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Timing, Initiators, and Causes of Divorce in a Mayangna/Miskito Community in Nicaragua

Jeffrey Winking^{1,*} and Jeremy Koster² ¹ Department of Anthropology, Texas A&M University, College Station, TX 77840, USA² Max Planck Institute for Evolutionary Anthropology, Deutscher Pl. 6, 04103 Leipzig, Germany; jeremy_koster@eva.mpg.de

* Correspondence: jwinking@tamu.edu

Abstract: There exists a paucity of evolution-oriented research focusing on why relationships end, particularly in comparison to the substantial literature centered around individual preferences that define the beginning of relationships. In contrast, there is a long tradition in the fields of sociology and family studies of exploring divorce; however, this body of research is largely limited to studies of Western populations. We address these gaps in the literature with an examination of patterns of divorce among a small-scale horticultural population in Nicaragua. We test a number of hypotheses derived from behavioral ecology perspective regarding the timing and causes of divorce. Results lend support to all but one of the hypotheses. Overall divorce rates are comparable to U.S. rates; however, they tend to occur earlier in marriages. Children appear to provide a slight buffering effect against divorce, although age in marriage does not. Gender differences in the reported causes of divorce fall along the lines that would be expected due to differences in partner preferences reported in previous research. Finally, this population also exhibits a similar peculiar pattern exhibited by Western populations, in which divorce is more costly for women, and yet women are slightly more likely to initiate divorces than husbands.

Keywords: divorce; marriage; small-scale; behavioral ecology



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1. Introduction

Across the globe, rising divorce rates over the past half century have meant that marital dissolution, single/co-parenthood, remarriage, and step-relationships are increasingly a part of family life the world over (Wang and Schofer 2018). Although there exists a considerable amount of cross-cultural diversity surrounding the institution of marriage, divorce generally carries a negative connotation (Broude and Greene 1983). It often represents the undesired outcome to relationships that begin under much more positive circumstances, and as research has shown, it is often associated with less favorable outcomes going forward. It thus makes sense that there exists such an extensive literature exploring the predictors and outcomes of divorce. This literature is dominated by studies rooted in the research and theoretical traditions of the fields of sociology and family studies. Here, we add to this by contributing a study founded on a behavioral ecology perspective. Evolutionary-based research has largely focused on the factors that influence the beginnings of relationships—gender differences in romantic and sexual strategies, partner preferences, etc. (Buss 1989; Gangestad and Simpson 2000). Aside from the large bodies of literature focusing on conflicts within relationships, such as jealousy (Scelza et al. 2020; Buss et al. 1992), far fewer evolutionary studies have examined the predictors and outcomes associated with the ending of such relationships (although, see: Apostolou et al. 2019; Betzig 1989; Gurven et al. 2009).

Another major limitation in the literature is the scarcity of studies which incorporate samples outside the U.S. or Europe. Marriage is an institution that exhibits a great deal of cross-cultural variation, and thus, the factors leading up to and the processes and

rituals associated with divorce undoubtedly vary quite substantially across the globe. This limitation in the literature greatly undermines our ability to determine whether seemingly robust cross-cultural patterns, such as the role of infidelity in motivating divorce, represent pan-human patterns or if they are simply artifacts of the culturally circumscribed record. Here, we contribute to the literature by providing the first exploration of the predictors, causes, and costs of divorce among a small-scale population. To contextualize this study, we begin with an examination of the literature regarding the predictors, causes, and outcomes of divorce; we then explore what a behavioral ecology approach to the study of divorce might look like.

1.1. Existing Literature on Predictors, Outcomes, and Initiators of Divorce

1.1.1. Predictors and Causes of Divorce

Aside from the impacts of divorce on the wellbeing of children, perhaps the most common topic of divorce research is the predictors and causes of divorce. These studies usually take two primary forms—one explores the impact of external factors and/or individual states (e.g., economic factors, youth, marital history, etc.) that associate with the likelihood of divorce, and the other explores reported causes of divorce (e.g., infidelity, abuse). Some factors, such as poverty, might be included in both.

Regarding predictors of divorce, literature reviews reveal a number of factors that are consistently associated with divorce in Western populations ([Amato 2010](#); [Clarke-Stewart and Brentano 2006](#); [Raley and Sweeney 2020](#)). These include factors that likely make it more difficult to manage a household, such as marrying young, poverty and/or joblessness, low levels of education, and bringing children into a marriage. Other factors might be indicative of orientations that are associated with divorce, such as being in a second or later marriage and coming from a family without continuously married parents ([Amato 2010](#)).

Explorations of the reported causes of marriage dissolution tend to be more straightforward than explorations of predictors, as they can be done retrospectively and do not require complicated prediction models. In four studies conducted in the U.S. over the past two decades, the four factors that are present in the top ten of all lists were relationship issues (such as growing apart), infidelity, financial problems, and drug abuse ([Scott et al. 2013](#); [Hawkins et al. 2012](#); [Amato and Previti 2003](#); [Johnson et al. 2001](#)). However, the reporting of frequencies tells us only the sensitivity of such factors (using the parlance of clinical health) ([Lalkhen and McCluskey 2008](#)). That is, it reveals only what proportion of divorces include such factors—it does not relate to specificity, or the likelihood of divorce occurring given that a particular risk factor is present. Thus, when comparing changes through time or among populations, differences might arise due to changes in frequencies with which these risk factors arise, as well as the impact they have on the likelihood of divorce.

The literature exploring retrospective reports of causes includes a much broader range of cultural diversity, which highlights the shared human patterns as well as the culture-specific problems faced by couples in different populations. For example, in three studies of Muslim-majority Arabic and Persian populations, relationship problems were also among the most common problems in all three studies, while infidelity was much rarer ([Rehim et al. 2020](#); [Cohen and Savaya 2003](#); [Barikani et al. 2012](#)). Additionally, unlike in the U.S., problems with extended families were a major cause for divorce in each population. A review of the cross-cultural record also reveals both shared notions of risks to marriage as well as features that would likely be foreign to Western newlyweds—while adultery was the most commonly cited acceptable reason for divorce across cultures, sterility was the second most common ([Betzig 1989](#)).

1.1.2. Child Outcomes of Divorce

A substantial body of research has focused on the impacts of marital dissolution on the wellbeing of children ([Amato 2010](#); [Raley and Sweeney 2020](#)). Reviews of the literature reveal robust effects on a number of outcomes, including increased problem behavior, poorer emotional wellbeing, and increased problems in adulthood. However, recent

research suggests an attenuation of the effect-sizes commonly reported in the twentieth century, as researchers have more effectively controlled for the socio-environmental factors that often precede divorce, and which also negatively impact child outcomes (Amato 2010). In fact, researchers have found that the divorce event itself has a more negative impact on children coming from low-conflict and more well-to-do families (Booth and Amato 2001; Ryan et al. 2015; Raley and Sweeney 2020).

