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A TEST OF THE "TEACHABLE MOMENT" HEURISTIC'S RELEVANCE FOR UNDERSTANDING CANCER SURVIVORS' HEALTH BEHAVIOR MOTIVATION AND PERFORMANCE: A CROSS-SECTIONAL STUDY

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DISSERTATION

A dissertation submitted in partial fulfillment of the
requirements for the degree of Doctor of Philosophy in the
College of Arts and Sciences
at the University of Kentucky

By
Gabriella Elena Puleo
Lexington, KY

Director: Dr. Jessica Burris, Professor of Psychology
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2021

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ABSTRACT OF DISSERTATION

A TEST OF THE “TEACHABLE MOMENT” HEURISTIC’S RELEVANCE FOR UNDERSTANDING CANCER SURVIVORS’ HEALTH BEHAVIOR MOTIVATION AND PERFORMANCE: A CROSS-SECTIONAL STUDY

Cancer diagnosis has potential to motivate health behavior changes to promote better health outcomes. The Teachable Moment Heuristic is a parsimonious, transtheoretical framework for understanding the conditions under which behavior change might occur, with constructs that include affective, cognitive, and social factors. This exploratory study aimed to measure the three primary constructs of the Teachable Moment, evaluate the extent to which they are associated with cancer survivors’ motivation to adopt favorable health behaviors, and explore their potential as a model for health behavior performance. Participants ($n = 93$) in this cross-sectional study were adult breast, prostate, colorectal, lung, and head/neck cancer survivors (45.16% male) who were diagnosed within the past five years ($M, SD = 2 \pm 1.68$ years). Overall, participants reported mild distress, moderate wellbeing, moderate perceptions of health risk, and moderate changes in their self-concept and social role within the past month. Correlation matrices and linear regression models were applied to examine the relationships between the Teachable Moment constructs and health behaviors in the domains of diet, physical activity, tobacco use, and alcohol consumption, with some significant associations and modest predictive utility. Results support further exploration of the Teachable Moment Heuristic on health promotion after cancer diagnosis, perhaps with a focus on longitudinal studies and identifying if there is an optimal “window of opportunity” during which to capitalize on high motivation for health behavior change.

KEYWORDS: Cancer survivors, Teachable Moment, Affective Response, Risk Perception, Self-Concept/Social Role

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07/26/2021

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INTRODUCTION

Due to advances in cancer screening, treatment, and long-term surveillance, cancer survivors¹ are now living longer after their diagnosis than ever before (National Cancer Institute, 2020). Consequently, it is critically important that cancer survivors engage in secondary prevention to mitigate risk for adverse outcomes like cancer progression, second primary cancer diagnosis, and early cancer-specific and all-cause mortality (Gritz et al., 2006; Meyerhardt et al., 2013). Additionally, as comorbid health conditions (e.g., hypertension, coronary artery disease, diabetes) may complicate cancer treatment or otherwise threaten the health and wellbeing of cancer survivors (Cuthbert, Hemmelgarn, Xu, & Cheung, 2018; Wang et al., 2015), the adoption of an overall healthy lifestyle is of the utmost importance. As such, measuring health behaviors, understanding what predicts them, and intervening with the goal of health promotion have become integral components of cancer survivorship research (Crawford-Williams et al., 2018; Demark-Wahnefried et al., 2015).

To facilitate cancer survivors' adoption of health promoting and disease preventing behaviors, the American Cancer Society has evidence-based guidelines for cancer survivors to follow. These guidelines provide specific recommendations related to diet, physical activity, alcohol consumption, tobacco use, and cancer surveillance (American Cancer Society, 2020a), with recommendations that are in line with those for US adults in the general population (Fiore, Jaen, & Baker, 2008; US Department of Health and Human Services, 2018, 2020). The American Cancer Society guidelines are

¹ "Cancer survivor" refers to anyone with a history of cancer, regardless of time since diagnosis or disease status (National Cancer Institute, Office of Cancer Survivorship).

similar to the recommendations of other organizations, including the National Comprehensive Cancer Network (NCCN) and World Cancer Research Fund (WCRF) (NCCN, 2016; WCRF, 2020). To summarize, cancer survivors are encouraged to: eat a well-balanced diet with plenty of fresh fruits, vegetables, and whole grains, limit red and processed meat, and avoid sugary drinks; perform at least 150 minutes per week of moderate cardiovascular activity and at least 2 days per week of strength training; limit alcohol consumption; completely avoid tobacco use; and adhere to current recommendations for cancer screening in order to improve quality of life, long-term health outcomes, and reduce the incidence of disease recurrence and overall health complications.

Unfortunately, cancer survivors' adherence to the American Cancer Society guidelines is unsatisfactory (Berdan, Tangney, Scala, & Stolley, 2014; Blanchard, Courneya, & Stein, 2008; Hyland, Jacobs, Lennes, Pirl, & Park, 2018; Puleo, Borger, Montgomery, Rivera-Rivera, & Burris, 2019). As one illustration, a 2014 population-based, case-control study (LeMasters, Madhavan, Sambamoorthi, & Kurian, 2014) of breast, colorectal, and prostate cancer survivors ($n = 11,766$) demonstrated that recent diagnosis was predictive of adherence to health behavior recommendations, whereas cancer survivors who were further out from diagnosis were less likely to demonstrate health behaviors in line with recommendations. That said, overall, cancer survivors' adoption of healthy behaviors was not significantly different from people without a cancer history. Furthermore, this study showed differences in adherence across health behavior outcomes. For example, when compared to noncancer controls, breast cancer survivors were much more likely to meet fruit and vegetable consumption guidelines, but

less likely to meet recommendations for physical activity (Centers for Disease Control and Prevention, 2019), while colorectal cancer survivors were less likely to meet physical activity and preventative care guidelines than noncancer controls. Another large study ($n = 772$) found childhood cancer survivors were no more likely than noncancer controls to follow the American Cancer Society guidelines for diet and physical activity as adults (Berdan et al., 2014). The lack of strict adherence to the guidelines could be explained, at least partly, by inadequate dissemination or promotion of the guidelines (Mowls, Brame, Martinez, & Beebe, 2016; Underwood et al., 2012) and/or limited knowledge of the importance of health behaviors for long-term cancer and other health outcomes (Puleo et al., 2019; Westhoff, Maria De Oliveira-Neumayer, Aben, Vrieling, & Kiemeny, 2016). It is also quite possible that there are many other factors at play, including some of the personal and social determinants of health behavior performance and change described in the most popular health behavior theories (Ajzen, 1991; Ajzen & Fishbein, 1980; Bandura, 1977; Glanz, 2008; Hochbaum, 1958; Prochaska & DiClemente, 1983).

The cancer survivorship literature would benefit from a comprehensive, yet parsimonious model of health behavior change that has the capacity to guide interventions for the adoption and maintenance of health-promoting behaviors. One promising means by which to understand cancer survivors' health behaviors is the Teachable Moment Heuristic (TM)². According to the TM, a major life or health event can serve as a powerful catalyst for health behavior change with the express purpose of health promotion and risk reduction, if certain conditions are met (McBride, Emmons, & Lipkus, 2003; McBride & Ostroff, 2003). The TM suggests the emotional, cognitive, and

² As shorthand, "TM" will be used to refer to both the conceptual model and its hypothesized turn of events

social responses triggered by select events can motivate and facilitate change, despite how deeply a behavior was previously ingrained. Within the framework of the TM, these three change processes occur in three domains: 1) affective response, 2) risk perception, and 3) social role and self-concept. In the context of a new cancer diagnosis, the TM indicates that an individual is likely to: 1) experience a heightened emotional response, either positive or negative (e.g., anxiety, gratitude), 2) perceive newfound risk to their physical health and wellbeing, and 3) undergo a change in self-perception as they adopt the identity of a cancer patient or survivor. In conclusion, there is yet untapped potential to use the TM to explain health behavior performance and change after cancer diagnosis, and this study seeks to explore its measurement and utility.

