suggests that help from children is one way in which women were able to manage the needs of multiple offspring at various stages of development (e.g. Kramer 2005, 2010). Although the current study found no sex specific effect, the results indicate that help, regardless of the sex of the child that provides it, does seem to have a positive impact on a mother's reproductive success. As such, it is worthwhile to further investigate the role of children as helpers with a larger sample size and a more detailed exploration of the type of help that children provide. Assessing the magnitude of help that children supply, and how this differs between direct alloparental help and indirect alloparental help, will offer a more nuanced understanding of the contributions by children. Furthermore, incorporating a longitudinal methodology would be beneficial by enabling the investigation of help across development and the impact that help has at different stages in a woman's reproductive lifespan.

CHAPTER FIVE

OBSERVATIONS OF ALLOCARE IN LALOMANU: A SAMOAN VILLAGE

"I learned to observe the world around me, and to note what I saw"

Margaret Mead – Blackberry Winter (1972)

1. Introduction

My aim here is test the idea presented in chapter 3, that the distribution of household chores is less gendered than Samoan people suggest, at least for children below 15 years of age. This may help explain the absence of any effect with respect to the sex of the first born child and with respect to the impact of sex that opens or closes an interval. In addition, the previous chapter used a measure of perceived or reported help, therefore, the intent of conducting observations was to include an alternative measure of help (observed) and to confirm the validity of my surveys in terms of reported help.

The value of an ethological approach to understanding human life history cannot be overstated. Much of the current literature, particularly with respect to help from kin, is based on surveys and, although these types of data are highly valuable, the addition of ethological and ethnographic methods provides insights that surveys cannot. Asking individuals what they 'prefer' or 'how they would behave' in any given situation offers insights into people's conscious attitudes, but observing behaviour in context can offer a far richer understanding. Observations can both establish the veracity of self-report, and may also be more consideraby more accurate than survey or interview data (Kramer & Veile, 2018).

Observing humans can be challenging, however, because, unlike non-human animals, it is difficult to habituate human subjects to the presence of observers. While conducting a time-allocation study in a population of Peruvian Machiguega people, Johnson (1975), noted this difficulty when employing an "instantaneous scan" technique. In an attempt to resolve the issue, he visited Machiguega households randomly and recorded the behaviours of the household members "at the instant before they became aware of the ethnographer's presence". Although Johnson (1975) argued that this technique resulted in an unbiased description of behaviours, he did admit that the method was often not realistic. Johnson also raised the further issue—one perhaps even more problematic for ethnographers—that, when observing households, regular members of the household often are not directly observable because their daily activities take them away from the home. To account for this, Johnson (1975) inquired into the whereabouts of absent members. Then, when possible, he verified the information by observation, but often, he noted, such observational checks were impossible. Thus, even using Johnson's ethnographic technique, inferences about the activities and the time-allocation of those activities for absent household members are necessarily made either by the ethnographer or other family members. These inferences add another layer of complexity to human ethology because inferences (no matter how confident the informant) are not observed behaviour and as such, are subject to unreliability.

1.2. Previous Observational Studies in Human Behavioural Ecology

Although most time-allocation research relies on interviews, it is also the case that employing an instantaneous scan methodology is common among several of the pioneering human observation studies (Betzig and Turke, 1985). Challenged with the same issue of absent individuals as Johnson, Hames (1979) conducted multiple daily

rounds through a Ye'kwana village and recorded the time, location, and the activity of individuals he observed. Hames then supplemented these observed reports with notes about the activities of individuals who were absent or out of sight. From these two sets of records he sought out people who could confirm the activities of the non-observed individuals. Hames reported that initially he was concerned about the reliability of the reports of absent individuals but upon verification found them to be extremely reliable.

Using a similar method to Hames, Flinn (1983), made multiple daily trips through a Trinidadian village and also recorded the time, location, and activity of individuals that were observed. Flinn also extended his focal scans to include unobserved individuals and subsequently verified the activity of these unobserved individuals by confirming with other individuals. Betzig and Turke (1985), during their time allocation study in Ifaluk, made multiple daily excursions, recording the time, location, and activity of observed individuals. However, Betzig and Turke (1985) report that Ifaluk is unique in that researchers were not constrained by unobservable activities. The location is small and all actors were observable at all times. Therefore, all the behavioural data that was recorded came from direct observation. The current study utilizes a similar methodology to Betzig and Turke, in that no supplemental reports were used, and all behavioural data came directly from first-hand observations. In other words, no inferences were made with respect to absent individuals.

Another problem inherent in human observational studies is the issue of observation and intention. When conducting instantaneous focal scans, one may observe an individual engaging in ambiguous behaviour, such as standing in a garden. Should that individual be recorded as standing or gardening? If the individual is recorded as gardening, then there is a level of inference or intention made on the part of the observer

that may not be justified, and may introduce inaccuracies. If the individual is recorded as standing, then important behaviours may be missed. Borgerhoff Mulder et al., (1985) recommends adopting a two-tiered approach – recording, at the time of an instantaneous scan, both a subject's observed physical activity (e.g. standing in a field) and the inferred intention (e.g. planting).

When applying this two-tiered system of behaviour classification in their time-allocation study on Ifaluk, Betzig and Turke (1985) demonstrated that, indeed, it does make a difference which of these tiers is used in descriptions of how time is spent in a given culture. Betzig and Turke (1985) found that, when reinterpreting individual behaviours from observed (first tier) to inferred (second tier), 14.6% of the 2616 observations changed. Further, Betzig (1985, 1986) was interested in the costs and benefits of being a chief in Ifaluk. Consequently, Betzig and Turke (1995) reconceptualised their behavioural data and recategorized activities as either non-productive/lesiure (e.g. resting, eating, grooming, walking or playing) or productive/labour behaviours (all others). Once recategorized, and having applied the two-tier system recommended by Borgerhoff Mulder et al., (1985), they found that overall, people were 33% more productive when using intention rather than observation to measure activity. It is therefore clear that neither system is without its flaws; however, the main point to be made here is that clarification and transparency with respect to methodology is necessary prior to analysis of behavioural data.

1.3. Rationale for Observational Data in the Present Study

Much of the previous work addressing the impact of alloparental help on female fertility has been conducted either in non-developed societies or in highly developed industrial nations with large, mobile populations. By contrast, Samoa is currently in a

state of transition from non-developed to developed nation status and as such provides a unique environment to conduct observational research and capture the daily activities in a transitioning nation.

In the previous chapter, we investigated the impact of reported help from children on fertility in Samoan women and found a positive relationship between women who report receiving help from their children and fertility (shorter interbirth intervals and more offspring overall) using surveys, however, here we are expanding on this by observing helping behaviours as they occur in this transitioning nation. In addition to observing activities, we are particularly interested in the possible sex and age patterning that we were unable to measure from survey data alone. By observing activities as they occur, we are not relying on self-reports from mothers faced with the difficult task of retrospectively attempting to quantify the type of help provided by each of their offspring. Rather, we can observe it occurring in real-time.

Turke (1989) suggested that the breakdown of kin networks lowers fertility because the costs of child rearing are paid directly by the parents. This implies that help from kin plays a role with respect to fertility and indeed, the relationship between fertility and the helping role of kin, such as grandmothers, is well documented. However, much of the alloparental help from kin literature is focused expressly on childrearing help (direct alloparental help). In the current study, we are interested in the impact of different types of help (direct alloparental help versus indirect alloparental help) provided by members of the household. Do activities that immediately or directly relieve the mother of child rearing or childcare costs, impact fertility more so than activities that are more broadly helpful.

In Samoa there is a division of labour by sex, however, in the previous chapter, I found no effect on fertility by sex of the first-born child. Presumably, if a division of labour by sex occurred in childhood then consistent with previous literature suggesting that help from female offspring offset the direct costs of childrearing for the mother, a sex difference should have emerged. Notably, in Samoa, much of the behaviour considered 'male typical' requires a mature body to preform (e.g. working in the plantation) and therefore, it is possible that the division of labour by sex does not occur until after maturity. Because of this, I predicted there should be no observed sex patterning with respect to helping behaviours in children (i.e., individuals under the age of fifteen years old—see below). Rather, I predicted an interaction between age and sex with respect to all helping behaviours: children's help should not vary by sex, whereas adult help (individuals above the age of 15) was predicted to show a clear sex difference, with men performing more indirect alloparental help and women performing more direct alloparental help. I also predicted a positive relationship between direct alloparental help and overall fertility, i.e., women who were observed to receive more direct alloparental help in their households were predicted to show higher overall fertility.

2. Methods

2.1. Study Site

Observations were conducted in Lalomanu, a village on the south coast of Upolu island, approximately an hour and a half drive from the capital city of Apia. The 2016 preliminary census reported a total population of 706 people in Lalomanu (n_{female} = 351, n_{male} = 355). Of the 706 people living in Lalomanu, 414 are aged 15-64, and 259 report

being married and 387 reported being single. Lalomanu has a total of 111 households, with 100 of those households living on customary land and 11 living on freehold land.

In 2011, Lalomanu was hit by a Tsunami. This destroyed many of the homes along the main road (Coast Island Road) that encircles Upolu island and runs through many of the coastal villages, including Lalomanu. As a result, many of the residents of Lalomanu were forced to move to homes further inland, forcing the elongation of the main village road that bisects Coast Island Road. Because of this relocation, the village layout loosely resembles a cross. (See figure 5.2).

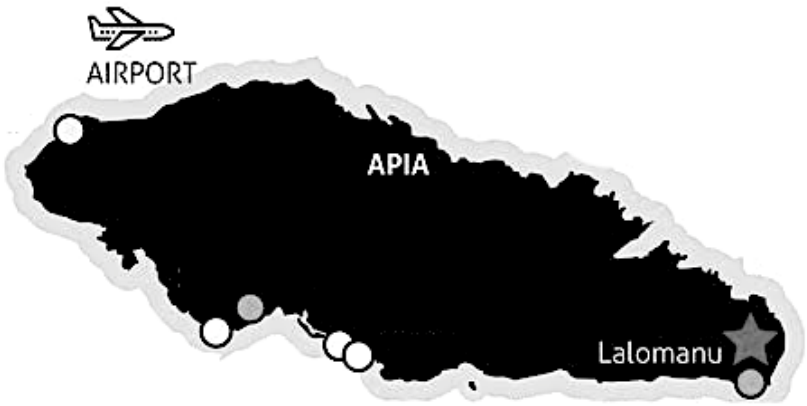


Figure 5.1. Upolu Island, study site (Lalomanu) located at the southern tip of the island

Figure 5.2. Study site, Lalomanu village. Households part of the study are numbered in

Samoa is divided into districts each containing approximately 10 villages. Each district typically contains one small hospital staffed mainly with nurse practitioners (a doctor visits each location approximately once a week), one small police station, and a district college (grades 9 through 12). Each village has its own primary school and Lalomanu is no exception. Centrally located, the Lalomanu primary school offers grades 1 through 8. There is no secondary education located in Lalomanu, and the district college is three villages away, approximately a 40-minute brisk walk. Lalomanu has both a hospital and a police station, offering 24-hour service.

2.2. Sample Characteristics

In total, 25 households were selected for the current study (See figure 5.2. Study households are numbered in yellow). Selection was based on the following criteria: households had to be visible from the road, occupied on a full-time basis (some households in Lalomanu are only occupied on a part-time basis), and all households observed had to include, as a regular occupant, a participant that took part in the interview portion of the study.

