Validation of a Milk Consumption Stage of Change Algorithm among Adolescent Survivors of Childhood Cancer

Darren Mays, PhD, MPH[1]; Elissa Gerfen, BA[1]; Revonda B. Mosher, RN, MSN, CPNP[2]; Aziza T. Shad, MD[1]; Kenneth P. Tercyak, PhD[1]

ABSTRACT

Objective: To assess the construct validity of a milk consumption Stages of Change (SOC) algorithm among adolescent survivors of childhood cancer ages 11 to 21 years (n = 75).

Methods: Baseline data from a randomized controlled trial designed to evaluate a health behavior intervention were analyzed. Assessments included a milk consumption SOC algorithm and hypothesized theoretical and behavioral predictors of SOC.

Results: Compared with survivors who expressed no readiness to change, those expressing readiness to change behavior for both 2 and 4 daily servings of milk reported more frequent milk consumption ($P < .001$), greater dietary calcium intake ($P = .006$), and were more likely to meet age-specific recommendations for daily calcium intake ($P = .01$).

Conclusions and Implications: Results provide support for the construct validity of the milk consumption SOC algorithm relative to behavioral criteria. Research is needed to further examine algorithm validity with respect to theoretical predictors of SOC.

Key Words: cancer, pediatrics, survivors, milk consumption, bone health, stages of change (*J Nutr Educ Behav*. 2012;44:464-468.)

INTRODUCTION

Bone health problems are a common late effect of cancer treatment among childhood cancer survivors, including suboptimal bone density and clinical signs of osteopenia.[1] These problems are linked to stunted growth and increased risk for osteoporosis and fractures in adulthood.[1] Risk for bone health problems may be exacerbated by the fact that few survivors meet recommendations for bone health behaviors, such as consuming recommended daily levels of calcium.[2]

Although clinical signs of bone health problems do not typically appear until adulthood,[1] interventions encouraging bone health-promoting behaviors among young cancer survivors may help prevent or delay onset of bone health morbidities. A comprehensive approach to promoting bone health among young survivors includes consuming a balanced diet and engaging in healthful physical activity.[1] Increasing calcium and vitamin D intake through diet and supplementation are effective methods of improving bone density[3] and may reduce risk for fracture in high-risk groups.[4,5] For childhood cancer survivors, follow-up care guidelines encourage meeting age-specific recommended levels of calcium for optimal bone health.[1] Milk is a leading source of dietary calcium,[6,7] and interventions targeting milk consumption may be 1 important element of comprehensive approaches to reduce long-term risk for bone health problems in this vulnerable population.[1,8]

Recent data support the efficacy of a bone health behavior intervention for young cancer survivors, including milk consumption.[9] However, the impact could be enhanced by tailoring content to address survivors' individual needs for behavior change.[10] The Transtheoretical Model (TTM) provides a framework for tailoring interventions to an individual's readiness to change, positing that health behavior change occurs via 5 stages of change (SOC), from Precontemplation (no intention to change behavior within next 6 mo) to Maintenance (performance of the recommended behavior for $\geq$ 6 mo).[11] Transition between stages is dynamic and includes progression toward maintenance and relapse to earlier stages.[11]

The SOC approach has been applied to the study of dietary behaviors, including milk consumption, among young people.[12-15] Stage of change is typically assessed using a staging algorithm, which characterizes individuals based on current behavioral practices, duration of practices, and intention to take action to change practices.[11] It is critical to first establish the construct validity of SOC algorithms designed to characterize SOC for the recommended health behavior. However, no such milk consumption algorithm has been validated among adolescent cancer survivors. The authors examined the construct validity of a SOC algorithm for consuming 2 and 4 daily servings

[1]Lombardi Comprehensive Cancer Center, Georgetown University Medical Center, Washington, DC

[2]Sinai Hospital of Baltimore, Baltimore, MD

Address for correspondence: Darren Mays, PhD, MPH, Lombardi Comprehensive Cancer Center, Georgetown University Medical Center, 3300 Whitehaven St NW, Ste 4100, Washington, DC 20007; Phone: (202) 687-8937; Fax: (202) 687-0305; E-mail: dmm239@georgetown.edu

of milk among adolescent survivors of childhood cancer. The algorithm is designed to provide a flexible tool to assess milk consumption and can be used with other sources of dietary information to tailor bone health interventions among young cancer survivors.

