Published in final edited form as:

Am J Phys Med Rehabil. 2020 November ; 99(11): 1032–1038. doi:10.1097/PHM.0000000000001474.

Relationship Satisfaction and Depression after Traumatic Brain Injury: An Actor-Partner Interdependence Model of Patients and Caregivers in Mexico and Colombia

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Abstract

Objective: Traumatic brain injury (TBI) represents a major public health concern, particularly in low- and middle-income countries like in Latin America. Family members are often caregivers for individuals with TBI, which can result in significant stress. Research is needed to examine depression and quality of the caregiving relationship in these dyads. This study examined relationship quality and depression longitudinally after TBI within the caregiving relationship.

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Author Disclosures:

No conflicts of interest have been reported by the authors.

Design: Dyads ($N = 109$) comprised of individuals with TBI and their caregivers were recruited from three hospitals in Mexico and Colombia. They self-reported depression and relationship satisfaction during hospitalization and at two- and four-months post-hospitalization.

Results: A 2-lag Actor Partner Interdependence Model demonstrated that patients and caregivers reporting high relationship satisfaction at baseline experienced lower depression two months later, which then predicted higher caregiver relationship satisfaction at four months. Moreover, patients with high relationship satisfaction at baseline had caregivers with lower depression at two months, which was then associated with patients' higher satisfaction at four months.

Conclusion: Within individuals with TBI and caregivers, depression and relationship satisfaction appear to be inversely related. Further, patients' and caregivers' depression and relationship satisfaction impact each other over time, demonstrating interdependence within the caregiving relationship.

Keywords

TBI (Traumatic Brain Injury); depressive symptoms; family caregivers; Latin America

Traumatic brain injury (TBI) is one of the most significant contributors to morbidity and mortality in the world¹, affecting 10 million people annually². Although TBI is omnipresent globally, it is referred to as the "silent epidemic" due to the invisible nature in which physical and psychosocial impairments manifest in addition to the global underrepresentation of TBI injury surveillance and reporting². Global disparities of TBI rates render it a major public health concern, disproportionately affecting low- and middle-income countries³, where social, cultural, and economic disparities negatively influence TBI outcomes¹. Although TBI rehabilitation requires intensive care, access to resources is often scarce in rural environments². Due to the lack of immediate care for individuals with TBI in these low- and middle-income countries, functional and psychosocial sequelae are often exacerbated¹.

Following TBI, individuals commonly experience cognitive impairments, particularly in executive functioning domains, as well as difficulties in activities of daily living, social relationships, and leisure activities. are often present following TBI^{4,5}. In addition to deficits in cognitive, physical, and social functioning, changes in mood and emotional functioning are also common. TBI is recognized as the leading cause of trauma-related psychiatric disorders, with depression symptoms as a hallmark comorbid occurrence⁶. Studies have shown that 9%–15% of individuals with TBI develop Major Depressive Disorder⁶. One study revealed that of the 559 individuals with an acute TBI enrolled in their study, 53.1% met criteria for major depression at least once during the year following TBI⁷.

Because of these wide-ranging impairments after TBI, family members often assume the role of informal caregivers, managing both physical and psychosocial impairments⁸. Added responsibilities of caring for people with TBI may affect caregivers in a variety of ways. Behavioral impairments of people with TBI closely predict emotional adjustment of caregivers⁸, and the mental health of caregivers has been shown to be affected by caregivers' appraisals of health outcomes of persons with TBI⁹. Changes in personality are also

common after TBI¹⁰ which can influence family relationships. Caregivers' appraisal of adverse family effects after TBI mediates the relationship between stressors (behavioral problems and/or social role problems with the person with TBI) and caregiver depression⁸. Caregivers experience a host of adversities in the context of familial relationships following TBI, including loss of emotional support and companionship difficulties when adjusting to spousal role changes, a decline in parenting support, financial strain, and a decrease in empathic communication¹¹. Spousal caregivers' reactions to TBI often include anxiety, isolation, and loss¹⁰.

Although changes to both individual and family functioning post-TBI are common, little is known about patient and/or caregiver relationship satisfaction in the context of TBI. Within non-TBI populations, a substantial body of research suggests that symptoms of depression and relationship satisfaction tend to be inversely associated¹². This also extends to non-romantic familial relationships, where symptoms of depression in one family member are associated with poorer overall family functioning¹³. However, historically, literature examining caregivers' relationship to family members with TBI is scarce, examining primarily parental and spousal perspectives from a unidirectional lens¹⁴. Further, studies examining these associations in low- and middle-income countries like in Latin America are nonexistent.