Current Study

Given the clinical significance of a healthy lifestyle for cancer survivorship, this study intends to measure the main components of the TM (namely, affective response, risk perception, and social role/self-concept) and evaluate to what extent they are individually and collectively associated with cancer survivors' health behaviors. Since proper measurement of the TM is yet to be determined, this study will cast a "wide net" in terms of construct measurement, including both cancer-specific and generic measures, and try to discern if one approach is more informative than another. Additionally, this study will measure four different health behaviors, including those that are commonly viewed in a positive (specifically, fruit and vegetable consumption and physical activity) and negative (specifically, alcohol use and tobacco use) light. Finally, this study includes a sample of cancer survivors that is heterogenous in terms of disease site and survivorship phase, with the goal being to heighten generalizability.

The current study has two objectives. First, this study aims to assess the association between TM construct variables and cancer survivors' motivation to adopt and maintain healthy behaviors in the near future. A descriptive element of the constructs is embedded in this aim, such that the sample's endorsement of affective response, risk perception, and social role/self-concept will be described. It is hypothesized that lower distress, higher wellbeing, greater perception of cancer-specific and general health risk, stronger identification as a healthy person and greater perception of control over health/more positive health expectations will be significantly, positively associated with motivation. Second, this study aims to assess the association between key TM construct variables and cancer survivors' current health behaviors. The hypotheses for this aim follow the same pattern as those for the motivational outcome, but with an emphasis on health-promoting behavioral outcomes (e.g., distress is negatively associated with frequency of cardiovascular exercise, wellbeing is positively associated with tobacco abstinence). Furthermore, it is expected that the combination of key TM construct variables, plus motivation, will be predictive of cancer survivors' health behaviors.

METHOD

Participants

Participants consist of adults aged 18 to 90 who received their first primary diagnosis of breast, colorectal, head/neck (i.e., larynx, oral cavity, pharynx), lung/bronchus, or prostate cancer in the past five years. These cancer sites were selected because they are among the most commonly diagnosed in the country (American Cancer Society, 2020b) and they allow for representation of both males and females in the study sample. Exclusion criteria included: 1) prior cancer diagnosis other than non-melanoma

skin cancer and/or cancer diagnosis prior to adulthood; 2) cognitive or psychiatric impairment that would interfere with the ability to provide written informed consent or complete study procedures (e.g., dementia, psychosis); 3) unreliable phone access (i.e., no landline or mobile phone for personal use); 4) pregnancy or plan to become pregnant within six months; and 5) inability to read, write, and speak English.

Procedure

Recruitment and enrollment. Participants were recruited through the Kentucky Cancer Registry (KCR) and the University of Kentucky Markey Cancer Center. KCR aided recruitment by identifying 108 individuals in their database who met the aforementioned criteria related to cancer site, diagnosis date, and age. KCR also specifically selected cases such that half of those identified were rural residents at the time of diagnosis. Once all individuals were identified, KCR contacted each physician on record and requested that they indicate any reasons why someone should not be invited to participate. If no reason was given, KCR contacted each person by phone or mail (no more than five total contact attempts) to inform them of their potential for study participation. Names and contact information for those who agreed to further contact were then released to study staff. Upon receipt of names and contact information, study staff made up to five attempts to reach people, provide a study overview, and screen for eligibility. Eligible and interested individuals then received more information about the study and written informed consent was obtained by mail. At Markey Cancer Center, participants were recruited through several avenues. Flyers were posted throughout the cancer center, and in-person recruitment at relevant outpatient clinics, the Radiation Oncology Clinic, and the Chemotherapy Infusion Clinic took place. Whether recruited

via flyer or in-person, up to five contact attempts were made to provide a study overview, screen for eligibility, and obtain written informed consent and HIPAA authorization from eligible and interested persons.

Data collection. Participants' clinical information was obtained from KCR or a review of their electronic medical record, as appropriate based on the recruitment source. Additionally, participants completed standardized, self-report surveys via a mailed paper-and-pencil form (87.10%, $n=81$), structured phone interview (8.60%, $n=8$), or structured face-to-face interview (4.30%, $n=4$). In the case of mail questionnaires, participants received and returned the survey at no cost to them. In the case of questionnaire completion by phone, participants were contacted at their preferred number, day and time at no cost to them. For the face-to-face interviews, a private space within the cancer center was utilized so data were collected before or after participants' appointments. The survey took 30-45 minutes to complete, and data were entered and securely stored in Research Electronic Data Capture (REDCap) (Harris et al., 2009).

Compensation. Participants were compensated \$25 for their time via a check mailed to their preferred address.

Measures

Demographics. Participants answered basic demographic questions about their age, gender, ethnicity, race, and socioeconomic status. Questions were taken from a recent Behavioral Risk Factors Surveillance System survey (Centers for Disease Control and Prevention, 2019).

Affective Response. The 22-item Impact of Events Scale Revised (IES-R) was used to measure cancer-specific distress (Bresser et al., 2007; McBride, Clipp, Peterson,

Lipkus, & Demark-Wahnefried, 2000) and is composed of three subscales that reflect the post-traumatic stress symptom clusters of avoidance, intrusion, and hyperarousal (Salsman, Schalet, Andrykowski, & Cella, 2015; Weiss & Marmar, 1997). Participants were asked to consider their experience with cancer in the past week and rate how stressful each item was for them on a 5-point scale from 0 = not at all to 4 = extremely. Sample items include: “I stayed away from reminders about it” and “I thought about it when I didn’t mean to.” Higher scores, which represent a sum of all items, indicate more cancer-specific distress (range=0-88, $\alpha=0.95$).

The Patient Reported Outcomes Measurement Information System was used to measure anxiety and depressive symptoms (PROMIS-A and PROMIS-D, respectively) (Pilkonis et al., 2011). These well-accepted measures of emotional distress have been used reliably in cancer survivors (e.g., Quach et al., 2016; Wilford et al., 2018). Sample items from the 6-item measures include: “In the past 7 days, my worries overwhelmed me” (PROMIS-A) and “In the past 7 days, I felt worthless” (PROMIS-D). Response options are on a 5-point scale where 1 = never and 5 = always. Higher scores for a combined 12-item scale indicate greater overall distress (range: 12-60, $\alpha=0.97$).

The 10-item Post-Traumatic Growth Inventory (PTGI) measures perceived benefits experienced after a major stressor (Cann et al., 2010) like cancer diagnosis and treatment. This measure was utilized to assess cancer-specific wellbeing akin to prior studies (Cormio, Muzzatti, Romito, Mattioli, & Annunziata, 2017; Kuswanto, Sharp, Stafford, & Schofield, 2020). The PTGI includes five subscales: appreciation for life, new opportunities, spiritual change, relating to others, and personal strength. Sample items include: “Due to my cancer, I established a new path for my life” and “Due to my

cancer, I know better that I can handle difficulties.” Participants are asked to respond to each item on a 6-point scale from 0 = I did not experience this change to 5 = I experienced this change to a very great deal. Higher total scores indicate more positive changes due to cancer, or greater cancer-specific wellbeing (range= 0-50, $\alpha=0.92$).

