Agricultural Cycle and the Prevalence of Posttraumatic Stress Disorder: A Longitudinal Community Study in Postwar Mozambique

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The influence of physical activity on the prevalence and remission of war-related mental disturbances has never been systematically evaluated. This study examined the influence of participation in the agricultural cycle on the posttraumatic stress disorder (PTSD) prevalence and correlated symptoms longitudinally in postcivil war Mozambique. Prevalence rates were examined in the end and the outset of the agricultural cycle in a community population (N = 240). The agricultural cycle, which is characterized by fluctuations in physical activities, social connectedness, and the sense of purpose in life influences the PTSD prevalence and correlated symptoms. By studying the influence of the agricultural cycle on PTSD prevalence, severe PTSD cases that fail to respond to the agricultural cycle can be identified, and subsequently evaluated regarding the need for specialized care.

In the mainstream scientific databases (e.g., MEDLINE) we could find no studies on posttraumatic stress disorder (PTSD) that had examined the influence of participation in agricultural activities on the prevalence and remission of PTSD over time. Community-based longitudinal studies on the prevalence of PTSD in non-Western societies are rare. The available longitudinal studies have focused mainly on war veterans (Solomon, Zur-Noah, Horesh, Zerach, & Keinan, 2008). Studies on the prevalence of war-related PTSD among civilians have taken a cross-sectional approach (de Jong et al., 2001). The risk factors related to prevalence of PTSD over time have also been analyzed. Some studies demonstrate that war violence not only precipitates PTSD conditions, but it can also hinder recovery efforts (de Jong et al., 2001). Other studies have indicated that dissociative experiences (Shalev, Peri, Caneti, & Schreiber, 1996; van der Hart, Nijenhuis, & Steele, 2005) and lack of social support (Schnurr, Lunney, & Sengupta, 2004) after traumatic experiences are significant predictors of the development and maintenance of chronic PTSD.

A shortcoming of studies on this topic was their limited geographic scope.

Most studies on treatment of PTSD have also been confined to Western victims of trauma (Sherman, 1998). Only a few studies have dealt with other population groups: refugees who live in centers in Western countries (Nicholl & Thompson, 2004) or refugees who have settled in camps in the developing world (Eisenbruch, de Jong, & van de Put, 2004), and victims who live in war-torn communities (Igreja, Kleijn, Schreuder, van Dijk & Vershuur, 2004). The commonality of treatment studies is their use of only cognitive–behavior therapy (Sherman, 1998). The influence of physical activity on the prevalence and remission of PTSD symptoms has not been systematically evaluated either for Western or non-Western war victims. Our study fills this gap in the literature by focusing on the influence of structured physical activities on the mental health of war survivors in Gorongosa, a rural district in central Mozambique. This district was the epicenter of the Mozambican civil war (1976–1992). Many people survived the war within the war zones. Following the war's end, survivors engaged in agricultural activities.

Previous studies on the effects of the civil war in Gorongosa (Igreja et al., 2004) identified the centrality of the agricultural cycle in people's daily lives and its likely impact on war-related mental disturbances. The annual agricultural cycle has the following characteristics: participation is voluntary, but there is also the inevitable need to participate to grow a subsistence level of staples; there is a difference in the amount of energy expended between the end (lower amount) and outset (higher amount) of the cycle; in some phases of the cycle there is a certain routine, which provides a daily structure to individuals' lives; and individual activities require a collective coordination, which increases social cohesion between people.

The theoretical conception of this study was shaped by (a) studies conducted principally in laboratories that examined the utility of physical training to deal with depression, anxiety, and sleeping disorders (Dunn, Trivedi, Kampert, Clark, & Chambliss, 2005; Lawlor & Hopker, 2001; Strohle et al., 2005); (b) indications that physical activities can generate positive therapeutic effects on chronic pain sufferers (Good, 1992) and on PTSD sufferers by enhancing their sense of control over their bodily sensations (van der Kolk, van der Hart, & Marmar, 1996); and (c) the suggestion that the effectiveness of bodily oriented therapies always involve a combination of mental and social elements (Bartenieff & Lewis, 1980).