Table 4.1. *Household descriptive statistics*

Female head of household (N = 25)	Mean (+SD)	Range
Age at first birth (years)	21.00 (2.39)	17-28 years
Age at time of study (years)	44.80 (8.14)	30- 64 years
Number of offspring	6.03 (2.05)	3-10 children
Household size reported	9.09 (3.09)	3-17 individuals

2.3. Data collection

To collect observational data, research assistant (CV) travelled through the village by car, multiple times a day, for six weeks. A typical Samoan fale (home) is designed in an open style to allow for maximum airflow (see Figure 5.12 for examples). Kitchens are usually outdoors, and most laundry is done by hand outside of the main fale. As such, it is possible to observe most of the household activity from the road. On each occasion, CV would travel by car on the main village road and visit all 25 households recording, on a handheld device, the activity of every individual that was observable, in each household. If the household appeared empty, CV would note that there was no activity to report for that particular household at that particular time. If an individual from one of those homes was seen in another part of the village, CV would also make a note. As CV visited every household on every trip through the village, all households were observed an equal number of times. Initially, the primary researcher (DF) accompanied CV during observations, however, when people in the households would see DF, activity often changed or would come to a halt. Because CV is originally from Lalomanu, he was able to move freely through the village without piquing the interest of the residents. Therefore, CV collected observational data alone.

2.4. Recording Data

As CV would travel through the village his aim was to record the activities that he observed in the households without being detected. Following Borgerhoff Mulder's (1985) recommendation, at times, intentions were recorded and not observed behaviours. For example, if an individual was observed walking out into the sea with a fishing line, it was inferred that the intention of the activity was fishing, even though the individual may not have yet cast the line. On a school day, if a child was observed walking towards the

school, wearing a school uniform, carrying a book bag, it was inferred that the intention of the activity was going to school. These inferences were rare and only made when no other explanation was reasonable. Audio recordings included the date and time of observation, the name of the female head of household, and any additional information that may have been necessary during analysis. For example, during the observation period, the village pastor passed away. Funerals are very elaborate in Samoa, particularly the funeral for a pastor. As such, the people from the village spent an extraordinary amount of time preparing for the funeral engaging in activities that they would not typically dedicate that much of their time, including weaving fine mats, decorating the village, and practicing cultural programs for the funeral (singing and dancing). This increase in activity is not representative of everyday life in a Samoan village and therefore observations were halted during this time and resumed after the funeral had taken place.

2.5. Coding Data

Initially the ethogram included 44 activity codes. However, in order to address the research questions, these codes were collapsed to 18 categories. (For full activity codes see Appendix C). As a result, the main activity codes were as follows:

1. **Away from home**: this code was used to note when individuals were seen somewhere other than in the home, but their activity was unknown; when individuals were seen coming or going to work; when individuals were seen on the bus or at the bus stop; when women were seen at a village women's committee meeting or men were seen at a men's village council meeting; when children were observed on their way to or from school.

2. **Caring for children:** this code was used when any individual was observed caring for a child in the home. This included carrying the child; watching/minding the child; dressing the child; cleaning the child; feeding the child; nursing the child; getting the child ready for school or church. This code therefore refers to people caring for their own children, grandparents caring for grandchildren, and/or aunts or uncles caring for nieces or nephews. Individuals caring for their siblings was coded separately.
3. **Caring for younger siblings:** this was used exclusively when older siblings were observed in allocare directed toward his or her own younger siblings. This included feeding a younger sibling; cleaning a younger sibling; minding a younger sibling; dressing a younger sibling; holding or carrying a younger sibling.
4. **Caring for family:** this referred to any family member caring for any other member of the family, with the exception of siblings caring for younger siblings. This may include feeding; serving food/fanning food; dressing; cleaning; preparing medication; or any caregiving behaviour.
5. **Cleaning inside home**: this included sweeping; mopping; dusting; laying mattresses in the sun; tidying and picking up clothes or other household items; washing dishes.
6. **Cleaning outside home:** this included sweeping the yard; picking up leaves or fallen fruit; scrubbing or washing down the fale.
7. **Cooking: t**his included cooking inside or outside at the umu and any food preparation such as scraping coconuts for coconut cream.
8. **Eating:** in Samoa, eating often occurs in stages with the highest status members eating first and lower status members serving food or caring for the high-status

members as they eat. In this case, only those actively eating or sitting at the food location are coded as eating. Lower status household members who are observed serving food or fanning the flies from the food are coded as 'caring for family'.

9. **Fishing/Plantation**; was used when individuals were observed specifically going to or from the plantations. It is easy to identify plantation activity because of the specific tools and baskets that individuals use. In addition, the majority of the plantations are located in the same area of the village making it easy to identify who is coming or going. On four occasions individuals were coded as 'fishing' when they were unambiguously observed walking into or toward the sea with a fishing pole and net.
10. **Home doing nothing/Sleeping**: This was used when individuals were observed in the home, but no particular activity could be identified. Additionally, this code specifically refers to people who were observed to be sleeping or lying down.
11. **Nobody visible:** this code was used to denote an empty home, or when no individual could be seen in the home by the researcher.
12. **Outside yard chores:** this differs from 'cleaning outside home' in the sense that it referred specifically to any house maintenance chores, such as rebuilding portions of the fale or weaving a new roof for the fale or painting the fale; gardening (subsistence or decorative); feeding livestock; clearing land.
13. **Running Errands:** used when individuals were observed away from the home at any of the small local businesses (gas station, bank, shop) or if the individual was seen taking food to the teachers or to the pastor.

14. **Sewing/Handicrafts:** this included observations of individuals weaving mats or other items such as fans; carving items; sewing (either by hand or with a machine); painting rocks; printing/stenciling fabric; making leis.
15. **Socializing/Recreation:** this included observations of individuals at bingo; children playing; practicing for a cultural program (Samoans regularly take part in cultural shows that involve Samoan dancing and singing. These occur at holidays and throughout the year at celebrations such as family reunions, or by youth groups for competitions or fundraising purposes); visiting with family or friends; watching television.
16. **Washing clothes:** this included washing clothes by hand or very rarely in a washing machine; hanging or setting washing out to dry; bringing in dried washing.
17. **Working from home:** used to indicate individuals were doing something in the home that earned an income. Most frequently this involved working in a small home shop, which is common in Samoa. These shops are either modified rooms at the front of the family home or small free-form structures at the front of the property (See Figure 5.12 for examples). In rare cases this could include manning a small table at the front of the property selling fish or fruits and vegetables.

2.6. Activities by Sex

In order to investigate whether patterns of activity varied with sex, all household members were coded as either male (n = 546 observations) or female (n = 950 observations) and in one case, fa'afafine (n = 3 observations). In the rare case that the sex of an individual observed was unknown, the corresponding observation was excluded.

2.7. *Activities by age*

The birthdate for the female head of household and the birthdates of her children had been recorded during previous interviews which allowed us to determine exact ages. However, since interviews were not conducted with every member of the family, birthdates and exact ages were not available for other members of the household, individuals were sorted using the marker of over age 15 and under age 15 (15 years old is the age that both the Samoan Demographic Health Surveys (DHS) and the Samoan censuses begin treating individuals as 'adults'). For example, the participants' husband, parents, siblings, daughters or sons in law, aunts and uncles were all clearly over the age 15, other infants, toddlers, and young adolescents in the home (that were not the participants' offspring), such as grandchildren, were clearly under age 15. All ages were confirmed with CV who was very familiar with all the households under study and confident in his assessment of age. In order to investigate whether observed activities varied by age, I coded as each activity according to whether it was being performed by an individual above or below 15 years of age. In the results these are referred to as adults and children respectively. Using this recategorization of age, allowed us to include individuals for whom we had no birthdate (for example the female head of household's husband).

2.8. Activities by Type (direct versus indirect alloparental help)

Similar to Betzig (1985, 1986), who recategorized her data to address her 'costs of being a chief' question, all observed behavioural data was assigned to one of three categories:

1. **direct alloparental help**: help that was directly related to child care (e.g. holding the baby, changing the baby, caring for children)

2. **indirect alloparental help**: help that was beneficial to the household but was not directly related to childcare (e.g. fishing, sweeping the yard, doing the wash),

3. **non-helping activity**: activities that not related to help (e.g. sleeping, going to school, socializing).

Coding into these broad categories was coded by two raters (one blind to the predictions and to Samoan way of life) and compared. Re-categorization was identical. For a full list of recategorized activities see Appendix C.

2.9 Statistical Analyses

Due to a small sample size and uneven representation within the observed activities, a Bayesian regression model was used to investigate the probability of age and sex patterning with respect to helping behaviours. The type of observed activity (direct alloparental help, indirect alloparental help, or non-helping) was treated as a Bernoulli random variable (a variable that may take one of two values – such as a coin flip). In the first test, direct alloparental behaviours were coded as 1 and all other behaviours were coded as 0. In the second test, direct alloparental behaviours were coded as 1 and indirect alloparental behaviours were coded as 0. All other non-helping behaviours were excluded. Additionally, because only one individual who identified as fa'afafine was represented in the dataset she was excluded from analysis.

3. Results

3.1. Frequency of Different Household Activities

The frequency of the different household activities can be seen in Table 5.2 and Figure 5.3. Caring for children was the fifth most frequently observed behaviour after Home doing nothing/sleeping, nobody visible at home, being away from home, and socializing and recreation. This suggests that caring for children is the top activity that requires household labour.

Table 5.2. *Frequencies of Activity Codes (N = 1542 observations)*

Activity Code	Counts	% of Total	Cumulative %
Away from Home	188	12.2 %	12.2 %
Caring for Children	99	6.4 %	18.6 %
Caring for Family	23	1.5 %	20.1 %
Caring for Younger Siblings	21	1.4 %	21.5 %
Cleaning Inside	25	1.6 %	23.1 %
Cleaning Outside	43	2.8 %	25.9 %
Cooking	78	5.1 %	30.9 %
Eating	61	4.0 %	34.9 %
Fishing/Plantation	47	3.0 %	37.9 %
Home Nothing/Sleeping	372	24.1 %	62.1 %
Nobody Visible Home	208	13.5 %	75.6 %
Outside Yard Chores	59	3.8 %	79.4 %
Running Errands	34	2.2 %	81.6 %
Sewing/Handicrafts	24	1.6 %	83.1 %
Socializing/Recreation	159	10.3 %	93.5 %
Washing Clothes	26	1.7 %	95.1 %
Working from Home	75	4.9 %	100.0 %

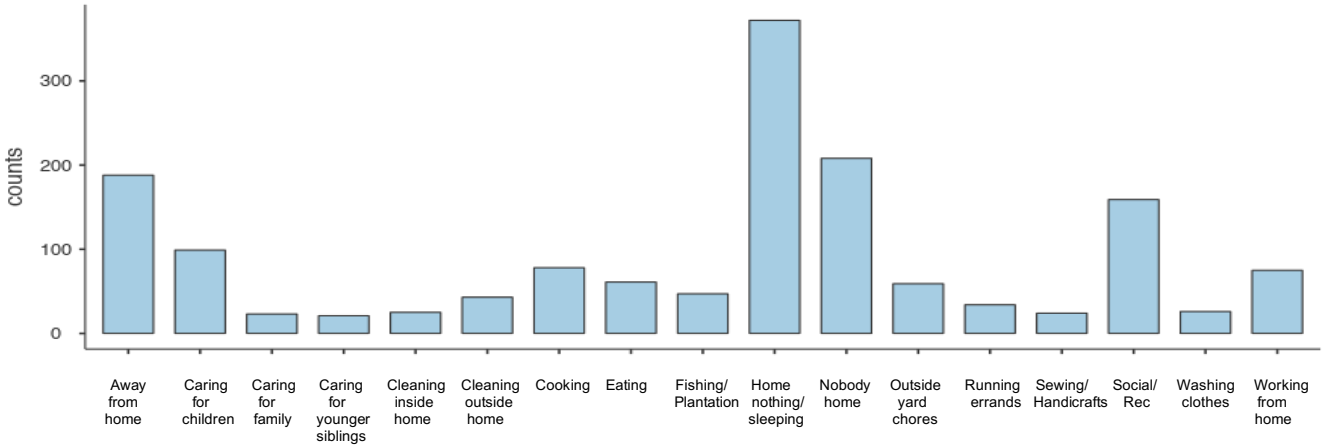


Figure 5.3. Frequency of each of the activity codes (N = 1542 observations across 25 households)

3.2. Patterns of Activity by Sex

As demonstrated by Table 5.3 and Figure 5.4, there is variation in help by sex with respect to the frequency of activities observed. Caring for children, caring for family, and caring for younger siblings are preformed overwhelming by females. Activities such as going fishing or to the plantation, outside yard chores, and cooking, are preformed more often by males.

