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Original Article

Functional Disability and Social Conflict Increase Risk of Depression in Older Adulthood Among Bolivian Forager-Farmers

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Abstract

Objectives. To present an explanatory framework for depression in older adulthood in a small-scale society. We propose that depression is a consequence of functional disability, which can reduce subsistence productivity and resource transfers within and across generations. Social conflict can also disrupt resource flows and should be associated with depression.

Method. To evaluate depression among Tsimane forager-farmers of Bolivia, we developed a reliable interview based on focus groups and a review of validated depression scales. Older adults (mean ± *SD* age = 62±9, *n* = 325) were recruited regardless of their health status. Demographic, economic, and medical data were collected during annual censuses and routine medical exams.

Results. Depression is associated with reduced energetic status, greater physical limitations, and reduced subsistence involvement after controlling for potential confounds such as age, sex, number of reported unresolved conflicts, and market involvement. Depression is also associated with greater reported conflict, particularly with non-kin.

Discussion. Tsimane depression is associated with disability, reduced subsistence productivity, and interpersonal conflict, all of which can disrupt resource flows. Depression appears to be a response to conditions regularly experienced over human history, and not simply a by-product of modernity.

Key Words: Conflict—Depression—Disability—Evolution—Tsimane—Well-being

Depression is an evolutionary conundrum given its prevalence and high cost. Depression increases risk of morbidity in diverse populations (Diener & Chan, 2011) and is a leading cause of foregone productivity due to disability worldwide (WHO, 2009). Reduced productivity can also induce depression (Paul & Moser, 2009), indicating

bidirectional associations between psychological well-being and resource access across various socioecologies and contexts. Psychological well-being may enhance motivation, productivity, and resilience to adverse events (Cohn, Fredrickson, Brown, Mikels, & Conway, 2009; Oswald, Proto, & Sgroi, 2009), and understanding factors affecting variability in psychological well-being are of clinical and practical importance. We conceptualize psychological well-being as a continuum from happiness to sadness, which are cross-culturally recognized emotions (Nesse, 1990).

This article presents an explanatory framework for depression in older adulthood in a small-scale subsistence society, where functional ability influences economic productivity and the extent of food and other transfers to kin and non-kin. We focus on depression given its large contribution to the global burden of disease and overrepresentation in psychological well-being research. Although clinical depression in the United States has formal criteria defined by the Diagnostic and Statistical Manual of Mental Disorders, we use the term "depression" to refer to the cluster of symptoms often associated with depression (e.g., sadness and loss of interest). Depression is defined here as persistent sadness that interferes with routine daily functioning. We acknowledge that depressive symptomology may be highly variable across cultures, individuals, and within individuals over time and that certain symptoms may have a higher sensitivity and specificity for identifying depression (due, e.g., to symptoms such as fatigue frequently co-occurring with other morbidities; Patel, 2001).

Most depression research is conducted in developed nations, and we know little about the prevalence or onset of depression in small-scale societies. Does depression exist, and if so, why? Tsimane forager-farmers of Bolivia are energy limited, lack significant material wealth, and experience high pathogen burden coupled with little access to health care. Tsimane are also physically active, relatively egalitarian, frequently pool resources, and experience minimal social isolation in kin-based villages. High rates of depression in developed nations may be due to pathological features of modern environments, such as rampant inequality, intense social competition in heterogeneous groups, and erosion of family ties (Nesse, 2000). If depression is not a maladaptive by-product of modern environments, but instead a response to conditions regularly experienced over human history, then it should be readily observable in small-scale societies like the Tsimane.