In this study, we investigated the impact of the activities of the agricultural cycle (and related seasonal fluctuations in social connectedness and sense of purpose in life) on the prevalence of severe PTSD symptoms, which served as an indicator of war-related mental disturbances in war-torn Mozambique. Secondary indicators included general psychiatric symptoms and nightmares. Compared to the studies reviewed above, in this investigation cooperative social interactions intrinsic to the agricultural cycle took place not in a laboratory, but in the natural environment.

In our longitudinal approach, we sought to determine whether changes in agricultural cycle activities generate measurable changes in the prevalence of war-related psychological problems. Specifically, the research sought to determine (a) the prevalence of war-related traumatic experiences; (b) the extent to which individuals experienced general psychiatric symptoms, PTSD, and nightmares; and (c) the categories of individual factors that predict the impact of the agricultural cycle on the prevalence of PTSD symptoms (that is, those whose PTSD symptoms responded to the different phases of the agricultural cycle, and those whose symptoms did not). Three categories of individual risk factors were examined as part of the study. The first involved wartime experiences, such as the death of a relative due to famine, having been forced to live naked most of the time during the war, and having experienced the threat of torture. The second risk dimension involved one's level of social support. Specifically, we measured whether a respondent was a churchgoer, had a mother who was living, had family members who could provide support, and we gathered self-rated perceptions of the quality of support the individual receives from family and friends. The third and final risk factor was the presence of dissociative experiences, such as spirit possession (Swartz, 2002).

In this study, we expected to find trauma rates comparable to other investigations that have focused on the civilian victims of war. Based on earlier analyses of the multiple features of the agricultural cycle in Gorongosa, and coupled with the literature that shows the correlates of PTSD respond to physical exercise, we formulated the following hypothesis: troubling symptoms will be least severe when individuals are fully engaged in the cycle and most severe during phases of inactivity. Moreover, because women work harder than men in Gorogongosa, we expected a differential gender response in relation to the phases of the agricultural cycle. It was also believed that social support variables would have a positive impact on mental health by reducing PTSD symptoms over the course of the agricultural cycle, whereas the severity of wartime and dissociative experiences were expected to hinder recovery.

METHOD

Participants and Study Design

To acquire research consent from the people in Gorongosa, the general goals of the study were collectively presented to the Mozambican authorities and the people of the region. All participants voluntarily enrolled in the research; for reasons of illiteracy, informed consent was verbally administered. Participants were interviewed in their homes or in their fields. The inclusion criteria were to be a survivor of the civil war and be a participant in the activities of the agricultural cycle. The study included all inhabitants of the community that met our inclusion criteria. The type

of physical activities did not allow for the creation of a control group because for survival reasons virtually everyone in this region had to work in the fields.

Our sample was composed of 240 adults (92 men, 148 women) who ranged in age from 20 to 60 years. Their main demographic characteristics were the following: 78.7% were married and 17.2% were widows. The types of families were divided between monogamous (47.1%) and polygamous (33.3%). As to religious affiliations, 59.2% belonged to a Christian church and 40.8% were non-Christian. Each participant indicated that he or she personally participated in agricultural activities carried out in the region. The respondents had overwhelmingly (75.8%) at least one field. Gender differences were minimal. The agricultural cycle in Gorongosa is composed of four major phases: outset: September–November; intermediary phase: December–February; first harvest: March–May; and end of the cycle: June–August. Each phase is designed to contribute to the production of staple food and it involves different degrees of structured physical effort and social interactions. Although the cycle is composed of four stages, the assessment of the prevalence of PTSD was made three times and in two key phases of the cycle: at the end and at the beginning. These phases were chosen because they either involve periods of inactivity or structured and intense activities. The end of the cycle, between June and August each year, is the winter season in Mozambique. No structured agricultural activities take place during this period. The outset of the new cycle begins in September. It involves extensive manual agricultural activities such as cleaning or opening new fields with hoes and burning the grass. According to rainfall patterns, farmers also start planting during this time. The farmers are collectively mobilized to carry out these agricultural activities, which demand a considerable expenditure of energy. The outset period is also featured by definition of goals to be accomplished in terms of food production over the course of the cycle. The expectations in terms of future food availability depend greatly on the level of engagement and level of commitment demonstrated during this phase. Without high levels of engagement during this phase, future food-production yields can be seriously compromised. This outset of the cycle continues until the first harvest in March.

