

Original Article

Infidelity, jealousy, and wife abuse among Tsimane forager–farmers: testing evolutionary hypotheses of marital conflict

Jonathan Stieglitz^{a,*}, Michael Gurven^b, Hillard Kaplan^a, Jeffrey Winking^c

^aDepartment of Anthropology, University of New Mexico, Albuquerque, NM 87131, USA

^bDepartment of Anthropology, University of California, Santa Barbara, CA 93106, USA

^cDepartment of Anthropology, Texas A&M University, College Station, TX 77843, USA

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Abstract

The role of men's jealousy over a wife's infidelity in precipitating marital conflict and wife abuse is well documented. The role of women's jealousy over a husband's infidelity has received little attention, which is puzzling given high potential costs to women of withdrawal of paternal investment. We address this gap by investigating marital conflict and wife abuse among Tsimane forager–farmers of Bolivia. We test predictions derived from male jealousy and paternal disinvestment hypotheses, which consider threats and consequences of infidelity by women (male jealousy hypothesis) and men (paternal disinvestment hypothesis). The paternal disinvestment hypothesis proposes that wife abuse is employed by husbands to limit wives' mate retention effort and maintain men's opportunities to pursue extrapair sexual relationships. Interviews were conducted among husbands and wives in the same marriages using a combination of open-ended and structured items. Spouses agree that the most frequently reported type of marital argument is women's jealousy over a husband's infidelity ($N=266$ arguments). Roughly 60% of abusive events occurred during arguments over men's diversion of household resources ($N=124$ abusive events). In multivariate analyses, likelihood of wife abuse is greater in marriages where husbands have affairs, where wives are younger, and where spouses spend more time apart ($N=60$ husbands, 71 wives). While we find strong support for both male jealousy and paternal disinvestment hypotheses, it is men's infidelity, not women's, that precipitates most instances of marital conflict and wife abuse. We conclude that men's aggression towards their wives facilitates men's diversion of family resources for their selfish interests. Published by Elsevier Inc.

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“The revelation of wifely infidelity is a provocation so extreme that a ‘reasonable man’ is apt to respond with lethal violence.... So says the common law. Other spousal misbehavior—snoring or burning supper or mismanaging the family finances—cannot be invoked as provocation. Reasonable men do not react violently to their wives' profligacy or stupidity or sloth or insults.” (Daly and Wilson 1988:196).

1. Introduction

What causes marital conflict, and which marital conflicts are more likely to result in men's violence against their

wives? It has long been argued that men's jealousy over women's infidelity is the strongest impetus to men's lethal and nonlethal violence against female partners (reviewed in Daly & Wilson, 1988; also see Goetz, 2008 and references therein). Less is known about the extent to which women's jealousy over men's infidelity precipitates men's violence against female partners. Husbands are more likely than wives to commit infidelity (Atkins, Jacobson, & Baucom, 2001), and men and women report a similar frequency and intensity of jealous emotions during recalls of potential infidelity (Shackelford, LeBlanc, & Drass, 2000). If men are likely to use time and resources for pursuit of extramarital sexual relationships, wives' jealousy may play a critical role in mate retention, but at potential cost of instigating marital arguments and violence against wives. Given men's greater size and strength, violence against wives may be used as a “bargaining” tool to strategically leverage a selfish outcome, despite potential costs to the victim, aggressor, and offspring.

* Corresponding author. MSC01-1040, Anthropology, 1 University of New Mexico, Albuquerque, NM 87131.

E-mail address: jonathan@unm.edu (J. Stieglitz).

This is the first study to document content and prevalence of marital arguments and prevalence of men's violence against wives during such arguments in a small-scale society, the Tsimane of Bolivia. We show that men's diversion of resources from the family is a major source of arguments between spouses and husbands' violence against their wives. We argue that husbands employ violence to limit wives' mate retention effort and maintain men's opportunities to pursue extramarital sexual relationships. We define violence against wives as any physical contact initiated by a husband with intent to harm a wife (hereafter termed wife abuse). The research design minimizes response and sampling bias in two ways: (1) data are obtained independently from both spouses instead of only one spouse, permitting assessment of spousal consistency in reporting (Szinovacz & Egley, 1995), and (2) couples are not self-selected for a high degree of marital conflict.

1.1. Male jealousy, marital conflict, and wife abuse

Jealousy is experienced when a relationship is threatened, leading to responses reducing or eliminating the threat (Buss, 2000; Daly, Wilson, & Weghorst, 1982). The possibility of paternity uncertainty promotes the evolution of male jealousy. Jealous responses either deter same-sex competitors from mate theft or deter mates from pursuing other sexual relationships. Wife abuse might be used as a "mate retention behavior," functioning to maintain exclusive access to a mate and ensure that paternal investment is directed toward biological offspring (Buss, 1988; Goetz & Shackelford, 2006; Kaighobadi, Starratt, Shackelford, & Popp, 2008). Risk of women's infidelity, men's jealousy, and wife abuse should therefore be linked.

Existing evidence supports these links. Two factors associated with risk of women's infidelity are the woman's mate value and the amount of time partners spend apart from each other. A woman's mate value is the degree to which she enhances a man's reproductive success, and is often proxied by age or reproductive condition. Younger women are preferred partners across cultures (e.g., Borgerhoff Mulder, 1988; Buss, 1989) and therefore likely have more extrapair mating opportunities than their older counterparts. Younger women are more likely to conceive following sexual encounters and have higher reproductive value (expected future fertility). This increases the cost to men of losing a young wife. Indeed, a wife's young age is associated with an increase in her husband's mate retention effort (Buss & Shackelford, 1997). Similarly, couples engage in aggressive interactions (verbal or physical) more frequently when a woman may be more likely to conceive (Flinn, 1988).