The 5-item Satisfaction with Life Scale (SWLS) is a valid and reliable measure of life satisfaction (Diener, Emmons, Larsen, & Griffin, 1985) with prior use in cancer survivors (Burriss & Andrykowski, 2010). Sample item: “In most ways my life is close to ideal.” Items are answered on a 7-point scale where 1 = strongly disagree and 7 = strongly agree and then summed. Higher scores indicate greater overall wellbeing (range=5-35, $\alpha=0.90$).

Risk Perceptions. An 8-item risk perception scale was created to separately tap into cancer-specific and general health risk (RP-C and RP-G, respectively), using or adapting items from prior studies (Burriss, Jacobsen, Loftus, & Andrykowski, 2012; Hay et al., 2007; Lerman, Daly, Masny, & Balshem, 1994; Lerman et al., 1991; Mullens, McCaul, Erickson, & Sandgren, 2004). Participants first responded to a question about their chances of getting cancer again (either recurrence or new primary) and then answered a total of three questions about the frequency of any cancer-related worry and the impact of any cancer-related worry on their mood and ability to perform daily activities. Sample items are “What do you think your chances are of getting cancer again?” and “How much does worry about getting cancer again affect your ability to perform your daily activities?” Each question was answered on a 5-point scale where 1 = not at all and 5 = extremely, extremely likely, or almost all the time, as appropriate. Items are summed to create a total score where higher scores reflect stronger risk perceptions

(range=4-20, $\alpha=0.82$). A parallel set of items was used to measure risk perceptions related to participants' overall health. Example items are "How frequently do you worry about developing new health problems?" and "Not considering your cancer, what do you think your chances are of having another major health problem?" Items are summed to create a total score that reflects stronger risk perceptions (range=4-20, $\alpha=0.83$).

Coefficient α for a combined, 8-item measure of risk perception (range=8-40) was 0.88.

Social Role. A 2-item Change in Social Role (SR) measure was created to examine a change in identity as a consequence of cancer diagnosis. This measure was adapted from items in other studies (Okely, Mason, Collier, Dunnachie, & Swanson, 2018; Pollak et al., 2010). Participants were specifically asked how their cancer diagnosis has impacted the degree to which they identify as a healthy person and as someone living a healthy lifestyle. The items are: "Since your cancer diagnosis, how much has your identity as a healthy person changed?" and "Since your cancer diagnosis, how much as your identity as someone who lives a healthy lifestyle changed?" Each question was answered on a 5-point scale where 1 = this part of my identity is less important now than before diagnosis and 5 = this part of my identity is more important now than before diagnosis. The items were summed, and higher scores reflect greater importance post-diagnosis (range=2-10, $\alpha=0.85$).

Self-Concept. A 6-item Self-Concept Scale (SC) that taps into an individual's sense of control and expectations for the future was created for this study, with one item pulled from a prior study (Christensen et al., 1999). Participants were separately asked how much control they have over their cancer and health in general, how well they expect their cancer-related and general health outcomes to go in the future, and how their cancer

diagnosis has changed their sense of control and health-related expectations. Sample items include: “Since you were diagnosed with cancer, how much has your sense of control over your health changed?” and “How do you expect the course of your cancer to go in the future?” Participants responded to all questions on a 5-point scale, where 1 corresponded to less control and more negative expectations (e.g., I have a lot less control now than before) and 5 corresponded to more control and more positive perceptions (e.g., I expect only positive outcomes). Items were summed to create a total score where higher scores reflect a more positive self-concept, that is, more perceived control and more positive expectations (range=6-30, $\alpha=0.81$).

Motivation to Engage in Healthy Behaviors. Single-item contemplation ladders (Biener & Abrams, 1991; Carpenter, Hughes, & Keely, 2003; Carpenter, Hughes, Solomon, & Callas, 2004) separately measured participants’ motivation to engage in these behaviors over the next 30 days: 1) consume a healthy diet, 2) engage in regular physical activity, 3) limit alcohol use, and 4) abstain from tobacco use. Participants were separately asked about their intention and confidence related to each of the four health behaviors, which resulted in 8 questions total. Sample items include: “How much do you intend or plan to avoid tobacco use over the next 30 days?” and “How confident are you that you can avoid tobacco use over the next 30 days?” Participants responded to the intention items on an 11-point scale, where 0 = very definitely no and 10 = very definitely yes, and to the confidence items on an 11-point scale, where 0 = not at all confident and 10 = extremely confident. Items were summed to create a total score where higher scores indicate higher levels of motivation (range=0-20, α s=0.91, 0.90, 0.62, and 0.76 for diet, physical activity, alcohol use, and tobacco use, respectively).

Diet. Five items measured participants' consumption of fruits and vegetables, with items adapted from recent Behavioral Risk Factors Surveillance System Survey (BRFSS) (Centers for Disease Control and Prevention, 2019) and the Health Information National Trends Survey (HINTS) questionnaires (NCI, 2017). Participants were first asked about 30-day point prevalence of fruit and vegetable consumption, with clear explanations about what did and did not count as a fruit/vegetable. For example, participants were asked this "Yes/No" question: "During the past 30 days, did you eat any fruit, not including fruit-flavored drinks or fruit juices?" Instructed to continue thinking about the past month, participants were separately asked the number of days in a typical week where fruits, leafy greens, and other vegetables were consumed. Participants responded to these questions on an 8-point scale where 0 = no days and 7 = every day.

Physical Activity. Four items assessed type and frequency of physical activity in the past month, again with items adapted from HINTS (NCI, 2017). Akin to the approach for diet, participants were asked about their 30-day point prevalence of moderate intensity cardiovascular exercise and strength training plus the number of days in a typical week they engaged in these behaviors. Sample item: "In a typical week, on how many days did you do any physical activity or exercise specifically designed to strengthen your muscles, such as weightlifting or strength training?" The point prevalence questions had "Yes/No" response options and the frequency questions used an 8-point scale where 0 = no days and 7 = every day.

Alcohol Use. Alcohol use items were adapted from BRFSS (Centers for Disease Control and Prevention, 2019) and are commonly used in studies of cancer survivors' health behaviors (Coups & Ostroff, 2005; Lown et al., 2008). Participants were asked two

questions to determine 30-day point prevalence of alcohol use, number of “alcohol use days” in the past month, and typical number of drinks consumed on alcohol use days. The items were: “During the past 30 days, on how many days did you have at least one drink of any alcoholic beverage such as beer, wine or liquor?” and “On the days when you drink, how many drinks do you typically drink?” Response options for the first question ranged from 0 = no days to 30 = every day (31-point scale), and response options for the second question ranged from 1 = 1 drink to 7 = 7 or more drinks (7-point scale).