The study design was carried out as follows. The first (baseline) period of measurement (what we hereafter refer to as Cycle 1) took place during the first 3 weeks of July 2003, some weeks following the end of the previous year's agricultural cycle. The second occasion of measurement (Cycle 2) took place during the first 3 weeks of October 2003, which was well into the "new" agricultural cycle. The third measurement took place during the slack time between seasons (in July 2004), which was well after the end of the May harvest.

Measures

Traumatic experiences were measured only during baseline data collection using an adapted version of the Harvard Trauma Questionnaire (HTQ), which originally consisted of 17 named events (Mollica et al., 1996). We added 10 additional wartime traumatic event items to this questionnaire, which had initially been elicited through interviews. Posttraumatic stress disorder levels were measured using the Self Inventory for PTSD (SIFP; Hovens, Bramsen, & van der Ploeg, 2001). The SIFP measures symptoms according to criteria used in the *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition* classification for PTSD (*DSM-IV*; APA, 1994). Items are answered using a Likert scale format. Reliability data have been published only for Western populations, with Cronbach's alpha values ranging from .92 (full scale), to .83, .86, and .79 for the intrusion, avoidance, and hyperarousal subscales, respectively. Comparable alpha coefficients from our study were reasonable at .87 for the full scale, and .92, .63, and .82 for the three subscales.

A cluster on nocturnal intrusions was assessed by administering the questionnaire on Nocturnal Intrusions after Traumatic Experiences (NITE; Schreuder, Kleijn, & Rooijmans, 2000). The NITE is a (partly) structured questionnaire that contains 19 items designed to assess anxiety dreams individuals experienced and posttraumatic nightmares with physical reactions. The minimum score on this measure in the present study was 0 and the maximum score was 14. In a previous study carried out in the same region of Mozambique, a Cronbach's alpha value of .73 was reported for the NITE (Igreja et al., 2004). In that study, reliability coefficients (Guttman Lambda-6) were calculated for the NITE on three separate measurement occasions and were not found to be unreasonable (i.e., .64, .72, and .71).

General psychiatric symptoms were measured using the Self-Report Questionnaire (SRQ; Kortmann & ten Horn, 1988). The SRQ is comprised of neurotic (20 items) and psychotic (4 items) subscales. Because the SRQ was used as a continuous scale in this study (and not as a category-based screening instrument), Cronbach's alpha coefficients were calculated as measures of reliability. The alpha value was satisfactory at .79 for the neurotic subscale (SRQ-20), but rather low for the psychotic subscale at .54. Because the psychometric properties of this latter subscale were inadequate, this measure was not used in the present study. In contrast to the other scales, the SRQ was only administered at Cycle 1 and Cycle 2 because resources were unavailable. Therefore, the pattern of effects for this scale was only examined for the first two times of measurement.

All the scales used in this study had been previously adapted to fit the cultural reality of the Gorongosa population (Igreja et al., 2004). Both the PTSD and NITE were used to make assessments on three occasions. For reasons of illiteracy, all the scales were administered as structured interviews.

Data Analysis

The first step in analysis involved examining the three main sets of predictors (wartime experiences, social characteristics/social

support, psychiatric symptoms, and dissociative experiences) in relation to PTSD scores at different points in the agricultural cycle (primarily using omnibus F tests). Certain variables from these factors were subsequently selected to build a more finely tuned model designed to predict the impact of agricultural cycle on PTSD. Each of the variables shown to be a risk factor (in univariate analyses) were then selected for inclusion in a binary logistic multiple regression analysis designed to predict the likelihood of response to the agricultural cycle.