Table 5.3. *Frequencies of Activity Codes by sex (N = 1499 observations)*

	Actor Sex		
Activity	**Fa'afafine**	**Female**	**Male**
Away From Home	0	106	76
Caring for Children	0	89	10
Caring for Family	0	19	4
Caring for Younger Siblings	0	20	1
Cleaning Inside	0	19	4
Cleaning Outside	0	20	20
Cooking	1	30	46
Eating	0	30	26
Fishing/Plantation	0	8	39
Home Nothing/Sleeping	0	191	167
Nobody Visible Home	0	208	0
Outside Yard Chores	0	16	42
Running Errands	1	16	17
Sewing/Handicrafts	0	23	1
Socializing/Recreation	1	79	69
Washing Clothes	0	24	2
Working from Home	0	52	22

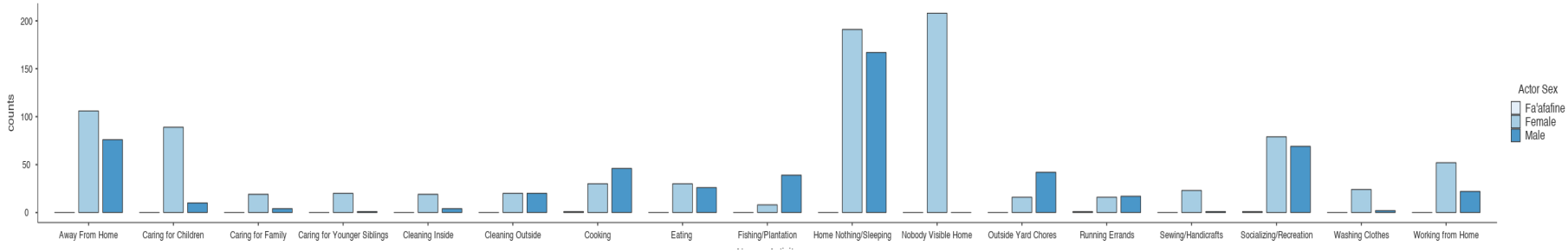


Figure 5.4. Frequency of activity codes by sex (N = 1499 observations)

3.3. *Patterns of Activity by Age*

Again, similar to the pattern that emerges with respect to the frequency of observed activities by sex, an age pattern is clearly evident whereby adults (individuals 15 years of age or older) are seen engaging in far more activities than children (15 years of age or younger) (See Table 5.4 and Figure 5.5).

Table 5.4. *Frequencies of Activity Codes by age (N = 1534 observations)*

Activity	**Adult**	**Child**
Away From Home	150	36
Caring for Children	99	0
Caring for Family	22	1
Caring for Younger Siblings	16	5
Cleaning Inside	18	7
Cleaning Outside	37	5
Cooking	73	5
Eating	46	15
Fishing/Plantation	41	6
Home Nothing/Sleeping	296	75
Nobody Visible Home	208	0
Outside Yard Chores	51	6
Running Errands	27	7
Sewing/Handicrafts	23	1
Socializing/Recreation	94	64
Washing Clothes	25	1
Working from Home	64	10

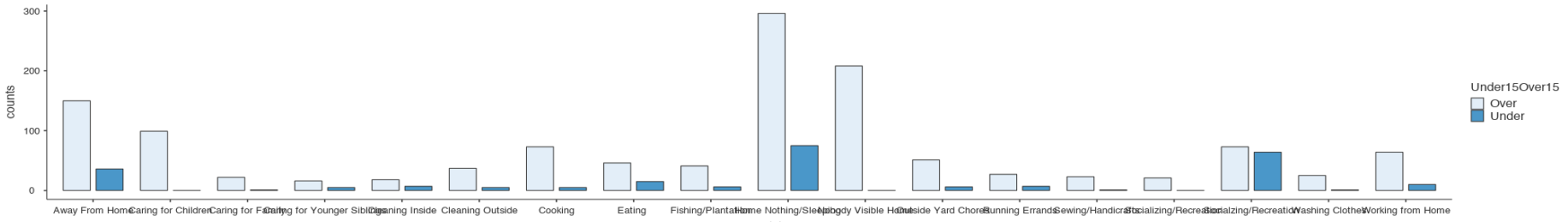


Figure 5.5. Frequency of activity codes by age (N = 1534 observations)

3.4. Age and Sex Differences in Direct Alloparental Help versus All Other Activities

As demonstrated in Figure 5.6, the relative frequency of direct alloparental help accounted for 9.5% of our observed activities (indirect alloparental help: 39.6%; non-helping activity: 50.9%). This is not to suggest that this is a small number, instead it demonstrates that nearly 10% of our observations included direct allocare being provided by an individual in the home. This week, I have engaged in 0% of activities that could be considered allocare by this coding system.

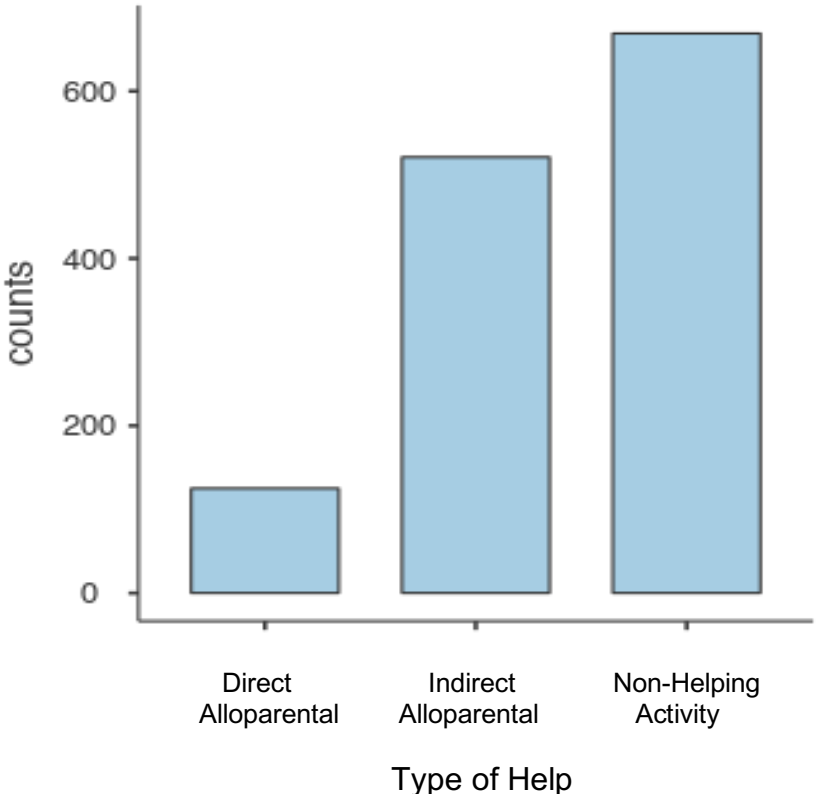


Figure 5.6. Frequency of each type of help. Instances where homes were empty or individuals' whereabouts were unknown have been excluded from analysis (N = 1315 observations).

A clear age and sex pattern was evident with respect to direct alloparental helping behaviour compared to all other observed activities. For children (i.e., those under the age of 15 years) there was a higher probability of observed activities being direct alloparental helping activities compared to any other kind of activities. For adults, (those over 15 years) the reverse was the case. For children, there was no sex difference in the likelihood of observed activities being directly alloparental. For adults, men were less likely to be observed engaging in direct alloparental behaviours than women. (See Figure 5.7 Table 5.5)

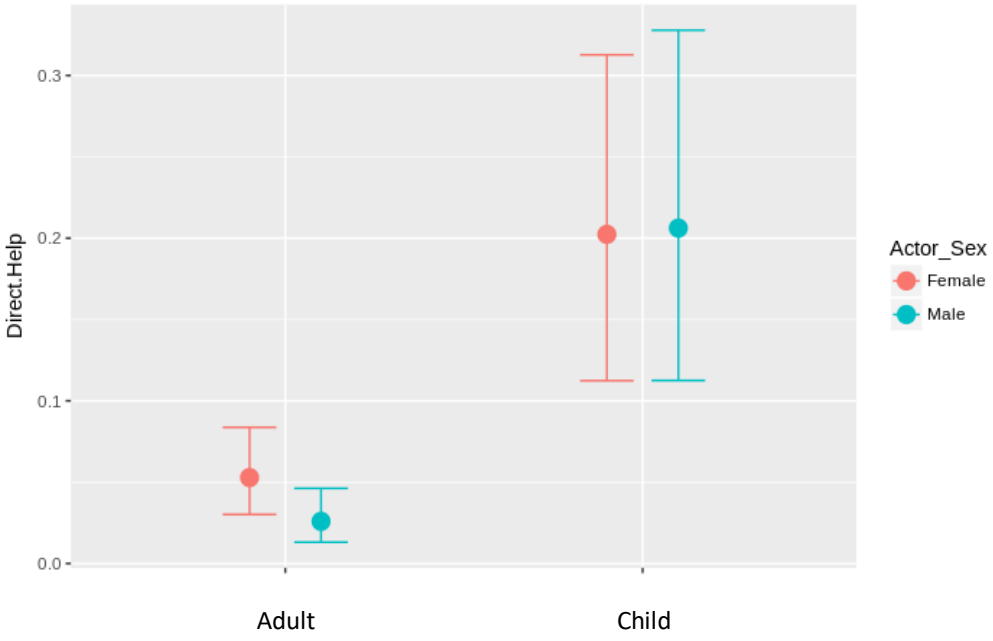


Figure 5.7. Plot of marginal effects – the probability of an observed activity being direct alloparental help in contrast to all other observed activities by age (child versus adult) and by sex.

Table 5.5. *Bayesian regression model (Bernoulli) Probability of an observed activity being direct alloparental help in contrast to all other observed activities by age and sex.*

Population-Level Effects (Fixed)	Estimate	Est. Error	95% Credible Interval		Rhat
Intercept	-2.90	.28	-3.47	-2.39	1.00
Under15Over15 (Under)	1.51	.28	.96	2.06	1.00
Actor_Sex (Male)	-.75	.28	-1.27	-.20	1.00
Under15Over15(Under):Actor_Sex(Male)	.77	.41	-.03	1.59	1.00
Group-Level Effects (Random)					
Family Number (number of levels: 25)	.91	.24	.52	1.47	1.00

*Formula Direct.Help ~ Uner15Over15 * Actor_Sex + (1|Family_Number). Prior = set_prior("normal(0,1)", class "b"), iter=1000, chains = 4, cores = 4). Effective Sample above 200 in all cases*

Against prediction, this model demonstrated no correlation with respect to the likelihood of direct help and number of offspring. This suggests that in this sample, the model did not predict elevated fertility. (See Figure 5.8).