1.1.3. Adult Outcomes of Divorce

Divorce is strongly associated with negative outcomes for adults in Western populations, although there are numerous contextual factors that mediate the effect (Raley and Sweeney 2020). U.S. women continue to suffer disproportionately higher financial costs from divorce, although women's increased participation in the labor force means that these differences have been diminishing through time (Tamborini et al. 2015). In addition to loss of income, divorced women experience higher risk of poverty and a loss of housing (Hogendoorn et al. 2020; Dewilde 2008). Remarriage increases women's financial standing, but women remarry at lower rates than men. Increasing age decreases the likelihood of remarriage in women, although the effect of children is less consistent (McNamee et al. 2014). While some research suggests that potential husbands might be more reluctant to marry women with children, divorced mothers might be more motivated to find a partner, canceling the effect (Buckle et al. 1996).

Much of the focus of research on the costs of divorce is on the financial and quality-of-life costs to women, but for some measures, it appears that men in Western populations bear the cost disproportionately. Men tend to report lower immediate subjective wellbeing and greater feelings of loneliness, although such differences disappear as individuals adapt (Dykstra and Fokkema 2007; Leopold 2018). Men also appear to suffer from greater reductions in physical health and even higher mortality after divorce than women do (Sbarra et al. 2011; Leopold 2018).

1.1.4. Who Initiates Divorce

Determining each partner's relative contribution to the decision to divorce is not always simple. As a respondent told one of the authors in a separate study, "I was the one who divorced my wife; when I returned from being away, she was living with another man, so I left her". The two most common approaches to determining who initiated divorce are linking it to who legally filed for divorce or to ask who most wanted the divorce. Both approaches reveal the same robust effect in Western populations: women are the initiators in about two-thirds of heterosexual divorces (e.g., see Sayer et al. 2011; Brinig and Allen 2000, and citations within). When comparing men and women's responses to who most wanted divorce, there is a tendency for individuals to be more likely to report that they themselves wanted the divorce compared to the partner's response (Amato and Previti 2003). However, even with such a bias, men are still more likely to report that it was their partners who wanted the divorce.

Although the pattern of women being more likely to divorce is robust among Western countries, the effect appears to attenuate with time in the marriage (Buckle et al. 1996). The presence of children tends to reduce risk of divorce overall, but does not exhibit a consistent effect on who initiates divorce, although the current literature is limited to studies involving samples with low fertility (Sayer et al. 2011; Hewitt 2009; Kalmijn and Poortman 2006).

The reasons why women are more likely to initiate divorce are poorly understood. The effect is counterintuitive, for, as described above, women often experience greater financial costs to divorce, are often more invested in children's wellbeing, and have a lower likelihood of repartnering following divorce (Leopold 2018). Some argue that it is this very disadvantage in bargaining leverage within marriages that might lead women to more often suffer from relationship imbalances that ultimately become intolerable (Brinig and Allen 2000). Indeed, women appear more likely to divorce when unhappy in a

marriage, and after divorce they tend to report higher subjective wellbeing (Leopold 2018; Amato 2014; Guven et al. 2012).

1.2. Marriage and Divorce in a Behavioral Ecology Perspective

Researchers have developed a number of theoretical models to make sense of the marriage and divorce patterns described above. Here, we explore a behavioral ecology approach, which in many ways resembles the Beckerian and Social Exchange models in the sociology, economics, and family studies traditions (Becker et al. 1977; Karney and Bradbury 1995). As in Beckerian models, behavioral ecologists treat decisions to enter or leave relationships as cost/benefit assessments, and often take into account the benefits of specialization and divisions of labor (Kaplan et al. 2000; Winking and Gurven 2011; Alger et al. 2020). As with Social Exchange models, behavioral ecologists have treated divorce as a breakdown of cooperative arrangements between self-interested agents (Gurven et al. 2009; Buckle et al. 1996). The primary difference is that, in the behavioral ecology approach, the utility being optimized and the currency being exchanged are predicted to fall along those dimensions that are (or were) most closely related to evolutionary fitness.

Behavioral ecologists approach the exploration of behavioral variation (e.g., why some couples divorce and some do not) as a question of competing demands—competing demands within individuals (e.g., to find a good reproductive partner, to find food, to raise children, etc.), and among individuals (e.g., competition for partners or resources). The fundamental assumption is that those strategies that optimize the balancing of those demands would be selected and increase in their representation. To understand the factors that motivate divorce in humans, we must first explore the hypotheses as to why marriage was seemingly advantageous over other reproductive strategies in human evolutionary history. This, however, requires defining marriage.

1.2.1. Defining Marriage and Divorce

As with many aspects of human behavior, marital patterns are extremely variable across and within populations. However, there are clearly boundaries to this variance—for instance, no culture has ever been documented that exhibits mating patterns similar to those of chimpanzees, bonobos, or orangutans, etc. “Marriage” thus remains a useful descriptor of the reproductive and romantic practices in cultures around the world. A working definition has nevertheless proven challenging (Bell 1997; Gough 1959; Murdock 1949; Coontz 2006; Westermarck 1936; Royal Anthropological Institute of Great Britain and Ireland 1951). Proposed definitions tend to include any combination of four elements: marriage tends to be associated with (1) some form of sexual preference and restriction (Bell 1997; Murdock 1949), (2) economic cooperation (Murdock 1949), (3) social acknowledgment of the relationship (Westermarck 1936), and (4) the social acknowledgment that children produced within marriage differ somehow from those produced outside it (Royal Anthropological Institute of Great Britain and Ireland 1951; Gough 1959).

In this review, we are primarily interested in the first two of these elements, as they are largely prerequisites for the more culturally embedded other two. Sexual preference and restriction are practices that are often culturally enforced, but even in the absence of such norms, they also organically develop by humans’ capacity for romantic attachment. The capacity to establish long-term psychological attachments to reproductive partners, i.e., pair-bonding, is something that is not evident in all species, and is thus likely the result of an evolutionary trajectory that has played out many times in many different species (Young 2003). There exists a substantial body of literature exploring the proximate endocrinological mechanisms that drive such behavior in animals and humans (Fernandez-Duque et al. 2009; Gettler et al. 2011; Insel 2010). Similarly, across pair-bonded animal species, there is considerable variation in the degree to which members of a pair-bond cooperate in their contributions toward shared fertility. Additionally, again, the capacity for parental concern among mammalian males does not exist in all species, has well-studied

endocrinological correlates, and likely represents the outcome of specific selective histories (Gettler et al. 2011; Geary and Flinn 2001; Wynne-Edwards and Reburn 2000).

We, therefore, define marriage simply—a long-term exclusive or semi-exclusive sexual relationship, often resulting in reproduction, which includes high levels of economic cooperation. Note that here, we do not differentiate between relationships that are culturally legitimized through the formal rituals often associated with marriage, and those which develop more informally. Indeed, in many societies, there exists no distinction (e.g., Hill and Hurtado 1996). Divorce, therefore, is simply defined as the dissolution of such a relationship.

1.2.2. Evolution of Marriage

Most attempts to explain the evolution of humans' unusual capacities for romantic attachment and biparental concern have focused on the remarkable costliness of human offspring (Lovejoy 1981; Lancaster and Lancaster 1983; Winking 2006). Human infants are born cognitively and physically altricial and present a great encumbrance to lactating mothers (Hurtado et al. 1992). Furthermore, despite being weaned early compared to other primates, they remain net consumers for a longer portion of their lifespans (Kaplan et al. 2000). Finally, as women resume reproduction long before previous children are nutritionally independent, families often include multiple offspring of varying levels of dependence (Bogin 1997). Thus, compared to other primates, human children require a higher level of investment, they require it for a longer period of time, and there are more of them. As the well of need to be filled grew, so too would the returns to sticking around and providing paternal investment.