RESULTS

Traumatic Experiences Related to the Civil War

The results of reported war-related traumatic experiences indicate that the degree of war exposure was very high. More than 70% of the participants reported being exposed to at least 11 major traumatic events. These included traumatic events of the original HTQ items and the added events: lack of food/water, combat situation, close to death, no shelter, lack of medical care, forced separation, witness the murder of strangers, and being lost or kidnapped. The added traumatic events were forced to live naked most of the time, ambushed, forced to live inside holes in the ground, kidnapped family, threat of execution/torture, *gandira* (i.e., forced labor), and loss of goods. Rape is considered to be a common practice among those who live in war zones; however, only 5% of female respondents reported having been raped by soldiers.

Prevalence of General Psychiatric Symptoms, PTSD, and Nightmares

Table 1 presents prevalence rates for general psychiatric symptoms, posttraumatic stress disorder, and nightmares at different points in the agricultural cycle. The general psychiatric symptoms, as measured by the SRQ, were high at Cycle 1, and scores were lower at Cycle 2. The difference in means between these two clusters of general psychiatric symptoms scores was found to be statistically significant ($\eta^2 = .21$).

The prevalence and severity of mean PTSD scores were also found to differ according to the period of the agricultural cycle. In an omnibus F test, a significant quadratic function was identified with the lowest PTSD score found at Cycle 2. Follow-up comparisons based on paired t tests revealed that the mean PTSD scores at Cycle 2 were significantly smaller than scores at either the end of the previous year's season or later at the Cycle 3 occasion of measurement, $t(231) = 16.63$, $p < .001$, $d = 1.69$ and $t(228) = -18.33$, $p < .001$, $d = 1.84$, respectively). Additional analyses that examined gender in relation to PTSD scores failed to reveal significant effects.

Analysis of the measurements for the three PTSD clusters also indicated, without exception, significant similar quadratic yearly fluctuation in scores (intrusion, $\eta^2 = .49$; avoidance, $\eta^2 = .36$; and hyperarousal, $\eta^2 = .53$). For the measure of intrusion, paired t tests revealed mean differences similar to the pattern established for the full scale. That is, a significant mean difference was observed between Cycle 1 and Cycle 2 and a similar significant

Table 1. Mean Symptom Scale Scores at the Three Times of Measurement During the Agricultural Cycle

Symptoms	End of Cycle 1		Outset of Cycle 2		End of Cycle 3		F (df)
	M	SD	M	SD	M	SD	
SRQ[a] ($N = 228$)							F (1, 227)
GPS (total)	7.42$_a$	3.92	5.56$_b$	3.72	–	–	61.77***
SIFP[b] ($N = 228$)							F (2, 454)
PTSD (total)	48.52$_a$	12.61	36.15$_b$	7.86	47.44$_a$	11.33	226.49***
Intrusion	13.51$_a$	5.67	8.72$_b$	3.43	13.05$_a$	5.00	121.37***
Avoidance	18.25$_a$	4.54	16.03$_b$	3.71	19.29$_c$	4.05	65.37***
Hyperarousal	15.51$_a$	5.24	10.54$_b$	3.50	13.75$_c$	4.47	140.32***
Nightmare[c] ($n = 221$)							F (2, 442)
Impact scale	5.35$_a$	5.00	4.07$_b$	4.74	5.11$_a$	4.61	7.61***

Note. Mean scores across rows that share the same subscript are *not* significantly different from one another. GPS = general psychiatric symptoms; PTSD = posttraumatic stress disorder.
[a]The Self-Report Questionnaire (SRQ-20): Sum of symptoms (range 1–20). [b]The Self Inventory for PTSD (SIFP): Sum of symptoms (range 19–76); PTSD cutoff threshold scores $\geq$ 45. [c]The Nocturnal Intrusions after Traumatic Experiences (NITE) questionnaire: Impact scale (range: 1–14).
*** $p < .001$.

difference was seen between Cycle 2 and Cycle 3. A comparable pattern of effects was observed across separate sets of planned comparisons for the avoidance and hyperarousal measures, with mean scores being high at Cycle 1, dropping to their lowest point at Cycle 2, and then rebounding in a positive direction at Cycle 3. As seen by an examination of the subscripts in Table 1, all means were significantly different from one another for avoidance and hyperarousal across all three occasions of measurement.