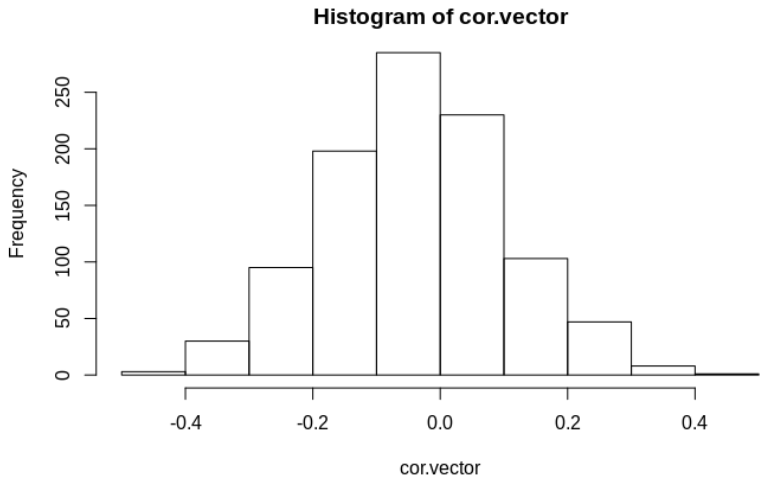


Figure 5.8. Correlation between numeric vectors. Is there a correlation between the likelihood of observed direct help and number of children by each head of household. A perfectly positively correlated vector will return 1, perfectly negatively correlated vector returns -1, and a vector showing little or no correlation will be close to 0. In this case, no correlation between the likelihood of observed help and number of children is found.

3.5 Age and Sex Differences in Direct Alloparental Help versus Indirect Alloparental Help

As a more specific test of the prediction that direct alloparental help would reveal an age and sex pattern and have a positive impact on fertility, I therefore tested direct alloparental help against only indirect alloparental helping behaviours. Again, a clear age and sex pattern was evident. For children, there was a higher probability of observed activities being direct alloparental helping activities in comparison to indirect alloparental help activities. Again, the pattern was reversed in adults. For children, there were no sex differences in the likelihood of observed activities being directly alloparental. For adults, men were less likely to be observed engaging in direct alloparental behaviours. (See Figure 5.9 Table 5.6)

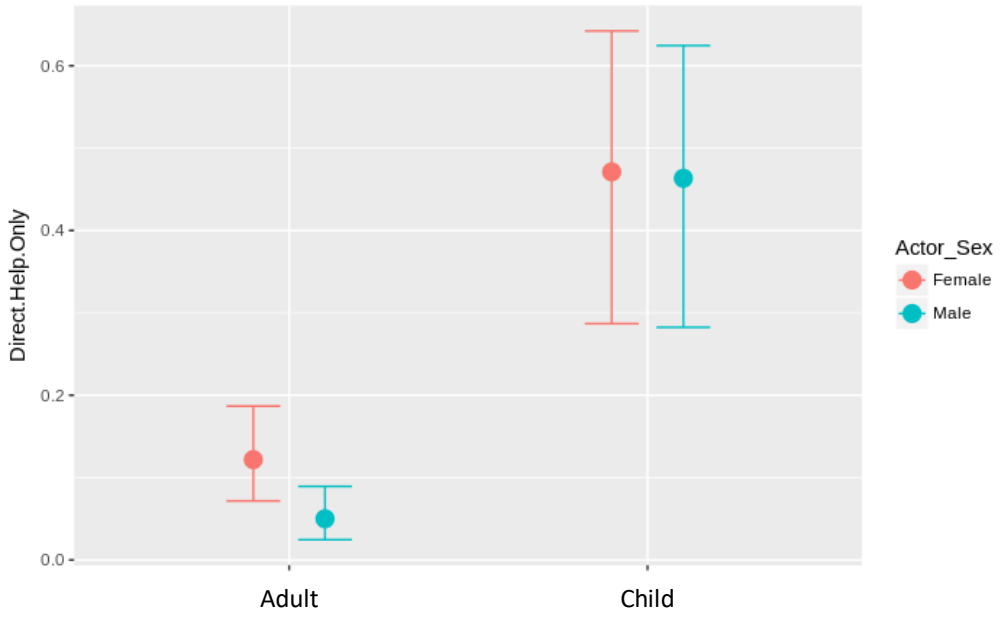


Figure 5.9. Plot of marginal effects – the probability of an observed activity being direct alloparental help in contrast to indirect alloparental help by age (child = under the age of fifteen or adult = fifteen and over) and by sex.

Table 5.6. *Bayesian regression model (Bernoulli) Probability of an observed activity being direct alloparental help in contrast to indirect alloparental help by age and sex.*

Population-Level Effects (Fixed)	Estimate	Est. Error	95% Credible Interval		Rhat
Intercept	-1.99	.28	-2.56	-1.47	1.00
Under15Over15 (Under)	1.87	.33	1.20	2.50	1.00
Actor_Sex (Male)	-.96	.30	-1.56	-.41	1.00
Under15Over15(Under):Actor_Sex(Male)	.91	.46	-.01	1.82	1.00
Group-Level Effects (Random)					
Family Number (number of levels: 25)	.95	.26	.54	1.56	1.01

*Formula Direct.Help.Only ~ Uner15Over15 * Actor_Sex + (1|Family_Number). Prior = set_prior("normal(0,1)", class "b"), iter=1000, chains = 4, cores = 4). Effective Samples all above 200*

Again, against prediction, this model demonstrated no correlation between the likelihood of direct help and number of offspring suggesting that in this sample, the model did not predict elevated fertility. (See Figure 5.10).

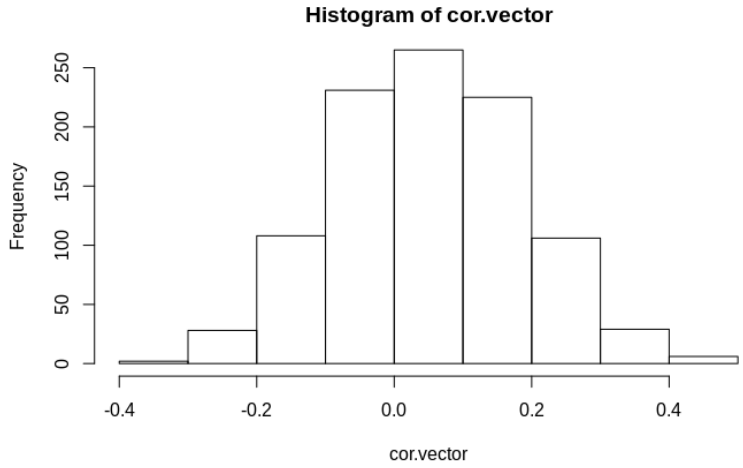


Figure 5.10. Correlation between numeric vectors. Is there a correlation between the likelihood of observed direct help and number of children by each head of household? A perfectly positively correlated vector will return 1, perfectly negatively correlated vector returns -1, and a vector showing little or no correlation will be close to 0. In this case, no relationship with respect to fertility is predicted by the model.

Although an age and sex patterning was found with respect to type of help (direct, indirect, non-help), no relationship between the likelihood of type of help and fertility was found. It could be that our sample was too small with not enough variance in the number of children between participants to elicit any effect (See Figure 5.11)

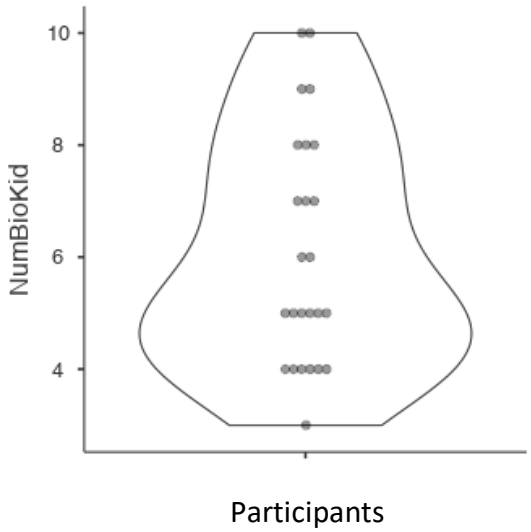


Figure 5.11. Violin plot demonstrating the distribution of number of biological children for each participant.

3.6. Does family size or number of children predict the probability of help?

A binomial mixed effects model indicated that neither number of children ($p = 0.17$) nor family size ($p = 0.75$) predicted observed help by any family member. Additionally, with respect to observed help from children only, a binomial mixed effects model indicated no effect of number of children ($p = 0.89$) nor family size ($p = 0.42$) on observed help (See Tables 5.7 and 5.8).

Table 5.7. *Binomial mixed effect model demonstrating no effect of number of children nor family size on observed help of any type by any family member (n = 1314)*

Fixed effects:

	Estimate	Std. Error	z value	Pr(>|z|)
(Intercept)	0.66	0.57	1.17	0.24
BIOKID	-0.09	0.07	-1.37	0.17
FAMSIZE	-0.01	0.04	-0.32	0.75

Correlation of Fixed Effects:

	(Intr)	BIOKID
BIOKID	-0.72	
FAMSIZE	-0.61	-0.040

Random effects:

Groups	Name	Variance	Std.Dev.
ID	(Intercept)	0.39	0.63

AIC	BIC	logLik	deviance	df.resid
1753.0	1773.7	-872.5	1745.0	1310

Table 5.8. *Binomial mixed effects model demonstrating no effect of number of children nor family size on observed help (of any type) by children only (n = 575)*

Fixed effects:

	Estimate	Std. Error	z value	Pr(>|z|)
(Intercept)	0.42	0.77	0.55	0.58
BIOKID	0.01	0.09	0.14	0.89
FAMSIZE	-0.04	0.05	-0.81	0.42

Correlation of Fixed Effects:

	(Intr)	BIOKID
BIOKID	-0.75	
FAMSIZE	-0.63	0.003

Random effects:

Groups	Name	Variance	Std.Dev.
ID	(Intercept)	0.49	0.70

AIC	BIC	logLik	deviance	df.resid
768.2	785.6	-380.1	760.2	571

4. Discussion

As predicted, age and sex patterning with respect to helping behaviour was observed in the current study. Specifically, the division of labour by sex in Samoa does not appear to emerge until after males have developed a mature body that affords them the ability to take part in male typical behaviours. For example, cutting down and carrying a 30kg bunch of bananas, carrying bundles of coconuts that must weight upwards of 50kg, or standing in the strong waves fishing. Therefore, the only way for a child, of either sex, to help is by pitching in with chores that they are developmentally capable of (e.g. sweeping). As such, we do not see a clear division of labour by sex until maturity.