No research to date has examined how TBI patient and caregiver relationship satisfaction are associated with each other longitudinally immediately following injury, nor how each member of the dyad's relationship satisfaction is associated with patient and caregiver depression during this critical time period. Further, these research questions have not been posed in Latin America, despite the high rates of TBI in the region and the limited rehabilitation resources available. Considering both TBI patient and caregiver perspectives on relationship satisfaction, as well as their own depression levels, is critical. Actor-Partner Interdependence Modeling (APIM) is an approach ideally suited to this research question⁹. It allows the proper analysis of dyadic data (here from the caregiver and person with TBI) by examining the statistical influence of one individual's scores on the other individual's scores within that dyad. As a result, the purpose of this study is to use APIM to examine the effects of both caregiver and patient relationship satisfaction on both patient and caregiver depression at three separate time points over the first four months after TBI in Latin America. We hypothesized that patient and caregiver relationship satisfaction would be positively associated at each time point, and that patient and caregiver depression would be positively associated at each time point. We also hypothesized that relationship satisfaction would predict one's own as well as the other member of the dyad's depression levels over time, more powerfully than will depression levels predict relationship satisfaction.

Methods

Participants

Participants comprised two groups: individuals with TBI and their caregivers. Table 1 shows participant demographic information. To be included in the study, patients had to have a diagnosis of TBI, must have been age 18 or older, and had to be able to communicate verbally or in written form in Spanish. Caregivers had to be the primary caregiver for the

person with TBI, must have been age 18 or older, and had to be able to communicate verbally or in written form in Spanish.

A total of 109 people with an acute TBI were recruited to the study from three hospitals in Mexico City, Mexico ($n = 68$), and Cali ($n = 21$) and Neiva ($n = 20$), Colombia. Demographic information was collected from patients about their age, gender, marital status, income, and current employment status (see Table 1). History of TBI (e.g., accident date, month since injury and cause of injury) and current injury situation was also collected from patients. Many patients reported that they sustained the TBI through a motorcycle accident ($n = 41$, 37.6%), with others reporting a serious fall ($n = 23$, 21.1%), act of violence, ($n = 17$, 15.6%), automobile accident, ($n = 12$, 11%), pedestrian accident ($n = 7$, 6.4%), bicycle accident ($n = 3$, 2.8%), gunshot wound ($n = 2$, 1.8%), sports injury ($n = 1$, 0.9%), or other ($n = 3$, 2.8%).

Data were also collected from patients' primary caregivers ($n = 109$; see Table 1 for demographic information). Most caregivers identified themselves as the patient's spouse ($n = 34$, 31.2%), while others identified as the patient's mother ($n = 25$, 22.9%), child ($n = 21$, 19.3%), sibling ($n = 14$, 12.8%), uncle or aunt ($n = 2$, 1.8%), or reported another kind of relationship ($n = 9$, 8.3%).

Procedure

This study was approved by the institutional review boards of Virginia Commonwealth University and the hospitals in Mexico City, Mexico, and Cali and Neiva, Colombia. Participants meeting eligibility criteria were invited to join the study and were asked to read and sign the informed consent form if they agreed to participate. Both individuals with TBI and their caregivers provided informed consent. After they responded to the questionnaires and demographic information, participants were paid an incentive of US\$10 cash for each data collection (or the equivalent in their country). Baseline data were collected from TBI patients and caregivers after enrollment and as soon as possible before hospital discharge, at 1.85 months post-injury on average ($SD = 3.06$ months). The second and third follow-up data collections were conducted at 2 and 4 months after hospital discharge in participants' homes. The same validated measures and format as the first data collection were used for both TBI patients and caregivers.

Measures

Symptoms of Depression—The Patient Health Questionnaire-9 (PHQ-9¹⁵) is a 9-item self-report instrument that measures depressive symptoms. Participants were asked how often during the last 2 weeks they were bothered by each of the depressive symptoms (e.g., "Feeling down, depressed, or hopeless"), which were rated on a 4-point Likert scale ranging from 0 (Not at all) to 3 (Nearly every day). PHQ-9 total scores are derived from the sum of all items and range from 0 to 27. Higher scores mean more severe depressive symptomology (0–4 = none, 5–9 = mild, 10–14 = moderate, 15–19 = moderately severe, 20–27 = severe depressive symptoms). In the current study, the Spanish version of PHQ-9 was used; it has been shown to have good internal reliability ($\alpha = .89^{16}$).