An omnibus F test was also conducted to examine the likelihood of reexperiencing trauma through nightmares at different points in the agricultural cycle. This test also demonstrated a significant quadratic annual fluctuation ($\eta^2 = .06$). Mean scores on the nightmare impact scale failed to differ at points Cycle 1 and Cycle 3, but both of these means were significantly higher than the nightmare score at Cycle 2.

Comparison of PTSD Levels Between Agricultural Cycle Responders and Agricultural Cycle Nonresponders

Figure 1 displays the results of post hoc analyses that compare the distribution of PTSD cases among those who responded to the influence of the agricultural cycle and those who did not; hereafter referred to as responders and nonresponders. Each individual was classified as either a responder or nonresponder based on their posttraumatic stress symptom score on the SIFP at Cycle 2. Pre-
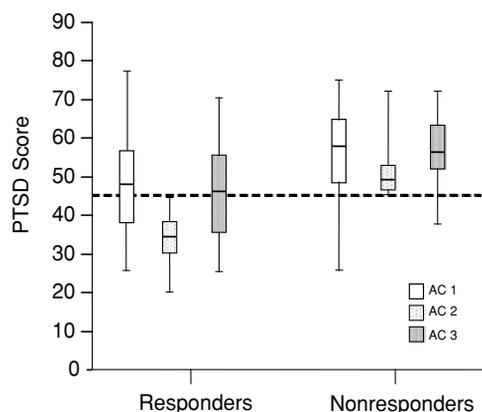

Figure 1. A box plot showing posttraumatic stress disorder (PTSD) scores for agricultural cycle responders ($n = 194$) and agricultural cycle nonresponders ($n = 34$) during the three measurement periods of the agricultural cycle. The line contained in each box depicts the median; the upper and lower edge of each box represents the first and third quartiles, respectively; and the whiskers represent minimum and maximum scores. The dashed line represents the PTSD cutoff score.

vious empirical studies have used a cutoff score of 45 on the SIFP as a PTSD threshold; this same value was used in the present investigation (cf., Igreja et al., 2004).

As seen in Figure 1, during the three measurement occasions, the majority of PTSD cases ($n = 194$) responded significantly to the influence of the agricultural cycle. Another group of cases ($n = 34$) did not respond to the influence of the agricultural cycle, as evidenced by scores that remained above the Time 2 PTSD cutoff threshold.

We used t tests to determine the extent to which differences existed in general psychiatric symptoms (GPS) between agricultural cycle responders and agricultural cycle nonresponders. Compared to responders ($M = 4.62$, $SD = 2.84$), nonresponders ($M = 10.88$, $SD = 3.74$) had a significantly higher prevalence of psychiatric symptoms, $t(226) = 11.28$, $p < .001$, $d = 1.49$. This demonstrates that nonresponders (14.9% of the sample) were more severely affected by GPS than responders. Subsequently, we analyzed the risk factors that differentiated responders from nonresponders.

Relative Risks for AC Responders and AC Nonresponders

A binary logistic regression analysis was conducted to examine the risk factors associated with agricultural cycle responders and agricultural cycle nonresponders. We defined three categories of variables in predicting responder/nonresponder status: social support levels, the experience of war-related traumatic events, and dissociative experiences (such as spirit possession). Eight separate covariates were used across these three dimensions (see Table 2). One additional covariate—participants' baseline SIFP score—was also included in the analysis as a control variable to take into account participants' initial symptom severity level.

A test of the full model with all nine predictors against a constant-only model was statistically significant, χ^2 (9) = 38.34, $p < .001$, which indicates that as a set, the nine variables reliably contributed to prediction of the criterion. The Nagelkerke R^2 value, a measure of strength of association for the model, was reasonably strong at .30. Table 2 shows that according to the Wald criterion, in the category of social support, only the loss of one's mother reliably predicted agricultural cycle responder status. The odds ratios (ORs) for the loss of one's mother increased the likelihood of being a nonresponder by roughly 60%. In the category of war-related traumatic events, only the death of a relative due to famine reliably predicted responder status. The OR for this indicator shows that death of a relative due to famine increases the likelihood of being a nonresponder by more than twofold. Dissociative experience reliably predicted responder status; the OR for this indicator revealed that spirit possession increased the likelihood of being a nonresponder 4.51 times. Finally, as anticipated, participants' baseline level of symptomatic severity predicted responder status.