All children under the age of fifteen, regardless of sex, engaged in behaviours that are classified as direct alloparental help. Above the age of fifteen, women were observed to engage in more direct alloparental help than men. This therefore supports the suggestion made in Chapter 4. that the lack of an effect of first-born child sex on fertility could be a consequence of the fact children's help was not as gendered as had been assumed. Instead, my results suggest that all children, regardless of sex, perform the same kinds of helpful behaviours. Thus, with respect to reproductive decision making, the sex of the first-born child may not be a relevant factor to consider in Samoa, in contrast to other populations where such an effect has been found. Sex does not appear to influence helping activities until long after the mother has reproduced many times. This study is, to my knowledge, the first to observe these patterns, and suggests that certain claims made about childhood activities in Samoa (e.g., reports that fa'afafine prefer women's chores in childhood: Bartlett & Vasey, 2006; Vasey & Bartlett, 2007; Vasey, Pocock, & VanderLaan, 2007; VanderLaan, Gothreau, Bartlett, & Vasey, 2011b; VanderLaan,

Forrester, Petterson, & Vasey, 2012; VanderLaan, Petterson, Mallard, & Vasey, 2014) should be treated with caution.

With respect to adults, in almost all cases, the frequency of female engagement is higher than male engagement, with the exception of "cooking", "fishing/plantation", and "outside yard chores". This suggests the existence of a division of labour by sex in adulthood, however, it could simply be an artifact of having more observations of females. The directionality cannot be inferred, in other words, are more females engaging in activities in the house and as a result more females are observed or are more females observed and therefore they appear to be doing more around the home. Despite this, after observing the activities happening in the households, it seems obvious that certain tasks require a mature body and are not tasks that can be carried out by children and therefore children of both sexes are equally as helpful to the mother in her immediate future.

Although we have demonstrated an age and sex patterning, against prediction we found no evidence of a relationship between type of helping behaviour (direct, indirect, or non-helping) and overall fertility. This could be simply that our sample was too small with not enough variance in number of children to demonstrate any effect (See figure 5.11.). This stands in contrast to the results in Chapters 3 and 4 where reported help was associated with higher overall fertility, and with shorter interbirth intervals. It is possible that perceived help and observed help are not capturing the same thing. For example, when responding to interview questions, when some women were asked if their children helped, they responded "no", however, while conducting interviews, it was evident that their children were behaving in ways that I would have identified as "help" (e.g. watching the baby). Additionally, if Samoan women perceived "help" as being of a financial nature (monetary), they may respond "yes" when asked if their children helped, however, it is

not something that would be easily observed. Therefore, it is possible that Samoan women's ideas of what constitutes "help" could differ from Canadian ideas of "help" resulting in survey responses and observations that are incongruent. This underscores an important consideration for researchers working in alternative populations – the necessity of ecologically valid measurement tools. These findings highlight the importance of employing a mixed methods approach as neither surveys nor observations may be adequate independently.

Figure 5.12 Observational photographs taken in Lalomanu

Typical Samoan homes

Samoan shops either attached to or in front of households

Samoan women and girls selling coconuts in front of a home. Coded as “Working from home”.




Samoan teenagers preparing food for the umu. All coded as “Cooking”

Samoan brothers walking through the village selling German buns. Coded as “Running Errands”



Samoan children of various ages all coded as “Socializing/Recreation”.


Samoan teenagers returning from the plantation and a Samoan man fishing. Coded as “Fishing/Plantation”

Samoan woman weaving a fine mat. Coded as “Handicrafts/Sewing”

Samoan men constructing a fale o’o and a young Samoan boy with a machete. Both coded as “Outside Yard Chores”.

CHAPTER SIX

CONSTRUALS OF "HELP"

"What people say, what people do, and what they say they do are entirely different things."

- Margaret Mead

1. Introduction

In this final data chapter, I turn from a quantitative examination of household help to a more qualitative investigation. Specifically, this chapter offers an analysis of the manner in which a simple question like "do your children help you in the home?" is not quite as simple as it may seem; it is a question that needs to be considered both in the context of the Samoan way of life, and in the context of a Canadian researcher bringing her own cultural assumptions to bear, and failing to anticipate the kinds of responses such a question might elicit. In what follows, then, I offer a more "ethnographic" assessment of how questions about the provision of help were construed and interpreted by my Samoan respondents, contextualizing the notion of help within Samoan lifeways, and providing a more nuanced perspective than a purely quantitative approach can achieve.

2. Children and Chores

Samoan children are given a large number of responsibilities and, thus, they appear to gain a sense of independence at a young age. Young Samoans can often be seen walking along the streets of the village carrying large buckets of water, bushels of coconuts or large baskets filled with produce or fish, and it is not unusual to see young

children walking the streets carrying or holding the hands of their much younger siblings with no adult present. It is also common to see young children, both in the capital city of Apia and in the villages, selling fish or home-made goods, such as taro chips, keke pua'a (pork buns), or handicrafts. Samoan boys learn to prepare the umu (stone oven built on the ground) and to make coconut cream. Samoan girls learn to cook and do laundry. In addition, Samoan women often refer to their younger siblings as "my son" or "my baby".

Samoans pride themselves on maintaining traditional values and stress the importance of the *fa'a samoa* (Samoan way of life). Samoan children living overseas (mainly in Hawai'i and New Zealand) report that doing chores or "*feaus*" is a way in which they preserve the *fa'asamoa* despite no longer residing in the country. Older Samoan children often compare the number of chores that they are expected to perform to those expected of *palagi* (foreign) children, frequently joking that *palagi* children couldn't handle their workload. One Samoan woman told me "As a kid I did wish I was *palagi*, so I didn't have to do so many *feaus*". Additionally, doing chores or *feaus* is seen as a way to demonstrate love and respect. One Samoan man told me "Because I love my parents, doing *feaus* is my way of showing my respect and appreciation...everything I do is out of love of my parents."

Given Samoan parents' expectations that children will dutifully carry out their *feaus*, interpretations of alloparenting are not always straightforward in Samoa; measurement tools developed in one society may not be reliable and valid when applied in this different cultural context. This highlights an important consideration for researchers working in other populations and emphasizes the importance of a mixed methods approach. For example, during one research visit, when Samoan mothers were asked if they received "help" from their children around the house, many women

answered “no”. However, it was apparent that children were, in fact, engaging in behaviours that I perceived as “help”. Upon follow-up, Samoan mothers explained that their children were not going above and beyond the tasks that were expected of them and, consequently, the mothers did not consider the behaviour as “help”. Additionally, unless the children were independently earning money or employed in the labour force, Samoan mothers did not view activities such as working in the plantation or fishing to be “help” either. I also found that “helping the family” often meant that offspring provided financial assistance, rather than physical work in the household. Thus, in Samoa, the Canadian conception of “help” may not necessarily be a valid measure of a Samoan conception of “help”, resulting in survey data beset with construct bias. As a result of this, in addition to quantifying levels of assistance by children and others, I also investigated how Samoans understand and interpret the term “help”, and how this maps onto Western construals of the same term.

3. Bias and Equivalence

A necessary component of any cross-cultural study is determining whether the measurement tools chosen are culturally valid and whether test scores from any given inventory or measurement tool are generalizable across populations. The terms bias and equivalence are frequently used when making these considerations (van de Vijer & Tanzer 2004). Bias occurs when score differences on the indicators of a particular construct do not correspond to differences in an underlying characteristic. Inferences that are based on biased scores should be considered invalid and more than likely do not generalize to other instruments measuring the same underlying characteristic. Equivalence, according to van de Vijer and Tanzer (2004), is the opposite of bias. Bias is

often used as a generic term for problematic factors in cross-cultural score comparisons, while equivalence tends more to be associated with measurement level. Equivalence of measures (or an absence of bias) is necessary for useful and valid comparisons across populations. Importantly, neither bias nor equivalence refer necessarily to the properties of any psychometric measurement tool but instead they refer to characteristics of cross-cultural comparisons of such psychometric measurement tools. As such, concerns about bias refer to the application of a measurement tool in a cross-cultural comparison.

Construct bias

Construct bias occurs when the understanding of a measured construct (like "help") is inconsistent across populations. One of the most well-known examples of construct bias can be found in the area of intelligence testing. Western intelligence tests tend to emphasize reasoning, memory, and acquired knowledge. Other measures of intelligence such as social qualities, are often not included on Western intelligence measures.

Evidence from non-Western populations, however, demonstrates the importance of these features for defining intelligence (Super, 1983). van de Vijer and Tanzer (2004) provide an excellent example of how construct bias may occur using filial piety. Filial piety is a term often associated with Confucian and Chinese Buddhist philosophy and refers to demonstrating respect for one's elders—being a good son or daughter (Ho, 1996). van de Vijer and Tanzer (2004) argue that, relative to Western societies, filial piety in Chinese societies is understood in terms of the expectations and obligations that Chinese parents place upon their children. For example, a willingness to take care of one's aging parents, both physically and financially, is a quality that is highly valued. In

non-collectivist Western populations, these behaviours relating to the care for elderly parents are only vaguely related to the construct of filial piety. Therefore, a psychometric tool designed to measure filial piety based on the Chinese construct would be inappropriate for measuring filial piety in a Western setting, and vice versa.

Understanding "help" in Samoa

Potential construct bias in the current study became evident upon observations of behaviours that were inconsistent with my survey reports. To determine the extent of the possible construct bias, I conducted follow-up interviews with 53 previously interviewed Samoan women, seeking clarity on what, specifically, the term "help" meant to them. The responses fell into four main categories: relief from the mother's duties: financial aid; satisfying the needs of the community and the church; and assisting others. The vast majority (81%) reported that the term, "help" referred to anything that relieves the mother of her duties. One 60 year-old mother of 10, reported that "help" means "helping me with all of my duties and responsibilities things like cooking, cleaning, running errands, doing the wash, doing dishes, that kind of thing." The same woman, when asked what specifically her children did to help, said that they babysat while she did other chores and that her eighth child, a 28-year-old son who lives with her, helps her the most now.

The second most frequent response (23%) was that "help" meant financial assistance. One 48-year-old mother of 7, said "Help is when my family has a *fa'alavelave* (church or village obligation usually takes the form of money, or sometimes goods), I can talk to my kids and ask them to all chip in and help financially". This same woman reported that currently, her eldest daughter helps her the most. In some cases, women combined answers saying that help was both financial and chore relief. A 52-year-old

shop-keeper and mother of 4, stated "Help is important, my kids help with *feaus* (chores) and looking after the shop. They do cleaning and wash and my kids help financially too".

Some women were very specific that the term "help" has an element of community service attached to it. For example, one self-employed 46-year-old mother of 7, explained that to her, "help" means "assisting or giving service to those in need. Working together as a group or community". However, after replying "yes" when asked if her children helped, she followed up by saying that they "do the cooking, cleaning inside and outside, do the wash, and give financial assistance". Despite defining help as community service, which may have been inconsistent with a Canadian interpretation, her functional definition fell completely in-line with my intended construct of "help".

Interestingly, in the seven cases (bar one) where the women's definitions of help excluded any reference to relieving the mother of her duties or responsibilities, their answers to the question of how specifically their children helped them all included behaviours that would, in fact, relieve the mother of her duties. For example, they stated that their children helped by babysitting, showering and dressing younger siblings, cleaning, cooking, wash, and dishes. Conversely, in a few cases (3) where women specifically defined "help" as something that would relieve the mother of her chores, when asked how their children helped, their responses were financial in nature (e.g. paying tuition for younger siblings, providing lunch money for younger siblings, helping out financially).