As paternal investment proved ever more lucrative, those strategies that facilitated it might have also been selected. Thus, men and women who were oriented more towards long-term reproductive relationships might have experienced higher reproductive success, as such a strategy would facilitate paternal investment by allowing for the possibility of extended father–offspring interaction and increased paternity confidence. Through time, these unusual characteristics of human reproduction likely coevolved. As paternal care became more available, pathways opened for offspring to evolve greater dependence, further enhancing the returns to marriage, and so on (Winking 2006).

Many researchers have been critical of this “paternal provisioning model”, however, noting that paternal investment is quite variable cross-culturally, and often not that impactful (Hawkes 1993; Bleige Bird et al. 2001; Sear and Mace 2008; Coxworth et al. 2015). Many have offered alternative models that focus more on the dynamics of the competitive markets for partners. For instance, men might have been selected to be more oriented toward long-term relationships as the emergence of menopause resulted in more men to be in the reproductive market than women (Coxworth et al. 2015), or as weaponry reduced the variation in men's competitive abilities (Chapais 2011), or as women's preferences shifted toward male providers as offspring need increased (Gavrilets 2012).

Although not all models position biparental care as the impetus for the selection of a long-term orientation, once long-term relationships were established, most suggest that the selection for paternal provisioning would have been stronger. Therefore, while there is some variability, there is also a fair degree of agreement among the models regarding the current motivations for entering into marriage—continually returning to the romantic market is costly, parenting needy children is easier with a partner with whom one is economically cooperating, and romantic attachment and parental concern motivate this entire process.

1.2.3. Why Divorce?

From a behavioral ecology perspective, divorce should be more likely to occur when at least one partner perceives the benefits of leaving a marriage to be higher than remaining. Furthermore, the benefits of leaving and staying are expected to be aligned with those that previously impacted fitness as described in the section above. Such a shift in perception

can occur within a marriage for a number of reasons (Snopkowski 2016). Many approaches that explore this process in the human and animal literature relate to the potential for errors in partner selection (Johnston and Ryder 1987; Choudhury 1995; Snopkowski 2016). This selection process is a classic Optimal Stopping Problem, in which a selection must be made before all available options are known (similar to choosing a house or even a parking space) (Dombrovsky and Perrin 1994). It is also a coordination problem, as each seeker must find a partner who believes that the seeker is that partner's best option as well. Given these constraints, individuals might come to realize that their selection was not optimal as they learn more about their partner or as better alternatives become available (Conroy-Beam et al. 2019).

Many unexpected realizations relate to partner characteristics and behaviors. While some of these, such as mutual incompatibility, might be experienced equally by men and women, some are experienced asymmetrically. For instance, men experience the asymmetric risk of cuckoldry (Scelza et al. 2020), and thus might be more responsive to cues of sexual infidelity than are women (see Scelza 2021 for an illustration of the substantial degree of cultural variation regarding infidelity). Women, however, often enter into unions with an asymmetric risk of abuse due to sexual dimorphism in body size, as well as patriarchal norms (Apostolou et al. 2019). Furthermore, for women, a major benefit of marriage is the sharing of the costs of fertility (Winking 2006; Geary 2000). This is particularly evident when comparing the human system to that of other primate species that live in large multi-male, multi-female groups, such as chimpanzees and many baboon species. Among these primates, males' expendable energy is largely squandered in costly male–male competition while females are fully responsible for parental care. Thus, women might be more sensitive to their partner's lack of willingness or ability to invest.

Other factors that alter the relative benefits and costs of divorce are external to individual characteristics and behaviors. For instance, divorce often becomes more costly through time as the number of children who might experience a negative impact increases. While most of the divorce literature has focused on child outcomes that do not directly relate to fitness (e.g., academic performance), a number of studies in the behavioral ecology tradition have revealed the negative impacts of parental loss on child survival and adult fertility (Winking et al. 2011; Sear and Mace 2008; Scelza 2010). The cost of divorce might also change in relation to the availability and quality of alternative options. For instance, re-partnering might become easier as one's status on the marriage market improves (e.g., due to increased social status) (Gurven et al. 2009). Kin residence patterns might shift to offer a new alternative living situation for a discontented spouse (Snopkowski 2016).

Ultimately, individuals must weigh countless factors regarding their partners, themselves, their children, their alternatives, and much more, when deciding whether to divorce or to remain in a marriage. We extend the logic of this section to the construction of hypotheses below, but first we describe the cultural context in which they are examined.

1.3. Study Population: The Mayangna/Miskito Horticulturalists of Nicaragua

A major limitation of the existing literature is its focus on the U.S. and other Western populations. A number of findings that are robust through time and across such cultures, such as the tendency for women to be more likely to initiate divorce, might represent patterns common to humans' peculiar mating, reproductive, and parenting systems. However, they might also be artifacts of the shared cultural dimensions that define Western populations. While a growing literature already exists exploring divorce in non-Western populations, we contribute here by offering the first in-depth exploration of divorce among a small-scale population.

There is no single defining feature of small-scale populations, and they represent a diverse array of individual cultures. However, compared to industrialized, state-level populations, they share a number of distinctions. Population centers tend to be much smaller and organized around kinship systems. Much of the food is directly produced by consumers. Families tend to be defined by earlier and higher fertility rates, and the division

of labor tends to be more strictly defined between men and women (Winking et al. 2018). While small-scale populations should not be romanticized as perfect analogs of humans' ancestral past, they nevertheless occupy a space among the dimensions of cultural variation that is distinct from that of nation-state populations—a space that has long been overlooked by cross-cultural research in the social sciences.

As described below, in many ways the Mayangna/Miskito population represents an ideal population to shed light on the robustness of reported trends. While this community exhibits many of the features described above that starkly differentiate it from the U.S. and other similar populations, they also share with these populations a number of cultural norms surrounding marriage—individuals are relatively free to choose their own partners, divorce is fairly common, and there is no major stigma attached to it.

1.3.1. History and Structure

Research took place in a pair of nearby villages consisting of a combined population of approximately 450 Mayangna and Miskito individuals. The Mayangna and Miskito are closely related Indigenous populations that reside in eastern Nicaragua. The Miskito are much larger as a population and politically ascendant compared to the Mayangna, and the Miskito language is the lingua franca in the region. Inter-marriage is common, and the two groups share a sense of Indigenous identity that differentiates them from the larger Nicaraguan population. Among the two communities taking part in the current study, members of each culture reside in both villages, although the larger village (approximately 350 individuals) is culturally Mayangna, and the smaller (approximately 100 individuals) is culturally Miskito.

Miskito and Mayangna villages tend to include populations in the high tens to low thousands. Within these villages, nuclear family households are clustered along lines of kinship. Married couples exhibit an uxori-local residence bias and tend to live within or near the household of the wife early in marriage (Koster et al. 2019). Residence rules are informal, however, and couples occasionally choose to reside near the man's kin.

These populations have a centuries-long interaction with colonizing populations. The British occupied much of the eastern coast of Central America, and numerous English loan words are present in both languages. The transmission of language, technology, norms, etc., from the greater Nicaraguan national culture has been the dominant force for some time. Today, all children attend a local school, where they learn Spanish among other subjects. All community members belong to the Catholic faith or one of the protestant sects that have proselytized in the region. Increasingly, more impactful technology has been more and more common, including chain saws, outboard motors, and solar panels. Unlike other villages a few hours travel away, however, cell phone reception is still not possible.