Relationship Satisfaction—The Relationship Assessment Scale (RAS¹⁷) is a 7-item scale used to assess subjective satisfaction with a relationship. It consists of 7 items (e.g., “To what extent has your relationship met your original expectation?”), and answers are rated on a 5-point Likert scale ranging from 1 (not well) to 5 (very well). Responses are averaged to form the total score, and higher scores indicate a higher level of satisfaction with the relationship. As the RAS had no Spanish language version, a methodology was used to translate and back-translate the measure, whereby a bilingual and bicultural researcher translated the original measure into Spanish, and a separate bilingual and bicultural researcher blinded to the original measure then back-translated it into English. Any discrepancies between the original English and back-translated English were resolved mutually. The RAS was piloted with rehabilitation teams at each site to assess its face validity in the three local cultures, while ensuring the standardization of the instrument across the three sites.

Data Analysis Plan

A correlation matrix was created examining the bivariate relationships among patient and caregiver depression and relationship satisfaction for each of the three time points. For the primary analysis an Actor-Partner Interdependence Model (APIM) was used. APIM is used to examine the associations between two or more constructs within participants who are paired in a dyad, in this case TBI patients and caregivers. In comparison to nondyadic analyses, APIM allows an estimation of simultaneous effects of a person’s own variable (actor effect) and the effect of the same variable from the partner (partner effect) on a specific outcome. In the present study, both TBI patients and caregivers completed the RAS and PHQ-9 measures three times, allowing for the examination of associations between these variables within each participant over time, as well as within each dyad over time. Because of the longitudinal nature of this approach, the study used cross-lag panel methodology, allowing for inferences about causal directionality between two or more variables over time.

In order to examine the associations among actor and partner relationship satisfaction and depressive symptoms over time, a 2-lag (i.e., from Time 1 to Time 2, and from Time 2 to Time 3) APIM was constructed. The model was estimated in Mplus using full information maximum likelihood (FIML) to account for missing data, which was no more than 4% at any time point. One dyad was lost to follow up at Time 2 and three additional dyads at Time 3. At time points 2 and 3, each individual’s score on the RAS and PHQ-9 was predicted by their own and their partner’s scores on the RAS and PHQ-9 at the previous time point. For example, the TBI patient’s RAS at Time 2 was predicted by his or her own RAS and PHQ-9s at Time 1, as well as by the caregiver’s RAS and PHQ-9 at Time 1. This enabled us to examine the actor and partner associations among RAS and PHQ-9 scores across time, while simultaneously accounting for the autoregressive effect—that is, the extent to which one’s own scores on the same measure are interdependent across time. Variances of actor and partner scores were also allowed to covary within each time point in order to partially account for the interdependence of each dyad’s scores. The initial model was analyzed with all possible paths (Figure 1), as described above, and then non-significant paths ($p > .05$)

were eliminated from the final model to obtain accurate measures of fit. In order to facilitate interpretation, path loadings are reported as standardized estimates.

Results

Descriptive Statistics and Correlation Matrix

Overall, patients and caregivers reported mild levels of depression and high levels of satisfaction within the caregiving relationship (Table 2). In the correlation matrix (Table 2), patient ratings of depression were highly correlated across all three time points ($r_s = .578-.785$), as were all caregiver ratings of depression ($r_s = .680-.891$). Similarly, patient ratings of relationship satisfaction were highly correlated across all three time points ($r_s = .671-.809$), as were all caregiver ratings of relationship satisfaction ($r_s = .740-.820$). Patient and caregiver ratings of depression were moderately correlated at each time point ($r_s = .282-.355$), as were patient and caregiver ratings of relationship satisfaction ($r_s = .221-.382$).

Path Model

Final Model Fit—The χ^2 goodness-of-fit test was statistically significant, $\chi^2(40) = 80.696$, $p < .001$. However, the ratio of the χ^2 statistic to the model degrees of freedom was 2.01, which is well below the critical ratio cutoff of 5.0. The root mean square error of approximation, comparative fit index, Tucker-Lewis index, and standardized root mean squared residual were .097, .95, .93, and .065, respectively. Overall, these fit indices suggest that the model demonstrates adequate fit with the data¹⁸.

