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Exploring emerging adults' consideration of future cancer risk reduction: Opportunity for shifting prevention paradigms?

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Exploring emerging adults' consideration of future cancer risk reduction: Opportunity for shifting prevention paradigms?

A dissertation submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy at Virginia Commonwealth University.

By

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ABSTRACT

Exploring emerging adults' consideration of future cancer risk reduction: Opportunity for shifting prevention paradigms?

By Jacqueline Knight Wilt, MPH

A dissertation submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy at Virginia Commonwealth University.

Academic Advisor: Maria D. Thomson, PhD
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Background

Early onset colorectal cancer (EOCRC) among individuals younger than age-based population prevention screening guidelines has been linked to lifestyle-related risk factors. Emerging adulthood (18-25 years) is when elevated autonomy can alter health behaviors with implications for future health. Greater consideration of future consequences for behavior predicts several lifestyle health behaviors. Future consideration is sensitive to resource availability, and thus may differ between students who are first-generation and/or from low-income households (FGLI) compared to Non-FGLI. This dissertation study aimed to (1) characterize college students' consideration of future cancer risk (CFC-Cancer), perceived colorectal cancer (CRC) risk and associations with EOCRC risk factors, (2) compare findings by FGLI status, and (3) explore students' health-related behavioral intentions given consideration of their future cancer risk.

Methods

A sequential mixed methods study utilized a sample of undergraduate students, age 18-25 years, to complete a survey, and follow-up interviews with a subset of participants stratified by low, medium and high CFC-Cancer. Analyses characterized survey results and linear regression models for CFC-Cancer and perceived CRC risk assessed for significant ($p \leq .05$) associations with current behaviors, stress and sociodemographic variables. Bivariate tests and stratified

linear regressions models assessed for significant differences between FGLI and Non-FGLI. Follow up interviews explored knowledge, attitudes and health behavioral intentions related to cancer prevention for the present and five years in the future. Interviews were transcribed verbatim for analyses guided by Grounded Theory principles to identify emergent themes.

Results

Students overestimated CRC risk and had moderate CFC-Cancer. Greater CFC-Cancer was associated with higher GPA, CRC knowledge and more protective lifestyle health behaviors. CFC-Cancer and perceived risk did not differ based on FGLI status; but FGLI had significantly more Black and Hispanic students, greater stress, and less CRC knowledge. Across CFC-Cancer groups interview participants expressed a desire to know more about cancer prevention they can implement now. Students with high CFC-Cancer endorsed direct cancer prevention education means such as seminars or individual appointments.

Conclusion

College students sometimes consider their future cancer risk when making current health behavior decisions. Furthermore, students want to know more about cancer and what risk reduction strategies they can implement as emerging adults and sustain into adulthood. More EOCRC risk factors were identified among the FGLI group compared to Non-FGLI which supports the need for health equity initiatives in the college setting. These findings support a paradigm shift for primary cancer prevention strategies to begin earlier in the life course as an upstream approach to impact early onset trends.

Keywords: early onset colorectal cancer; cancer prevention; emerging adults; consideration of future consequences; lifestyle health behaviors; health equity

CHAPTER 1:

BACKGROUND

Early Onset Colorectal Cancer

Around the globe an observed trend in cancer diagnoses and deaths among individuals younger than age-based preventive population screening guidelines continues to rise.[1] Colorectal cancer (CRC) is one of those increasingly diagnosed among younger adults globally and here in the United States. Early-onset colorectal cancer (EOCRC) is the second most common cancer diagnosis and third leading cause of cancer mortality in individuals under age 50 years in the US.[2] EOCRC incidence trends from 1975 to 2010 projected to year 2030 estimate a 90% increase of colon and 124% of rectal cancers among individuals aged 20 to 34 years from 2010 rates.[3] Until 2021, individuals under age 50 were not eligible for early detection screening and instead presented adverse symptoms including rectal bleeding, abdominal pain or bloating, diarrhea, constipation, anemia, nausea and weight loss prior to diagnosis.[4] Consequently from 2010-2019, stage of CRC diagnoses differed significantly by age; survivors under age 50 years were diagnosed at more advanced stages compared to those 50 years or older. Stage of diagnosis for those under 50 years were 32.7% localized, 37% regional, 25.3% distal, and survivors 50-64 years were 37.9%, 34.1% and 22.3% respectively.[5]