1.3.2. Marriage and Family

The nuclear family is the primary unit of social and economic organization (Koster 2018). In the early to mid-teens for women, and in the mid-to late teens for men, individuals begin experimenting with relationships. Parents will often make their opinions known, but even young adults enjoy a fair degree of autonomy in choosing their partners. There is a clear expectation that sexual activity should be limited to long-term relationships, but single motherhood is not uncommon and is not strongly stigmatized (McSweeney 2002; Koster 2011). Some of these early relationships continue on into adulthood, resulting in reports of very young ages for age at marriage. However, as most marriages are not marked by a ceremony, such scenarios would be more similar to a U.S. couple marrying after dating in high school. There are some distinctions from high school romances, though, as it is more common for these relationships to continue on into adulthood, there is typically no elaborate ceremony to mark such a relationship "becoming" a marriage, and if the relationship continues for a number of years, it is common for the first children to be born while the mother is still in her teens. Most failed marriages in this population result from these early relationships, and it is sometimes difficult to discern between a short-lived

marriage and a failed long-term courtship. Some marriages are consecrated in later years by a visiting priest. This marks the relationship as more concrete and more likely to endure, although this does not seem to be viewed as a requirement for a longterm marriage (for the present study, the year the relationship began is used to mark the beginning of the marriage).

Within the household, the sexual division of labor is much sharper than that exhibited in modern Western populations (Koster et al. 2013). As a horticultural population, men are responsible for heavy labor in family agricultural fields, as well as hunting, fishing, and most wage-earning activities. Women are responsible for most childcare and domestic tasks, such as cooking and washing clothes. However, husbands and wives can often be found working cooperatively in agricultural and domestic work, and it is clear that many couples share a great affinity for one another.

Parenthood begins much earlier compared to Western contexts, and fertility remains high throughout adulthood. First birth is common in the late teens for both men and women, and completed fertility exceeds seven children (Winking and Koster 2015). Additionally, although contraception use is increasing and ideal family sizes are decreasing, young adults still report a desire for more than five children (Kurten 2019).

Divorce can be initiated by either party, and usually involves one or both partners leaving the residential home and returning to kin. Children from the marriage most often stay with the mother, but occasionally will be raised by the grandparents, and rarely by the father. Step-parentage is thus not uncommon and is primarily a step-father/step-child relationship. Most divorces occur in the first years of a marriage, making the process simpler, particularly if no children were born. When marriages end after many years, some couples seek mediation from local or family leaders to divide the resources, such as livestock, that accumulate over time, and fathers will often contribute money for the education and wellbeing of children remaining with the mother. Divorced mothers will usually move back to their parents' or another relative's house—female-led households are very rare.

1.4. Research Questions and Hypotheses

Here, we explore three research questions. The first is how frequently and when does divorce occur in this population? To do this we construct the survival curve of marriage (the proportion remaining intact). To explore when divorces occur, we will test demographic predictors of marital dissolution. Given that increasing the wellbeing of children is a benefit shared by both men and women, we hypothesize that couples will be less likely to divorce as they have more children, independent of length of the marriage, as more children would be exposed to the negative impacts of divorce (H1). Although previous research in other populations reveals no consistent effect of family size on divorce, the range of family sizes in this Mayangna/Miskito sizes in this study is substantially larger than those in prior research. Furthermore, as marriage also offers a solution to avoiding the cost of having to find another partner, we also hypothesize that younger individuals will be more likely to divorce, independent of the length of marriage, as they have a greater opportunity to find a new partner (H2) (we acknowledge that this is analytically the same as the hypothesis that those who marry at a younger age are more likely to divorce).

The second research question is what are the causes of divorce? We will explore reported causes for previous divorces as well as responses to hypothetical threats to one's marriage to test if they align with the predictions of the behavioral ecology approach. Specifically, we will test if men are more likely to divorce upon discovery of infidelity (H3), and if women are more likely to divorce due to a lack of investment (H4) or abuse (H5).

The last research question is who initiates divorce and how is this related to the costs of divorce? In U.S. samples, women are consistently more frequent initiators of divorce despite incurring greater long-term financial costs following divorce. We explore whether the Mayangna exhibit the same pattern—that women are more likely to initiate divorce than men (H6), and that this effect is attenuated as the relative costs for women increase

compared to those of men as women's age and number of children increase (H7). We examine costliness of divorce through participants' reports of whom they believe divorce to be more costly for (for men or women) and why this is so, and through time until remarriage. We predict that a strong majority of both men and women will report that it is women who suffer more from divorce (H8), and that women will remarry at a slower rate (H9).

2. Materials and Methods

2.1. Marriage and Divorce Interviews

In the summer of 2016, the authors visited the two communities and held community-wide meetings to describe the nature of the research, the methods that would be incorporated, and the compensation given. We allowed time for discussion and answered all questions. Individuals were given a number of days (depending on the schedule) to make their decision whether to participate. Participants were also read the consent information sheet prior each individual interview. This research was approved by the Texas A&M IRB (Protocol IRB2014-0249D).

The interviews were conducted by JW and a local translator over the course of four weeks (the interview script is available in the Supplemental Materials). All individuals who were currently or had been previously married were invited to participate. Some took place in a central location, while others took place on the participants' porches, depending on what they thought would be more convenient. Prior to the Marriage and Divorce interview, JW conducted an Investment Model Scale interview for a related study (Winking et al. 2018). The entire process would take approximately 20 to 30 min, and the participants were compensated with approximately a fifth of a daily wage (approximately USD 2.00).

2.2. Reproductive History Interviews

As part of broader demographic surveys in 2005, 2013, and 2016, reproductive histories were elicited using conventional methods (Beall and Leslie 2014). In general, birthdates for children born after 1990 are reasonably well-documented and typically accompanied by birth certificates provided by the government. For previous generations, when informants expressed uncertainty about the timing of births, estimates were inferred by inquiring about same-aged cohorts, considering relative birth order among siblings, and inquiring about the timing of births in relation to important historical events, such as the onset of the Contra War in 1982.

2.3. Calculation of Years of Marriage

As mentioned above, whether or not early and/or short-lived relationships should be considered marriages is not always clear. Individuals were not given criteria and were allowed to define marriage for themselves. For the analyses in the present study, only those that were reported to last more than six months were included. As marital histories were recorded in both the Marriage and Divorce Interview as well as the Reproductive History Interview, we were able to assess the internal reliability of their responses. For the marriages of individuals who participated in both interviews, 160 of the 190 marriages (84%) were reported in both interviews, nine (5%) were included in only the Marriage and Divorce Interviews, and 21 (11%) were recorded in only the Reproductive History Interviews. An additional 30 marriages were reported in the Marriage and Divorce Interviews by people who did not participate in the Reproductive History Interviews. Only those individuals who took part in the Marriage and Divorce Interviews are included in the present study (except for analyses of first marriage and first birth, for which all resident individuals are included).