In 1913, in his now famous Behaviourist Manifesto, John Watson asserted that the study of scientific psychology should concern itself only with behavioural acts that can be described objectively. Asking women *how* their children help is a more objective measure than asking them what "help" *means* to them. In the case of my study, it seems that—

despite my initial fears—construct bias has not occurred since an overwhelming majority of women's responses to both "what does 'help' mean" and "how do your children help?" are consistent with a Canadian interpretation of "help". In other words, the measure I used was valid (measuring what it was intended to measure) and culturally appropriate. This construal of help confirmation provides a level of robustness to the finding in Chapter 4 that women who report receiving help from their children have shorter interbirth intervals and more children overall. It appears that women reporting that they receive help are, indeed, understanding the term "help" in the way that it was originally intended. Additionally, this finding verifies the identification and categorization of helping behaviours described in Chapter 5, since much of the behaviour identified in that chapter as "helpful" is consistent with women's reports of behaviour that they too consider helpful.

4. Who helps?

Given that help relieves a mother of her chores, and appears to be an expected part of most Samoan children's lives, it raises the question of whether help is more expected of daughters or of sons? Much of the existing alloparental literature focusing on help finds a sex difference with respect to the impact on fertility. For example, during his time in Ifaluk, Turke (1988) found that women with first born daughters had a higher fertility than women with first born sons. He suggested that daughters and not sons provide help to their mothers in a way that directly relieves some of the costs associated with child rearing. This, in turn, affords the mother the opportunity to direct limited resources towards further reproduction. Hames and Draper (2004) suggest that daughters are more economically useful to the family because they stay in the natal households longer than

sons and therefore any resources that they produce (e.g. food) is used for household consumption compared to the food that males produce (e.g. fish) which is often distributed to other households. In support of this argument, Dunbar's (2002) work with Gypsies in Hungary found that first-born daughters indeed remained at home longer than first-born sons or second-born daughters. Additionally, Bereczkei and Dunbar found that Hungarian Gypsy women with first-born daughters had shorter birth intervals, a longer reproductive span, and higher fertility. Their time allocation data indicates the underlying mechanism for this reproductive pattern is the elevated rate of helping by daughters, specifically, helping with housework and childcare.

In Chapter 4, I found no support for a first-born sex difference with respect to length of interbirth interval or overall fertility and in Chapter 5, when observing Samoan households, I found that prior to the age of fifteen, there was no division of labour by sex with respect to helping behaviour. When speaking to Samoan women, of the 110 who specifically identified either a son or a daughter when asked "who helps the most?" the responses were evenly split with 38% of the women identifying sons and 37% identifying daughters. Although this doesn't account for confounds such as women who only gave birth to sons or to daughters, it does suggest generally, that Samoan women perceive their sons and daughters as being equally helpful.

4.1. *"Big Family, Big Future"*

In addition to asking directly if Samoan women received help from their children and asking them who helps them the most, one of the more illuminating sets of questions I asked concerned future reproduction. I asked women if they wanted more children, and why? I also asked what they considered to be the ideal number of children, why this was

considered ideal and if they wanted boys or girls. During the interviews, many of the women struggled with these questions. In particular, when asked to identify an ideal number of children, one woman, while looking at me with incredulity, said "the number of children I have is perfect. How could I not want one of my children?"

The 2014 Samoan Demographic Health Survey also identified issues pertaining to questions regarding ideal family size noting a tendency of the respondents to rationalize the number of children they already had. The DHS suggests a way to combat this problem is to ask women who currently have no children. However, this method still falls short because, in the 2014 DHS sample, 42% of women with no children reported that their ideal number of children was zero. It is impossible to determine whether this is because they truly do not want children or if it is because they have no children. Perhaps, with respect to ideal number of children, the only method that may be statistically useful is a longitudinal design. This is not to say, however, that the responses were uninteresting. Although women struggled to answer this question, of the 85 women who did answer, only 20 produced responses that matched their actual number of children. Most women (55/85, 65%) reported an ideal number that was higher than their current number of children. Although this proportion may seem high, almost half of those 55 women (47%) currently had two children or fewer. In women who had seven or more children, only four reported a higher ideal number of children than the children they had. If there is a correlation between actual number of children and reported ideal number of children, it appears to be a negative one.

It is possible that when considering their answer to the question about the ideal number of children, women were not necessarily applying the ideal to themselves and were considering it in more abstract terms. One woman, a mother of one, reported that

four children was ideal because “I always wanted four children”. However, when asked if she wanted to have more children of her own she replied “No. I had two pregnancies and that was enough.” Another woman, a mother of two, told me that the ideal number of children is five. When I asked her if she would like more children she said “No, because I can’t afford more”. Another woman, a mother of three, reported that the ideal number of children is six because she always wanted three boys and three girls. When I asked her if she would like more children, she replied emphatically “No. I don’t have a husband”. A mother of nine who told me that she was too old to have any more children reported that the ideal number of children was 10 because “big family, big future”.

A consistent theme when I asked women to explain the number of children that they thought was ideal was the expectation of future help. Of the 47 women who reported that “yes” they wanted more children, 49% specifically referred to the future benefits of more children. One mother of seven told me that she wanted more children because “They will be more useful in the future when we both not working. The children can help and provide for our family”. Another woman who currently has one child explained “Yes, I want more children. I want to have a big family and I want to raise more children because they bring happiness to our family and they are the future. The ideal number of children is five because I love the number five and I’m sure five children will be enough to help and provide for our family when they complete school and get good jobs”.

When I talked with these women about why or why not they wanted more children and asked them to explain how they had arrived at their ideal number of children, the most frequent explanation to both involved future benefits. Future benefits indicated by the women were either financial benefits or physical help in the future (e.g. taking care of them in old age). This is not to say that the Samoan women who were interviewed did

not recognize the immediate benefits of having children. When I asked women "ideally, would you prefer more sons or more daughters?" Of the 73 women who responded, 37% said an even number of each, 37% said more sons than daughters, and 26% said more daughters than sons. Interestingly, the reasoning for wanting more sons than daughters appears to be financial. Many women indicated that daughters were more expensive to raise than sons. In particular, girls' clothing was identified as being a major financial burden. One woman told me, "In Samoa, girls are very expensive. Clothing, daily care, very expensive. And you worry that they might get abused, sexually. But for boys, they require much less attention, clothing. They wear shorts or an ie lavalava" (traditional Samoan piece of fabric that wraps around one's waist, like a sarong). Surprisingly, 53% of women expressed that boys were easier to raise than girls (38% said boys and girls were equivalent, but only 9% said girls were easier to raise). However, three women told me explicitly that boys are naughty (nobody said the same about girls), so it is possible that when they say "easier to raise" what they mean is that boys cause less worry than girls. Indeed, the most common reasons given as to why boys are easier to raise is that they require less attention and are less of a financial burden.

Overwhelmingly, when women were considering the costs and benefits to having children, the most frequent lines of reasoning involved help of some sort. Either help to the mother with her chores, help to the father with his chores, or help to the family in general. It seems, anecdotally at least, that (even though boys are viewed as easier to raise), boys and girls are equally valuable for the help that they provide immediately and in the future.

4.2. Remittances

In the Samoan language, the word "*alofa*" means to love or to care for or care about. When Samoans say "*Oute alofa ia te oe*", it translates to "I love you", but does not carry the same emotional weight as the equivalent saying in English. Instead, it means "I will look out for you" or "I care about what happens to you". When Samoans sign off on letters or emails or say goodbye, they will often say "*alofa aku*" which means love to you, but not in the weighty sense of the English word. For example, I once received an email from a Samoan car rental agency that was signed "*alofa aku*". If I'd received such an email from an equivalent agency in Canada, I would have had a vastly different reaction to the one I experienced in Samoa.

When Samoans gather for weddings or birthdays and give a gift of money they refer to this as "*mea'alofa*" which translates to "stuff" or "things of love". When they give money to the Pastor they refer to it as giving an "*alofa*" and at cultural events, they regularly pass around a bowl for people to give money. This bowl is referred to as the "bowl of *alofas*". Thus, in Samoa, love or caring for an individual is very much related to money, and one way to demonstrate love or respect is to give money. When I conducted my village interviews, I gave money not only to the participants to thank them for their time, but also to any of the high chiefs or influential people in that village. This is considered giving an *alofa*. Such gifts are accepted humbly and with gratitude, but make no mistake, they are expected.

This conflation of money and love is also seen within families. The expectation of individuals living in Samoa is that family who live overseas will send regular remittances. Indeed, remittances are big business in Samoa: in February of 2019, the Central Bank of Samoa reported that during the 2017/2018 fiscal year, remittances were the top foreign

exchange earner at just over $503 million tala ($257 million CDN), which equated to approximately 20% of Samoa's GDP. The Central Bank of Samoa also reported that, of the total remittances sent, almost 70% were for families or individuals.

During my first field season, I asked women about their income and their perceived socioeconomic status. I found an inverse relationship between the two variables whereby individuals who had a higher income felt poorer and individuals with a low income felt wealthier. I assumed that the reason for this was the collectivist nature of the country. Those who had a higher income were financially responsible for more people, and thus this left them feeling poorer. I had assumed that people were including any remittances that they received from family in the income that they were reporting. As it turns out, I, assumed incorrectly.

During my second field season, I specifically asked Samoan women about remittances and whether money from family overseas was "income". One woman politely smiled at me and shook her head, "No. Income comes from working. Remittances come from family". During the second field season, then, I began adding a question about remittances to the interviews that I was conducting. Among the 53 women who answered this question, only seven (13%) told me that they did not receive any remittances at all. Among the 87% who reported that they did receive remittances on a regular basis, approximately 32% reported receiving them monthly and 32% reported receiving them biweekly. The other responses were more difficult to quantify and ranged from "whenever needed" to "occasionally". When I asked who was sending the money, in all cases, it was a family member. Not one woman identified a friend as the sender. Although many of the women identified multiple family members as remittance senders, the majority (51%) identified either her sibling(s) or her husband's sibling(s).

Remittances from children accounted for 32% and money sent from parents accounted for 17%. When asked who the senders were, many respondents said "my children" or "my siblings" and as such, I was unable to look for any age or sex patterning. Bowles and Posel (2005) argue that the inclusive fitness benefits of supplementing the income of family members has been the driving force underlying South African migrant worker's remittances home. Indeed, Bowles and Posel (2005) found that, using an inclusive fitness model, genetic relatedness reliably predicted migrant workers' remittances. The effect was highly statistically significant, however, the authors caution that the effect size was modest, leading them to conclude that genetic relatedness does play a role but is not the only factor explaining remittances. Although a kin-relatedness pattern was not possible in the current study, it is interesting that remittances from aunts, uncles, cousins, nieces, or nephews, accounted for 21% of the total. Considering the substantial role that remittances seem to play in Samoa, exploring the impact they have on fertility, reproductive decision-making and inclusive fitness therefore seems worthwhile.

Developing culturally appropriate measures seems to be an important, yet hastily carried out task. In the scant literature on Samoa, it is now easy for me to see the glaring errors that persist, publication after publication. My Samoan husband used to shake his head at me and argue about literature that I was using to justify projects that I was working on. "No", he would say, "you're wrong. That's not how it is here". I would just smile and say condescendingly "well…that's what the evidence suggests" to which he would reply "well, maybe the evidence is wrong". He was correct. When culturally inappropriate measures are used study after study and they return the same results, it bears consideration that perhaps the measurement tools are consistently measuring the

same errors resulting in an enduring construct bias. My husband would tell me, over and over again, that fa'afafine may say that they are willing to help care for their nieces and nephews but that in actuality, they do not because "nobody is going to leave their children in the care of a fa'afafine". Again, he was correct. Of the multiple fa'afafine who lived in the households that we observed, only one fa'afafine was recorded and only on three occasions. When I began this project, I told him that my predictions were that women who receive help from their children would have more children overall. Again, he said "I don't think that's why people have lots of kids here. I think it's because the more kids they have, the more likely it is that one or two of those kids will be successful and either move overseas or get a good job here in Samoa. That way, they can give money to their parents". I dismissed his comment thinking…we will see when the data comes in. Again, he was correct. Almost half of the women reported "future benefits" as the primary reason to have a large family.

