Shared health characteristics in Hispanic colorectal cancer patients and their primary social support person following primary diagnosis

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Abstract

Purpose: The aim of this paper was to determine individual and shared levels of psychosocial, behavioral, and symptomological health characteristics among Hispanics with recent history of cancer and their primary social support person (PSSP) in the years following diagnosis.

Patients and Methods: Recruited from a population-based cohort study were 409 Hispanic patients with a previous diagnosis of colorectal cancer. Forty-seven patients identified a PSSP, who assists with medical decision-making and health-related matters, who also participated in the study. Current behavioral (smoking, alcohol use, physical activity, and complementary and alternative medicine use), psychosocial (stress and mindfulness), and physical symptom (fatigue) data were obtained using validated instruments. Analyses tested the individual and shared (between patients and PSSPs) variance in these health measures.

Results: The sample was diagnosed on average 3.1 years (standard deviation = 1.7) prior to assessment. PSSPs were mainly spouses/partners (63%) or children (28%) of patients. Among patients, stress was positively associated with being a current smoker ($p < 0.01$) and with fatigue ($r = 0.45$, $p < 0.001$); stress was negatively correlated with mindfulness ($r = -0.41$, $p < 0.001$); mindfulness was negatively associated with smoking (odds ratio (OR) = 0.72, $p < 0.01$) and alcohol consumption (OR = 0.83, $p < 0.05$); the inverse relationship between mindfulness and fatigue was partially mediated through lower levels of stress ($\beta = -0.17$, $p < 0.001$). Similar patterns were observed among PSSPs. Patient mindfulness was negatively correlated with PSSP stress ($r = -0.45$, $p < 0.01$). Complementary and alternative medicine use showed interdependence between patients and PSSPs for use of herbal remedies (OR = 6.2; $p < 0.01$) and bodywork (OR = 8.3, $p < 0.05$).

Conclusion: Hispanic colorectal cancer patients and their PSSP share a common health milieu in the years following a cancer diagnosis, offering opportunities for advancing interpersonal intervention approaches in cancer care.
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Introduction

A diagnosis of cancer often results in major life role modifications that place additional demands on the patient as well as their social supports (e.g., relative, spouse, and partner). These added demands, accompanied stressors, and uncertainties often contribute to psychological distress and can modulate health-related behavior in both the patient and their social supports [1]. The psychosocial and health-related symptoms arising from the adverse effects of cancer and its clinical remediation are well recognized [2,3]. The extent to which such symptoms in the cancer patient influences others in the patient's immediate social network and vice versa is understudied [4]. Research is warranted to examine the psychosocial, behavioral, and symptomological health dynamics that function between people with a cancer diagnosis and their primary social support person (PSSP; here defined as a relative, spouse/partner, or friend who the patient identifies). The dyad might possibly share commonalities in their health profiles in the years after cancer diagnosis in a manner that either elevates or reduces future cancer risk in both individuals. This work aims to contribute to our understanding of interpersonal dynamics experienced after cancer diagnosis and might have the capacity to inform the development of interpersonal preventive interventions.

To date, the majority of studies pertaining to biopsychosocial factors in cancer care are restricted to their sex-specificity (breast cancer in female patients and prostate cancer in male patients), thus limiting our understanding of possible sex differences within the same cancer type. Lung cancer is an example of a counterpoint [5]. Colorectal cancer (CRC) is the second most commonly diagnosed cancer among men and women combined [6], and few studies have reported on the psychosocial, behavioral, and symptomological effects experienced by CRC patients.

Further, we know relatively little regarding the cancer-related dynamics shared among underrepresented groups in research including Hispanics and their PSSPs. Hispanics are a quickly growing segment of the US population [7]. In their lifetime, one in two Hispanic men and one in three Hispanic women will receive a cancer diagnosis [8]. Hispanic communities often are family-centric but have less access to preventive services and medical care, and thus, there may be a disproportionate burden encountered by Hispanic cancer patients and their PSSPs [9,10].