If estimates of the years of marriage beginnings and endings were available from the two datasets and/or from the husband and wife, and the estimates differed, the average was used (rounding up). This was constrained by the rules that marriages had to begin at least as early as the year of birth of the first child, and they could not end earlier than one year prior to the year of birth of the last child. On occasion, estimates were adjusted due to assessments of confidence—for instance, if an individual reported that they were unsure, but their spouse made no such admission.

2.4. Analysis

Due to the varied nature of the hypotheses and data, a number of analytical strategies are employed. All analyses were conducted in R and the script is available in the Supplemental Materials. For most tests of hypotheses, we use Bayesian regression using the BRM function in the BRMS package. This is employed with a discrete-time events history approach which models the annual likelihood of divorce (or remarriage). Along with relevant fixed effects variables (both time-varying and non-time-varying), we include appropriate random effects controls depending on the nature of the hypothesis, which can include a categorical identifier for the marital dyad, as well as crossed random effects for husbands' and wives' identifiers.

3. Results

3.1. Community Ages of First Marriage and First Birth

Median ages of first marriage and first birth were calculated using the full Reproductive History Dataset (including all individuals age 12 and over), as the Marriage and Divorce dataset does not include unmarried individuals. The Reproductive History Dataset is derived from the reproductive histories of 146 individuals who were present in the community during 2013 or 2016 data collection. This resulted in a dataset which included life history data (years of birth, marriage, reproduction, and death) for 422 individuals.

A Kaplan–Meier survival analysis reveals that the median age of first marriage in this community was 17 for women ($n = 102$), ranging from 12 to 22, and 19 for men ($n = 120$), ranging from 12 to 32 (Figure 1a). While some men and women in their twenties had yet to marry, by age thirty, all women ($n = 38$) and all but one man ($n = 41$) had married at least once. It should be noted here that the low ages in these ranges are due to a multitude of factors. Many of the younger ages stem from marriages reported from older individuals, for which age estimates are less precise. Additionally, the notion of “marriage”, as described in the previous section, often includes relationships that would be more akin to those characterizing a youthful boyfriend/girlfriend relationship in Western cultures. However, they do differ in their formal social acknowledgment as well as the general expectation that they could lead to life-long partnerships. The median age of first birth was 18 for women ($n = 103$), ranging from 12 to 23, and 21 for men ($n = 124$), ranging from 14 to 34 (Figure 1b). Again, all women ($n = 38$) and all but two men ($n = 46$) had had a child by age 30.

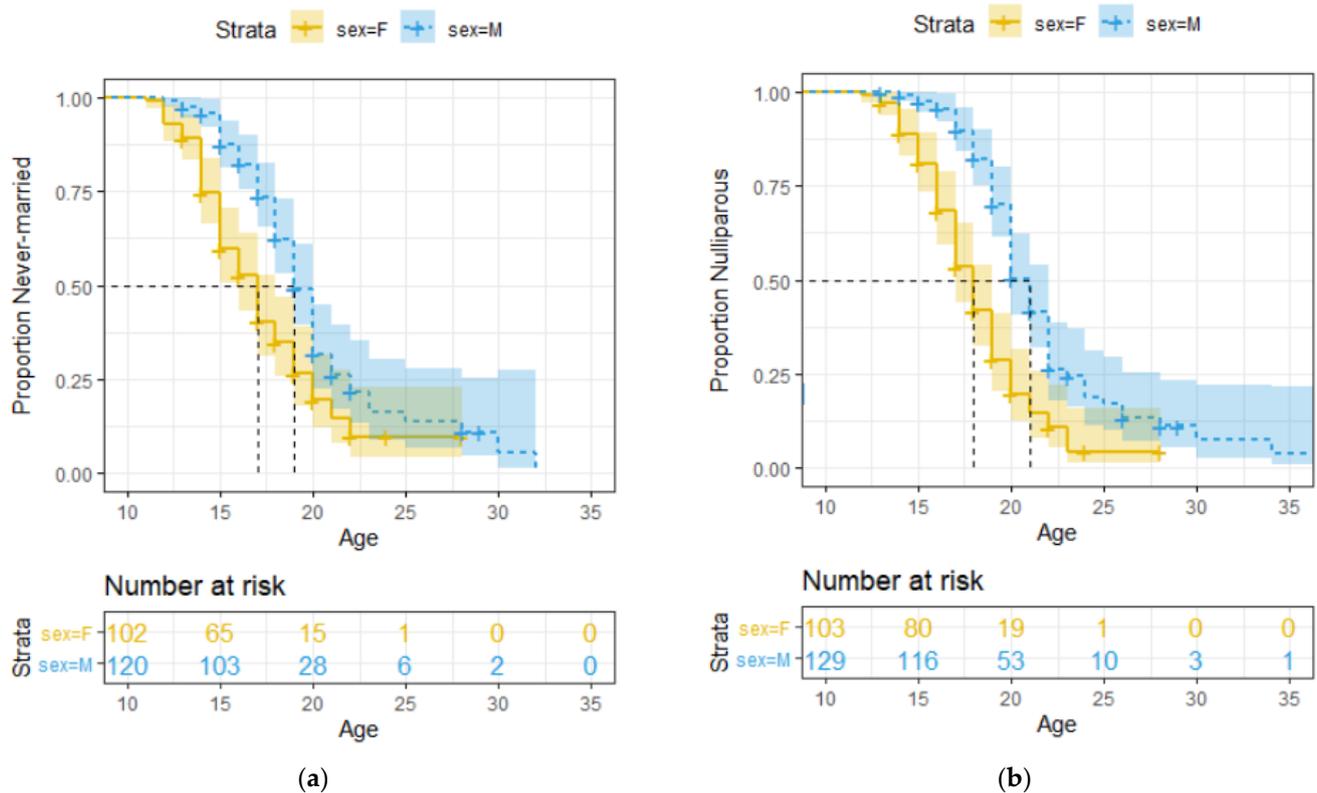


Figure 1. Kaplan–Meier plots of community-level first marriage (a) and first birth (b).

3.2. Timing and Predictors of Divorce

The Marriage and Divorce Dataset includes adults who were present and had been married at least once in 2016. This includes 56 women and 53 men who reported on 175 marriages (Table 1). A Kaplan–Meier survival analysis reveals a median length of a marriage of four years, although this is largely due to high divorce risk in the first (25.7%) and second year of marriage (15.3% of remaining) (Figure 2). Of those couples who make it past the median four years, the survival analysis suggests that 72.2% stay married. No divorce occurred after twenty years of marriage. The survival analysis results in an estimate of approximately two thirds of marriages ending in divorce. Similarly, of the marriages that began more than 20 years prior to data collection, 62.9% ($n = 81$) had ended in divorce.

Table 1. Marriage and divorce sample characteristics.