Model Interpretation—The APIM with standardized loadings for significant paths appears in Figure 2. All autoregressive actor effects, such as the association between one's own depression scores at Time 1 and Time 2, were significant and positive ($p_s < .001$), indicating that these within-person scores were positively related to each other across time. Relationship satisfaction at Time 1 was significantly associated with one's own depression score at Time 2 for both patients, $\beta = -.32$, $SE = .07$, $p < .001$, and caregivers, $\beta = -.15$, $SE = .07$, $p = .038$; the negative direction of these actor effects suggests that for both patients and caregivers, one's own higher relationship satisfaction at Time 1 was associated with lower depressive symptoms at Time 2. For caregivers, depressive symptoms at Time 2 were also significantly and negatively associated with relationship satisfaction at Time 3, $\beta = -.16$, $SE = .06$, $p = .006$, but not for patients ($p > .05$). Interestingly, only two partner effects were statistically significant: patient relationship satisfaction at Time 1 was inversely related to caregiver depressive symptoms at Time 2, $\beta = -.16$, $SE = .07$, $p = .024$, which in turn was inversely related to patient relationship satisfaction at Time 3, $\beta = -.13$, $SE = .06$, $p = .03$. However, the same paths were not significant for caregiver relationship satisfaction and patient depressive symptoms.

Discussion

The aim of the current study was to examine the associations among one's own and partner relationship satisfaction and depression in a sample of 109 TBI patients and caregivers in

Mexico City, Mexico, and in Cali and Neiva, Colombia. Notably, this was a longitudinal study that solicited each partner's self-ratings of depression and relationship satisfaction across three time points spanning hospitalization through 4 months post-discharge. Within-person symptoms of depression were highly correlated across the three time points, as were within-person ratings of satisfaction in the caregiving relationship. In addition, patients' and caregivers' ratings of depression were moderately correlated with each other across all three time points, as were their ratings of relationship satisfaction.

Patients' and caregivers' relationship satisfaction at Time 1 was negatively associated with their own symptoms of depression at Time 2; that is, those who experienced higher relationship satisfaction while the patient was hospitalized tended to experience lower symptoms of depression 2 months post-hospitalization. In addition, caregivers' higher depression scores at 2 months were associated with lower relationship satisfaction at 4 months post-hospitalization. These findings are consistent with a large body of literature demonstrating an inverse association between depression and relationship satisfaction in romantic couples^{12,19}. Moreover, the cross-lag findings support previous research suggesting that relationship satisfaction acts as a buffer against stress and potential sequelae, including symptoms of depression^{20–22}. These results could suggest that experiencing one's caregiving relationship as generally satisfying may help provide a sense of stability or of security in the months post-TBI, which could in turn protect against the negative impact of TBI-related life changes on adjustment and psychological symptoms.

Interestingly, there was not an association between patients' symptoms of depression and relationship satisfaction between 2- and 4-months post-hospitalization. This could suggest that as patients adjust to new post-injury impairments and other changes, their depressive symptoms are more closely linked with other salient variables, such as the degree of TBI-related impairment, post-TBI functional outcomes, or perceived quality of caregiving. For example, even when they find satisfaction in the caregiving relationship, patients may still experience a sense of social isolation from non-caregivers⁵ and disruption to their other social relationships⁴, potentially contributing to symptoms of depression. Future studies could investigate this association more directly by including measures of these and related constructs as potential moderators.

Evidence for partner effects emerged between relationship satisfaction and symptoms of depression. Patients' higher relationship satisfaction in the hospital was associated with caregivers' lower symptoms of depression at 2 months post-hospitalization, which in turn was associated with patients' higher relationship satisfaction again at 4 months. Taking into account the actor effects discussed above, the findings could suggest that when patients perceive that they have a high-quality relationship with their caregiver immediately post-TBI, this relationship satisfaction acts as a buffer against psychological sequelae resulting from the stress of the injury, resulting in patients' lower symptoms of depression. Patients' high relationship satisfaction and sense of stability could impact how caregiving is received, thereby resulting in caregivers' lower symptoms of depression in the next 2 months as they adjust to their new role. This may be a similar effect to a previous study that found that appraisals of adverse family effects mediated the relation between stressors and symptoms of caregiver depression⁸. In turn, when caregivers experience lower symptoms of depression,

they are better able to enact positive caregiving behaviors, contributing to patients' perceptions of a more satisfactory relationship. Interestingly, the results did not show a similar pathway between caregivers' relationship satisfaction and patients' depressive symptoms. This may again suggest that patients' depressive symptoms are more affected by their own impairment and functioning post-TBI.