Tobacco Use. Tobacco use items were adapted from BRFSS and are consistent with prior, similar studies (Centers for Disease Control and Prevention, 2019). Akin to the measurement of alcohol use, participants were asked questions to determine 30-day point prevalence of any tobacco use, number of cigarette smoking and other tobacco use days in the past month (product types measured separately and in totality), and average number of cigarettes smoked on smoking days. Sample item: “During the past 30 days, on how many days did you smoke a cigarette?” Response options ranged from 0 = no days to 30 = every day (31-point scale). For the question about quantity of cigarettes smoked, a timeline follow-back assessment of the past seven days was used to assess behavior in a typical week (Griffith, Shiffman, & Heitjan, 2009).

Data Analysis

Descriptive statistics (e.g., percentages, frequencies, means \pm standard deviations) were used to describe the sample’s demographic and clinical characteristics as well as the nature of key study variables. To aid interpretation of the sample means for the key TM construct variables (i.e., affective response, risk perception, social role, and self-concept), the possible range of scores for each variable was split into tertiles, such that the 1st tertile

corresponds to “low,” the 2nd to “moderate,” and the 3rd to “high” endorsement of that variable. Bivariate correlations were then run to examine the association between the main TM construct variables and 1) demographic and clinical variables, 2) motivation to engage in healthy behaviors, and 3) health behavior performance, with Pearson’s r and Spearman’s ρ used as appropriate. The results for the demographic and clinical variables were reserved for an Appendix, as they are not germane to the study aims. For the subset of continuous health behavior variables (e.g., the number of days in a typical week where fruits were consumed or strength training occurred), hierarchical linear regression models were then performed to evaluate the relationship between the TM construct variables and health behavior performance. Step 1 included simultaneous entry of all individual affective response, risk perception, social role, and self-concept measures and Step 2 included the addition of motivation, with the motivational variable corresponding to the select health behavior outcome (e.g., the 2-item measure of motivation to abstain from tobacco use was used to predict tobacco use days in the past month). While the standardized β for each predictor was recorded, the total variance explained (R^2) separately at Step 1 and 2, and the R^2 change between the steps were the primary statistics of interest for the regression models. In all analyses, $p < .05$ was used to determine statistical significance.

RESULTS

Sample

Accrual. In total, 167 individuals were screened for this study. Of those screened, 74.85% ($n = 125$) were eligible, and of those eligible, 74.40% ($n = 93$) enrolled and provided data.

Demographic characteristics. Participants' average age was 61.45 ± 10.87 years. The majority were White, non-Hispanic (92.47%, $n = 86$). Around half of participants were male (45.16%, $n = 42$). Many participants were in a relationship (60.22%, $n = 56$), had some college education (60.22%, $n = 56$), and resided in a rural county at cancer diagnosis (63.44%, $n = 59$). Fewer than half of participants reported an annual household income above \$50,000 (40.86%, $n = 38$), with just over a quarter reporting less than \$20,000 (26.88%, $n = 25$). Just over one-third of participants were employed (35.48%, $n = 33$), with more describing employment status as homemaker, student, or retiree (40.86%, $n = 38$).

Clinical characteristics. Participants were diagnosed, on average, in the past 2 years ($SD = 1.68$) years, with almost half diagnosed in the prior year (43.0%, $n=40$). Diagnoses were breast (31.18%, $n = 29$), prostate (19.35%, $n = 18$), head/neck (17.20%, $n = 16$), lung (17.20%, $n = 16$) and colorectal (15.05%, $n = 14$) cancer. More than half had regional (38.7%, $n = 36$) or distant disease (20.4%, $n = 19$) at diagnosis. Nearly all participants received cancer treatment (94.62%, $n = 88$), with many having multi-modal treatment (66.67%, $n = 62$).

Descriptive Summary of Key Variables

Descriptive information for the TM constructs and health behavior variables are presented in Tables 1 and 2, respectively.

Table 1. Descriptive information for the Teachable Moment construct variables

Variable	M ± SD	Range
Affective Response (n=89–92)		
Cancer-specific distress, IES-R	19.28 ± 16.9	0 – 71
Emotional distress, PROMIS A&D	23.27 ± 11.19	12 – 58
Cancer-specific wellbeing, PTGI-SF	26.03 ± 12.83	0 – 50
Life satisfaction, SWLS	22.66 ± 7.98	5 – 35
Risk Perceptions (n=86–92)		
Cancer-specific risk, TM-CRP-C	9.29 ± 3.42	4 – 20
General health risk, TM-CRP-G	8.25 ± 3.09	4 – 18
Overall health risk, TM-CRP	17.49 ± 6.02	8 – 38
Social Role and Self-Concept (n=90–92)		
Social role, TM-SR	7.08 ± 1.94	2 – 10
Self-concept, TM-SC	18.09 ± 4.43	7 – 29
Motivation to Adopt Healthy Behaviors (n=88–90)		
Diet – intention, CL	7.52 ± 2.76	0 – 10
Diet – confidence, CL	7.23 ± 2.93	0 – 10
Diet – motivation, CL	14.83 ± 5.39	0 – 20
Physical activity – intention, CL	6.22 ± 3.56	0 – 10
Physical activity – confidence, CL	6.00 ± 3.60	0 – 10
Physical activity – motivation, CL	12.22 ± 8.83	0 – 20
Alcohol use – intention, CL	8.69 ± 2.82	0 – 10
Alcohol use – confidence, CL	9.28 ± 2.20	0 – 10
Alcohol use – motivation, CL	17.98 ± 4.31	0 – 20
Tobacco use – intention, CL	8.58 ± 3.15	0 – 10
Tobacco use – confidence, CL	8.90 ± 2.73	0 – 10
Tobacco use – motivation, CL	17.48 ± 5.29	0 – 20

Notes. CL=Contemplation ladder; IES-R=Impact of Events Scale, revised; PROMIS A&D = Patient Reported Outcome Measurement Information Systems Anxiety and Depression 4-Item Scales; PTGI-SF=Post Traumatic Growth Inventory Short-Form; SWLS=Satisfaction with Life Scale; TM-CRP=TM – Change in Risk Perception (C=Cancer, G=General health); TM-CSC=TM – Change in Self-Concept; TM-CSR=TM – Change in Social Role

Table 2. Participants' health behavior practices in the past month by domain

Variable	% (n)	M ± SD	Range
Diet (<i>n</i> =90) ¹			
Any fruit or vegetable consumption, Past month	97.80 (89)		
Fruit days, Typical week		4.09 ± 2.21	0 – 7
Leafy green vegetable days, Typical week		2.95 ± 1.88	0 – 7
Other vegetable days, Typical week		4.63 ± 1.79	0 – 7
Fruits consumed ≥ 4 days, Typical week	58.70 (54)		
Vegetables consumed ≥ 4 days, Typical week	71.00 (66)		
Physical Activity (<i>n</i> =89) ¹			
Any physical activity, Past month	55.40 (51)		
Cardio exercise days, Typical week		2.39 ± 2.31	0 – 7
Strength training days, Typical week		0.85 ± 1.58	0 – 7
Alcohol Use (<i>n</i> =91) ¹			
Any alcohol consumption, Past month	65.90 (60)		
Alcohol use days, Past month		2.98 ± 6.78	0 – 30
Alcoholic drinks per day, Typical week ²		1.94 ± 1.39	1 – 7
Tobacco Use (<i>n</i> =74–91) ³			
Any tobacco use, Past month	17.6 (13)		
Cigarette use days, Past month		3.63 ± 9.61	0 – 30
Other tobacco use days, Past month		1.36 ± 6.04	0 – 30
Tobacco use days, Past month		4.09 ± 10.09	0 – 30
Cigarettes smoked per day, Typical week ⁴		11.05 ± 8.45	1.14 – 25.00

Notes. ¹ For all variables that correspond to a “Typical week/month” participants reported the number of days they consumed the item (diet) or engaged in the behavior (physical activity, alcohol use, and tobacco use); ² On days when alcohol use occurred, on a scale where 1 = 1 drink and 7 = 7 or more drinks; ³ Missing data for *n*=19 participants who did not respond to questions about non-cigarette tobacco use and missing data for *n*=2 participants who did not respond to questions about cigarette smoking; ⁴ For participants (*n*=13) who reported cigarette use in the past month

Affective response, risk perception, social role, and self-concept. Participants, as a whole, described mild cancer-specific distress, mild emotional distress, moderate cancer-specific wellbeing, and moderately high life satisfaction. Participants' average score on measures of cancer-specific risk and general health risk scales both fell in the moderate range. Perception of a change in participants' social role and self-concept after cancer diagnosis were both moderate.