	N	Mean	St. Dev	Range
Individuals				
Women				
Age	56	32.61	12.27	18–72
Number of marriages	56	1.69	1.13	1–5
Men				
Age	53	38.43	13.84	19–76
Number of marriages	53	2.30	1.13	1–8
Marriages				
Length (All)	175	7.37	9.51	1–58
Length (Ongoing)	63	15.00	11.88	1–58
Length (Ended in Death)	4	8.50	9.26	1–20
Length (Ended in Divorce)	108	2.88	2.89	1–20

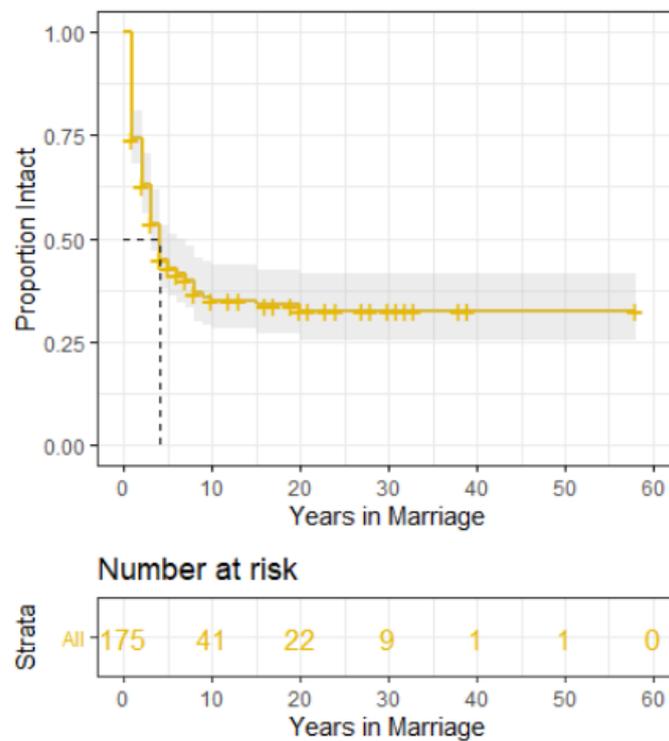


Figure 2. Kaplan–Meier plot of marriage “survival”.

The results of a discrete-time event history analysis exploring predictors of divorce are described in Table 2. We used a Bayesian mixed logit model to evaluate the likelihood of divorce on a year-by-year basis (for the first 20 years), and included a marital identifier as a varying intercept, as well as non-time-varying fixed effects (“Husband Age of Marriage” and “Wife Age of Marriage”) and time-varying fixed effects (“Year in Marriage” and “Number of Dependents”). The risk of divorce declines through time in a marriage ($\beta = -0.11$). Even after controlling for this effect, the number of dependents (as a time-varying variable) is a significant negative predictor of divorce ($\beta = -0.22$), in support of H1. Because years in marriage and age are collinear through time—and both are reasonable correlates of risk of divorce—we use husband’s and wife’s age at marriage as a measure for age that is independent of years in marriage. Neither the husband’s age at marriage ($\beta = -0.01$) nor the wife’s age at marriage ($\beta = -0.02$) are predictive of the risk of divorce, and thus H2 is not supported. The overall conclusions hold even when we remove marriages that begin in youth (when either partner is <18 years old) (Supplementary Materials, Table S1).

Table 2. Discrete-time event history analysis of risk of divorce using Bayesian logistic regression. Reported coefficients are posterior means.

	B	95% CI
Intercept	−0.52	(−2.06, 1.06)
Husband Age at Marriage	−0.01	(−0.06, 0.04)
Wife Age at Marriage	−0.02	(−0.10, 0.04)
Number of Dependents	−0.22	(−0.4, −0.05)
Year in Marriage	−0.11	(−0.25, 0.05)

n = 1077 risk years, 164 marriages. Marriage ID included as random effect.

3.3. Causes of Divorce

When participants were asked for the major causes for past divorces, they rarely offered reasons that negatively implicated their own actions. Only five out of 109 responses included a self-incriminating cause, meaning that comments primarily reflected what men and women found as divorceable behaviors or traits in their partners. The causes fall into four broad categories, as tabulated by one of the authors (JW) (Table 3), including (1) problems with partner behavior (such as a lack of respect, abuse, drug use, laziness), (2) infidelity and jealousy, (3) circumstances (such as challenges with in-laws, the war, or disagreements about where to live), and (4) one partner wishing to not be in the marriage and/or to be married to someone else. Men more frequently mentioned issues of infidelity and jealousy (35.8% of divorces, $n = 67$) than women (14.3%, $n = 42$, Fisher exact, $p = 0.01$), whereas women more frequently mentioned behavioral problems (38.1%, $n = 42$) than men (17.9%, $n = 67$, Fisher exact, $p = 0.025$). Looking at more specific categories, we find that men more frequently cited their partner's infidelity (women: 4.8%, $n = 42$; men: 20.9%, $n = 67$; Fisher exact, $p < 0.025$) in support of H3, whereas women more frequently cited abuse (women: 14.3%, $n = 42$; men: 0.0%, $n = 67$; Fisher exact, $p = 0.003$), in support of H4, as well as drug use (women: 11.9%, $n = 42$; men: 1.5%; $n = 67$, Fisher exact, $p = 0.031$), and laziness (women: 9.5%, $n = 42$; men: 0.0%, $n = 67$, Fisher exact, $p = 0.020$).

Table 3. Reported causes for past divorces.

Cause of Divorce	Women	Men	p (Fisher Exact)
Partner behavior	16 (38.1%)	12 (17.9)	0.025
No respect/don't get along	10 (23.8)	11 (16.4)	0.455
Partner abuse	6 (14.3)	0 (0.0)	0.003
Partner alcohol/drug abuse	5 (11.9)	1 (1.5)	0.030
Partner laziness	4 (9.5)	0 (0.0)	0.020
Infidelity & Jealousy	6 (14.3%)	24 (35.8)	0.016
Partner infidelity	2 (4.8)	14 (20.9)	0.025
Own infidelity	0 (0.0)	4 (6.0)	0.158
Partner jealousy	4 (9.5)	8 (11.9)	0.764
Circumstance	7 (16.7)	13 (19.4)	0.803
Location disagreement	6 (14.3)	4 (6.0)	0.179
Don't get along with in-laws	1 (2.4)	3 (4.5)	1.00
War	0 (0.0)	6 (9.0)	0.080
Not wanting marriage	7 (16.7)	13 (19.4)	0.803
Partner left to marry other	2 (4.8)	2 (3.0)	0.638
Partner wanted someone else/didn't want current marriage	5 (7.1)	10 (14.9)	0.779

Similar gender effects were revealed when participants were asked how likely they would be to seek divorce given eight hypothetical scenarios (Table 4). Men more frequently reported they would pursue divorce for all scenarios except abuse. The three highest ranked scenarios for men were partner infidelity (76.2% saying they would likely divorce), partner alcoholism (75.6%), and not being able to get along (66.7%). For women, the top three were partner alcoholism (56.1%), partner laziness (56.1%), and partner abuse (54.4%). Men and women were in agreement that having problems with in-laws, partner sterility, and not being in love were the scenarios least likely to motivate them to divorce. Overall, the hypothesis that men would be more focused on infidelity than women (H3), is supported, as is the hypothesis that abuse would be a more salient factor for women (H5). While no women directly referenced men's levels of investment (H4), their disproportionate focus on laziness provides tentative support to the hypothesis.

Table 4. Percentage reporting they would likely divorce in different scenarios.