Our central thesis is that flows of resources and assistance are critical in every phase of the human life course and that depression is a consequence of reduced resource flows. A universal feature of human life histories in small-scale societies is downward intergenerational resource flows (Kaplan, 1994; Kaplan, Gurven, Winking, Hooper, & Stieglitz, 2010; Kaplan, Hill, Lancaster, & Hurtado, 2000; also see Lee, 2000, for data on the cross-cultural universality of downward flows within families). Children are net receivers of resources and assistance, whereas parents and grandparents are net givers during reproductive and postreproductive

years. Resource flows from other kin and non-kin can also be important determinants of reproduction, health, and mortality (e.g., Hawkes, 2003; Hill, Barton, & Hurtado, 2009; Hill & Hurtado, 2009; Hrdy, 2009; Jaeggi & Gurven, 2013). We propose that a reduction in resource flows from expectations increases risk of depression. Resource flows can be disrupted for various reasons; one principal source of disruptions is the inability to provide support due to disability, illness, or some other permanent or temporary shock. Another source of resource flow disruptions is interpersonal conflict.

We hypothesize that depression in older adulthood is a consequence of reduced ability to produce and transfer resources that have fitness value for self and kin ("the productive value hypothesis"). Food obtained from subsistence activities is necessary for growth, reproduction, and survival, and food production and transfer to descendants is a fundamental determinant of fitness in small-scale societies. Subsistence productivity is influenced by a vector of individual-level variables that affect strength and skill levels including age, energetic status, health status, and degree of physical limitations. In the absence of food storage or bank accounts, successful subsistence production relies heavily on cooperation and coordination with other group members to buffer risks of food shortfalls. Social conflict has the potential to disrupt risk management strategies and therefore should also be associated with depression.

Gaining recognition as a high producer and as generous may be a psychological goal in many cultures, given fitness benefits of high social status and mate value. In developed nations, providing support appears to increase well-being regardless of whether aid is reciprocated, which is consistent with the gaining-recognition hypothesis. For example, among older married Americans, self-reported support provided to others (kin and non-kin) in the form of assistance with daily tasks and emotional support reduces risk of mortality prospectively, even after controlling for support received (which does not consistently affect mortality risk) and other confounders (Brown, Nesse, Vinokur, & Smith, 2003). Similarly, adults with greater self-perceptions of "generativity" (concern for the well-being of others) engage more frequently in socializing and providing support and are also less likely to experience functional disability prospectively (Gruenewald, Liao, & Seeman, 2012). In contrast, "feeling burdensome" to others providing support is associated with depression among younger and older adults (Brown, Dahlen, Mills, Rick, & Biblarz, 1999; Liang, Krause, & Bennett, 2001).

In this article, we test predictions derived from the productive value hypothesis among older Tsimane adults. We test whether depression is associated with the following indicators of declining functional ability and productivity, which may covary with each other and independently predict depression: older age, reduced energetic status, greater physical limitations, and reduced involvement in subsistence activities. We also test whether depression is associated with greater reported social conflict. Unresolved conflict can threaten bidirectional flows of food and aid, which are

necessary to buffer risks associated with a variable food supply and morbidity that inhibits work. Whether conflict is associated with depression may depend on degree of kinship between conflicting parties and the extent to which production and transfers are disrupted. Kinship helps structure the direction and magnitude of transfers, and unresolved conflict with kin should entail greater fitness costs than conflict with non-kin (all else equal). Elsewhere (Gurven, Stieglitz, Hooper, Gomes, & Kaplan, 2012), we have shown that prevalence of recent unresolved conflict among Tsimane adults is low (17%); many conflicts are resolved quickly and by the involved parties themselves in the absence of legal institutions and formal hierarchies. Most unresolved conflicts are with distant kin or non-kin and may be associated with systemic social barriers to improving resource access (e.g., discrimination and exploitation in the market economy).

We control for potential confounding effects of market involvement on depression. Tsimane market involvement may include itinerant wage labor, sale of subsistence goods, and town visits and is indicated here by Spanish fluency and village distance to the closest market town of San Borja. Although market involvement entails greater access, on average, to goods, health care, and schooling, shortcomings of the "more is better" approach to well-being regarding market wealth are well documented (Easterlin, 2003; Snodgrass, 2013). Material aspirations may actually increase with wealth, education, or exposure to wealthier reference groups, inevitably leading to increases in perceived shortfalls between goals and accomplishments. Among Tsimane, non-market goals may be equally or more important to psychological well-being than market goals and include maintaining good health, high subsistence productivity, and strong sharing networks.