Time partners spend apart from each other increases opportunities for surreptitious pursuit of extrapair relationships. Time apart is associated with an increase in men's mate retention effort (Baker & Bellis, 1995; Buss & Shackelford, 1997; Shackelford, Goetz, McKibbin, &

Starratt, 2007; Starratt, Shackelford, Goetz, & McKibbin, 2007). Degree of men's mate retention effort increases with risk of female infidelity even after controlling for men's dominant personality (Goetz & Shackelford, 2009).

The male jealousy hypothesis generates the following predictions: a husband's jealousy over a wife's suspected infidelity should be (1) ranked highly as a common type of intense marital conflict; (2) a type of conflict frequently associated with wife abuse; (3) greater in marriages where a wife's mate value, using her age as a proxy, is higher (i.e., when she is younger); and (4) greater in marriages where spouses spend more time apart. In addition, likelihood of wife abuse should be (5) greater in marriages where a wife is younger and (6) greater in marriages where spouses spend more time apart. A husband's jealousy is operationalized dichotomously, as reporting an argument over a wife's suspected infidelity in the past year. Spousal time apart is also operationalized dichotomously, as whether a husband participated in multiday solitary wage labor in the past year.

1.2. Paternal disinvestment, marital conflict, and wife abuse

Sex differences in potential reproductive rates affect optimal levels of reproductive effort (Trivers, 1972). Whereas male reproductive effort is limited to courtship and copulation in most mammals and primates (Clutton-Brock, 1991), humans have a history of high paternal investment (Gray & Anderson, 2010). While nonhuman primate females increase work effort during pregnancy and lactation, thereby increasing maternal mortality (Altmann, 1980), women decrease metabolism and store fat during pregnancy (Prentice & Goldberg, 2000) and decrease work effort during lactation (Hurtado, Hill, Kaplan, & Hurtado, 1992). This suggests significant energetic support of reproduction by men. Throughout much of life Tsimane fathers produce more calories consumed by children per day than mothers and grandmothers combined; wives consume over 250 calories per day produced by husbands (Kaplan, Gurven, Winking, Hooper, & Stieglitz, 2010). Tsimane men thus clearly direct resources toward their nuclear families.

Unlike men, women do not risk investing inadvertently in unrelated offspring. However, women do risk losing access to resources critical for reproduction if men divert resources to attract other women. Women experience jealousy as a response reducing or eliminating the threat of resource loss (Buss, 2000; Daly et al., 1982; Schutzwahl & Koch, 2004; Symons, 1979).

Paternal disinvestment is a construct representing men's diversion of resources from the family for individual fitness gain (Stieglitz, Kaplan, Gurven, Winking, & Vie Tayo, 2011). Men's infidelity is an obvious indicator of paternal disinvestment because time and resources invested in gaining and maintaining access to extrapair mates are unavailable for familial investment. Men's infidelity is expected to result in women's jealousy and women's mate retention effort.

Tsimane wives frequently complain to husbands about husbands' suspected infidelity (Stieglitz et al., 2011). Wives' complaints to husbands are considered mate retention effort because complaints attempt to obstruct current and future male infidelity and resource diversions (cf. Buss, 1988). The paternal disinvestment hypothesis proposes that wife abuse is employed by husbands to limit wives' mate retention effort and maintain men's opportunities to pursue extrapair sexual relationships. Consistent with this logic, women's physical aggression against mates precipitates most instances of partner violence against women (O'Leary & Slep, 2006). Men's infidelity, women's jealousy, women's mate retention effort, and wife abuse should therefore be linked.

The paternal disinvestment hypothesis generates the following predictions: a wife's jealousy over a husband's suspected infidelity should be (1) ranked highly as a common type of intense marital conflict; (2) a type of conflict frequently associated with wife abuse; and (3) greater in marriages where a husband has an affair. In addition, likelihood of wife abuse should be (4) greater in marriages where a husband has an affair. The positive association between men's infidelity and rate of wife abuse should be mediated by marital arguments over wives' jealousy. A wife's jealousy is operationalized dichotomously, as reporting an argument over a husband's suspected infidelity in the past year.

It is important to note that predictions 5 and 6 generated by the male jealousy hypothesis (Section 1.1) do not follow exclusively from this hypothesis. If a husband's infidelity is more likely when a wife is younger, then an inverse relationship between a wife's age and rate of wife abuse is also consistent with the paternal disinvestment hypothesis. Similarly, if a husband's infidelity is more likely when spouses spend more time apart, then a positive correlation between spousal time apart and rate of wife abuse is also consistent with the paternal disinvestment hypothesis. We address implications of these shared predictions in the Discussion.

2. Methods

2.1. Study population

Most Tsimane reside in 60+ villages in the Maniqui River basin in lowland Bolivia. Tsimane diet consists largely of plantains, rice, fish, meat, and fruit. Store-bought items include sugar, salt, cooking oil, kitchen utensils, medicine, and clothing. Such items are purchased with cash obtained through men's itinerant wage labor with loggers, ranchers, or river merchants. Women rarely earn wages, and money is rarely saved. While the vast majority of husbands' wages are used for family purchases (Stieglitz, unpublished data), wives frequently complain to husbands about their excessive consumption of store-bought alcohol (Stieglitz et al., 2011).

Despite a lack of patriarchal norms, low variance between sexes in resource holdings, and limited residential privacy (houses are closely spaced, and most lack walls), Tsimane wife abuse is rife (Stieglitz et al., 2011). Common forms of wife abuse include shoving, kicking, and slapping, and reports of wives temporarily fleeing a home to avoid a husband's imminent aggression are not unusual.