It is important to note that the current sample was recruited from Colombia and Mexico, and the partner effects found may be influenced by Latino cultural values impacting relationship satisfaction and quality in both caregivers and TBI patients. Familismo, which refers to Latinos' identity as part of a family²³, and interdependence, which postulates that others' welfare is more important than the individual's and one sacrifices for the good of the group²⁴, are Latino cultural values rooted in collectivism. The current study's findings wherein satisfaction with the caregiving relationship may act as a buffer against symptoms of depression is congruent with these cultural collectivistic values. Future studies would also benefit from evaluating patient and caregiver gender as moderators. Most patients in the current sample were male (82.6%) and most caregivers were female (81.7%). However, these findings could differ in pairs where the patient was female and the caregiver male, or even same-sex pairs (this could include same-sex romantic partners, friends, parent-child or sibling dyads, etc.). Traditional Latino gender roles and societal expectations around the nature of caregiving may significantly impact the associations between depression and relationship satisfaction. For patient-caregiver pairs in a romantic relationship, gender norms around relationships and marriage could also impact the experience of relationship satisfaction. Future studies are encouraged to investigate cultural factors including familismo and interdependence that may influence relationship satisfaction or potentially buffer against TBI caregiver depression.

Overall, the initial correlation matrix and the results from this APIM provide evidence for the interpersonal nature of depression and satisfaction within the caregiving relationship in the months following hospitalization for TBI in Latin America. This is especially notable because these interpersonal associations emerged even while controlling for autoregressive effects (such as the interdependence among one's own depressive symptoms across time) and actor effects (e.g., the effect of one's own symptoms of depression at the previous time point on one's current relationship satisfaction).

Clinical Implications

The current study provides additional support for a relational approach to TBI rehabilitation especially in TBI caregiver interventions. Empirically supported TBI caregiver interventions include psychoeducation²⁵, stress management strategies focused on post-injury adjustment²⁶, behavioral management techniques²⁷, and problem-solving training to family caregivers²⁸. Caregiver interventions have been shown to result in a reduction of caregiver burden²⁶, anxiety²⁵, and depression²⁸. In a study of TBI patient-caregiver dyads, a combination of these techniques including psychoeducation, coping skills, stress management, emotional processing, problem solving, and caregiver self-care based in principles of family systems theory and cognitive behavioral therapy resulted in a number of positive outcomes including increased caregiver problem solving skills and lower perceived

obstacles²⁹. Similarly, a peer-mentoring program focused on adjusting the behavior of TBI patients' closest family and friends to avoid triggers resulted in improved familial relationships³⁰. A multicultural and familial approach is recommended in TBI rehabilitation programming including these empirically supported treatments focused on the integration of caregivers and family members during all stages of treatment to improve relationship satisfaction and reduce distress.

Limitations and Future Directions

Although this study is among the first to examine associations among one's own and partner relationship satisfaction and depression in a sample of Latin American TBI patients and caregivers, several important limitations should be considered when evaluating these findings. First, we did not systematically track how many dyads were approached to participate in this study, and as a result number of refusals or reasons for ineligibility are unknown. Individuals who have higher-quality or more satisfactory relationships may be more likely to consent to participating in a research study and to continue with follow-up assessments in comparison to individuals with unhappy or unstable relationships. Further, because the participants with TBI self-consented to participate, they likely experienced less severe TBI-related cognitive impairments than others who were unable to participate in the consent process (and therefore unable to participate). These factors may also have interacted, such that caregivers of individuals with more severe cognitive deficits were also more likely to experience lower relationship satisfaction and thus may be underrepresented in the current sample. Future longitudinal research on TBI in Latin America would benefit from collecting data on these variables. Second, because of the relatively small sample size, the analyses in the current study did not examine the nature of the relationship between patients and caregivers as a potential moderator of effects. The majority of caregivers self-identified as a parent, child, or sibling of the patient (56.9%), while one-third of the caregivers self-identified as the spouse of the patient, and 8.3% of caregivers identified another kind of relationship. Future research could evaluate whether these associations differ among patients and caregivers who are immediate or extended family members, those in a romantic relationship, or those who are friends or roommates. The strength of the associations could be moderated, for example, by the centrality of the relationship to the patient (i.e., a caregiving spouse versus a friend who acts as caregiver), or even the length of the relationship, particularly as expectations for caregiving may change according to the type, length, or intensity of the relationship. It could be, for example, that associations between satisfaction and depression may differ between dyads where the patient and caregiver roles contradict traditional or cultural norms around caregiving, such as an older parent caring for an adult child.

Fourth, as described above, future research would benefit from including the gender of patient/caregiver roles as potential moderators of effects, as gender roles and norms around caregiving may impact these associations. Fifth, the current sample was recruited from Mexico and Colombia, and as such results may not be fully generalizable to other Central and South American countries. Caution is recommended and a multicultural framework is encouraged during interpretations of findings and implementation of recommended interventions.