Method

Study Population

Tsimane inhabit 90+ villages that vary in proximity to the market town of San Borja. A recent census conducted as part of the Tsimane Health and Life History Project (THLHP) estimates roughly 13,000 Tsimane. The majority of the diet comes from fishing, hunting, and horticulture. The remainder comes from market items obtained through trade with itinerant merchants or bought with cash earned from either men's sporadic wage labor or sale of cultigens, wood, or thatched roof panels. Tsimane maintain their indigenous language (unrelated to Spanish) as a first language. Many villages now have schools run by bilingual Spanish-Tsimane teachers. Spanish is taught in school, but only 8% of adults in the present sample report a high degree of fluency.

Tsimane recognize a mood state that approximates depression (*yoquedye'*), and often attribute its onset to "thinking too much" about debilitating illness (self or kin) or death of a loved one (unexpected or not). Suicide associated with persistent sadness has been documented. No participant has ever taken prescription medication to treat depression.

Depression Interview

To evaluate depression, we developed an interview based on focus groups, 10+ years of ethnographic experience, and a review of validated depression scales used among diverse samples with good test–retest reliability (Beck's Depression Inventory, Hamilton Depression Rating Scale, Center for Epidemiologic Studies Depression Scale). The 18-item interview contains most or all of the symptoms contained in previous scales. The interview was translated into Spanish and then Tsimane by two bilingual Tsimane research assistants and the authors. To test translation accuracy, the Tsimane interview was back-translated into Spanish by a different Tsimane researcher, and discussions among the three Tsimane and the authors ensued until an effective translation was found that captured the essence of each item. All 18 items were mutually intelligible to Tsimane researchers when presented in either language. To minimize recall problems, participants were queried about prevalence of symptoms (e.g., changes in sleep and appetite, fatigue, and lack of concentration) over the past month. Responses were given on an anchored scale where 1 corresponds to "rarely," 2 to "occasionally," 3 to "often," and 4 to "always" (see Supplementary Figure S1 for mean item scores by sex). Items were summed to create a "depression score."

Although many respondents were previously unfamiliar with Likert-type scales, few were new to formal interviews because of their continuous participation in the THLHP since 2002. Our long-term presence has helped establish trusting and collaborative relationships among participants. Respondents were given a tutorial on using the scale, after which all individuals showed clear evidence of understanding the scale and the interview. Interviews were administered in a private location in the Tsimane language by Tsimane researchers with multiple years of relevant experience as part of the THLHP.

After the interview, the interviewer used the same 4-point scale to rate a subset of respondents based on his observations of the extent to which the respondent was laughing and smiling (jovial) while participating in other THLHP interviews (~45 min in total). This was done to help assess external validity of the interview, as joviality can reflect mood and interest. Depression scores were significantly correlated with joviality in the expected negative direction (Spearman's ρ = –0.42, p = .003, n = 48).

Adults aged 50+ were recruited regardless of their health status, as part of our larger aging study (n = 325 adults in 57 villages). An initial round of data was collected in 10 villages in 2006–2007 as part of Schniter's dissertation research (Schniter, 2009). A second round of data was collected in 2011–2012, following establishment of the THLHP's San Borja health clinic. Adults were transported from their villages to the clinic to participate in this and other studies. The two rounds of data were analyzed separately to ensure similar item and depression score distributions, sufficient reliability (see Data Analysis),

and consistent effects of age, sex, and other covariates on depression score. Once this was confirmed, we merged the two rounds of data and analyzed the merged sample, on which we report.

Mean ± *SD* age in the sample is 62 ± 9 (range = 50–85); 46% of the sample is between ages 50 and 59, 32% between ages 60 and 69, and 22% age 70+.