Precancerous cellular modifications begin as early as 10-20 years prior to CRC diagnosis.[6] Current cancer prevention efforts occur too late in life to actually modify risk of cellular mutation and redirect cancer risk.[6,7] CRC prevention for people at average risk is primarily operationalized as population age-based screenings which begins at age 45 years and repeats every one to ten years based upon initial findings and type of screen used.[8] These recommendations are the product of statistical models using population level data to determine

the best age to begin screening based upon life-years-gained if cancerous cells are found.[9] This strategy of early detection prioritizes secondary over primary prevention which aims to limit risk exposure. Given a 10-20 year latency, a CRC diagnoses made at age 45 would likely have mutation risk factors for colon polyps beginning as early as age 25-35[6] and primary prevention strategies during that time may have reduced CRC risk.

EOCRC Lifestyle-Related Risk Factors

As many as 70% of EOCRC cases have been linked to lifetime exposure to modifiable lifestyle factors including obesity, a diet with low fiber and high saturated fats and red/processed meats, physical inactivity, high alcohol consumption, smoking tobacco products and stress.[10] Furthermore, primary prevention for CRC specifies that healthcare providers should guide patients to integrate a better diet to replace red and processed meats, saturated fat, refined grains and sugars; avoid heavy alcohol consumption; meet current physical activity guidelines; and maintain a healthy central adiposity.[11]

Several researchers instead propose adopting risk profiles for screening recommendations in place of population age-based guidelines.[12,13] In a recent study, higher values for an environmental/lifestyle risk score including obesity, dietary, alcohol consumption, smoking, sedentary behavior, education obtainment, diabetes history, aspirin/anti-inflammatory medication use, and family history of CRC were associated with increased relative and absolute risk for EOCRC based upon data from three large cohort studies.[13]

Emerging Adulthood and Health Behaviors

Emerging adulthood is a critical life stage of dynamic and complex biopsychosocial maturation that alters personal health trajectories.[14] Body composition (i.e. fat mass, lean body

mass, and bone density) continues to change as individuals reach physiological maturation during this stage.[15] The brain experiences the greatest developmental changes in executive functioning that foster development of autonomy, agency, identity formation and orchestrating goal-oriented behavior during this life phase.[14–16] Executive functioning and health management skills influence health-related quality of life among emerging adults.[17]

The transition from adolescence to emerging adulthood encompasses some of the most substantial changes to personal lifestyle health behaviors.[18] College students navigate newfound independence and autonomy as they move away from parental oversight and gain greater responsibility for daily lifestyle choices including diet, physical activity, sleep and stress management. Overtime these choices become behavioral patterns that elevate or reduce EOCRC risk. Longitudinal studies identified that health behaviors for diet, exercise, sleep, screen time, smoking and alcohol consumption during this life stage tend to group together as low-,moderate-, or high-risk.[18,19] For over a decade, the annual cross-sectional National College Health Assessment has found that college students' self-report consistently subpar participation in physical activity, decreased consumption of fruit/vegetables, and progressively worse perceived stress. Among students surveyed in 2008, 46% met aerobic activity guidelines, 34% consumed ≥3 servings of fruit/vegetables, and 50% perceived greater than average or tremendous stress; in 2019 these rates were 46%, 26%, and 58% respectively.[20,21] Obesity rates among this population have also worsened over the same time period from 11% to 15%.

Critically, these lifestyle health behaviors are often sustained into adulthood, and relate to health outcomes.[18] A study among late-life adults (mean age 75 years) found that current health promoting diet and exercise behaviors had a significantly positive relationship with being exposed to better health habits during emerging adulthood (age 20 years).[22] The paradigm

suggests that continuity of preventive health behaviors is more likely among those who engage those behaviors at a younger age, and emerging adults have a greater likelihood of initiating protective health behaviors compared to older populations.[23] Among an Australian cohort study, increasing leisure time physical activity between ages 20 and 24 years was associated with healthier dietary patterns, better sleep and overall self-rated health observed at age 60 to 64 years.[24] Another longitudinal study investigating the transition of lifestyle health behaviors of emerging adults into young adulthood (age 26-31 years) found that 39% of those with mostly protective behavior patterns sustained their behaviors, 25% adopted more protective behaviors, and only 12% changed to higher risk behaviors.[18]