Rank	Women		Men	
	Scenario	% Likely to Divorce	Scenario	% Likely to Divorce
1	Partner alcoholism	59.6%	Partner infidelity	76.2%
2	Partner lazy	56.1	Partner alcoholism	75.6
3	Partner abusive	54.4	Don't get along	66.7
4	Don't get along	52.6	Partner lazy	59.5
5	Partner infidelity	32.8	Partner abusive	47.6
6	Don't get along with in-laws	31.6	Don't get along with in-laws	42.9
7	Partner sterile	29.8	Partner sterile	35.7
8	Not in love	28.3	Not in love	30.6

3.4. Initiators of Divorce

When asked who more strongly desired each divorce—the wife, the husband, or both equally—the pattern that emerged from participant responses mirrored that reported for large Western populations. Both men and women more frequently reported that a divorce was desired more by the wife than by the husband, and women reported they themselves wanted a divorce slightly more often than men, which supports H7 (Table 5). However, the proportions that men and women assigned to each category were not significantly different ($n = 94$, Fisher exact, $p = 0.344$). Of the cases in which one partner was reported to have wanted the divorce more ($n = 79$, 84% of all cases), women were reported to want it more in 59.5% of the divorces, and men in 40.5% of the divorces (testing against an evenly split distribution, $n = 79$, $\chi^2 = 2.848$, $p = 0.091$). Only one divorce was recorded by both the previous husband and wife—they both agreed that the husband wanted the divorce more.

Table 5. Divorces that were wanted more by husbands, wives, and both equally.

	Wife Wanted More	Husband Wanted More	Both Wanted Equally
Female respondents	19 (54%)	13 (37)	3 (9)
Male respondents	28 (47)	19 (32)	12 (20)

In a Bayesian mixed-effects logistic regression, with each divorce as the unit of analysis, and respective Husband and Wife identifiers included as crossed random effects, the number of children present at the time of divorce is negatively associated with the likelihood of the woman being the one who most wanted the divorce, although Year in Marriage and individual age exhibit no effects, partially supporting H7 (Table 6). For divorces that occur without children, over two-thirds of respondents reported that the wife wanted the divorce more (Figure 3). However, this proportion drops to less than a third for those that occur when the couple has three or more children.

Table 6. Bayesian logistic regression of likelihood a divorce was most wanted by the wife. Reported coefficients are posterior means.

	B	95% CI
Intercept	1.23	(−0.68, 3.22)
Wife's Age at Divorce	−0.03	(−0.13, 0.06)
Number of Dependents	−0.31	(−0.60, −0.04)

$n = 90$ divorces, Husband ID and Wife ID included as crossed random effects.

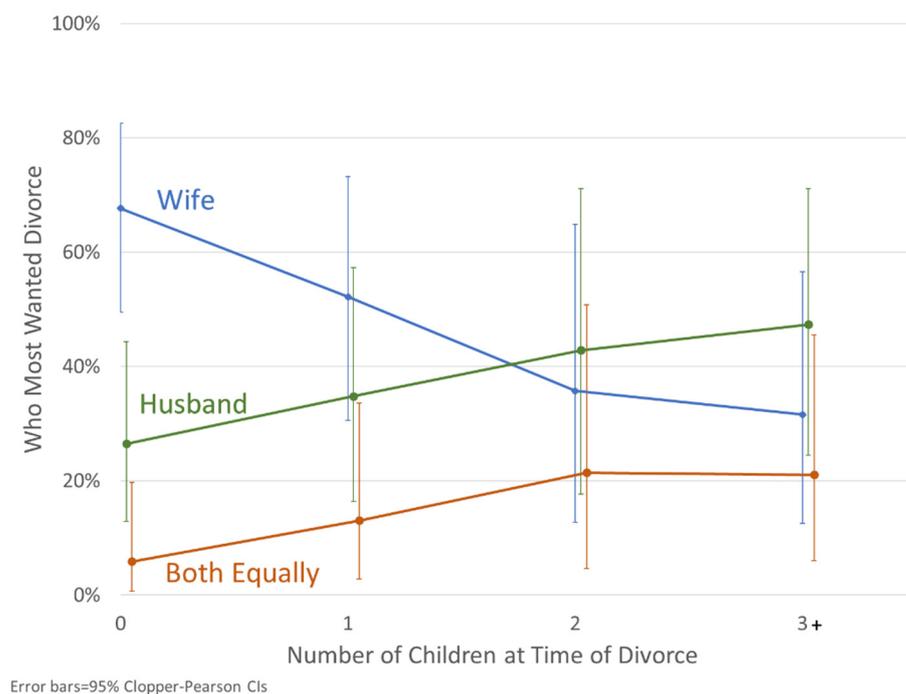


Figure 3. Proportion of Divorces Most Wanted by the Wife, Husband, or Both by Number of Children.

3.5. Costs of Divorce

In support of H8, there was general agreement in this community that divorce is more costly for women than for men. When asked if divorce tended to be more difficult for women or for men, 74.6% of women ($n = 59$) and 47.8% of men ($n = 46$) reported that it was more difficult for women. Only 3.4% of women and 10.9% of men said it was more difficult for men (the remainder said it was equally difficult for both men and women). When asked why divorce was difficult for women, the most commonly discussed topics related to the difficulty of raising and providing for children, who most often stay with the mother. Children were mentioned in 52.9% of responses ($n = 85$), and an increased burden or lack of needs (e.g., clothes, food, and money) was mentioned in 30.1% of responses. For instance, one woman explained, “All of the work is left to her—she has to care for the children, maintain the clothes—it’s all left to her”. Indeed, participants reported that following divorces involving children, the children stayed with the mother after 78.0% ($n = 59$) of divorces, and responsibilities were somehow shared with the father in an additional 5.1% of the cases. Fathers became the sole caretakers following only 6.8% of such divorces. Grandparents became the primary caretakers for 10.2% of the cases, but in all but one, it was the maternal grandparents who cared for the children.

The most commonly mentioned problems afflicting men after divorces were seemingly less dire, supporting the opinion that women suffer more from divorce. These challenges included not having a spouse to perform the domestic tasks that are often the responsibility of wives, such as cooking and washing clothes (mentioned in 30.1% of comments, $n = 73$), and the fact that men often miss their children (31.5% of comments). One man related, “When he’s alone, he’s worried about his family, and he has to wash his own clothes and cook his own food”.

The results of a discrete events history analysis provide tentative support for H9—that divorce is more costly for women, at least regarding the length of time to remarriage (Table 7). Surprisingly, the number of dependents was associated with a slight increase in the likelihood of remarriage in years after divorce. Furthermore, there were no discernible interaction effects between gender and age or gender and number of dependents (Supplementary Materials, Table S2).

Table 7. Discrete-time event history analysis of risk of remarriage using Bayesian logistic regression. Reported coefficients are posterior means.

	B	95% CI
Intercept	−1.16	(−2.38, −0.07)
Gender = Woman	0.49	(−0.11, 1.07)
Age	−0.01	(−0.06, 0.05)
Number of Dependents	0.15	(−0.01, 0.30)
Other Partner Wanted	−0.40	(−0.94, 0.14)

$n = 335$ risk years, 53 individuals. Individual ID included as random effect.

4. Discussion

We set out to document the timing, predictors, causes, initiators, and outcomes of divorce among a near-natural fertility Mayangna/Miskito community. We show that this population exhibits an early initiation of marriage and reproduction, with median times ranging from the late teens to the early twenties, and universal participation. By the age of thirty, nearly all individuals have married and reproduced at least once.