Conclusion

The current study investigated the associations among depressive symptoms and satisfaction within the caregiving relationship in samples of TBI patients and caregivers in sites in Mexico and Colombia. Patients and caregivers who reported high relationship satisfaction immediately post-injury experienced lower symptoms of depression 2 months later, and caregivers with lower symptoms of depression at 2 months reported higher relationship satisfaction at 4 months post-hospitalization. When patients reported higher satisfaction at hospitalization, their caregivers experienced lower symptoms of depression two months later, which was in turn associated with higher satisfaction in patients again at 4 months post-hospitalization.

Acknowledgements:

This study was funded by grant #R21TW009746 from Fogarty International Center of the National Institutes of Health and in part by the Department of Veterans Affairs Office of Academic Affiliations Advanced Fellowship Program in Mental Illness Research and Treatment, the Medical Research Service of the Veterans Affairs Central Virginia Health Care System, and the Department of Veterans Affairs Mid-Atlantic Mental Illness Research, Education, and Clinical Center (MIRECC).

References

1. Bonow RH, Barber J, Tempkin NR, Videtta W, Rondina C, Petroni G The outcome of severe traumatic brain injury in Latin America. *World Neurosurg.* 111:e82–e90. doi:10.1016/j.wneu.2017.11.171
2. Hyder AA, Wunderlich CA, Puvanachandra P, Gururaj G, Kobusingye OC. The impact of traumatic brain injuries: A global perspective. Neufeld JA, ed. *NeuroRehabilitation.* 2007;22(5):341–353. doi:10.3233/NRE-2007-22502 [PubMed: 18162698]
3. Vaishnavi S, Rao V, Fann JR. Neuropsychiatric problems after traumatic brain injury: Unraveling the silent epidemic. *Psychosomatics.* 2009;50(3):198–205. doi:10.1176/appi.psy.50.3.198 [PubMed: 19567758]
4. Rabinowitz AR, Levin HS. Cognitive sequelae of traumatic brain injury. *Psychiatr Clin North Am.* 2014;37(1):1–11. doi:10.1016/j.psc.2013.11.004 [PubMed: 24529420]
5. Sander AM, Maestas KL, Sherer M, Malec JF, Nakase-Richardson R. Relationship of caregiver and family functioning to participation outcomes after postacute rehabilitation for traumatic brain injury: A multicenter investigation. *Arch Phys Med Rehabil.* 2012;93(5):842–848. doi:10.1016/j.apmr.2011.11.031 [PubMed: 22417896]
6. Bryant RA, O'Donnell ML, Creamer M, McFarlane AC, Clark CR, Silove D. The psychiatric sequelae of traumatic injury. *Am J Psychiatry.* 2010;167(3):312–320. doi:10.1176/appi.ajp.2009.09050617 [PubMed: 20048022]
7. Bombardier CH. Rates of major depressive disorder and clinical outcomes following traumatic brain injury. *JAMA.* 2010;303(19):1938. doi:10.1001/jama.2010.599 [PubMed: 20483970]
8. Harris JKJ, Godfrey HPD, Partridge FM, Knight RG Caregiver depression following traumatic brain injury (TBI): a consequence of adverse effects on family members? *Brain Inj.* 2001;15(3):223–238. doi:10.1080/02699050010004040 [PubMed: 11260771]
9. Perrin PB, Norup A, Caracul A, Bateman A, Tjørnlund M, Arango-Lasprilla JC. An Actor-Partner Interdependence Model of acquired brain injury patient impairments and caregiver psychosocial functioning: A dyadic-report, multinational study. *J Clin Psychol.* 2017;73(3):279–293. doi:10.1002/jclp.22324 [PubMed: 27362465]
10. Liss M, Willer B. Traumatic brain injury and marital relationships: a literature review. *Int J Rehabil Res.* 1990;13(4):309–320. doi:10.1097/00004356-199012000-00004 [PubMed: 2100298]