Tsimane marriages are stable despite the fact that many unions are arranged by kin. Demographic interviews of Tsimane aged ≥ 45 reveal an average of 1.3 lifetime marital partners for both sexes (men: S.D.=0.66, max=4, $N=219$; women: S.D.=0.64, max=5, $N=199$). Polygyny is rare and usually sororal. There are no rules of postmarital residence, but the norm is residence near the wife's natal kin early in marriage.

2.2. Data collection

Data on marital arguments were collected by J.S. in one village in 2010 among monogamously married men and women from the same marriage. Male participants ranged in age from 19 to 53 (mean \pm S.D.=37.1 \pm 10.19, $N=21$). Female participants ranged in age from 16 to 49 (mean \pm S.D.=31.64 \pm 10.05, $N=25$). Husbands of four women were absent due to wage labor (all four men were under age 30 and married to younger women). To increase sample size for hypothesis tests in Sections 3.3–3.5, we include pilot data collected by J.S. in 2007 among monogamously married men and women from two other villages. Sample sizes vary due to missing data and because not all follow-up questions were asked systematically during piloting. Participants from all three villages were familiar with J.S. because he resided in each village for several weeks or months prior to conducting interviews. Interviews were conducted privately to ensure confidentiality and in the Tsimane language to increase informants' comfort levels.

Participants were queried about most intense marital arguments in the past year and in other years of the same marriage. We used a free-listing technique because it does not force respondents into selecting preconceived categories and allows for a more thorough account than otherwise possible. We focused on most intense arguments because we reasoned that they would provide the most accurate recall. No restriction was placed on number of arguments one could mention. For each argument mentioned, we asked identical structured questions of both sexes. We asked whether a wife experienced abuse during the argument, whether a husband had an affair in the preceding year, and whether a husband was involved in multiday solitary wage labor in the preceding year. To categorize arguments, we queried participants about other potential causes, ensuring that causes we identified were not germane to the argument mentioned. Participants were asked whether wife abuse occurred in the preceding year if either no

arguments were reported that year or wife abuse was not reported during an argument that year.

Demographic interviews used to assign ages and assess kinship were conducted by a Tsimane research assistant in one village from 2003 to 2004 and by J.S. and a senior graduate student in two villages from 2006 to 2007 (see Kaplan et al., 2010, for a description of methods). These data were updated during subsequent censuses.

J.S. obtained institutional (University of New Mexico) review board approval and three-tiered informed consent from (1) Tsimane government, (2) village leaders, and (3) interviewees.

2.3. Data analysis

Husbands' and wives' reports are analyzed separately to assess spousal consistency in reporting. Data on marital arguments (Section 3.1) and prevalence of wife abuse during arguments (Section 3.2) are segregated by year of occurrence (past year versus other years in marriage). This is done to determine if recently reported arguments are representative of all arguments. In addition to presenting aggregate-level data (i.e., reports from spouses from different marriages), we present couple-level data (i.e., reports from spouses from the same marriage) referencing the past year. Aggregate-level data can inflate degree of spousal consistency in reporting. For example, while aggregate husband–wife comparisons show similar rates of wife abuse, couple comparisons show that spouses disagree considerably on frequency and occurrence of men's abusive tactics (Szinovacz, 1983).

Binary logistic regression is used to model effects of covariates on three outcomes: likelihood of reporting in the past year (1) an argument over a husband's jealousy (Section 3.3); (2) an argument over a wife's jealousy (Section 3.4); and (3) wife abuse (Section 3.5). Results are presented as log-odds (*B*) and/or odds ratios (OR).

3. Results

3.1. Content and prevalence of marital arguments

3.1.1. Husbands' reports

A wife's jealousy is the most commonly reported type of argument (Table 1). One third of husbands reported this argument in the past year; over 80% (17/21 husbands) reported its occurrence in marriage. A wife's complaint over a husband's use of money is the second most commonly reported argument and was prevalent in the past year. Other recurrent sources of conflict include a husband's drinking and work effort. A husband's jealousy was reported by nearly 20% of husbands (3/4 husbands reported multiple arguments over their own jealousy in the same year), but not one man reported this argument in the past year. Median number of years since this argument occurred is 20 (mean ±S.D.=16±8). Of all arguments, 58.2% refer directly to men's diversion of resources from the family (summing arguments over a wife's jealousy, husband's use of money, and husband's drinking in Table 1). A husband's jealousy accounts for only 6.1% of all arguments (Table 1).

Table 1
 "What are the worst arguments with your spouse in the past year, and throughout your marriage in other years?" (free list; *n*=21 husbands, 25 wives)