Motivation. Across health behaviors of diet, alcohol consumption, and tobacco use, motivation to adopt or maintain healthy behaviors over the next month was high, while motivation for healthy physical activity levels in this same period was moderate. For diet and physical activity, intention to adopt healthy behaviors was slightly higher than confidence to do so. For alcohol use and tobacco use, the opposite was true; confidence was slightly greater than intention.

Health behaviors. Nearly all participants endorsed at least one instance of fruit or vegetable consumption in the past month (97.80%, $n = 89$). In a typical week, participants reported consuming fruits on 4.09 ± 2.21 days, leafy green vegetables on 2.95 ± 1.88 days, and other vegetables on 4.63 ± 1.79 days. Just over half of participants reported the occurrence of physical activity in the past month (55.4%, $n = 51$). In a typical week, participants reported 2.39 ± 2.31 days of cardiovascular activity and less than one day of strength training (0.85 ± 1.58). Roughly two-thirds of participants reported some alcohol consumption in the past month (65.9%, $n = 60$), with 2.98 ± 6.78 days of alcohol use in a typical week. Less than a fifth of participants reported tobacco use in the last month (17.6%, $n=13$). Participants reported tobacco use on 4.09 ± 10.09 days in a typical week.

Participants who smoked cigarettes reported smoking, on average, roughly half a pack per day on a smoking day (11.05 ± 8.45).

Bivariate Correlations among Key Variables

Correlations between the TM constructs and motivation and health behavior variables are presented in Tables 3 and 4, respectively.

Motivation to adopt or maintain healthy behaviors. Of the four variables that tapped into affective response, life satisfaction was the only one significantly correlated with participants' motivation to engage in healthy behaviors. Specifically, life satisfaction was positively correlated with motivation to eat a healthy diet ($r = .25, p = .02$) and abstain from tobacco use ($r = .21, p = .04$). Neither the cancer-specific nor general health risk perception variable was correlated with motivation. While social role was not significantly correlated with motivation, self-concept was positively correlated with motivation to adopt healthy behavior related to diet ($r = 0.22, p = .04$) and physical activity ($r = .29, p = .01$). Finally, motivation was consistently, positively associated with health behavior, with significant associations for 9 of the 11 health behavior variables (data not shown).

Health behavior performance. For the four health behavior variables measured by point prevalence, only one was significantly correlated with a TM variable. Specifically, endorsement of alcohol use within the past month was correlated with lower emotional distress ($\rho = -.26, p = .01$). For the seven health behavior variables measured as frequency or quantity, correlations with the TM variables were more likely to reach the threshold for statistical significance. All four measures of affective response demonstrated a relationship with one or more health behaviors. Higher cancer-specific

distress was associated with fewer alcohol use days ($r = -.24$, $p = .03$). Emotional distress was negatively associated with number of strength training days ($r = -.26$, $p = .02$) and number of alcohol use days ($r = -.21$, $p = .04$). Greater cancer-specific wellbeing and more life satisfaction were associated with more fruit and vegetable days (both $r = .21$, $p = .04$). Perception of cancer-specific risk was associated only with fewer days of cardiovascular activity ($r = -.25$, $p = .02$), and perception of general health risk was not significantly associated with any health behavior.

Table 3. Correlations between the Teachable Moment construct variables and motivation to change health behaviors ¹

Variable	Diet – Motivation ²	Physical activity – Motivation ²	Alcohol use – Motivation ²	Tobacco use – Motivation ²
1. Cancer-specific distress, IES-R	-.08	-.14	-.09	-.13
2. Emotional distress, PROMIS A&D	-.11	-.12	.04	-.16
3. Cancer-specific wellbeing, PTGI-SF	.13	-.01	-.12	-.05
4. Life satisfaction, SWLS	.25*	.17	.08	.21*
5. Cancer-specific risk, TM-CRP-C	-.04	-.16	.05	-.01
6. General health risk, TM-CRP-G	-.17	-.14	-.05	-.13
7. Social role, TM-SR	.04	.07	-.12	-.19
8. Self-concept, TM-SC	.22**	.29*	-.12	-.10

Notes. ¹ Pearson's *r* correlations; ² All motivation variables are measured with a Contemplation Ladder that corresponds to the health behavior of interest; * $p < .05$; ** $p < .01$; IES-R=Impact of Events Scale, revised; PROMIS A&D = Patient Reported Outcome Measurement Information Systems Anxiety and Depression 4-Item Scales; PTGI-SF=Post Traumatic Growth Inventory Short-Form; SWLS=Satisfaction with Life Scale; TM-CRP=TM – Change in Risk Perception (C=Cancer, G=General health); TM-CSC=TM – Change in Self-Concept; TM-CSR=TM – Change in Social Role

Table 4. Correlations between the Teachable Moment construct variables and health behavior performance

Variable	Any fruits or veg. ¹	Fruit days ²	Leafy green veg. days ²	Other veg. days ²	Any physical activity ¹	Cardio exercise days ²	Strength training days ²	Any alcohol use ¹	Alcohol use days ²	Any tobacco use ¹	Tobacco use days ²
1. Cancer-specific distress, IES-R	-.12	.00	.02	-.12	-.10	-.16	-.10	-.21	-.24*	.22	.22
2. Emotional distress, PROMIS A&D	-.19	-.09	-.03	-.14	-.15	-.12	-.26*	-.26*	-.21*	.24	.29**
3. Cancer-specific wellbeing, PTGI-SF	.01	.21*	.14	.22*	-.11	-.13	.09	-.04	-.03	.06	-.02
4. Life satisfaction, SWLS	.18	.21*	.06	.23*	.20	.10	.09	.05	-.06	-.22	.23*
5. Cancer-specific risk, TM-CRP-C	-.09	-.00	-.05	-.01	-.13	-.25*	-.16	-.16	-.14	.08	.04
6. General health risk, TM-CRP-G	.04	-.11	-.10	-.13	-.11	-.13	-.15	.07	.11	.25	.20
7. Social role, TM-SR	.01	.03	.07	-.02	-.02	-.06	-.01	-.16	-.06	.05	.12
8. Self-concept, TM-SC	.14	.06	.17	.23*	-.14	.16	.06	.01	.02	.03	.04

Notes. ¹ The variable reflects behavior in the past month and the association is measured by a Spearman's rho correlation; ² The variable reflects behavior in a typical week and the association is measured by a Pearson's *r*; * $p < .05$; ** $p < .01$; IES-R=Impact of Events Scale, revised; PROMIS A&D = Patient Reported Outcome Measurement Information Systems Anxiety and Depression 4-Item Scales; PTGI-SF=Post Traumatic Growth Inventory Short-Form; SWLS=Satisfaction with Life Scale; TM-CRP=TM – Change in Risk Perception (C=Cancer, G=General health); TM-CSC=TM – Change in Self-Concept; TM-CSR=TM – Change in Social Role

Finally, while social role again did not demonstrate any significant relationships, stronger self-concept was correlated with more days of vegetable consumption ($r = .23$, $p = .03$).