METHODS
Procedures

The Survivor Health and Resilience Education Program was a randomized controlled trial to test the efficacy of a multiple health behavior intervention among adolescent survivors of childhood cancer. Study methods and bone health behavior outcomes were previously reported.[9] The study included adolescents ages 11 to 21 years who were treated for cancer, ≥ 1 year post-treatment and ≥ 1 year cancer-free. Participants were recruited from 2 local pediatric cancer centers; the Georgetown University institutional review board approved all procedures. Following participant assent and parental consent, participants completed a baseline assessment via 2 consecutive 30-minute telephone interviews.

Measures

Demographic characteristics included age, sex, race, household composition, and school performance (mostly A's and B's or other grades). Clinical characteristics included diagnosis of leukemia (the primary cancer diagnosis) or another form of cancer, and years since diagnosis.

Theoretical predictors were derived from the TTM. Bone health knowledge was assessed as a proxy for consciousness raising, the process of change that is critical to move individuals from Precontemplation to Contemplation by providing new information supporting behavior change.[11] Using 6 multiple choice items adapted from the National Bone Health Campaign for children[16] and prior research,[17,18] knowledge was operationalized as a continuous variable indicating the number of items correctly answered (range 0-6). Self-efficacy is an individual's confidence to engage in a behavior and is central to TTM.[11] Calcium consumption self-efficacy was assessed using 11 Likert-type items

adapted from prior research.[19] Responses were summed to create a total score with higher values reflecting greater self-efficacy (range 0-55; Cronbach α = 0.86).

Milk consumption behaviors were assessed using 2 items adapted from the National Bone Health Campaign.[16] Milk consumption frequency was measured by asking "How often would you say you drink milk?" Responses ranged from 1 (never) to 4 (always), and a continuous variable was created for analyses. The second item asked "During a normal day, do you drink at least 4 glasses of milk?"

Calcium intake was measured with the 5-Step Multiple Pass 24-hour recall method.[20] This method involves asking participants to describe everything that s/he ate/drank for a 24-hour period, when and where food was eaten and details of each food item, and the method reviews information to confirm accuracy. Calcium intake in milligrams was derived using NutritionistPro (version 3.2, Axxya Systems, Inc., Stafford, TX, 2004), a third-party software program that converts dietary data into nutritional information. The investigators analyzed a continuous variable for overall calcium intake and a dichotomous variable indicating whether participants met age-specific dietary calcium guidelines.[21]

An algorithm originally developed among adult women was used to assess SOC for consuming 2 and 4 daily servings of milk (see Supplementary Data).[22] The algorithm assessed criteria for each of the TTM stages,[11] defining a standard serving of milk as 1 cup.[23] Questions assessed participants' current behaviors and readiness to consume 2 and 4 daily servings of milk. The investigators created a 3-level variable with the following categories: (1) *No readiness to change* (Precontemplation or Contemplation for 2 cups and Precontemplation for 4 cups); (2) *Readiness 2 cups* (Preparation, Action, or Maintenance for 2 cups and Precontemplation for 4 cups); and (3) *Readiness 2 and 4 cups* (Preparation, Action, or Maintenance for 2 cups and Contemplation, Preparation, Action, or Maintenance for 4 cups). These categories were created based on the distribution of participants across SOC (Figure) and to reflect levels of readiness to change for both behaviors. For example, participants

in Precontemplation or Contemplation for 2 cups and Precontemplation for 4 cups expressed little or no readiness to change either behavior. In comparison, those in Preparation, Action, or Maintenance for 2 cups and Contemplation or beyond for 4 cups expressed some readiness to change both behaviors, or were achieving behavioral goals.

Analyses

Construct validity is established by examining associations between the focal construct and related predictors.[24] To examine the algorithm's construct validity, the authors used bivariate analyses to assess relationships among SOC and clinical and demographic characteristics, and behavioral and theoretical predictors. None of the clinical and demographic characteristics was associated with SOC, therefore the final analyses were unadjusted bivariate F tests and χ^2 tests of associations between SOC and behavioral and theoretical predictors of interest.

RESULTS
Participant Characteristics

The Table displays participant characteristics, and the Figure illustrates survivors' SOC for 2 and 4 daily servings of milk. For the combined outcome, 24% of survivors (n = 18) expressed no readiness to change (Figure). Sixteen (21%) expressed readiness to change behavior for 2 daily servings of milk, and 55% (n = 41) expressed readiness to change behavior for both 2 and 4 daily servings of milk.

Predictors of SOC

Compared with survivors who expressed no readiness to change and those who only expressed readiness to change for 2 daily servings of milk, those who reported readiness to change for both 2 and 4 servings reported significantly more frequent milk consumption ($P < .001$, Table). Similarly, survivors who expressed readiness to change for 2 and 4 servings were the most likely to report consuming ≥ 4 servings of milk on a normal day (n = 17, 42%, $P = .01$) and to meet dietary calcium