Type of argument	Husbands' reports (<i>n</i> =115 arguments)			Wives' reports (<i>n</i> =151 arguments)			Combined reports (<i>n</i> =266 arguments)		
	Past year (<i>n</i> =56)	Other years (<i>n</i> =59)	% total ^a (rank)	Past year (<i>n</i> =76)	Other years (<i>n</i> =75)	% total (rank)	Past year (<i>n</i> =132)	Other years (<i>n</i> =134)	% total ^a (rank)
	# arguments (# men)			# arguments (# women)			# arguments (# individuals)		
Wife is jealous with husband	12 (7)	22 (16)	29.6 (1)	20 (10)	28 (14)	31.8 (1)	32 (17)	50 (30)	30.8 (1)
Husband's use of money	16 (8)	5 (5)	18.2 (2)	7 (5)	2 (2)	6.0 (5)	23 (13)	7 (7)	11.3 (2)
Husband drinks too much	6 (4)	6 (3)	10.4 (3)	5 (4)	1 (1)	4.0 (8)	11 (8)	7 (4)	6.8 (5)
Husband does not hunt/fish	3 (3)	6 (5)	7.8 (4)	9 (6)	3 (3)	7.9 (3)	12 (9)	9 (8)	7.9 (4)
Husband does not work in field	6 (5)	3 (3)	7.8 (4)	3 (3)	3 (3)	4.0 (8)	9 (8)	6 (6)	5.6 (6)
Husband is jealous with wife	–	7 (4)	6.1 (6)	5 (5)	15 (8)	13.2 (2)	5 (5)	22 (12)	10.2 (3)
Wife does not care for joint child	3 (3)	3 (3)	5.2 (7)	4 (3)	4 (3)	5.3 (7)	7 (6)	7 (6)	5.3 (7)
Wife lives far from natal kin	3 (2)	1 (1)	3.4 (8)	3 (2)	2 (2)	3.3 (11)	6 (4)	3 (3)	3.4 (10)
Wife visits natal kin too often	2 (2)	2 (2)	3.4 (8)	1 (1)	–	0.7 (16)	3 (3)	2 (2)	1.9 (12)
Husband does not care for joint child ^b	–	3 (2)	2.6 (10)	7 (5)	3 (3)	6.6 (4)	7 (5)	6 (5)	4.9 (8)
Wife does not cook/wash clothes	2 (2)	–	1.7 (11)	5 (4)	4 (4)	6.0 (5)	7 (6)	4 (4)	4.1 (9)
Wife does not want to have sex	2 (1)	–	1.7 (11)	–	3 (1)	2.0 (13)	2 (1)	3 (1)	1.9 (12)
Husband is wage laboring too often	–	1 (1)	0.9 (13)	–	–	–	–	1 (1)	0.3 (17)
Wife does not work in field	1 (1)	–	0.9 (13)	4 (4)	2 (2)	4.0 (8)	5 (5)	2 (2)	2.6 (11)
Wife is "unattractive" or sterile	–	–	–	1 (1)	3 (2)	2.6 (12)	1 (1)	3 (2)	1.5 (14)
Husband's natal kin is "unkind" to wife	–	–	–	1 (1)	1 (1)	1.3 (14)	1 (1)	1 (1)	0.8 (15)
Husband visits others too often	–	–	–	1 (1)	1 (1)	1.3 (14)	1 (1)	1 (1)	0.8 (15)

^a Total ≠100 due to rounding error.

^b Includes complaints over a husband's "neglect" that are unrelated to resource acquisition (e.g., involvement in reproductive decisions of adolescent children).

3.1.2. Wives' reports

Wives also report their own jealousy as the most prevalent type of argument (Table 1). In the past year, 40% of wives reported this argument; 80% (20/25 wives) reported its occurrence in marriage. A husband's jealousy is the second most commonly reported argument, with 20% of wives reporting its occurrence in the past year and 52% in marriage. Other recurrent sources of conflict include a husband's work effort and use of money, and a wife's work effort. Of all arguments, 41.8% refer directly to men's diversion of resources from the family. A husband's jealousy accounts for only 13.2% of all arguments (Table 1).

3.1.3. Couple-level data

Number of arguments reported by a husband and wife in the past year is strongly correlated ($r=0.64, p=.002, N=21$ couples). But there are noteworthy reporting differences between spouses (Table 2). While all wives reported at least one argument in the past year (mean=2.9, max=8), five husbands (24%) reported no arguments whatsoever (mean=2.7, max=9). Where husbands are more likely than wives to report arguments (column A>B in Table 2), a wife's behavior is more likely to be the cause. Where wives are more likely than husbands to report arguments (column B>A in Table 2), a husband's behavior (or that of his natal kin) is more likely to be the cause. Where spousal agreement exists (column E in Table 2), arguments pertain to a husband's use of money and drinking, a wife's jealousy, and work effort of both spouses.

3.2. Prevalence of wife abuse during marital arguments

3.2.1. Husbands' reports

Wife abuse is most often associated with arguments over a wife's jealousy (Table 3). Nearly 40% of husbands reported wife abuse in marriage due to a wife's jealousy. Almost 20% reported wife abuse in marriage due to an argument over a husband's use of money. Fourteen percent of husbands reported wife abuse in marriage due to their own jealousy. Less frequently mentioned types of arguments associated with wife abuse include a husband's drinking and wage labor involvement, work effort of both partners, and a wife's frequent visitation of her natal kin. Of all abusive events, 67.5% ($n=25$) occurred during arguments over men's diversion of resources from the family (summing events during arguments over a wife's jealousy, husband's use of money, and husband's drinking in Table 3). A husband's jealousy accounts for only 13.5% of abusive events ($n=5$, Table 3).

3.2.2. Wives' reports

Wives also report their own jealousy as most often associated with wife abuse (Table 3). Over 70% reported wife abuse during this argument in marriage. While only two wives (8%) reported wife abuse due to a husband's jealousy in the past year, 36% reported abuse during this argument in marriage. Less frequently mentioned types of arguments associated with wife abuse include a husband's use of money, work effort of both partners, residence decisions, indicators of a wife's mate value (physical appearance/fertility), frequency of sex in marriage, a

Table 2
Spousal consistency in reporting marital arguments in the past year ($n=21$ couples)

Type of argument ^a	# couples in which argument reported by				
	(A) Husband only ^b	(B) Wife only ^c	(C) Both spouses ^d	(D=A+B+C) Either spouse	(E=C/D) Spousal agreement ^e
Wife is jealous with husband	5	5	2	12	0.17
Husband's use of money	5	1	3	9	0.33
Husband does not hunt/fish	2	4	1	7	0.14
Husband does not work in field	4	2	1	7	0.14
Husband drinks too much	2	2	2	6	0.33
Wife does not care for joint child	3	2	0	5	0
Husband does not care for joint child	0	5	0	5	0
Wife does not cook/wash clothes	1	2	1	4	0.25
Wife does not work in field	1	3	0	4	0
Husband is jealous with wife	0	3	0	3	0
Wife lives far from natal kin	2	1	0	3	0
Wife visits natal kin too often	2	1	0	3	0
Wife does not want to have sex	1	0	0	1	0
Husband's natal kin is "unkind" to wife	0	1	0	1	0
Husband visits others too often	0	1	0	1	0
Wife is "unattractive" or sterile	0	1	0	1	0

^a An argument was not counted more than once, even if different occurrences of the same type of argument were reported by both spouses.
^b Argument reported at least once by husband.
^c Argument reported at least once by wife.
^d Argument reported at least once by both spouses.
^e Reflects extent of agreement among couples in which either spouse reported the argument (adapted from Szinovacz, 1983).