This underscores an important feature of conducting cross-cultural research beyond appropriate measurement tools. Namely, the necessity of living in the population, not simply being a tourist. I have been lucky enough to work alongside a research partner who is intimately familiar with the population and confident enough to express a dissenting opinion. In an earlier project that I worked on in Samoa, I had a fa'afafine research partner who conducted all of the in-person interviews in Samoan. I sat beside her through hundreds of interviews and heard her, on many occasions, before participants had a chance to answer, say "airena, ah?" I was unfamiliar with the language at that time that it did not strike me as concerning. However, one weekend, I was sitting at the beach with my now husband and I heard another fa'afafine say "airena!". I turned to him and asked him what it meant. He told me that fa'afafine have their own language, a sort of pig latin,

and that “airena” was fa’afafine speak for “leai”. I was stunned because “leai” means “no”. Thus, during hundreds of interviews that I had overseen, the fa’afafine research assistant had been answering “no” for participants.

Working in an alternative population is undeniably exciting but the responsibility to correctly design ecologically valid measures, interpret and represent the accurate responses of participants, and to integrate into the population as more than a tourist, must be of a higher priority than collecting massive quantities of potentially erroneous data. In this case, I was lucky, my understanding of “help” did align with the understanding of “help” expressed by participants. However, had I been wrong, I would have had to begin again.

In addition, the existing literature on Samoa is not an appropriate substitute for immersing oneself within the population. The existing ethnographies about Samoa no longer reflect the contemporary way of life. Samoa has developed rapidly and, as such, the existing literature falls short. For example, the most well-known Samoan ethnography – *Coming of Age in Samoa* by Margaret Mead—was first published in 1928 and is no more reflective of contemporary Samoa than any other ethnography published nearly 100 years ago, from any population. Later publications, such as Derek Freeman’s *Margaret Mead and Samoa: The Making and Unmaking of an Anthropological Myth*, published in 1983, based on observational data collected in the 1940s and 1960s, from a time before Samoans had independence and were still under New Zealand rule, before Samoa had joined the United Nations, and before Samoa had public broadcast television. Indeed, literature such as Elinor Ochs’ (1982) *Talking to Children in Samoa* draws on Mead’s ethnographic work conducted more than fifty years prior. Ochs (1982) suggests that the linguistic patterns that she observes are reflective of Samoan values and cultural

beliefs. More than thirty years later, however, it is reasonable to assume that those values have changed. For example, education was not a priority in Samoa thirty years ago, nor was family planning, and climate change was not eliminating the shorelines. In addition to simply being outdated, in a patriarchal society such as Samoa, existing literature reflecting the experiences of males are very different than the experiences of females. For example, in *The Samoan Fono: A Sociolinguistic Study*, Duranti (1981) attends and observes a number of typical Samoan *Fono* (a gathering of titled males in the village) and conducts a linguistic analysis based on his observations and interviews with locals. Although his linguistic analysis seems thorough, as a female, I would not be permitted to attend a *fono* and as a result, my experiences in the village are vastly different. This is also the case with respect to Derek Freeman's research in Samoa, where he was bestowed an honourary *matai* (chief) title and invited to attend gatherings limited to males. As such, the existing literature should be used sparingly.

CHAPTER SEVEN

DISCUSSION – THE TAUALUGA

The word "Taualuga" in Samoan refers to the last stage of traditional house building in which the topmost beam is secured to the building (fale), signifying completion. The term "taualuga" symbolizes the conclusion of a monumental task and the beautifying final touches involved.

In this thesis, I used a mixed methods approach to investigate the role of children as alloparents and the impact of children's alloparental help on fertility. Although the role of children as alloparents has been studied previously, much of the research has focused on traditional or non-developed populations, and not transitioning populations. Additionally, alloparental help provided by children has not received as much attention as the role of other kin with respect to its impact on fertility. Here, I will discuss the key findings of my thesis, highlight some of the limitations to my study and suggest future directions for research on this topic.

6.1 Fertility in Samoa

Samoa, a transitioning island nation in the South Pacific, has a fertility rate that is on the rise. Contrary to the patterns observed in most populations undergoing the demographic transition, Samoa's fertility rates have not yet begun to fall. This, despite the ongoing attempts by the Government of Samoa to decrease fertility and extend the time between births (interbirth interval). One factor that the Samoan NPP failed to consider, however, was the role of allocare, specifically allocare by children. In chapter three,

through the use of survey data, I demonstrated a relationship between fertility and help from children. Importantly, help from children appears to be one of the factors most strongly associated with fertility in Samoa. Other factors typically associated with fertility, such as education and wealth do not appear to have a meaningful effect.

6.2 The relationship between reported help and fertility

In Chapter four, I explored the relationship between fertility and allocare further by examining interbirth intervals, as well as total number of offspring. I found that Samoan women, who reported receiving help from their children, experienced shorter interbirth intervals (on average, and per birth) than women who reported receiving no help from their children. In addition, women who reported receiving help from their children had more offspring overall than did women who reported receiving no help. Although the directionally of this relationship cannot be stated with certainty, this finding provides further evidence supporting an effect of help on fertility.

Much of the current allocare by children literature suggests that there exists a relationship between fertility and the sex of the first-born child. The idea here is that girls provide help that is more directly impactful to their mothers and that this reduces the immediate costs to childcare, allowing their mothers to direct energy and resources towards further reproduction thereby increasing fertility. I found no evidence in support of this suggestion, rather there was no difference in the length of the interbirth interval or overall fertility in mothers with first-born daughters versus first-born sons. Furthermore, I found no difference in the length of interbirth intervals based on the sex of the child that opens the interval or closes the interval nor a difference in fertility between mothers based on the type of interval (girl-girl, girl-boy, boy-girl, boy-boy). The findings of Chapter

four are the first indication that, in Samoa, the important factor appears to be help alone and not the sex of the individual offspring who provides it.

6.3 Observations in Lalomanu

While conducting interviews with women for the survey portion of my thesis, it became evident that, despite some women replying "no" when asked "do your children help?", I could see their children engaging in behaviour that I thought was helpful (e.g. minding their younger siblings). I had already planned to conduct an observational study wherein the focus was the differing types of helpful behaviour—direct allocare (minding the baby) versus indirect allocare (running errands)—and where I planned to explore age and sex patterning. However, once I noticed the inconsistency between women's responses and what I was observing, the need for an ethnographic component became more significant. Conducting observational research is difficult. The logistics are complicated to work out and it took my research partner and I many trials to perfect. Once we developed a system for travelling through the village and recording household activities, one of the primary challenges became addressing how disruptive my presence seemed to be. When I was present during our daily 'rounds' it was quite often the case that all household activities would grind to a halt and members of the household would invite us for a meal or for a drink, or they would want to come over and chat. Collecting activity data, as it was occurring, became increasingly difficult. However, because my research partner was an inhabitant of the village, when he was alone, he drew very little attention. Thus, it was necessary for him to record the observations alone.

Behavioural observation data revealed an age and sex patterning with respect to the type of allocare being observed. I found an interaction in that children (individuals

under the age of fifteen) showed no effect of sex with respect to the type of behaviours in which they engaged. That is, both girls and boys participated equally in the same types and frequency of allocare. However, in adults (individuals above the age of fifteen), I found that more females than males participated in behaviours that were considered direct allocare. This suggests that the division of labour by sex that is reported in Samoa does not occur until adulthood. This further supports the findings from Chapter four, where I found no effect on fertility by the sex of the first-born child. Since children are providing the equivalent type and amount of help it seems that a daughter is no more helpful in childhood than a son and, as such, sex of offspring has little on impact Samoan mothers' reproductive output. Frequently the literature from researchers working in Samoa refers to a division of labour by sex in childhood, however, the findings from my observations suggest that these references should be taken with caution.

In contrast to Chapter four where reported help by women was associated with shorter interbirth intervals and higher overall fertility, with respect to observed help, I found no effect on fertility. This inconsistency between reported help (more subjective) and observed help (more objective) and the impact on fertility is important. It could underscore a multifaceted complexity to the meaning of "help". For example, observations are limited to behaviour that is expressed, but it is possible that women understand the term in a manner that is not necessarily observable (for example, the provision of financial assistance). It is therefore possible that reported help and observed help do not capture the same things.

6.4 Construals of "help"

After I observed children behaving in a manner that I perceived as "help" in homes where women were reporting that they received no help, I asked two women "isn't that help?" They replied "no, that is part of being a child in Samoa". I became concerned that I had not operationally defined the term "help" in a way that was culturally appropriate to Samoans. Thus, I added a question to my interviews that encouraged women to define what the term "help" meant to them. As it turned out, my fears were unnecessary because most women defined "help" in a way that was consistent with how I had intended it. However, their responses illuminated the complex nature of the word.

Many women suggested multiple meanings for the term help including physical help (help with chores) and financial help (monetary support) lending support to the suggestion that reported help and observed help may not be capturing the same things thus an inconsistency in the effects of help found in Chapter four and Chapter five. Importantly, the multifaceted definition of help that was provided by women emphasizes another important consideration for researchers conducting cross-cultural research: the importance of developing culturally appropriate, ecologically valid measures. In attempting to compare the effect of variables that are defined by terms that may carry different meanings in different cultures, the necessity of transparency and clearly defined operational definitions is imperative. In addition, to comprehensively investigate the impact of alloparenting on fertility, researchers must consider the complete social environment and incorporate all alloparental caregivers in order to reveal possible age and sex interactions.

6.5 Limitations and Future Directions

One of the difficulties in conducting research such as this is that, during interviews, women are often asked to retrospectively speculate or to answer questions that they had not previously considered. As such, it is challenging to assess the veracity of the responses. Cross-sectional survey data also make it difficult to infer any directionality with respect to causation. For example, do women have more children because they receive help or do they have more help because they have more children?

With observational studies, the observations recorded are snapshots in time and do not necessarily capture the full spectrum of activities, nor can observations capture unobservable tasks (e.g. giving money, buying cash power through one's phone, sending groceries on the bus). It feels too easy to say that a larger sample size may help. However, a larger sample size is always beneficial. Importantly, the best way to address fertility questions may be through a longitudinal design. This would allow for the control of variables that may be fluid (e.g. income) and time-varying and would permit an inference of directionality.

In my sample, some responses seemed to cluster. For example, in one village, in which many of the participants were women who had married into the village, there was a higher frequency of contraceptive use. In Samoa, women who marry into a village (called: nofotane) have a different social status than women for whom it is their natal village. Studying the impact of these types of social networks and the impact on fertility would be fascinating, not least in terms of help from children because, in many cases, the children of the *nofotane* hold a higher social status than their own mothers. Again, incorporating longitudinal data into a social network analysis may provide the

opportunity to determine how these factors influence women's reproductive decision making and overall fertility.

6.6 The Taualuga

At the start of my field-work in Samoa for this dissertation, I had already traveled to the country on four previous occasions, working on other projects. I had boarded for extended periods of time with a Samoan family in the capital city and, had I been asked, I would have said yes, I had experienced Samoan life. And I had, superficially. I knew many of the customs and traditions that were part of the f*a'asamoa*, so I knew that, as a guest, I would be served food first, and I knew that when I went to conduct interviews, I was expected to wear a lavalava and cover my knees.