Regression Models for Select Health Behaviors

Linear regression models that examined the independent and combined influence of the three primary TM constructs plus motivation on participants' typical health behaviors are presented in Table 5. The full results are shown in Table 5, so the text below primarily serves to highlight the significant findings. As shown, the total amount of variance explained in each model ranged from .13 (leafy green vegetable days) to .68 (tobacco use days). Regression results indicated that in step 1 of the model, only non-leafy vegetable consumption, strength training, and tobacco use days were significantly correlated with TM constructs. In contrast, with only one exception (non-leafy vegetable consumption), all models were significantly associated with health behavior performance at step 2, which included the addition of motivation.

For affective response, the nature and strength of the relationships varied across predictors and outcomes. Greater cancer-specific distress was predictive of more favorable health behavior, demonstrating a positive association with strength training

Table 5. Results of the linear regression models for health behavior performance ¹

Variable	Fruit days ²	Leafy green veg. days ³	Other veg. days ⁴	Cardio exercise days ⁵	Strength training days ⁶	Alcohol use days ⁷	Tobacco use days ⁸
Step 1							
1. Cancer-specific distress, IES-R	.21	-.10	-.26	-.07	.46*	-.56*	.12
2. Emotional distress, PROMIS A&D	-.09	.14	.08	.11	-.62**	-.05	.14
3. Cancer-specific wellbeing, PTGI-SF	.25*	.19	.30*	-.07	.08	.05	-.07
4. Life satisfaction, SWLS	.32*	-.04	.12	-.01	.01	-.19	.03
5. Cancer-specific risk, TM-CRP-C	.01	.11	.14	-.34*	.03	-.08	-.21
6. General health risk, TM-CRP-G	-.06	.10	.04	.13	-.21	.38*	.18
7. Social role, TM-SR	-.03	.12	-.11	-.09	.08	-.03	-.07
8. Self-concept, TM-SC	.10	.06	.18	-.13	-.23	-.01	.04
R ²	.18	.08	.20	.11	.21	.19	.24
Step 2							
9. Motivation	.27*	.04*	.21	.56**	.39**	-.36	-.74**
R ² Change	.06	.05	.04	.27	.13	.112	.44

Notes. ¹ The variables reflect behavior in a typical week. Data shown are standardized β weights where all TM construct variables are entered in Step 1 and the health behavior-specific motivation variable is entered in Step 2. The footnote for each model corresponds to the model statistics at the final step; ² $F(9,67) = 2.39, p = .02, R^2 = .24$; ³ $F(9,67) = 1.13, p = .35, R^2 = .13$; ⁴ $F(9, 67) = 2.28, p = .03, R^2 = .24$; ⁵ $F(9,68) = 4.63, p < .001, R^2 = .38$; ⁶ $F(9,68) = 3.87, p = .001, R^2 = .34$; ⁷ $F(9, 63) = 3.16, p < .001, R^2 = .30$; ⁸ $F(9, 57) = 13.52, p < .001, R^2 = .68$; * $p < .05$; ** $p < .01$; IES-R=Impact of Events Scale, revised; PROMIS A&D = Patient Reported Outcome Measurement Information Systems Anxiety and Depression 4-Item Scales; PTGI-SF=Post Traumatic Growth Inventory Short-Form; SWLS=Satisfaction with Life Scale; TM-CRP=TM - Change in Risk Perception (C=Cancer, G=General health); TM-CSC=TM - Change in Self-Concept; TM-CSR=TM - Change in Social Role

days ($\beta = .46, p = .03$) and a negative association with alcohol use days ($\beta = .56, p = .01$). In contrast, greater emotional distress was predictive of fewer strength training days ($\beta = -.62, p < .01$). Cancer-specific wellbeing was consistently predictive of dietary habits, specifically demonstrating a positive association with fruit consumption ($\beta = .25, p = .04$) and non-leafy vegetable consumption ($\beta = .30, p = .01$). Finally, greater life satisfaction was predictive of more fruit days ($\beta = .32, p = .03$), but no other health habits. For risk perception, the nature and strength of the relationships varied as well. Results indicate that heightened cancer-specific risk perception was predictive of fewer cardiovascular activity days ($\beta = -.34, p = .04$), whereas greater general health risk perception was associated with more alcohol use days ($\beta = .38, p = .02$). Neither social role nor self-concept demonstrated significant relationships with participants' health behaviors. Finally, with only one exception, all motivation variables were significantly predictive of participants' health behaviors, though the strength of these relationships varied widely (β s = $-.74$ to $.56$). To note, while the tables illustrate individual beta weights for each association, the findings should be considered in light of the overall regression models.

DISCUSSION

Considering the implications of a healthy lifestyle for cancer survivors, it is important to comprehensively survey cancer survivors about their health behaviors and determine risk and protective factors post-diagnosis (Cuthbert et al., 2018; Gritz et al., 2006; Meyerhardt et al., 2013; Wang et al., 2015). This small, cross-sectional study of 93 cancer survivors was designed to explore the relevance of the TM for understanding four domains of health behaviors: diet, physical activity, alcohol consumption, and tobacco use. Given the exploratory nature of the study, it was critical to recruit a heterogeneous

sample and broadly measure the TM construct variables and behavioral outcomes. Notably, the sample was split adequately between male and female participants, rural representation was appropriate, and the full spectrum of socioeconomic status was well represented. In addition, five disease sites were represented, which is a welcome departure from the norm in cancer survivorship literature (Jacobsen et al., 2016). These strengths aside, few participants were racial or ethnic minorities, and while this is representative of the cancer survivor population in the state where the study was conducted (US Census Bureau, 2019), this remains a limitation. Similarly, the combination of cancer types, variability in time since diagnosis, and disease stage might have impacted participants' responses to TM measure items. For example, cancer survivors further removed from time of diagnosis might report lower distress, greater wellbeing, lower perception of risk, and lesser impact on social role and self-concept when compared to newly diagnosed survivors. Regarding the rigors of measurement, each TM construct was measured in general and cancer-specific terms, and health behaviors were assessed in more robust ways than is typical in this area (i.e., intensity and frequency of a behavior versus the mere absence or presence of a behavior) (Mayer et al., 2007; Phillips-Salimi, Lommel, & Andrykowski, 2012; Underwood et al., 2012). The reliance on self-report for measurement of participants' health behaviors does raise the possibility of overreporting favorable outcomes (e.g., strength training days) and underreporting unfavorable outcomes (e.g., tobacco use days), yet the results reflect a wide spectrum of responses that suggest genuine responding. Overall, the basic study design and approach positioned it well to achieve its aims.