Demographics and Anthropometrics

Age, community membership, and Spanish fluency were assessed during demographic interviews and annual THLHP census updates. Retrospective reproductive histories were elicited among all adults, and birth years were assigned based on a combination of methods described elsewhere (Gurven, Kaplan, & Zelada Supa, 2007). These include using known ages from written accounts, relative age lists, dated events, photo comparisons of people with known ages, and cross-validation of information from independent interviews of kin. Each method provides a roughly independent estimate of age, and when estimates yielded a date of birth within a 3-year range, the average was generally used (unless some estimates were judged to be better than others). Individuals for whom reliable ages could not be ascertained are not included in analyses.

Height and weight were measured during routine medical exams using a Seca stadiometer (Road Rod 214) and Tanita scale (BF680). Body mass index (BMI) is used to indicate energetic status.

Functional Ability, Subsistence Involvement, and Social Conflict

As part of the THLHP's monitoring of functional ability in older adulthood, participants aged 50+ performed a modified battery of mild exercises originally used in the MacArthur Studies of Successful Aging (Berkman et al., 1993). We coded whether participants experienced any difficulty (yes = 1, no = 0) standing from a chair without using their arms, standing repeatedly, and balancing in the tandem position, and on each leg, without using their arms or body. We also measured time taken (in seconds) to walk 3 m, pivot, and return as quickly as possible. Eleven measures were summed to create a "disability score" (mean ± *SD* = 11.2 ± 2.9, range = 5.5–21.0).

To assess involvement in subsistence activities, we asked participants if they continued engaging in routine tasks (yes = 1, no = 0) and then summed the items to create a "subsistence involvement score." For men, this included four tasks: hunting, chopping big trees, walking all day, and lifting heavy loads (mean ± *SD* = 2.1 ± 1.4, range = 0–4), and for women, three tasks: weaving bags, weaving mats, and walking all day (mean ± *SD* = 2.1 ± 0.9, range = 0–3).

To assess social conflict, as part of the depression, interview participants were first asked, "What problems bother you most in your life right now?" After recording open-ended responses, we asked participants whether they are currently bothered by any conflict (*carijis, chutidye'*) with (a) a spouse (yes = 1, no = 0), (b) an adult child, (c) other kin, or (d) non-kin. Gossip can be an important source of conflict as it can damage reputation, and we asked participants whether they are also currently bothered by gossip spread by kin or non-kin. Another manifestation of social conflict is sorcery (*farajtacdye'*), as many Tsimane believe that unseen powers can punish humans following social transgressions (e.g., stinginess). Several illnesses are attributed to sorcery, which is feared by younger and older generations. We, therefore, also asked participants whether they are currently bothered by sorcery originating from either kin or non-kin. The six binary items were summed to create a "social conflict score" (mean ± *SD* = 2.2 ± 1.0, mode = 2, range = 0–6). Tsimane have no taboos against speaking about interpersonal conflicts, most participants were familiar with the Tsimane researchers collecting the data, and confidentiality was maintained at all times.

Data Analysis

Ordinary least squares (OLS) regression is used to model the associations of functional ability, productivity, and conflict on depression. Two items from the original 18-item depression interview (irritability and indecision) were omitted from analyses because neither was significantly correlated with any other item and because mean item scores were low (<2) for both sexes. Internal consistency of the 16-item depression interview slightly surpassed the standard benchmark of 0.7 (Cronbach's α = .71). Unless otherwise noted, depression score is reported as the percentage of the maximum possible score (summed 16 items/64 × 100). Missing values were omitted from analyses. Adults that did not participate in the exercise battery are, on average, older than adults that participated in the exercise battery (66.8 vs. 61.8, *t* = −4.755, *p* < .001). However, non-participants did not significantly differ from participants in terms of sex, BMI, Spanish fluency, residential proximity to town, or depression score. Analyses were performed with PASW Statistics 18.

Results

Descriptives

Depression scores are normally distributed for each sex. Sample means by depression score tercile for men and women are provided in Table 1. For both sexes, higher depression scores are associated with lower BMI, higher disability score, lower subsistence involvement score, higher social conflict score, greater Spanish fluency, and greater residential proximity to town.