Table 3
Prevalence of wife abuse during marital arguments (n=21 husbands, 25 wives)

Type of argument precipitating wife abuse	Husbands' reports (n=37 abusive events)			Wives' reports (n=87 abusive events)			Combined reports (n=124 abusive events)		
	Past year (n=12)	Other years (n=25)	Total (% total ^a)	Past year (n=30)	Other years (n=57)	Total (% total ^a)	Past year (n=42)	Other years (n=82)	Total (% total ^a)
	# events (# men)			# events (# women)			# events (# individuals)		
Wife is jealous with husband	5 (3)	9 (7)	14 (37.8)	14 (6)	26 (13)	40 (46.0)	19 (9)	35 (20)	54 (43.5)
Husband's use of money	5 (1)	3 (3)	8 (21.6)	5 (3)	1 (1)	6 (6.9)	10 (4)	4 (4)	14 (11.3)
Husband drinks too much	–	3 (2)	3 (8.1)	1 (1)	1 (1)	2 (2.3)	1 (1)	4 (3)	5 (4.0)
Husband does not hunt/fish	–	1 (1)	1 (2.7)	–	–	–	–	1 (1)	1 (0.8)
Husband does not work in field	1 (1)	1 (1)	2 (5.4)	–	1 (1)	1 (1.1)	1 (1)	2 (2)	3 (2.4)
Husband is jealous with wife	–	5 (3)	5 (13.5)	2 (2)	14 (7)	16 (18.4)	2 (2)	19 (10)	21 (16.9)
Wife does not care for joint child	1 (1)	1 (1)	2 (5.4)	1 (1)	4 (3)	5 (5.7)	2 (2)	5 (4)	7 (5.6)
Wife lives far from natal kin	–	–	–	2 (1)	1 (1)	3 (3.4)	2 (1)	1 (1)	3 (2.4)
Wife visits natal kin too often	–	1 (1)	1 (2.7)	1 (1)	–	1 (1.1)	1 (1)	1 (1)	2 (1.6)
Husband does not care for joint child	–	–	–	1 (1)	–	1 (1.1)	1 (1)	–	1 (0.8)
Wife does not cook/wash clothes	–	–	–	2 (2)	3 (3)	5 (5.7)	2 (2)	3 (3)	5 (4.0)
Wife does not want to have sex	–	–	–	–	2 (1)	2 (2.3)	–	2 (1)	2 (1.6)
Husband is wage laboring too often	–	1 (1)	1 (2.7)	–	–	–	–	1 (1)	1 (0.8)
Wife does not work in field	–	–	–	1 (1)	1 (1)	2 (2.3)	1 (1)	1 (1)	2 (1.6)
Wife is "unattractive" or sterile	–	–	–	–	3 (2)	3 (3.4)	–	3 (2)	3 (2.4)

^a Total ≠100 due to rounding error.

husband's drinking, and a wife's frequent visitation of her natal kin. Of all abusive events, 55.2% (n=48) occurred during arguments over men's diversion of resources from the family. A husband's jealousy accounts for only 18.4% of abusive events (n=16, Table 3).

3.2.3. Couple-level data

Either spouse reported at least one abusive event in the past year in 6/21 couples (see Table 4 for spousal consistency in reporting wife abuse by type of argument). Roughly 20% of husbands (4/21) and 25% of wives (5/21) reported wife abuse in the past year. Number of beatings reported by a husband and wife in the past year is strongly correlated (r=0.84, p=.036, N=6 couples where either spouse reported violence). Husbands reported more beatings than wives in 2/6 couples; in both couples, a husband

had an affair in the past year, and a wife's jealousy was reported at least once by one or both spouses. Where wives are more likely than husbands to report wife abuse (column B>A in Table 4), a husband's behavior is more likely to be the cause. Where spousal agreement exists (column E in Table 4), wife abuse is associated with a wife's jealousy and a husband's use of money.

3.3. Effect of wife's age and spousal time apart on likelihood of reporting a husband's jealousy

3.3.1. Husbands' reports

A husband's jealousy constituted only 6% of all arguments (Table 1). Because not one man reported this argument in the past year, we are unable to test these predictions (but see wives' reports). Examining the sample

Table 4
Spousal consistency in reporting wife abuse in the past year (n=6 couples where either spouse reported wife abuse)

Type of argument precipitating wife abuse ^a	# couples where wife abuse reported by				
	(A) Husband only ^b	(B) Wife only ^c	(C) Both spouses ^d	(D=A+B+C) Either spouse	(E=C/D) Spousal agreement
Wife is jealous with husband	1	1	2	4	0.5
Husband's use of money	0	1	1	2	0.5
Husband does not work in field	1	0	0	1	0
Husband drinks too much	0	1	0	1	0
Wife does not care for joint child	1	0	0	1	0
Husband does not care for joint child	0	1	0	1	0
Wife does not cook/wash clothes	0	1	0	1	0
Wife visits natal kin too often	0	1	0	1	0

^a Violence was not counted more than once, even if reported by both spouses on different occasions during the same type of argument.

^b Violence reported at least once by husband.

^c Violence reported at least once by wife.

^d Violence reported at least once by both spouses.