Previous research findings suggest that people with various cancer types and their PSSP form a type of social dyad wherein health-related factors such as emotional distress are interdependent [5,11,12]. This becomes important as the patient and PSSP's ability to adjust to and cope with life role modifications influences their own individual health while also having a bidirectional effect on the other's well-being [4,13]. Recent studies of predominantly Caucasian, non-Hispanic CRC (79%) [14] and lung cancer (85%) patients [15] showed similar correlational patterns of depressive and anxiety symptoms within dyads of CRC patients and their PSSPs. For physical health symptoms, this interrelationship lasted out to 5 months post-cancer diagnosis.

In the current population-based study, we examined individual and shared variance in behavioral (smoking, alcohol use, physical activity, and complementary and alternative medicine (CAM) use), psychosocial (stress and mindfulness), and physical symptom (fatigue) factors among 408 Hispanic CRC patients and 47 of their PSSPs to determine the long-term effects of a cancer diagnosis on the dynamics between people with a cancer diagnosis and their PSSP. Findings were expected to have relevance for understanding interpersonal cancer risk factors in this underrepresented population. Behaviors examined in this study (smoking, alcohol, and physical activity) reflect the conventional risk factors that predict CRC [16]. The psychosocial and physical symptom factors selected for this study are among the health issues most often reported by cancer patients and survivors (psychological stress and fatigue) [2] and a more recently popularized protective psychological factor (mindfulness) [17], which is a modifiable target that has been shown in some studies to remediate psychological stress, fatigue, and cancer-related symptomatology in people with cancer [18,19].

Mindfulness is most prevailingly defined as 'the awareness that emerges through paying attention on purpose, in the present moment, and nonjudgmentally to the unfolding of experience moment by moment' [17] (p. 145). Programs that aim to cultivate mindfulness, such as the widely disseminated mindfulness-based stress reduction program, are available in some major cancer treatment centers [17,20] and have demonstrated utility for attenuating cancer-related fatigue symptoms [20,21]. To build upon previous research, in our cohort of Hispanics diagnosed with CRC, we hypothesize that (1) patterns of relationships across psychosocial, behavioral, and symptomological measures examined in this study will be similar between CRC patients and their PSSP and (2) interdependence in these measures will exist between CRC patients and their PSSP. As a secondary hypothesis, we also test whether psychological stress mediates the association between mindfulness and fatigue in the cancer sample to uncover a possible mechanism of action that is protective of cancer-related physical symptoms.

Methodology

Participants and procedures

Data were obtained from participants in the Hispanic Colorectal Cancer Study, which is a population-based cohort study of individuals self-identified as Hispanic with a diagnosis of CRC. All men and women over 21 years of age with a first-time diagnosis of CRC (International Classification of Diseases for Oncology, Third Edition codes: C18–C20) after January 2008 who were able to communicate in English or Spanish were eligible for participation. Cases were identified from the California Cancer Registry and/or from two hospitals in Los Angeles (LAC + USC County Hospital and USC Norris Comprehensive Cancer Center). As of October 2014, we had recruited 987 patients of whom 409 (41% of recruitment total) completed the questionnaire. All patients were post-first line treatment, and 74% had survived at least 3 years. The PSSP recruitment protocol and questionnaire were introduced in a later iteration of data collection. The researchers identified $n = 127$ PSSPs to contact for recruitment among the final iteration of CRC patients recruited for the study. The questionnaire defined a PSSP as someone who is involved in their medical decision-making and/or who acts as a main social support. Among this subset of CRC patients, $n = 47$ PSSPs were willing to enroll in the study. The University of Southern California Institutional Review Board approved this study. All patients and their identified PSSPs were interviewed in person and/or by telephone. For participant convenience, PSSPs had the additional option of completing the questionnaire by mail. All questionnaires were available in English or Spanish as preferred by the participant.