11. Blais MC, Boisvert J-M Psychological and marital adjustment in couples following a traumatic brain injury (TBI): A critical review. *Brain Inj.* 19(14):1223–1235. doi:10.1080/02699050500309387
12. Whisman MA. The association between depression and marital dissatisfaction In: Beach SRH, ed. *Marital and Family Processes in Depression: A Scientific Foundation for Clinical Practice*. Washington: American Psychological Association; 2001:3–24. doi:10.1037/10350-001
13. Friedmann MS, McDERMUT WH, Solomon DA, Ryan CE, Keitner GI, Miller IW. Family Functioning and Mental Illness: A Comparison of Psychiatric and Nonclinical Families. *Fam Process.* 1997;36(4):357–367. doi:10.1111/j.1545-5300.1997.00357.x [PubMed: 9543657]
14. Peters LC, Stambrook M, Moore AD, Esses L. Psychosocial sequelae of closed head injury: Effects on the marital relationship. *Brain Inj.* 1990;4(1):39–47. doi:10.3109/02699059009026147 [PubMed: 2297599]
15. Kroenke K, Spitzer RL, Williams JBW. The PHQ-9: Validity of a brief depression severity measure. *J Gen Intern Med.* 2001;16(9):606–613. doi:10.1046/j.1525-1497.2001.016009606.x [PubMed: 11556941]
16. Arrieta J, Aguerrebere M, Raviola G, Flores H, Elliott P Validity and utility of the Patient Health Questionnaire (PHQ)-2 and PHQ-9 for screening and diagnosis of depression in rural Chiapas, Mexico: A cross-sectional study. *J Clin Psychol.* 2017;73(9):1076–1090. [PubMed: 28195649]
17. Hendrick SS. A generic measure of relationship satisfaction. *J Marriage Fam.* 1988;50(1):93. doi:10.2307/352430
18. Meyers L, Gamst L, Guarino A *Applied Multivariate Research: Design and Interpretation*. 3rd ed. Thousand Oaks, CA: Sage; 2017.
19. Proulx CM, Helms HM, Buehler C. Marital quality and personal well-being: A meta-analysis. *J Marriage Fam.* 2007;69(3):576–593. doi:10.1111/j.1741-3737.2007.00393.x
20. Beach SRH, Katz J, Kim S, Brody GH Prospective effects of marital satisfaction on depressive symptoms in established marriages: A dyadic model. *J Soc Pers Relatsh.* 2003;20(3):355–371. doi:10.1177/0265407503020003005
21. Kouros CD, Papp LM, Cummings EM. Interrelations and moderators of longitudinal links between marital satisfaction and depressive symptoms among couples in established relationships. *J Fam Psychol.* 2008;22(5):667–677. doi:10.1037/0893-3200.22.5.667 [PubMed: 18855503]
22. Whisman MA, Uebelacker LA. Prospective associations between marital discord and depressive symptoms in middle-aged and older adults. *Psychol Aging.* 2009;24(1):184–189. doi:10.1037/a0014759 [PubMed: 19290750]
23. Niemann YF Stereotypes of Chicanas and Chicanos: Impact on family functioning, individual expectations, goals, and behavior In: Velasquez RJ, Arellano LM, McNeill BW, eds. *The Handbook of Chicana/o Psychology and Mental Health*. Mahwah, NJ: Laurence Erlbaum Associates; 2004:79–100.
24. Santiago-Rivera AL, Arredondo P, Gallardo-Cooper M *Counseling Latinos and La Familia: A Practical Guide*. Vol 17 Thousand Oaks, CA: Sage; 2002.
25. Brown R, Pain K, Berwald C, Hirschi P, Delehanty R, Miller H Distance education and caregiver support groups: comparison of traditional and telephone groups. *J Head Trauma Rehabil.* 14(3):257–268. doi:10.1097/00001199-199906000-00006
26. Albert SM, Im A, Brenner L, Smith M, Waxman R Effect of a social work liaison program on family caregivers to people with brain injury. *J Head Trauma Rehabil.* 2002;17(2):175–189. doi:10.1097/00001199-200204000-00007 [PubMed: 11909513]
27. Carnevale GJ, Anselmi V, Busichio K, Millis SR. Changes in ratings of caregiver burden following a community-based behavior management program for persons with traumatic brain injury: *J Head Trauma Rehabil.* 2002;17(2):83–95. doi:10.1097/00001199-200204000-00002 [PubMed: 11909508]
28. Rivera PA, Elliott TR, Berry JW, Grant JS. Problem-solving training for family caregivers of persons With traumatic brain injuries: A randomized controlled trial. *Arch Phys Med Rehabil.* 2008;89(5):931–941. doi:10.1016/j.apmr.2007.12.032 [PubMed: 18452743]

29. Kreutzer JS, Stejskal TM, Ketchum JM, Marwitz JH, Taylor LA, Menzel JC. A preliminary investigation of the brain injury family intervention: Impact on family members. *Brain Inj.* 2009;23(6):535–547. doi:10.1080/02699050902926291 [PubMed: 19484627]
30. Hanks RA, Rapport LJ, Wertheimer J, Koviak C. Randomized controlled trial of peer mentoring for individuals with traumatic brain injury and their significant others. *Arch Phys Med Rehabil.* 2012;93(8):1297–1304. doi:10.1016/j.apmr.2012.04.027 [PubMed: 22840826]

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What is Known:

Traumatic brain injury (TBI) is associated with severe sequelae like impairments in mood and cognition. Family members often act as primary caregivers for these individuals, which can result in significant stress on the caregiving relationship.