Consideration of Future Consequences

One mechanism that facilitates various health behaviors is future orientation, "a time perspective that is focused on the future, especially on how to achieve one's desired goals."[25] Consideration of future consequences (CFC) is a construct that operationalizes future orientation as the extent to which people consider distant versus immediate consequences of behavioral choices.[26] A meta-analysis identified that CFC can predict many lifestyle health behaviors including diet and physical activity among several populations including college students.[27] Even cancer prevention behaviors for cervical and skin cancer (i.e., HPV vaccination and sunscreen use) are related to CFC within this population.[27]

Current research is limited to exploring emerging adult CFC and cancer prevention behaviors for more proximal cancer concerns (i.e., cervical and skin), and excludes cancers traditionally considered a distal risk, such as CRC. In one study, a health domain specific CFC explained variance in diet and exercise behavior significantly more than the general CFC measure;[28] thus we wonder how a cancer-specific CFC scale would relate to current health

behaviors. Replication of the health adapted CFC scale could measure consideration of future cancer risk when making health behavior choices (CFC-Cancer).

Social Drivers of Health Behaviors and Outcomes

Racial cancer disparities for EOCRC include the likelihood of EOCRC is 100% higher for Hispanics and 50% higher for Non-Hispanic Blacks compared to Non-Hispanic Whites.[29] Hispanics and Blacks EOCRC survivors have worse 5-year survival rates for Stage III (68% and 80% respectively) and IV (12% and 22%) diagnoses compared to Whites (Stage III: 97%, Stage IV: 74%).[29] A study of EOCRC racial disparities found that worse incidence and outcomes among Black individuals was not diminished in light of socioeconomic status, access to healthcare or healthy lifestyle factors.[30] Social drivers of these racial disparities include income and education are two social drivers of health related to cancer disparities.[31] Higher CRC incidence and worse survival outcomes are found among neighborhoods with low-income and less education.[32] Older CRC patients (≥65 years) from these communities have 19% higher all-cause mortality when compared to the highest socioeconomic community even after controlling for race.[33]

Consideration of future outcomes from behavior choices is also sensitive to social drivers such as income. In one study, CFC mediated the relationship between income status and colorectal screening among eligible adults – low-income participants had lower CFC and less colorectal screening attendance.[34] Decision-making literature proposes that decision-making processes for individuals from low-socioeconomic backgrounds are influenced by resource scarcity, environmental instability, and subjective social status; thus choices are driven by proximal context rather than distal outcomes.[35] Consequently, health-related behavior decisions may be guided by immediate needs and hinder long-term outcomes.