Prior to discussion of this study's major findings, it is necessary to contextualize participants' health behaviors within the relevant cancer survivorship literature. In this study, nearly all participants reported consuming fruits and vegetables within the past month, and on average, participants consumed fruit and vegetables every other day, which is on par with national samples (Ansai & Wambogo, 2021). In contrast to this more promising health behavior outcome, just over half of participants reported exercising within the past month. Those participants who exercise reported engaging in an average of only two physically active days per week. The overall rate of exercise is slightly higher than some national samples, which estimate that about a third of cancer survivors do not engage in any leisure exercise (NCI, 2021), yet it still falls short of what is ideal. Similarly, for the substance use outcomes, there was a mix of positive and negative results. More than half of participants reported consuming alcohol, and those who did reported doing so infrequently (e.g., on average, about three days per month), which is also consistent with national estimates (Blanchard et al., 2003; Lin, Fisher, Harris, & Tseng, 2019). However, just under one-fifth of participants reported current tobacco use, and these participants reported moderate nicotine dependence (i.e., an average of about half a pack of cigarettes per day), comparable with national estimates (Salloum et al., 2019). Given the overall health behavior performance in this sample, it is unfortunately the case that many participants are simply not meeting the ACS guidelines as they should. Perhaps with greater availability of health promotion programs specifically designed for cancer survivors (Bantum et al., 2014; Bradbury et al., 2019; NCCS, 2021), it is possible that adherence rates improve over time.

Any interpretation of this study's findings regarding the association between cancer survivors' health behaviors and the TM must be considered in light of the TM itself. For this reason, it is worth commenting on participants' response to the TM measures. Decision making for measure selection considered the pros and cons of whether to evaluate affective response in terms of positive and/or negative affect, mood, and the like, whether to measure conditional and/or overall health risk perceptions, and whether to evaluate social role and self-concept individually or combined among other things. Finally, it was necessary to consider a combination of "intention" to adopt and maintain healthy behaviors with the parallel construct of "confidence" to create an overall indicator of motivation, given the role of both in the likelihood an individual actually engages in health behaviors (Ajzen, 2020; E. R. Park et al., 2014; Sheeran, 2002). When possible, standardized measures with a documented history of strong psychometric properties were chosen for the TM constructs (e.g., PTGI tapped into cancer-specific wellbeing). When no standardized measure was deemed to satisfactory tap into a TM construct, a decision was made to either adapt items from another study or questionnaire or create a scale with specific, directive items (e.g., Change in Social Role scale, Change in Risk Perception scales). As indicated above, the final selection of measures was broad and meant to be rather comprehensive, but it is not without its problems.

Regarding the first TM construct, affective response scales for distress were positively skewed, indicating an overall low endorsement of general and cancer-related distress, whereas the parallel scales for wellbeing were more normally distributed. Distress is a common reaction to a cancer diagnosis (Andrykowski, Lykins, & Floyd, 2008; Carlson, Waller, & Mitchell, 2012; Rivera-Rivera & Burris, 2020; Walker et al.,

2012); distress can range in severity from mild sadness and worry to clinical depression and anxiety and it can last for months and years after the diagnosis (NCCN, 2013). That said, cancer diagnosis can also prompt feelings of wellbeing, although this is studied and reported far less frequently (Andrykowski et al., 2008; Koutrouli, Anagnostopoulos, & Potamianos, 2012; Rivera-Rivera & Burris, 2020). On balance, due to the varied time since diagnosis and cancer types represented in this sample, an overall low to mild level of distress and at least a moderate level of wellbeing is reasonable. For the second TM construct, both cancer-specific and general health risk perceptions were somewhat positively skewed, suggesting modest perception of health risk overall within the sample. Cancer survivors, in general, are at heightened risk for more health problems including another cancer diagnosis partly due to the unfortunate adverse effects of some of the leading cancer treatments (i.e., radiation, chemotherapy) (Jena, Patnayak, Lakshmi, Manilal, & Reddy, 2016; Vogt et al., 2017). Additionally, cancer survivors often live with other chronic diseases (Cuthbert et al., 2018; Wang et al., 2015) and tend to report worse health-related quality of life than non-cancer controls (Burris & Andrykowski, 2011; E. S. Lee et al., 2011; L. J. Lee et al., 2011; LeMasters, Madhavan, Sambamoorthi, & Kurian, 2013; Richardson, Wingo, Zack, Zahran, & King, 2008). Given this, it is possible this sample demonstrated “rose colored glasses” as it relates to their perception of future health risk, especially in light of their self-reported health behavior profile. For the third TM construct, social role and self-concept scales were both normally distributed, with moderate endorsement of scale items. Individuals are assumed to experience a change in self-concept as they adopt an identity of “cancer patient” or “cancer survivor” or learn to cope with disruptions in their ability to carry out their normal social roles and

responsibilities (e.g., primary parent or caregiver, club soccer player, fulltime employee) (Bell & Ristovski-Slijepcevic, 2013; MacTiernan et al., 2014; Zebrack, 2000). Although the literature exploring changes in social role and self-concept after cancer diagnosis is limited, there is evidence to support change in the “self” following diagnosis, such that cancer survivors reflect upon their identity pre- and post-cancer and make some lifestyle adjustments (Bertero & Chamberlain Wilmoth, 2007; Kuswanto, Stafford, Sharp, & Schofield, 2018). Finally, nearly all motivation scales were negatively skewed, with diet-, alcohol-, and smoking-related motivation endorsed highly, and physical activity-related motivation moderately. This makes sense given participants’ actual health behavior performance which suggested some floor and ceiling effects, at least in term of past month incident behavior. Practically speaking, the descriptive information for each aspect of the TM is useful in providing some clue about cancer survivors’ emotional, cognitive, and social functioning at a time when health promotion is encouraged.

Theoretically, low to mild distress, moderate to high wellbeing, moderate perception of health risk, and positive impacts on social role and refinement of self-concept represent a favorable disposition for actualizing the TM of cancer diagnosis. In the bivariate correlational analyses for the outcome of motivation (and to some extent health behavior performance), most of these hypotheses were borne out, at least in terms of the direction of association, as the strength of the associations were generally weak and statistical significance infrequently obtained. Specific comments about each of the TM constructs follows. First, higher levels of cancer-specific and general distress were associated with lower motivation across the board for any health behavior engagement (with one exception). In contrast, while higher life satisfaction was associated with higher

motivation across the board, the same was not found for higher cancer-specific wellbeing. Cancer-specific wellbeing was only positively associated with diet-related motivation, and negatively associated with physical activity-, alcohol-, and tobacco-related motivation. This unexpected result could be due to self-acceptance rather than a desire to engage in change (Baker, Dye, Denniston, & Ainsworth, 2001; Dillard, McCaul, & Klein, 2006). The relationship between distress and motivation is consistent with some health behavior literature, which illustrates the impact of negative affect and mood on one's lifestyle (McCaul & Goetz, 2007; C. L. Park & Gaffey, 2007; Strine, Balluz, & Chapman, 2004) yet deviates from other literature that shows how distress can motivate adaptive behaviors (Harper, Schmidy, & Beacham, 2007; McCaul, Peters, Nelson, & Stefanek, 2005). Second, cancer-related risk perception was only positively associated with motivation to consume less alcohol while general health risk perception was negatively associated with all motivation variables. Several possible explanations exist, namely, whether a cancer survivor equates his or her own impressions of threat as credible enough to engage in more positive health behaviors, whether another variable like worry or mood moderate the relationship between cancer-related risk perception and motivation (Ferrer, Portnoy, & Klein, 2013; Klein, Zajac, & Monin, 2009; Sheeran, Harris, & Epton, 2014), whether perception of health risk is normalized in the context of cancer diagnosis such that it is no longer motivating, or whether there is a widespread lack of awareness about the value of positive health behaviors for cancer prognosis and other health promotion (Hawkes, Pakenham, Chambers, Patrao, & Courneya, 2014; Kostopoulou & Katsouyanni, 2006; Schnoll et al., 2002). Finally, both social role and self-concept variables were positively related to diet and exercise motivation, but