Table 5
Multiple logistic regression of likelihood of wife abuse in the past year

Parameter	Husbands' reports (n=60)				Wives' reports (n=71)			
	B	SE	p	OR	B	SE	p	OR
Husband had affair in past year=yes (ref:no)	1.682	0.782	.031	5.377	1.61	0.841	.05	5.002
Wife's age ^a	-2.773	1.271	.029	0.063	-0.147	0.045	.001	0.863
Husband absent from village in past year=yes (ref:no)	1.545	0.892	.083	4.686	2.177	0.845	.01	8.816
Wife's natal kin=resident in cluster (ref:absent)	-0.77	0.97	.428	0.463	0.033	0.912	.972	1.033
Joint dependents <age 10=co-resident (ref:non-resident)	-1.876	1.281	.143	0.153	-2.478	1.572	.115	0.084
Constant	8.495	5.021	.091		4.5	2.433	.064	
Nagelkerke R ²	0.445				0.63			

^a Log of wife's age was used to model husbands' reports as it provided a better fit.

of arguments over a husband's jealousy in other years of marriage, we find that age of the oldest wife in the year of the argument is 22. A husband was absent from the village due to wage labor in the year preceding each jealous argument.

3.3.2. Wives' reports

Likelihood of reporting a husband's jealousy in the past year is significantly lower among older women ($B=-0.103$, $p=.024$, adjusted OR=0.903, controlling for spousal time apart, $N=64$). Likelihood of reporting a husband's jealousy is marginally greater in marriages where spouses spend more time apart ($B=1.943$, $p=.084$, husband absent=yes, adjusted OR=6.981, controlling for wife's age). Inclusion of a wife's age-by-husband absenteeism interaction term does not yield a significant parameter estimate. Residence near the husband's natal kin does not affect likelihood of reporting a husband's jealousy (not shown).

3.4. Effect of husbands' infidelity on likelihood of reporting a wife's jealousy

3.4.1. Husbands' reports

Despite a small sample, likelihood of reporting a wife's jealousy in the past year is marginally greater in marriages where a husband has an affair ($B=1.833$, $p=.074$, husband had affair=yes, OR=6.25, $N=21$). Controlling for men's affair status, men's absenteeism does not affect likelihood of reporting a wife's jealousy (nor is there a significant interaction effect of men's affair status-by-men's absenteeism).

3.4.2. Wives' reports

Wives married to husbands who had affairs in the past year are significantly more likely to report being jealous with a husband ($B=2.398$, $p=.006$, husband had affair=yes, OR=11.0, $N=30$). In separate models controlling for husbands' infidelity in the past year, neither husband's age, wife's age, nor residential arrangement significantly affects likelihood of reporting a wife's jealousy (not shown).

3.5. Effect of husbands' infidelity, wife's age, and spousal time apart on likelihood of wife abuse

Full models are shown in Table 5. Husbands are less likely than wives to report wife abuse in the past year, but the

effect is not significant ($B=-0.583$, $p=.125$, sex=male, OR=0.56, $N=131$). Because lower rates of wife abuse are associated with residence near the wife's natal kin (Figueredo et al., 2001) and presence of offspring (Koenig, Stephenson, Ahmed, Jejeebhoy, & Campbell, 2006), we control for both variables. Here neither variable significantly affects likelihood of wife abuse in the past year using either partner's reports.

3.5.1. Husbands' reports

A husband's infidelity is associated with a significantly greater likelihood of wife abuse in the past year controlling for other factors (Table 5). Adjusted odds of wife abuse are over five times greater if a husband had an affair. The positive association between a husband's infidelity and rate of wife abuse is mediated by a wife's jealousy: male infidelity no longer predicts likelihood of wife abuse after including an "argument over female jealousy" parameter in the model, which is significant ($B=3.628$, $p=.045$, wife's jealousy reported in past year=yes, controlling for parameters in Table 5, $N=57$). We are unable to test whether an "argument over male jealousy" parameter has an independent effect on rate of wife abuse after controlling for parameters in Table 5 given the small sample of men's reports of their own jealousy. Likelihood of wife abuse is greater among younger wives and where spouses spend more

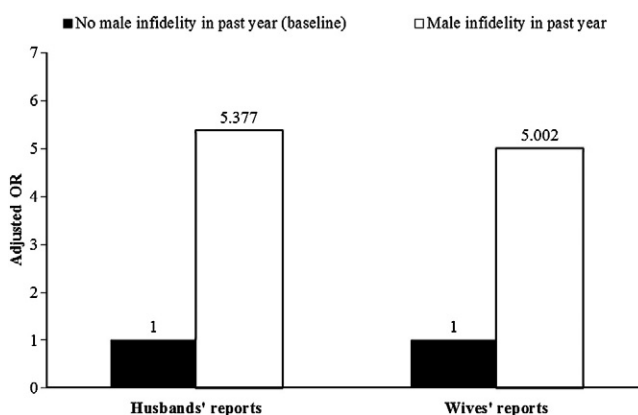


Fig. 1. Adjusted odds ratio (OR) for effect of male infidelity on likelihood of wife abuse in the past year (controls in Table 5 set to sample means).