Table 1. Sample Means by Depression Score Tercile

	Men (*n* = 170)			Women (*n* = 155)		
	Depression score tercile			Depression score tercile		
	Low	Medium	High	Low	Medium	High
Age (years)	61.9	63.9	61.9	59.3	61.6	61.4
Height (cm)	162.7	161.2	161.7	149.5	150.3	151.1
Weight (kg)	63.9	59.9	61.8	53.8	54.2	54.6
BMI (kg/m²)	24.1	23.0	23.5	24.1	23.9	23.9
Disability score	10.1	10.3	11.9	10.7	11.1	13.1
Subsistence involvement score	2.3	2.0	1.9	2.3	2.1	2.1
Social conflict score	2.1	2.1	2.5	2.1	2.1	2.3
Spanish fluency (%)						
None	8.5	14.3	8.3	51.0	49.0	43.6
Moderate	80.9	79.4	76.7	42.9	49.0	47.3
Fluent	10.6	6.3	15.0	6.1	2.0	9.1
Distance to town (km)	37.2	34.9	31.6	38.3	37.2	29.6

Note. BMI = body mass index.

Does Depression Vary by Age and Sex?

Age is not associated with depression score for either sex in a linear or non-linear fashion. Higher depression scores are more common among women (Supplementary Figure S2), and women score 8% higher than men (mean ± *SD* for women and men = 63.7 ± 10.2 and 58.9 ± 9.7, respectively, no controls). Mean item score for women exceeds that of men for 14/16 items (Supplementary Figure S1) and 8/16 items at *p* ≤ .05.

Is Depression Associated With Reduced Energetic Status, Greater Physical Limitations, and Reduced Subsistence Involvement?

Table 2 presents coefficients from four OLS regression models, including a reduced model (A) with age and sex as predictors of depression. BMI (standardized β = −0.113, *p* = .028), disability score (standardized β = 0.364, *p* < .001), and subsistence involvement score (standardized β = −0.118, *p* = .031) are each associated with depression score in the predicted direction (Table 2: Model B).

Is Depression Associated With Greater Reported Unresolved Conflict?

Selected descriptives on reported social conflicts are provided in Supplementary Table S1. As predicted, social conflict score is positively associated with depression score (standardized β = 0.110, *p* = .032) (Table 2: Model C). Compared with adults reporting no conflict, adults reporting conflict with either non-kin, non-nuclear kin, or with an adult child scored higher on depression, although only reports of conflict with non-kin (including both Tsimane and non-Tsimane Bolivians) are significantly associated

with depression score (5% increase, Figure 1). Reported conflict over gossip or sorcery is not associated with depression score.

Controlling for Market Involvement

In the full model (Table 2: Model D), effects of sex, BMI, disability score, subsistence involvement score, and social conflict score all remain significant. Depression score is associated with both indicators of market involvement although main effects of Spanish fluency (unstandardized β for fluent vs. none = 3.822, *p* = .073) and distance to town (standardized β = −0.072, *p* = .168) are not significant.

Discussion

Tsimane depression in older adulthood is associated with indicators of declining functional ability and productivity, including reduced energetic status, greater physical limitations, and reduced subsistence involvement. Similarly, Iraqw and Datoga women of rural Tanzania report hunger and morbidity as major life stressors (Pike & Patil, 2006). Depression appears to reliably covary with functional disability across diverse societies (Stieglitz et al., in press), yet this association can be especially tight in energy-limited subsistence societies, where direct effects of physical condition on economic production may be stronger relative to sedentary modern societies. Managing disability-related production shortfalls with modern technology (e.g., glasses and hearing aids) or by liquidating savings accounts are not options in small-scale societies. In modern societies, unemployment (analogous to reduced subsistence productivity in small-scale societies) is a major cause of depression (Paul & Moser, 2009). Yet even in modern societies with subsidized health insurance, sick leave from work, and unemployment

Table 2. OLS Regression Coefficients for Predictors of Depression Score[a] ($n = 325$)