Measures

Patient demographic information, current smoking, and current alcohol use were assessed with items from the Colon Cancer Family Registry [22]. Current smoking (at least one cigarette a day or one cigar/pipe per month for 3 or more months) and alcohol use (at least one alcohol beverage once per week for 6 or more months) were quantified by examining start and quit dates at the survey period. If users did not report a quit date, there were coded

as current. Current physical activity was collected using the American Cancer Society Third Cancer Prevention Study Questionnaire (2007) with reference to the most recent decade of life. We defined metabolic equivalent hours using the metabolic equivalent values from the 2011 Compendium of Physical Activities and weighed total hours per week on the number of months of participation engaged in each activity [23]. The eight items measuring CAM use were taken directly from the 2011 National Institute of Health National Center for Complementary and Alternative Medicine national survey measures [24]. CAM refers to a group of diverse medical and healthcare systems, practices, and products that are not generally considered part of conventional medicine.

Validated self-report psychosocial and symptomological measures included the following: (a) six items that comprised the general fatigue sub-score of the Multidimensional Fatigue Symptom Inventory – Short Form [25]; (b) seven items comprising the stress items of the short Depression Anxiety Stress Scales (DASS-21) [26]; and (c) six items comprising the short Mindful Attention Awareness Scale [27]. These short form scales were used to reduce respondent burden and have been validated in previous research [25-27]. DASS-21 questions were available in Spanish using a validated translation [28], and the remaining questions were translated into Spanish using an experienced translator with back translation verified for meaning. With our data, these scales performed with high internal consistency where the Cronbach's α and item-total correlation range were 0.88 and 0.69–0.83 for DASS (psychological stress), 0.95 and 0.88–0.91 for the Multidimensional Fatigue Symptom Inventory (general fatigue), and 0.84 and 0.70–0.82 for the Mindful Attention Awareness Scale (mindfulness), respectively. PSSP characteristics were coded as separate variables within each observation corresponding to the PSSP's related patient. This ensured that analysis of patient–PSSP dyads used paired data.

Statistical analysis

All statistical procedures were performed using STATA, Release 13 [29]. To determine whether there were differences in health characteristics by sex, clinical stages of diagnosis, and whether the patient reported having a PSSP (regardless of whether the PSSP participated), we tabulated frequencies and percentages with Fisher's exact tests for current behavioral variables (smoking, alcohol, exercise, and CAM use) by sex, clinical stages of diagnosis, and whether the patient reported having a PSSP. Independent samples *t*-tests and analysis of variance were applied to compare mean scores for stress, fatigue, and mindfulness by sex, clinical stage of diagnosis, and whether the patient reported having a PSSP.

Again, for paired analyses between patients and their PSSPs, patient and PSSP variables were coded within the same observation if they corresponded with each other. Pairwise correlations were performed between stress, fatigue, and mindfulness scores in patients and their PSSPs to test the associations between these constructs and for shared psychological and symptomological characteristics between patients and PSSPs. To determine whether CAM use in PSSP's predicted CAM use in patients, we performed unadjusted logistic regressions to compute odds ratios for types of CAM utilization behaviors in patients on corresponding types of CAM utilization behaviors in PSSPs. Path analysis was performed to test whether stress mediated the relationship between mindfulness and fatigue in our sample of CRC patients. We performed unadjusted logistic regressions for dichotomous behavioral outcomes (smoking, alcohol use, exercise, and CAM use) on psychosocial and symptomological characteristics (stress, fatigue, and mindfulness) within CRC patients to test whether these characteristics predicted these behaviors among Hispanic CRC patients. To ensure that selection bias was minimal, we confirmed that there were no differences in our study variables between CRC patients whose PSSPs participated in the study and those whose PSSPs did not.

Results

Sample characteristics

A total of 409 (52.8% male) patients were included in this study with a mean time since diagnosis of 3.1 years (standard deviation (SD) = 1.7). The average age at diagnosis for men was 59.7 years (SD = 12.4) and 57.2 years for women (SD = 11.7). The majority of the patients were born in Mexico (45.5%) followed by US-born (33.7%). Participants that were born outside of the USA had been living in the USA for an average of 33.6 years (SD = 13.3). Questionnaires were conducted in Spanish with most of the participants (54.1%). The majority of patients had a colon neoplasm (58%) that was diagnosed as a regional stage cancer (51.2%) and did not receive chemotherapy or radiation (54.0%). The majority of the study population had a history of CRC polyps (55.9%), and the reason for their first colonoscopy was not for a routine checkup (73.8%). Of patients, 43% reported having a PSSP who assists with medical decision-making and health issues related to their cancer diagnoses. Of those PSSPs, 1.2% were parents, 45.0% were spouses or partners, 31.4% were children, and 22.5% were of other relationship to the patient (e.g., friend).