negatively to alcohol and tobacco motivation. This is partially consistent with the hypothesis, but the view of self as a someone with healthy habits or control over his or her health is seemingly incompatible with the lack of motivation to moderate alcohol use and abstain from tobacco use (van den Putte, Yzer, Willemsen, & de Bruijn, 2009; Zebrack, 2000). A possible explanation for the tobacco outcome is that only a small percentage of the sample endorsed current use, and those who abstained did not fully appreciate the intention behind the question about continuing to do so. For alcohol, it is likely that the participants who drink only do so infrequently or only socially, perceiving this to be a “healthy habit,” and therefore do not see the need to moderate or alter their drinking even further. As is, the unexpected results for social role and self-concept might be an unintentional artifact of measurement and methodology.

Although bivariate associations between affective response, risk perception, social role/self-concept and motivation give credence to the TM, a better indicator of its utility is the combined predictive value of its key constructs for health behavior performance. This is because the TM purports that affective response, risk perception, and social role/self-concept jointly influence health behavior change indirectly through motivation, self-efficacy, and acquisition of skills (McBride et al., 2003). In line with this, this study’s linear regression models for health behavior included not only the three key TM construct variables but also motivation, which as measured here tapped into both intention and confidence (or self-efficacy). Consistent with the mechanisms of the TM, cancer survivors’ endorsements of affective response, risk perception, social role/self-concept and motivation demonstrated a robust overall association with cancer survivors’ health behaviors, as shown by 13 to 68% of variance explained. That said, the strength

and direction of the individual TM construct relationships varied more than expected, with only motivation consistently showing a strong, positive impact contributing over and above the other variables. The TM Heuristic places motivation as a mediator between the three core constructs and health behavior performance, and as such, it is reasonable to expect such a proximal relationship between the variables. Many health behavior theories include a motivational factor, such that the stronger the motivation to perform a behavior, the more likely a behavior will occur (Ajzen, 1991; Ajzen & Fishbein, 1980; Bandura, 1977; Hochbaum, 1958; Prochaska & DiClemente, 1983). Clearly, the TM would be incomplete without the inclusion of motivation, but it is not fair to say that motivation is necessary *and* sufficient. This is because the bivariate correlations do signal some associations between affective response, risk perceptions, and social role/self-concept on the one hand and cancer survivors' health behaviors on the other. Thus, the question of how much the individual TM constructs uniquely influence cancer survivors' health behaviors persists, with awareness that overlap across the constructs (e.g., more wellbeing is associated with lower risk perception) might limit their individual predictive value. Even so, the overall utility of the TM, from the vantage point of intervention design or health communication, might be unaffected by a lack of firm knowledge of the individual roles of affective response, risk perceptions, and social role/self-concept in motivation, health behavior performance, and change.

In conclusion, this study provides some insight into the explanatory power of the TM in the context of cancer survivorship, but more research is necessary. While the TM conceptualizes cancer as a cueing event, many people view cancer as a chronic disease. This brings up the possibility that the TM's power in explaining cancer survivors' health

behaviors could be limited to a short period of time after diagnosis and/or only those cancer survivors whose cancer experience is a salient aspect of their daily life, an issue that remains unresolved for now. Several other considerations and recommendations for research in this area are suggested. First, larger samples are a prerequisite to better exploring the strength of the overall TM model as well as determining which individual components of the TM contributes the most to health behavior outcomes. Second, there should perhaps be a focus on time since diagnosis as a confounding or moderating variable, as there might be a “window of opportunity” for the TM. Third, creating composite variables for each core construct (i.e., affective response, risk perception, social role/self-concept) would simplify future predictive analyses while accounting for the complexity of each construct. Fourth, with respect to TM construct measurement, qualitative studies could be particularly useful for refining the social components of the model, which would aid identifying the best standardized measures for the self-concept and social role constructs. Similarly, the mediator of skills acquisition warrants further consideration as part of the TM model, and additional factors like patient education, self-efficacy, and social support should also be explored for their role in the eventual adoption of positive health behaviors. Fifth, health literacy might be a potential barrier between a cancer survivor’s motivation and his or her health behavior performance and change and should be assessed prior to treatment engagement or future research. Finally, longitudinal studies are clearly indicated for this line of research, particularly when one considers the possibility of targeting interventions to naturally occurring spikes in motivation for health promotion and risk reduction.

Appendices

Appendix A. Correlations between the Teachable Moment construct variables and demographic variables

Variable	Age ¹	Sex ²	Race ²	Relationship status ²	Education ²
1. Cancer-specific distress, IES-R	-.34**	.21	.29**	-.32**	-.11
2. Emotional distress, PROMIS A&D	-.34**	.24*	.22*	-.35**	-.15
3. Cancer-specific wellbeing, PTGI-SF	-.26*	.27*	-.01	-.04	.12
4. Life satisfaction, SWLS	.16	.06	-.21	.36**	.18
5. Cancer-specific risk, TM-CRP-C	-.35**	.37**	.11	-.16	-.02
6. General health risk, TM-CRP-G	-.25*	.12	.15	-.15	-.05
7. Social role, TM-SR	-.04	-.01	.24**	-.18	-.08
8. Self-concept, TM-SC	.17	-.08	-.01	.24*	-.02

Notes. ¹ The variable is measured by a Pearson's *r* correlation; ² The association is measured by a Spearman's rho;
 * $p < .05$; ** $p < .01$.

Appendix B. Correlations between the Teachable Moment construct variables and clinical variables

Variable	Time since Diagnosis ¹	Cancer stage ¹	Insurance status ²
1. Cancer-specific distress, IES-R	-.25*	.09	-.05
2. Emotional distress, PROMIS A&D	-.23*	.04	-.10
3. Cancer-specific wellbeing, PTGI-SF	-.06	.05	-.08
4. Life satisfaction, SWLS	.17	-.07	-.18
5. Cancer-specific risk, TM-CRP-C	-.19	-.03	.01
6. General health risk, TM-CRP-G	-.12	-.04	.08
7. Social role, TM-SR	-.01	-.13	.00
8. Self-concept, TM-SC	.03	-.09	.05

Notes. ¹ The variable is measured by a Pearson's r correlation: ² The association is measured by a Spearman's rho;
* $p < .05$; ** $p < .01$.

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AWARDS

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2018 **Markey Cancer Center, Trainee Travel Award, December 2018**
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PUBLICATIONS

Puleo, G. E., Borger, T., Bowling, W. & Burris, J. L. The state of the science on cancer diagnosis as a “teachable moment” for smoking cessation: A scoping review of the literature. *Nicotine and Tobacco Research*. In press.

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