Predictor	Model A		Model B		Model C		Model D		
	Unstandardized B	SE	Unstandardized B	SE	Unstandardized B	SE	Unstandardized B	SE	Standardized β
Intercept	57.230***	4.019	61.640***	6.305	57.518***	6.555	67.588***	6.952	—
Age (years)	0.026	0.063	−0.082	0.063	−0.057	0.064	−0.058	0.064	−0.050
Sex = male	−4.866***	1.111	−3.799***	1.042	−3.963***	1.039	−4.450***	1.146	−0.436
BMI (kg/m²)			−0.390*	0.177	−0.362*	0.176	−0.400*	0.176	−0.116
Disability score[b]			1.263***	0.178	1.210***	0.179	1.139***	0.182	0.328
Subsistence involvement score[c]			−1.028*	0.473	−1.066*	0.471	−1.126*	0.469	−0.129
Social conflict score[d]					1.129*	0.524	1.288*	0.525	0.126
Spanish fluency (fluent vs. none)							3.822	2.128	0.374
Distance to town (km)							−0.035	0.025	−0.072
Adjusted R^2	0.050		0.188		0.197		0.205		

*Notes.* BMI = body mass index; OLS = ordinary least squares.

[a]Raw depression score (summed 16 items) was converted to % maximum possible score (summed items/64×100). Unstandardized betas represent change in % maximum possible depression score.

[b]Higher score indicates greater degree of physical limitations.

[c]Higher score indicates greater involvement in daily subsistence tasks.

[d]Higher score indicates greater reported unresolved conflict.

* $p < .05$. ** $p < .01$. *** $p < .001$.
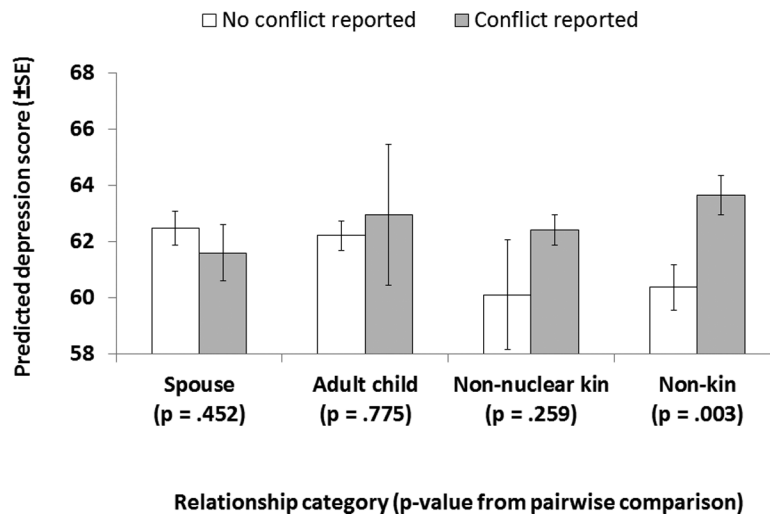
Figure 1. Predicted depression score (% maximum) by whether unresolved conflict is reported (controlling for age, sex, body mass index, disability score, and subsistence involvement score, *n* = 325).

benefits, functional disability from illness, injury, or senescence commonly reduces quality of life (Covinsky et al., 2010; Ormel et al., 1994). Aside from lowering productivity, functional disability can reduce transfers to kin, social status, and mate value, each of which may induce depression in older adulthood.

Tsimane depression in older adulthood is also associated with greater interpersonal conflict, particularly with non-kin (Figure 1). Although unresolved conflict with both kin and non-kin may involve imbalances in exchanges of food, labor, or money, costs of prolonged kin conflict may be greater due to shared fitness interests and kin-based residence (all else equal). Relationships with kin may be more resilient to conflict, more likely to result in conflict resolution, and perhaps less likely to induce depression. In contrast, conflict with non-kin, particularly non-Tsimane, may involve exploitative market transactions (e.g., debt peonage), may reflect systemic barriers to improving access to critical resources, and may be more likely to induce chronic psychosocial stress and depression.