Table 2. Binary Logistic Regression Predicting Risk Factors for Agricultural Cycle Responders and Nonresponders

Risk Factors	*B*	*SE B*	Wald Coefficient	Odds Ratio
Social support				
Churchgoing (not)	0.90	0.48	3.55	2.47
Mother alive (not)	−1.02	0.49	4.36*	0.36
Family support (low)	1.02	0.57	3.23	2.76
Quality of relations (poor)	−0.09	0.89	0.01	0.92
War-related traumatic events[a]				
Death of relative due to famine	0.89	0.30	8.59**	2.43
To live naked most of the time	−0.02	0.01	1.55	0.99
Threat of torture	−0.38	0.42	0.79	0.69
Dissociative experience				
Spirit possession	1.51	0.56	7.36**	4.51
Baseline PTSD Severity				
SIFP score at Time 1	−0.07	0.02	10.05**	0.94
Constant	0.46	1.93	0.57	—

Note. Nonresponders had a score of 0, responders had a score of 1. PTSD = Posttraumatic stress disorder; SIFP = Self Inventory for PTSD.
[a]The three war-related traumatic events included in this analysis were selected from the Harvard Trauma Questionnaire on the basis of observed bivariate relationships between the all items and responder status.
*$p < .0.$ **$p < .01.$

DISCUSSION

The prevalence of PTSD symptoms in our study was high. Prevalence rates varied, however, as a function of annual changes in the agricultural cycle. The principal goal of agricultural work is not to remit troubling mental health symptoms, but rather to guarantee self-sustainability through food production. Yet, some features of the agricultural cycle are comparable to structured physical exercise interventions designed to reduce conditions that correlate with PTSD (Goenjian et al., 2000).

Our findings are consistent with studies that have identified PTSD, general psychiatric symptoms, and nightmares to be prevalent in various non-Western postwar community samples (de Jong et al., 2001; Shrestha et al., 1998). The fluctuating course of PTSD over time is also consistent with studies that have applied longitudinal approaches (Solomon et al., 2008). Until now, however, no one has examined the extent to which fluctuations in PTSD prevalence rates are dependent upon the types of physical activities engaged in by war survivors. This study provides evidence that systematic fluctuations in PTSD exist in settings where survival depends on both individual and collective engagement in agricultural activities. The fact that prevalence rates are contingent on the timing of certain activities suggests that longitudinal methodologies may be more effective at diagnosing PTSD as compared to cross-sectional approaches. The two key periods of the agricultural cycle are largely shaped by annual environmental changes and the type of staples cultivated in the fields. These features of the cycle imply that the level of energy expended and levels of social connectivity fluctuate accordingly, and together, may play a role in influencing PTSD prevalence rates. The end of the agricultural cycle, marked by the absence of structured agricultural activities, revealed that participants had high prevalence rates for symptoms. This result corroborates the idea that inactivity and relaxation can trigger intrusive, hyperarousal, and anxiety symptoms in PTSD sufferers (Rotshchild, 2000). Moreover, although there is research to indicate that an association exists between PTSD and functional impairment (Zatzick et al., 1997), in the present investigation all respondents were found to be active participants in the agricultural process. This suggests that among these war survivors, the imperative of survival through physical activity was paramount, and it could not be overcome by even relatively high levels of posttraumatic stress.

The positive role of the agricultural cycle in remitting PTSD and other mental disturbances also seems to be associated with the fact that participation in agricultural activities, particularly during the decisive Cycle 2 phase, directs individuals to focus on the future because successful food production depends on the degree of investment made in the present. This focus on future outcomes gives people a sense of a purpose in life, which likely also contributes to the seasonal reduction of PTSD. Ultimately, the agricultural cycle renews hope annually, and gives PTSD sufferers a sense of safety and mastery over what they previously experienced as a very dangerous environment. Reestablishing a sense of safety, predictability and mastery are considered important components in boosting trauma recovery (van der Kolk et al., 1996).