Universal marriage and reproduction is a common feature of populations characterized by natural fertility and subsistence-level economies. These populations exhibit far less variation in life history schedules and economic paths compared to wealthier, industrialized populations. This naturally leads to marriage functioning differently and being conceptualized differently (Coontz 2006). For instance, in the Investment Model Scale (Rusbult 1980)—a research instrument designed to measure one’s commitment to a relationship—the suggested alternatives to a romantic relationship are listed as “dating another, spending time with friends or on my own, etc.”. When translating this scale into Mayangna, local research assistants agreed that the more salient alternatives in this community were to “live with another partner, live with your parents, or live alone”, (Winking et al. 2018). Romantic relationships are not seen primarily as a means to improve the quality of one’s leisure time or even to establish a meaningful emotional connection. They represent an inevitable step in the unfolding of life and are necessary to build a family and to share the economic tasks that keep a household functioning. This does not mean that strong connections and romantic love are not important for building these relationships, but they are not the sine qua non of a successful marriage. In fact, out of eight possible reasons to divorce a partner, “not being in love” was rated the least important factor by both men and women (Table 4).

To further explore patterns of divorce in this community, we applied a behavioral ecology theoretical approach to produce nine hypotheses regarding the predictors, causes, initiators, and outcomes of divorce in this population, all but one of which received at least tentative support (Table 8). In this approach, we explored the different models offered in the literature regarding the evolutionary functions of marriage. We then identified the purported functions common to the different models, namely, the avoiding of costly searching for romantic/reproductive partners, and the benefits of biparental investment in the wellbeing of shared children.

We found that the number of children in a marriage was indeed negatively associated with the likelihood of a marriage ending in divorce. In the previous literature, such effects were inconsistent and complex—young children often serve as a buffer against divorce, but older children do not (Hewitt 2009). This could be an artifact of self-selection, however, as more committed couples might be more likely to decide to have children. Furthermore, previous research involved low-fertility populations with little variation in the number of children within and across marriages. In the present study, by the median length of marriage, four years, 84.2% ($n = 81$) of couples had at least one dependent. By year 10, all had reproduced save a small number of couples who were unable to have children, with an average of 5.0 dependents per couple ($n = 40$). Thus, the test here is a clearer examination of the impact of children, as the potential for self-selection effects are likely diminished. The buffering effect of children is likely not an artifact of more committed couples being more

likely to decide to have children, as virtually all couples are deciding to do so. Furthermore, we are able to examine the impact of children along a much larger range of variation in the number of offspring.

Table 8. Hypotheses and results.

Hypothesis	Result
H1. <i>Marriages will be less likely to end in divorce when there are more dependent children in the household, controlling for the length of marriage.</i>	Supported
H2. <i>Marriages will be more likely to end in divorce when individuals are younger.</i>	Not supported
H3. <i>Men will be more likely to divorce due to partner infidelity.</i>	Supported
H4. <i>Women will be more likely to divorce due to a lack of partner investment.</i>	Tentatively supported Women were more likely to divorce due to partner “laziness”.
H5. <i>Women will be more likely to divorce due to partner abuse.</i>	Supported
H6. <i>Women are more likely to initiate divorce.</i>	Supported
H7. <i>Women’s greater likelihood to initiate divorce will be mitigated as women age and the number of children increases.</i>	Tentatively supported Women’s likelihood of initiating divorce decreases with the number of children but not age.
H8. <i>Participants will report that women suffer more from divorce.</i>	Supported
H9. <i>The time to remarriage will be longer for divorced women than divorced men.</i>	Tentatively supported The effect was in the predicted direction, but weak.

Younger individuals were predicted to be more likely to divorce due to lower costs of re-entering the marriage market—at younger ages, there are more age-appropriate partners available for marriage, and for women, youth itself often makes one more competitive on the market (Buss 1989). However, we did not find any such association. This is contrary to the robust effect reported in existing literature, in which the effect is interpreted as the negative impact of marrying young (Raley and Sweeney 2020). That is to say, after controlling for years in marriage (a very salient determinant of divorce risk), age and age at marriage become the same variable. Thus, it appears here that individuals are no more likely to divorce at younger ages and/or when they marry younger.

For the other hypotheses, we examined how men and women experience the benefits of marriage differently. If, as argued in evolutionary models of human marriage, marriage facilitates biparental investment by increasing paternity confidence, then men might be more sensitive to partner infidelity. This is indeed what we found, both in the reported causes for past divorces, and in hypothetical reasons for divorcing. Similarly, the predictions that women would be disproportionately focused on partner investments and abuse were supported.

The final series of predictions were founded upon previous research: that women were more frequent initiators of divorces, and that they suffered greater negative consequences from marriage (Sayer et al. 2011; Tamborini et al. 2015). Indeed, we find that women in this community experience greater negative consequences from divorce, and despite this, they continue to more frequently initiate divorce. Similar to studies involving Western populations, there was a slight tendency for women to be less likely to remarry following divorce, although age was not a significant factor. Those with more children were actually slightly *more* likely to remarry. In the existing literature, the impacts of children on rates of remarriage are mixed, and, as was argued in the introduction, this positive trend might reflect a more active motivation to more quickly find a partner among single parents. Overall, this study suggests that the pattern of women incurring greater costs from divorce but still being more likely to initiate divorce is not an artifact of industrialized, Western culture, but can also occur in a near-natural fertility population, where the decision to divorce is open to both men and women and divorce is not heavily stigmatized. Naturally, this presents a quandary.

Evolutionary models of marriage suggest that, all things equal, the greatest cost of marital dissolution to women would be the loss of investment toward children. This could be mediated by remarriage, but higher numbers of children can also hinder remarriage. As predicted, results suggest that, as the number of children increases in the marriage, the proportion of divorces initiated by women declines, such that men become more likely to initiate divorce once there are at least two children in the family.

Conclusions

As with Beckerian and Social Exchange models, which have long been used to interpret patterns of divorce in Western populations, the behavioral ecology approach employs a cost–benefit method. However, the behavioral ecology approach contributes by anchoring these models to theoretically motivated currencies—namely the wellbeing of children, the avoidance of the costs of re-entering the marriage market, and the reproductive and interpersonal challenges unique to either men or women. Here, we tested nine hypotheses derived from the logic of behavioral ecology and report support for all but one of them, illustrating the utility of such an approach. This study also highlights the importance of expanding the cross-cultural record to include small-scale populations, which have long been overlooked in the social science literature. This is particularly important for research questions that directly relate to topics such as reproduction and family—two dimensions which exhibit patterns of variation across small-scale populations that are largely absent in Western populations. Lastly, the expansion of cross-cultural breadth highlights the cultural embeddedness of marriage and divorce by revealing the extent of cultural diversity inherent to the institution of marriage. However, it also reveals the boundaries of that variation, outlining the space that defines this uniquely human phenomenon.

Supplementary Materials: The following are available online at <https://www.mdpi.com/article/10.3390/socsci10060212/s1>, Marriage and Divorce Interview, Table S1: Discrete-time Event History Analysis of Risk of Divorce for Couples over 18 Years of Age Using Bayesian Logistic Regression. Reported coefficients are posterior means, accompanied by 95% confidence intervals from the posterior distribution, Table S2: Discrete-time Event History Analysis of Risk of Remarriage Using Bayesian Logistic Regression including interaction effects for Gender*Age and Gender*Number of Dependents.

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