Darwin hypothesized that emotion and mood evolved by natural selection to motivate responses to recurring adaptive problems (Darwin, 1872). Positive valence motivates continuation of prior behaviors associated with its occurrence, whereas negative valence motivates disengagement and pursuit of alternative strategies (Nesse, 2000; Seligman, 1975). The productive value hypothesis developed here posits that depression is a consequence of reduced ability to produce and transfer resources that are valuable to self and/or kin. The common finding across cultures that support given to others and "feeling needed" are associated with greater mental and physical well-being (Brown et al., 2003; Gierveld and Dykstra, 2008; Gruenewald et al., 2012) is consistent with a human life-history perspective emphasizing the importance of downward intergenerational resource flows in older adulthood. Suicide, an

extreme manifestation of depression, may be more likely to occur among individuals who are a net burden on kin (de Catanzaro, 1984, 1991). Depression and suicide may therefore mitigate inclusive fitness losses among individuals who extract more resources than they provide (Brown et al., 1999). This "avoiding obsolescence" hypothesis of depression is consistent with the logic of our more general model linking resource production, kin transfers, and psychological well-being. Whether depression helps individuals devise novel strategies for increasing one's industriousness or utility in other domains during periods of declining caloric productivity, thereby reducing the net burden on kin, should be explored further.

Several evolutionary models posit that depression functions primarily to elicit social support, which suggests increased psychological well-being following support received. For example, depression is hypothesized to solicit greater investment from a social partner by imposing costs on that partner (the "labor strike" hypothesis) (Hagen, 2003), avoid exclusion from vital social relationships (Allen & Badcock, 2003), and improve one's ability to solve social or other problems through rumination (Andrews & Thomson, 2009; Watson & Andrews, 2002). Yet the hypothesis that receiving support improves either mental or physical well-being has not been supported empirically (Brown et al., 2003; Liang et al., 2001; Seeman, Bruce, & McAvay, 1996). In light of the findings presented here, the links between supports given and received, the degree and resolution of interpersonal conflicts, and psychological well-being merit further consideration. Whether depression "serves" to elicit support or is simply an outcome of not receiving it remains unclear.

Adult Tsimane women score higher on depression than men (Supplementary Figures S1 and S2), which is consistent with previous findings from industrialized societies (Van de Velde, Bracke, & Levecque, 2010). However, unlike many

industrialized societies, Tsimane lack formal patriarchal institutions (e.g., political, economic) that have been linked to limited autonomy, upward mobility, and chronic psychosocial stress among women. Yet Tsimane women experience uniquely high direct energetic costs of reproduction compared to men (total fertility rate = 9). These cumulative costs likely affect the rate of decline in functional ability, as women in our sample scored significantly higher on disability than age-matched men (not shown). Whether sex differences in rates of functional decline help explain differences in psychological well-being in adulthood should be explored further.

This study has limitations. The design is cross-sectional, which limits our ability to establish that declining functional ability and productivity cause depression. Prospective studies of depression and its remission are necessary to test unique predictions derived from alternative evolutionary hypotheses. However, the fact that age itself is exogenous and that functional ability and productivity are strongly age related provide suggestive evidence for a causal link between declining functional ability, productivity, and depression. Causality is likely bidirectional, if depression reduces functional ability and productivity (WHO, 2009). An additional study limitation is that we are unable to distinguish between shorter versus longer bouts of depression.

To conclude, situating prevalence of Tsimane depression in cross-cultural context is not straightforward given differences in methodology across studies and varying emphasis on clinical criteria. Normally distributed depression scores among Tsimane call into question the utility of clinical distinctions, which imply threshold effects and which vary in their biomedical significance. Nevertheless, 18% of Tsimane women and 7% of men regularly experience depressive symptoms (Supplementary Figure S2). These estimates are comparable to the combined 1-month prevalence of major depressive disorder, mood disorder, dysthymia, and anxiety disorder among Americans aged 18+ (Regier et al., 1988) even after conservatively adjusting for comorbidity. Depressive symptomology appears to be regularly experienced under conditions more similar to the ones in which our species evolved and is not simply a by-product of modernity.

Supplementary Material

Supplementary material can be found at: http://psychsocgerontology.oxfordjournals.org/

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