Psychosocial, behavioral, and symptomological characteristics in colorectal cancer patients

Table 1 displays CRC patient psychosocial, behavioral, and symptomological health characteristics by sex, as well as by whether or not they reported having a PSSP. There were no significant differences between men and women

Table 1. Psychobehavioral factors in CRC patients by sex

| | Sex | | | | | Has PSSP | | | |
| | Male | | Female | | | Yes | | No | | |
	n (%) or M (SD)		n (%) or M (SD)		p	n (%) or M (SD)		n (%) or M (SD)		p
Behavioral factors										
Current smoker					0.14					0.29
Yes	32	(14.8)	19	(9.8)		156	(89.7)	201	(85.9)	
No	184	(85.2)	174	(90.2)		18	(10.3)	33	(14.1)	
Current alcohol drinker					0.75					0.59
Yes	72	(33.8)	61	(31.9)		113	(65.7)	158	(68.4)	
No	141	(66.2)	130	(68.1)		59	(34.3)	73	(31.6)	
Current physical activity					0.16					0.76
Less than 500 min	113	(52.3)	115	(59.6)		99	(56.9)	129	(55.1)	
500+ min	103	(47.7)	78	(40.4)		75	(43.1)	105	(44.9)	
Current CAM use					0.42					0.31
Yes	85	(39.5)	84	(43.5)		77	(44.5)	92	(39.3)	
No	130	(60.5)	109	(56.5)		96	(39.3)	142	(60.7)	
Psychosocial factors										
Stress	5.4	(5.1)	6.0	(5.1)	0.10	5.5	(4.7)	5.8	(5.4)	0.64
Fatigue	7.3	(6.4)	8.0	(6.5)	0.23	7.9	(6.7)	7.4	(6.3)	0.45
Mindfulness	5.0	(1.15)	5.1	(1.1)	0.55	4.9	(1.2)	5.1	(1.1)	0.06

CRC, colorectal cancer; PSSP, primary social support person; SD, standard deviation; CAM, complementary and alternative medicine.

in current smoking, alcohol consumption, physical activity, or CAM usage, as well as in stress, fatigue, and mindfulness. There were no significant differences in any of these health characteristics between patients with and without PSSPs.

Clinical, psychosocial, and symptomological characteristics in colorectal cancer patients

Cancer stage and time since diagnosis were not associated with any of the psychosocial and symptomological characteristics examined in this study. Patient stress did not significantly differ ($t = 0.78$, $p = 0.44$) between those who had received treatment at the time of diagnosis (including chemotherapy, radiation, or both) ($M = 5.8$, $SD = 5.3$) and those who had not received treatment ($M = 5.4$, $SD = 4.8$). Patient fatigue was significantly higher ($t = 2.54$, $p < 0.05$) in patients who have received treatment ($M = 8.3$, $SD = 6.7$) than those who have not ($M = 6.6$, $SD = 6.0$).

## Psychosocial and symptomological characteristics between colorectal cancer patients and PSSPs

Table 2 displays the intercorrelations between CRC patient and PSSP scores. Among patients, stress was positively correlated with fatigue ($r = 0.47$, $p < 0.001$), while mindfulness was negatively correlated with stress ($r = -0.42$, $p < 0.001$) and fatigue ($r = -0.33$, $p < 0.001$). Our path analysis of the association between mindfulness and fatigue mediated by stress is shown in Figure 1 with standardized coefficients for direct paths. Among patients, path analysis indicated that mindfulness was inversely associated with fatigue (total effect size = -0.33, $p < 0.01$),