However, it was not until I began living in a rural village and experiencing Samoan life daily as a member of that village, that I began to understand what it was like to be Samoan. When I traveled to Samoa in the summer of 2013, forced by circumstance to begin an entirely new Ph.D. project, I was living in the village and, as yet, had no research project. I was unsure if I would be able to think of one. As I sat at the back of the property, staring out over the ocean, two young girls, Ake and Faliu, from the house, both under the age of seven, came running up to me. They were taking turns carrying a baby—a newborn girl named Simeauli, who was only a couple of weeks old. The girls said something in Samoan that I did not understand, and then, Ake, the six-year old, passed the baby to me and ran off. Knowing that I was wholly unqualified to look after a newborn, and also somewhat disturbed by the fact that the baby was alone in the company of such young children, I called the girls back, and insisted that they come with me to take the baby back to the main house.

Once we got to the house, I found Su'e, the mother of the newborn, and relieved myself of the responsibility of caring for the baby. Almost immediately after handing the baby back, Su'e called Ake and Faliu and handed Simeauli back to them. They trotted off, baby in arms, and put her down in a bed near the front of the house. Everyone in the house smiled politely at me as I turned to leave, but I suddenly knew that, where I'd believed I was saving the day by returning a newborn baby to her mother, I was, in fact, just inconveniencing everyone. Ake and Faliu had been told to watch the baby, they had not just brought her to the back of the property on some covert mission that they would now be disciplined for. It was I, the naïve foreigner, who was in the wrong. As I humbly walked back to my look-out at the back of the property, I knew that I had just discovered my research project. Becoming a part of the culture that I was hoping to work with, and learning my lesson, was a necessary component of my serendipitous breakthrough. And I am still learning.

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APPENDICES

Appendix A

A.1 Complete Survey:

Please answer the following questions to the best of your ability.
If at any time you wish to withdraw from this study, you are free to do so without any negative consequences.

1. What is your birthdate (day/month/year) _____
2. What is your marital status?
    i. Married
    ii. Divorced
    iii. Single (never married)
    iv. In a committed relationship
    v. Widowed
3. What is your highest level of education (completed)?
    i. University or Post Secondary Education
    ii. College or High School
    iii. Primary School
    iv. No formal education
4. What is your occupation? _____
5. If you are married or living with your partner, what is his occupation?
    _____
6. How many people living in your home have jobs? _____
7. What is your average household income (tala per fortnight)
    _____
8. Do you get any remittances?
    i. Yes
    ii. No
9. If yes, how regularly do you receive them?
10. Who sends remittances the most often (list all that apply and their relationship to you)

11. How would you rate your household?
    i. Wealthy
    ii. Above average income
    iii. Average
    iv. Below average income
    v. Poor

12. Whose village do you live in?
    i. Yours
    ii. Your spouse's
    iii. Both you and your spouse are from this village

13. Have you ever used any birth control?
    i. Yes
    ii. No

14. If you have used birth control, what type(s) have you used?

    _____

15. How many biological children do you have? _____

16. How old were you when you had your first child?

    _____ years old

17. How old were you when you had your last child?

    _____ years old

18. Please list all your biological children and include their birthday. Please use: B (boy), G (girl), F (fa'afafine) *Please indicate if any of these children are being raised by someone other than yourself.*

B/G/F	*Birthday*
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

_____ _____

_____ _____

_____ _____

_____ _____

19. Do you want to have more children?
    i. Yes
    ii. No
    iii. I don't know

20. Why do you or do you not want to have more children?

21. What do you think is the ideal number of children?
    i. Boys?
    ii. Girls?

22. Do you think it is easier to raise a boy or a girl?
    i. Boy
    ii. Girl

    Why?

23. How many adopted children do you have? _____

24. How old was the child (or children) when you adopted them?

25. What was the reason for adoption?

Notes:

HOUSEHOLD DYNAMICS

26. Please describe the people who live (full time) in the same fale as you and the nature of their relationship to you. *For example: My sister, her husband, her three children*

27. In your own words, explain what "help" means to you.

28. Do any of the people in the fale help you look after your children?
    i. Yes
    ii. No

29. Do any of the people in the fale help you with housework
    i. Yes
    ii. No

30. Who helps you the most?

31. Do your older children help you?
    i. Yes
    ii. No

32. How do they help?

33. Who helps you the most?

    _____

34. Do you have children who do not live in the same house as you?
    i. Yes
    ii. No

35. Do you have children who are done school?
    i. Yes
    ii. No

CHILDREN WHO ARE DONE SCHOOL

If you have no children who are done school please skip this section

36. Children who are done school

Child 1: Age _____

Is this child	Boy	Girl	Fa'afafine
Is this child	Single	Married	Divorced
Does this child have any kids?	Yes	No	I don't know
Does this child live with you	Yes	No	Sometimes
Does this child work?	Yes	No	Sometimes
Does this child help with falavelaves?	Often	Sometimes	Never
Does this child give you money?	Often	Sometimes	Never
Does this child help with feaus?	Often	Sometimes	Never

Child 2: Age _____

Is this child	Boy	Girl	Fa'afafine
Is this child	Single	Married	Divorced
Does this child have any kids?	Yes	No	I don't know
Does this child live with you	Yes	No	Sometimes
Does this child work?	Yes	No	Sometimes
Does this child help with falavelaves?	Often	Sometimes	Never
Does this child give you money?	Often	Sometimes	Never
Does this child help with feaus?	Often	Sometimes	Never

Child 3: Age _____

Is this child	Boy	Girl	Fa'afafine
Is this child	Single	Married	Divorced
Does this child have any kids?	Yes	No	I don't know
Does this child live with you	Yes	No	Sometimes
Does this child work?	Yes	No	Sometimes
Does this child help with falavelaves?	Often	Sometimes	Never
Does this child give you money?	Often	Sometimes	Never
Does this child help with feaus?	Often	Sometimes	Never

Child 4: Age _____

Is this child	Boy	Girl	Fa'afafine
Is this child	Single	Married	Divorced
Does this child have any kids?	Yes	No	I don't know
Does this child live with you	Yes	No	Sometimes
Does this child work?	Yes	No	Sometimes
Does this child help with falavelaves?	Often	Sometimes	Never
Does this child give you money?	Often	Sometimes	Never
Does this child help with feaus?	Often	Sometimes	Never

Notes:

HOUSEHOLD

37. What appliances do you have in the house (please circle all that apply)

    i. _____Masigi Tamea (Washing machine)
    ii. _____Ogaumu Uila (Oven (indoor, not umu))
    iii. _____Pusa Aisa Tu (Refrigerator)
    iv. _____Pusa Aisa Ta'atia (Freezer)
    v. _____Microwave
    vi. _____Ogaumu Kesi (Stove top or burners for cooking)
    vii. _____Tipoti Uila (Kettle)
    viii. _____ TV
    ix. _____Moavao (Lawnmower)

38. Do you have metered or cash power?
    i. Metered
    ii. Cash Power

39. Do you have metered water?
    i. Yes
    ii. No

40. Do you have a car?
    i. Yes
    ii. No

41. Is there a hospital in your village?
    i. Yes
    ii. No

42. If there isn't a hospital in your village, where is the nearest hospital?

    _____ (Name of the village)

Location of interview: _____ *(Name of village)*

Appendix B

Table B.1. *Poisson Regression examining relationship between reported help and overall fertility (age of the mother at the time of her first birth and age of the mother at the time of the interview included as covariates), n = 165*

Coefficients	Estimate	Robust SE	Pr(>|z|)	LL	UL
(Intercept)	1.35	0.29	< 0.0001	0.91	1.79
OLDERCHILDRENHELPYES	0.43	0.09	< 0.0001	0.25	0.61
AGEOFMOTHERATFIRSTBIRTH	-0.05	0.01	< 0.0001	-0.06	-0.03
AGEOFMOTHERATINTERVIEW	0.02	0.00	< 0.0001	0.01	0.02

Null deviance: 210.49 on 163 degrees of freedom
Residual deviance: 118.61 on 160 degrees of freedom
AIC: 649.58

Table B.2. *Cox proportional hazards mixed effects model on effect of reported help from children on the length of IBI. Fixed effects: Age of mother at opening birth, number of children present in the home at the time of the opening birth, and reported help from children. Random effects: Participant ID. (N_{IBI} = 652, 3 observations deleted due to missing values)*

Fixed Coefficient	coef (β)	exp(coef) (hazard ratio)	se(coef)	z	p
AGEOFMOTHERATOPENBIRTH	-0.01	0.99	0.01	-0.53	0.590
CHILDRENPRESENT	-0.13	0.88	0.04	-3.33	0.001
Factor (HELP)YES	0.37	1.45	0.15	2.48	0.013

Random effects

Group	Variable	Std Dev	Variance
ID	Intercept	0.49	0.24

	NULL	Integrated	Fitted
Log-likelihood	-2979.03	-2963.44	-2885.70

	X^2	df	p	AIC	BIC
Integrated loglik	31.20	4.00	< 0.000	23.20	6.05
Penalized loglik	8.78	3.05	< 0.000	51.08	-239.63

Appendix C

C.1 Full ethogram of all activity codes:

1. Cleaning inside home
2. Playing
3. Working from home/shop
4. Sleeping/Napping
5. At Home Doing nothing in particular
6. Going/Gone to School
7. Not at Home
8. Going to/from Plantation
9. In Apia
10. No Activity to Report
11. Washing/Hanging/Bringing in Clothes
12. Looking after other family members
13. Looking after own child
14. Looking after younger siblings
15. Weaving a Mat
16. Eating
17. Serving Food
18. Visiting with family
19. Gone/Going to Work
20. Cleaning outside home
21. Visiting with friends
22. House Maintenance
23. Cooking
24. Gardening
25. Getting children dressed
26. Running errands
27. Sewing
28. Women's Committee Meeting
29. Babysitting grandchildren
30. Chopping Firewood
31. Overseas
32. Doing Dishes
33. Bingo
34. Men's Committee Meeting
35. Practicing for a Program
36. Got Home from Work
37. Fishing
38. Travelling
39. Feeding Livestock
40. Feeding her children
41. Watching Television
42. Land and Title Court Case
43. Folding clothes
44. Collecting water

C.2 Re-categorized activities (direct alloparental help, indirect alloparental help, or non-helping activities.

Direct Alloparental Help	**Indirect Alloparental Help**	**Non-Helping Activity**
Caring for younger siblings - Looking after younger siblings	Running errands - Going to/from shop	Eating
Caring for family - Looking after family members - Serving food to family	Cooking - Cooking in kitchen - Cooking at umu	Home doing nothing/Sleeping - Sleeping/Napping - At home doing nothing in particular
Caring for children - Feeding children - Getting children dressed - Looking after children	Outside yard chores - Chopping firewood - Feeding livestock - Gardening House maintenance	Away from home - Going to/from school - Going to/from work - In Apia - Land and Title court - Men's committee meeting - Women's committee meeting
Socializing/Recreation - Playing with siblings - Playing with children	Socializing/Recreation - Practicing for a program	Socializing/Recreation - Bingo - Playing – Non-helping - Visiting with friends or family
	Cleaning inside - Cleaning inside home - Doing dishes Cleaning outside - Cleaning outside of home Sewing/handicrafts - Sewing - Weaving a mat Washing Clothes - Washing/hanging/bringing in clothes Working from home - Working from home/shop Fishing/Plantation - Fishing - Going to or from plantation	