What is New:

No known studies to date have examined associations between depression and the quality of the caregiving relationship in Latin America. Patients' and caregivers' depression and relationship satisfaction impact each other over time, demonstrating the interdependent nature of these constructs within the caregiving relationship.

Figure 1.
Initial Actor-Partner Interdependence Model with All Paths
Note. Non-significant paths are denoted with dotted lines.

Figure 2.
Actor-Partner Interdependence Model with Standardized Loadings for Significant Paths
Note. PT = patient; CG = caregiver.

Table 1.

Sample Means, Standard Deviations, and Percentages for Demographic Variables

Variable	Patients <i>n</i> = 109	Caregivers <i>n</i> = 109
Age, <i>M</i> (<i>SD</i>)	35.87 (14.08)	41.46 (13.85)
Sex, <i>n</i> (%)		
Male	90 (82.6)	20 (18.3)
Female	19 (17.4)	89 (81.7)
Marital status, <i>n</i> (%)		
Single	48 (44)	19 (17.4)
Married	27 (24.8)	34 (31.2)
Divorced	2 (1.8)	21 (19.3)
Separated	2 (1.8)	0
Widowed	2 (1.8)	6 (5.5)
Open Relationship	27 (24.8)	26 (23.9)
Other	1 (0.9)	3 (2.0)
Current employment status, <i>n</i> (%)		
Full-time	34 (31.2)	28 (25.7)
Part-time	9 (8.3)	22 (20.2)
Homemaker	8 (7.3)	34 (31.2)
Unemployed	49 (45)	18 (16.5)
Student	7 (6.4)	5 (4.6)
Pension/retired	2 (1.8)	2 (1.8)
Income, <i>n</i> (%)		
< minimum wage	32 (29.4)	40(36)
1x minimum wage	28 (25.7)	28(25.7)
1–2x minimum wage	22 (20.2)	17(15.6)
2–3x minimum wage	13 (11.9)	5(4.6)
3–4x minimum wage	4 (4.6)	7(6.4)
4–5x minimum wage	2 (1.8)	5(4.6)
> 5 minimum wage	3 (2.8)	4(3.7)

Table 2

Correlations, Means (M), and Standard Deviations (SD) for Model Variables

	1	2	3	4	5	6	7	8	9	10	11	Range	M	SD
1. PT Depression, T1												0-27	6.93	6.29
2. PT Depression, T2	.578***											0-27	5.06	5.09
3. PT Depression, T3	.596***	.785***										0-27	4.88	5.23
4. PT Relationship Satisfaction, T1	-.374***	-.503***	-.519***									1-5	4.4	0.8
5. PT Relationship Satisfaction, T2	-0.172	-.483**	-.449***	.671***								1.57-5	4.35	0.78
6. PT Relationship Satisfaction, T3	-.255**	-.421**	-.484***	.694***	.809***							1.57-5	4.31	0.8
7. CG Depression, T1	.322**	0.151	.273**	-.304**	-.242*	-.304**						0-22	5.78	5.74
8. CG Depression, T2	0.184	.282**	.287**	-.364***	-.401***	-.462***	.680***					0-22	4.67	4.79
9. CG Depression, T3	0.175	.263**	.355***	-.306**	-.378***	-.401***	.690***	.891***				0-22	4.58	4.87
10. CG Relationship Satisfaction, T1	-.212*	-0.174	-.206*	.221*	0.16	.276**	-.411***	-.420***	-.300**			1.57-5	4.25	0.72
11. CG Relationship Satisfaction, T2	-0.111	-0.156	-0.166	.252**	.246*	.284**	-.340***	-.423***	-.294**	.740***		1-5	4.18	0.83
12. CG Relationship Satisfaction, T3	-0.127	-0.159	-.272**	.262**	.204*	.382***	-.385***	-.484***	-.413***	.734***	.820***	1.43-5	4.19	0.79

Note. PT = patient; CG = caregiver.

*
 $p < .05$,**
 $p < .01$,***
 $p < .001$.