Table 2. Intercorrelations between CRC patient and PSSP psychosocial and symptomological health characteristics

| | 1 | 2 | 3 | 4 | 5 | 6 |
| | 5.7 | 7.6 | 30.2 | 5.7 | 6.2 | 30.6 |
M (SD)	(5.1)	(6.5)	(6.8)	(3.8)	(4.8)	(5.6)
1. Patient stress	—					
2. Patient fatigue	0.47***	—				
3. Patient mindfulness	−0.42***	−0.33***	—			
4. PSSP stress	0.18	0.19	−0.45**	—		
5. PSSP fatigue	0.16	0.25	−0.17	0.55***	—	
6. PSSP mindfulness	−0.02	0.19	0.04	−0.44**	−0.26	—

CRC, colorectal cancer; PSSP, primary social support person; SD, standard deviation. CRC patient $n = 358$; PSSP $n = 38$; sample size reduced due to missing data values in bivariate analysis.
*$p < 0.05$.
**$p < 0.01$.
***$p < 0.001$.
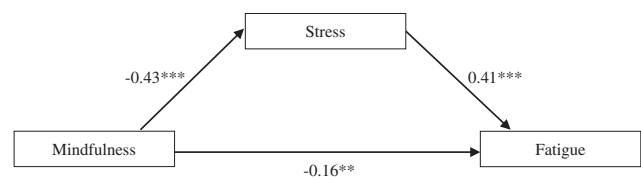
Figure 1. Path model of mindfulness, stress, and fatigue in Hispanic colorectal cancer patients (with standardized coefficients). *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$

and that this relationship was partially mediated by stress (mediated effect size = -0.17, $p < 0.001$). Among PSSPs, stress was positively correlated with fatigue ($r = 0.55$, $p < 0.001$), and mindfulness was negatively correlated

with stress ($r = -0.44$, $p < 0.001$). Notably, among CRC patients with a PSSP, patient mindfulness was negatively correlated with PSSP stress ($r = -0.45$, $p < 0.01$).

Association between psychosocial/symptomological characteristics and behavior in colorectal cancer patients

Table 3 displays estimates for cancer-related behavior regressed on psychosocial and symptomological characteristics among CRC patients. Stress level was positively associated with smoking status (OR = 1.08, $p < 0.01$). Mindfulness was negatively associated with smoking status (OR = 0.72, $p < 0.01$) and alcohol consumption (OR = 0.83, $p < 0.05$). There was no association between any factor and current physical activity.

Complementary and alternative medicine use behavior in colorectal cancer patients and primary social support persons

Table 4 displays CAM use behaviors in CRC patients and PSSPs. CAM use was common in this sample (41.4% of CRC patients and 55.6% of PSSPs used CAM in the past year). Herbal remedies were the most common type of CAM used by patients (33.7%) and PSSPs (47.8%) followed by bodywork (13.7% of patients and 26.7% of PSSPs). Among patients, the most common reason for using CAM was treating illness (57.5%), and among PSSPs, the most common reasons were overall wellness (68.0%) and pain management (68.0%). The odds of reporting use of herbal remedies was 6.2 times higher among patients whose PSSP used herbal remedies ($p < 0.01$) than those who did not. The odds of reporting use of bodywork was 8.3 times higher among patients whose PSSP used bodywork than those who did not ($p < 0.05$).

Table 4. Interdependence of CAM use between CRC patients and PSSPs

	Patient (n = 408)		PSSP (n = 45)		OR (95% CI)
	n	%	n	%	
CAM use					
Any type	169	41.4	25	55.6	2.8 (0.8, 9.6)
Herbal remedies	137	33.7	22	47.8	6.2 (1.7, 23.2)**
Bodywork (e.g., massage therapy and chiropractic manipulation)	56	13.7	12	26.7	8.3 (1.6, 44.6)*
Mind/body practices	31	7.6	8	17.8	1.8 (0.2, 20.7)
Naturopathy[a]	22	5.4	1	2.2	—
Other[a]	56	13.7	3	6.7	—

CAM, complementary and alternative medicine; PSSP, primary social support person; CRC, colorectal cancer.
Odds ratios (OR) of CAM utilization behaviors in patients dependent on CAM utilization behaviors in PSSPs.
[a]Odds ratio not provided for naturopathy due to minimal cell size.
*$p < 0.05$.
**$p < 0.01$.