Although in our study physical activities were not part of a structured therapeutic program, the observed drop in the prevalence of symptoms is consistent with studies that show that a program of regular physical exercise can exert positive effects on symptoms correlated with PTSD, such as the reduction of depression (Dunn et al., 2005), diversion from negative thoughts (Lawlor & Hopker, 2001), and a decrease in the risk of disturbed sleep (Sherrill, Kotchou, & Quan, 1998). Our results are also consistent with studies that suggest that patients with depression may benefit from work-focused interventions (Adler et al., 2006). Unlike studies that have identified gender differences in the prevalence of PTSD in postwar societies (de Jong et al., 2001), we did not find significant gender effects. This lack of differential gender responses to the agricultural cycle seems to reinforce the result that in this community sample it is not solely the physical activities that exert a positive impact on mental health, but also the structured nature of the agricultural activities, the increased frequency of social interactions, and the sense of purpose and meaning in life that the agricultural cycle promotes in one of the two phases distinguished in this study.

During the third assessment at the one-year follow-up, the prevalence of PTSD and other mental disturbances had again returned to high levels. From a strict therapeutic perspective, it is important to note that the agricultural cycle does not cure PTSD. Rather, working in the field shields war survivors from being flooded with distressful memories of the war on an annual basis. When people stop working at the cycle's end, which coincides with the outset of the local winter, it again becomes difficult for war survivors to deal with their troubling symptoms. One key finding from this study was that the level of PTSD avoidance symptoms was higher at Cycle 3 relative to baseline, and the level of hyperarousal symptoms was lower. A speculative explanation of this result is that higher levels of avoidance behavior (as a way of coping) could result in somewhat lower levels of arousal symptoms.

Another important finding from this study involves the group of war survivors who did not respond to the influence of the agricultural cycle. These agricultural cycle nonresponders showed elevated PTSD levels during the entire course of the annual cycle. This resistance to symptom reduction may be related to the cultural meaning of the three variables identified as significant: the loss of one's mother, the traumatic death of a relative due to famine, and a previous dissociative experience in the form of spirit possession. With respect to this latter item, in its destructive form spirit possession is a severe affliction that disrupts one's sense of personal and social identity. The negative role played by these three risk factors among agricultural cycle nonresponders is consistent with other studies that have demonstrated their association with the maintenance of PTSD over time (Schnurr et al., 2004). This lack of responsiveness to the influences of the agricultural cycle may have also resulted from other factors such as individual variability in response to environmental stimulation or from the presence of complex PTSD (Herman, 1992). Finally, we found it puzzling that

when it came to the effect of the social support indicators, there were trends toward inverse relationships between agricultural cycle responder status and (a) failing to attend church, as well as (b) low levels of family support. On the basis of these paradoxical findings, future studies would seem warranted that explore both the protective and risk mechanisms that underlie church-going behavior, and the way in which having the support of family member could in some circumstances be a protective factor, and in others, result in higher levels of stress (as was the case in this investigation).

This study has limitations. First, given the nature of the investigation it was not possible to establish a control group (see Method section). Second, PTSD prevalence rates were only assessed on three occasions of measurement, during two different defining periods of the agricultural cycle. It would have been appropriate to carry out assessments at other points in time to obtain a fuller picture of PTSD fluctuation over the entire course of the agricultural cycle. Another limitation was that given the small sample size, it was not possible to assess interactions among variables when predicting which individuals would be agricultural cycle responders and agricultural cycle nonresponders.

Despite these limitations, this study meaningfully demonstrates how the agricultural cycle provides war survivors with adaptive ways of living with PTSD over time. This study also provides useful information regarding the future diagnosis of PTSD. It indicates the need to analyze the relationship between participation in cyclical physical activities and the prevalence of PTSD, and through this examination, determine the types of individuals who are likely to suffer the most. Investigation of these particularly severe cases should help to inform the design and development of culturally sensitive and cost-effective interventions in resource-poor, conflict-ridden nations like Mozambique.

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