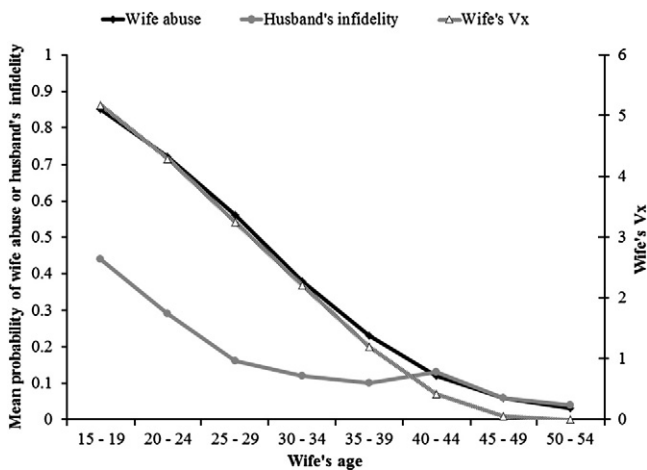


Fig. 2. Probability of wife abuse in the past year (wives' reports) by wife's age and reproductive value (V_x). Wives' reports are used because this model explains a greater proportion of variance in likelihood of wife abuse (see Nagelkerke R^2 in Table 5). Also shown is the probability of a husband's infidelity per year; estimates are derived using generalized estimating equations analysis on repeated measures over time ($N=1718$ person-years in marriage representing 129 husbands [among an expanded sample], controlling for sex of respondent). Controls are set to sample means to derive all estimates; means of 5-year age intervals are shown.

time apart (Table 5, though effect of husbands' absenteeism is marginally significant). Inclusion of a wife's age-by-husband absenteeism interaction term does not yield a significant parameter estimate.

3.5.2. Wives' reports

Consistent with husbands' reports, adjusted odds of wife abuse are roughly five times greater if a husband had an affair (Table 5, Fig. 1). Also, male infidelity no longer predicts likelihood of wife abuse after including an "argument over female jealousy" parameter in the model, which is significant ($B=10.864$, $p=.006$, wife's jealousy reported in past year=yes, controlling for parameters in Table 5, $N=68$). Inclusion of an "argument over male jealousy" parameter in the model does not yield a significant parameter estimate after controlling for parameters in Table 5 (not shown). Likelihood of wife abuse is greater among younger wives (Table 5); rate of decline in wife abuse tracks age-related decline in both wives' reproductive value and husbands' infidelity (Fig. 2). Likelihood of wife abuse is also greater in marriages where spouses spend more time apart (Table 5); adjusted odds of wife abuse are nearly nine times greater if a husband was absent from the village in the past year.

4. Discussion

Consistent with the paternal disinvestment hypothesis, a wife's jealousy is the most frequent marital argument (Table 1). Using a free-listing technique, we find that roughly 80% of husbands and wives report marital conflict due to wives'

jealousy. Roughly 50% of all arguments refer directly to men's diversion of resources from the family (summing arguments over a wife's jealousy, husband's use of money, and husband's drinking using combined reports in Table 1). Spouses agree that wife abuse is most often associated with arguments over a wife's jealousy (Tables 3 and 4). Roughly 60% of all abusive events occurred during arguments over men's diversion of resources from the family (summing events during arguments over a wife's jealousy, husband's use of money, and husband's drinking using combined reports in Table 3).

Consistent with the male jealousy hypothesis, a husband's jealousy is a frequently reported type of marital argument (Table 1). This is despite the fact that response bias is evident from husbands' reports of their own jealousy (Tables 1 and 2). A husband's jealousy accounts for 10% of all marital arguments (using combined reports from Table 1). Spouses agree that wife abuse is frequently associated with arguments over a husband's jealousy (Table 3; but see Table 4). Almost 20% of all abusive events occurred during arguments over a husband's jealousy (using combined reports in Table 3).

Likelihood of reporting a husband's jealousy is greater in marriages involving younger wives. In addition, men's jealousy is marginally greater in marriages where spouses spend more time apart. These findings are consistent with positive correlations between men's mate retention effort and risk of women's infidelity reported in Western and other non-Western settings (Baker & Bellis, 1995; Buss & Shackelford, 1997; Flinn, 1988; Goetz & Shackelford, 2006; Kaighobadi et al., 2008; Shackelford et al., 2007; Starratt et al., 2007).

Likelihood of reporting a wife's jealousy is greater in marriages where a husband has an affair. This suggests that mate retention effort positively covaries with risk of partner infidelity, even in the absence of risk of cuckoldry. This underscores the importance of paternal investment, particularly because wives may realize that their mate retention effort increases risk of wife abuse.

Consistent with the paternal disinvestment hypothesis, likelihood of wife abuse is greater in marriages where a husband has an affair, even after controlling for a wife's age, spousal time apart, and household demographic factors (Table 5, Fig. 1). This effect, which is not predicted by the male jealousy hypothesis, is mediated by marital arguments over wives' jealousy. Positive associations between male infidelity and rate of violence against female partners have been reported elsewhere based on aggregate-level data provided by either sex (Djikanovic, Jansen, & Otasevic, 2009; Dunkle et al., 2006; Hollander, 2005; Koenig et al., 2006; McCloskey, Williams, & Larsen, 2005). We propose that wife abuse is linked to the importance of paternal investment and is a means by which husbands control wives' responses to the male dual reproductive strategy of familial investment and pursuit of extramarital sexual relationships.

As predicted by the male jealousy hypothesis, likelihood of reporting wife abuse is greater in marriages involving younger wives (Table 5, Fig. 2). The inverse relationship between rate of wife abuse and a wife's age is also consistent with the paternal disinvestment hypothesis. This is because Tsimane women's jealousy is greater at younger ages, as men's infidelity is most common during this time (see Stieglitz et al., 2011; Winking, Kaplan, Gurven, & Rucas, 2007). Likelihood of reporting a wife's jealousy in the past year is significantly lower among older women ($B=-0.064$, $p=.013$, adjusted OR=0.938, controlling for sex of informant, $N=82$). This effect is mediated by a husband's infidelity (Section 3.4).