Discussion

In the present population-based study of Hispanic CRC patients diagnosed on average 3 years prior to assessment, we observed some evidence for a shared psychosocial, behavioral, and symptomological climate after a cancer diagnosis between the patient and their self-identified PSSP who was a relative, spouse/partner, or friend. The inclusion of a PSSP in our study is unique from previous research on caregivers in that it focuses more on a social participatory role on behalf of the PSSP rather on the role of an assigned caregiver (e.g., a primary caretaker, hospice care, and nursing). These dyadic roles have salient implications for interrelated health behavior practices and psychosocial health for both cancer patients and PSSPs, which we sought to explore in several ways: (1) testing whether there were differences in psychosocial, behavioral, and symptomological health characteristics (smoking, alcohol consumption, physical activity, CAM

Table 3. Cancer-related behavior regressed on psychosocial and symptomological health characteristics among CRC patients

	Dependent variables					
	Stress		Fatigue		Mindfulness	
Independent variables	OR (95% CI)	p	OR (95% CI)	p	OR (95% CI)	p
Current smoker	1.08 (1.03, 1.14)	<0.01	1.02 (0.98, 1.07)	0.28	0.72 (0.57, 0.90)	<0.01
Current alcohol drinker	1.01 (0.96, 1.05)	0.81	1.00 (0.97, 1.03)	0.89	0.83 (0.69, 0.99)	0.04
Current physical activity	1.00 (0.96, 1.04)	0.88	0.99 (0.96, 1.02)	0.41	1.12 (0.94, 1.34)	0.22
Current CAM user	1.06 (1.02, 1.10)	<0.01	1.05 (1.02, 1.08)	<0.01	0.83 (0.69, 0.99)	0.01

CAM, complementary and alternative medicine; CRC, colorectal cancer.
Odds ratios (OR) are reported for logistic regression.
Significance levels of $p < 0.05$ are reported in bold.

usage, stress, fatigue, and mindfulness) between CRC patients with and without a PSSP; (2) testing whether several indicators of psychosocial and symptomological health (stress, fatigue, and mindfulness) are correlated between patient and PSSP; (3) testing whether these psychosocial and symptomological characteristics are associated with the health behaviors (i.e., smoking) explored in the study; and (4) testing whether PSSP utilization of various types of CAM (i.e., mind and body practices) is associated with patient utilization of corresponding CAM practices.

We identified that those perceived by the cancer patient to be PSSPs were most often family members, most often a spouse or child. There were no significant differences in psychosocial, behavioral, and symptomological characteristics between patients with and without PSSPs. These findings should be interpreted with consideration of the cross-sectional nature of our analysis. Therefore, our findings may not capture the complex differences in patient experiences between those with and without PSSPs. PSSPs play a specific role in medical decision-making and providing regular assistance for cancer-related problems, including the provision of care and lifestyle behaviors [30,31]. Therefore, it is possible that our findings may be conflated by complications and challenges faced by CRC patients who actually require a PSSP. For this reason, reporting having a PSSP could be an indicator of both social support and a lack of functional independence.

Our findings allude to a link between patients and PSSPs on several health-related characteristics. Mindfulness was negatively correlated with levels of stress and fatigue among both patients and PSSPs. In addition, there was an inverse relationship between patient mindfulness levels and PSSP stress levels, suggesting perhaps that a patient with a high capacity for enhanced attention and awareness in the present moment might possibly have a benefit on oneself as well as on the PSSP. Our path analysis indicated that stress significantly mediated effects of mindfulness on fatigue in patients. In turn, our cross-sectional analysis indicate that among CRC patients, mindfulness was inversely associated with smoking and alcohol use, which is consistent with studies demonstrating the efficacy of mindfulness-based interventions on treating substance use disorders [32]. These findings support other hospital-based studies suggesting that the patient and PSSP form a dyad where emotional distress can be interdependent, yet to a limited degree [5,11,12,33,34].