The paternal disinvestment hypothesis therefore suggests a reexamination of the relationship between a wife's age and rate of wife abuse. Numerous potential fitness benefits to women of engaging in extrapair sex have been identified (Greiling & Buss, 2000). Women's infidelity might represent a response to men's infidelity, to punish a partner and/or compensate for loss of male investment by having affairs with men offering resources (Symons, 1979). Is a husband's infidelity associated with his wife's infidelity? If so, we might expect a higher prevalence of arguments over a wife's suspected infidelity in marriages where either a husband has an affair or arguments occur over suspected male infidelity. Using combined reports, a husband's jealousy was reported by 17 individuals at least once in a given year ($N=20$ person-years because three wives reported at least one such argument in multiple years). In 17/20 person-years where a husband's jealousy was reported, a husband had an affair in the preceding year. Similarly, a husband's jealousy was reported by either spouse at least once in 14 couples. At least one spouse in six of these couples (43%) also reported a wife's jealousy at least once that year. These findings, while preliminary, suggest an association between a husband's infidelity and his wife's infidelity that requires further testing. They are consistent with two related findings reported by Greiling and Buss (2000): (1) an important perceived benefit to women of extrapair sex is to gain revenge against a partner following his infidelity, and (2) women rank discovery of their partner's infidelity as the context most likely to result in their own infidelity.

One hypothesis is that promiscuous men are more likely paired with promiscuous women and increase mate retention effort as a result. This might explain why we and other researchers (Baker & Bellis, 1995; Buss & Shackelford, 1997; Flinn, 1988; Goetz & Shackelford, 2006; Kaighobadi et al., 2008; Shackelford et al., 2007; Starratt et al., 2007) find positive correlations between men's mate retention effort and indicators of women's infidelity. While this finding is consistent with the hypothesis that men's mate retention effort minimizes risk of cuckoldry, it is also somewhat counterintuitive. All else equal, one might expect men actively engaging in mate retention tactics to be more effective at restricting women's infidelity.

The extent to which wife abuse is used to punish past and/or prevent future female infidelity is unclear. If women's infidelity is indeed a response to men's infidelity, given that rate of Tsimane men's infidelity peaks at younger ages (Fig. 2), one might expect women's infidelity to peak at younger ages as well. Since rate of wife abuse is highest at younger ages (Table 5 and Fig. 2), violence may be used by husbands to both prevent future cuckoldry and punish women's infidelity at its peak. This logic is consistent with both male jealousy and paternal disinvestment hypotheses. If supported cross-culturally, it suggests that an expanded framework incorporating men's infidelity explains more variance in rate of wife abuse than traditional frameworks only emphasizing women's mate value. The negative relationship between women's age and rate of violence against women that is predicted by the male jealousy hypothesis is not always found (Alio, Nana, & Salihu, 2009; Dude, 2009).

Likelihood of reporting wife abuse is greater in marriages where spouses spend more time apart. This finding is consistent with data from Western samples showing a positive relationship between time apart and male mate retention effort (Baker & Bellis, 1995; Shackelford et al., 2007; Starratt et al., 2007). Although time apart can increase risk of female infidelity and male jealousy as predicted by the male jealousy hypothesis, this hypothesis also predicts that husbands with younger wives should maintain close partner proximity. Yet, Tsimane men's absenteeism due to wage labor peaks early in marriage, when wives are younger (Stieglitz et al., 2011). Many young Tsimane men who have worked with us over the years have voiced concerns over their wives' fidelity during long stints away from home. So why do young Tsimane men engage in long-term solitary wage labor if by doing so they increase their risk of cuckoldry?

One hypothesis is that wage earnings, while often used to make family purchases, are also used by husbands to pursue affairs. This hypothesis is consistent with our finding that a common source of marital arguments and wife abuse according to both spouses is a husband's use of money (Tables 1–4). It is also consistent with our finding that men's absenteeism due to wage labor positively covaries with likelihood of their own infidelity, controlling for other factors (Stieglitz, unpublished data). Furthermore, husbands' self-reports of daily wages and wives' estimates of their husbands' wages are not strongly correlated: husbands report a wage that is 8% higher than what their wives report (Stieglitz et al., 2011). Mating effort might therefore partially motivate Tsimane men's wage labor, despite the fact that men's absenteeism increases their risk of cuckoldry. From this perspective, the positive relationship between men's absenteeism and rate of wife abuse (Table 5) is consistent with the paternal disinvestment hypothesis. Taken together, these findings highlight that, within marriage, pursuit of divergent mating strategies might result in deception over resource production and distribution (Haselton, Buss,

Oubaid, & Angleitner, 2005); such deception increases risk of verbal and physical aggression between partners.

4.1. Limitations

Causation cannot be inferred, so men's absenteeism due to wage labor or men's infidelity might be an outcome of wife abuse. Disinvesting men might also be more likely to select partners tolerating wife abuse or might have more abusive personalities. Even if paternal disinvestment causes wife abuse, the effect might not be direct. For example, wives might punish disinvesting husbands by having affairs, which might result in men's jealousy and wife abuse. Or wives might punish disinvesting husbands by withdrawing their own parental investment, which might result in husbands' attempts to maintain maternal investment using wife abuse. These hypotheses require further testing. Because we lack ordinal measures of men's infidelity (e.g., one-time sexual encounter compared to repeated encounters with the same individual), we are unable to test whether extent of men's affair involvement positively covaries with rate of wife abuse. Finally, sample size is small, we only focus on physical wife abuse, and interview data can produce socially desirable responses. But it is noteworthy that most results are robust across sexes.

4.2. Conclusion

Men's diversion of resources from the family is a salient driver of marital conflict and wife abuse using Tsimane husbands' and wives' reports of their own marriages. While we find strong support for both male jealousy and paternal disinvestment hypotheses, it is men's infidelity, not women's, that precipitates most instances of marital conflict and wife abuse. Men's aggression towards their wives therefore facilitates diversion of family resources for men's selfish interests. An evolutionary framework emphasizing consequences of infidelity by both partners helps integrate existing findings and offers novel research directions.

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