An intriguing finding is the inverse relationship between patient mindfulness and PSSP stress levels. Some shared psychology and symptomology between patients and PSSP, together with the well-established association between mindfulness and stress [35] research, may possibly account for these findings. In general, the relationship between mindfulness and stress can be interpreted as reciprocal [35,36]. Previous research shows that mindfulness training can lead to reduced engagement in

maladaptive, habitual behaviors that are often automatically carried out under stress and enables one to act congruently with one's conscious intentions and goals [35]. Conversely, the presence of stress can cascade to deficits in mindfulness and psychosocial breakdown [35]. It is possible that this explains why mindfulness was negatively correlated with levels of stress and fatigue and a lower likelihood of health risk behaviors in our CRC sample.

Complementary and alternative medicine approaches have increased in popularity over the last decades across several ethnic/racial groups [37]. Among cancer patients, the use of CAM also appears to be widespread with an average patient use of 31.4% across studies [38], which is somewhat lower than our finding of 41.4% of reported use among Hispanic CRC patients. Herbal medicine was the most commonly reported type of CAM, which may include any non-conventional therapies subsequent to their diagnosis such as dietary supplements and medicinal remedies. Only a small proportion of patients reported using mind–body interventions such as mindfulness-based meditation. We observed shared patterns in CAM utilization behaviors between patients and their PSSPs, suggesting implications for interpersonal learning activities that engage both the person with cancer and their PSSPs in an effort to reduce cancer risk and improve health in cancer patients as well as those in the social network.

Our findings have potential implications for targeted prevention of cancer in elevated risk populations. A substantial percent of Hispanic CRC patients in our study reported first-degree family members as their PSSP. First-degree family members have an elevated risk of cancer diagnosis as compared with the general population [39]. Given that CRC patients are identifiable given their formal engagement with the healthcare system, health promotion and disease prevention messages could be tailored and delivered simultaneously to the CRC patient and PSSP dyad using various modalities (e.g., Internet, phone calls, text message, and mailings) to reinforce proper lifestyle modifications that are shown to reduce CRC risk (e.g., substance use, diet modification, and exercise) and age-appropriate preventive screening behavior to detect early neoplastic changes. Simultaneously delivered health promotion and prevention intervention messages could potentially reduce intervention costs and length of time required to deliver intervention and increase the potential for synergistic social support and health behavior modeling in a high-risk population. This is especially relevant considering our findings that health behaviors related to CAM usage were, in some instances, interdependent between CRC patients and their PSSP. In addition, CRC patient mindfulness level appears relevant to PSSP stress levels, suggesting a possible role for integrating methods to enhance mindfulness in such health promotion activities in clinical and community settings, if stress is an important

target in the intended population [40]. Furthermore, our findings indicate that access to mindfulness interventions may be low in Hispanic CRC patients, despite its demonstrated benefits among people with cancer diagnoses [18,19].

Our study has limitations and notable strengths. Because these data are cross-sectional, we are unable to account for various health measures prior to the diagnosis, and it is possible that previous experiences of adverse psychological stressors could influence our results. Furthermore, the cross-sectional nature of our analyses limits our inferences regarding directionality. Unlike prior studies, we present a population-based sample of Hispanic CRC patients. Although not part of the eligibility, it is unknown whether the entire sample of PSSPs was also Hispanic. Unlike in other hospital-based studies, our population reported psychosocial measures on average 3 years after diagnosis. Part of our results may reflect social dynamics relevant only to the survivorship period. We are unable to more accurately assess the potential effects of time since diagnosis, which would require longitudinal measurement. Additionally, there is a potential for self-selection bias among PSSPs, as those who were willing to participate in the PSSP questionnaire may have greater interdependence with patients than PSSPs who did not participate in this component of the study.

Conclusion

With these limitations considered, our findings extend previous work on the interpersonal dynamics shared between cancer patients and their PSSPs during active cancer treatment by suggesting that Hispanic CRC patients and their PSSP report overlap in their psychological, behavioral, and symptomological health features in the years following a cancer diagnosis. Future prevention research might consider the utility of targeting health promotion messaging to the cancer patient and PSSP dyad in an effort to improve quality of life during cancer survivorship and for enhancing cancer-protective behaviors such as screening and lifestyle modification in at-risk family members.

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Conflict of interest

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