First Generation and/or Low-Income Students

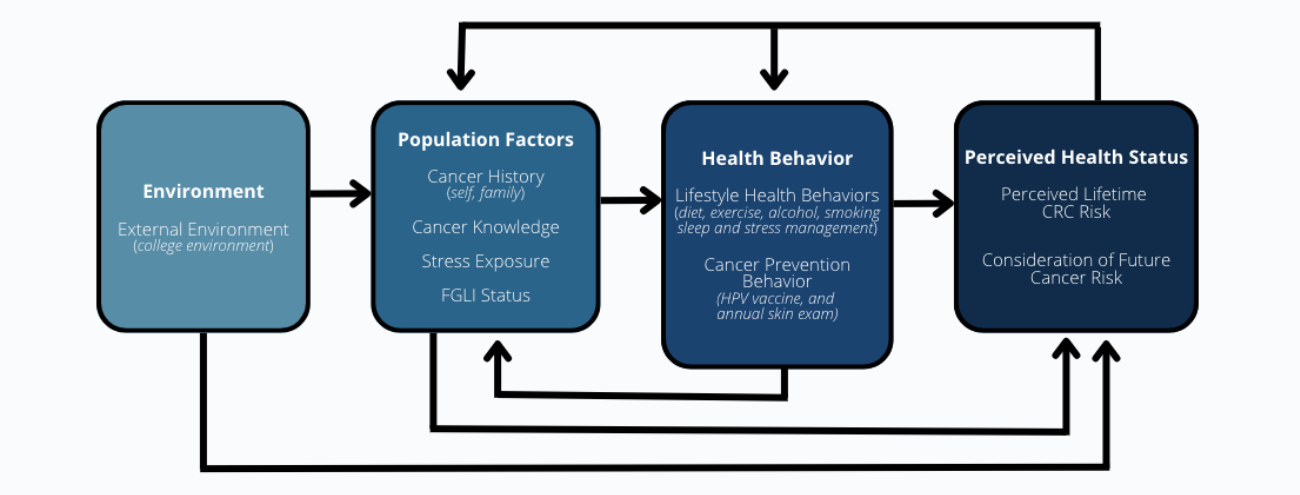
Among adolescents (14-17 years), lifestyle health behaviors varied according to parental education; those with less educated parents were more likely to display high or moderate risk behaviors.[19] Receiving financial aid, some form of food assistance and financial independence poses significantly greater risk for food insecurity among college students.[36] Students who are first generation to attend college or from low-income households (FGLI) experience unique stressors including navigation of financial aid and dependence on institutional supports (i.e., teacher/tutor, mentor/advisor/role model access and feeling represented on campus).[37] Stress among first-generation students has been significantly associated with availability of institutional supports, this was not the case for continuing-generation students.[38] Consequently, FGLI students may consider consequences of current behaviors on future CRC risk less than their peers because they are oriented to focus on immediate needs and resources.

A recent study observed that first generation students self-rated their health as "fair to poor" significantly more often than non-first-generation students.[39] The same study, identified that FGLI students have significantly poorer quality sleep and work more hours for income, but also participate in heavy alcohol consumption less often compared to Non-FGLI peers.[39] A review of US college student healthcare-seeking behavior recommends that future research explore specific student population needs, such as FGLI.[40] Presently life course health development and social inequality research need further exploration of individual agency in redirecting health trajectories among individuals from disadvantaged backgrounds.[41] This merits exploration to identify potential disparities among college students to inform tailored strategies that shape equitable utilization of campus resources that support cancer risk reduction.

THEORETICAL FRAMEWORK

The Life Course Health Development framework[42] and Andersen's Behavioral Model of Health Services Use[43] form the theoretical foundation for this study to explore college student's cancer future orientation (perceived lifetime CRC risk and consideration of future cancer risk when making health behavior choices). The theoretical framework is depicted in Figure 1.

Figure 1. *College Student Cancer Future Orientation Conceptual Framework*



Life Course Health Development specifies that health trajectories are the product of cumulative risk and protective factors which are susceptible to timing and sequence of biopsychosocial events that occur during developmentally critical periods.[42] Emerging adulthood is a critical life stage for development and modification of factors that induce or reduce EOCRC risk including lifestyle health behaviors and HPV vaccination.[18] Principles of the Life Course Health Development framework specify that adoption of health promoting behaviors is more easily accomplished at younger ages, and earlier initiation of such behaviors has better promise for sustainability across the lifespan.[14,42] Exploring how current lifestyle health behaviors are related to cancer future orientation (perceived lifetime CRC risk and consideration of future

cancer when making health behavior choices) can inform risk reduction strategies to improve behaviors and future orientation beginning in emerging adulthood to be sustained across the life course for EOCRC risk reduction.

Andersen's Model dictates that the healthcare system, external environment, and population factors such as predisposing characteristics, enabling resources and need influence current health behavior and consequently health outcomes, including perceived health.[43] Furthermore, the model includes feedback loops explaining how health outcomes and current health behaviors may reciprocally influence predisposing factors. Within the context of cancer future orientation among college students, external environment encompasses the campus' social and physical environment, and predisposing factors include a history of cancer (self or family), stress exposure (early life and current) and FGLI status. Exploring the experience of FGLI students is a pillar of the proposed study and aligned with Andersen's Model given that social inequality (i.e., population factors) between FGLI and Non-FGLI student backgrounds may influence current behaviors, intentions and attitudes towards cancer risk. This study applies Andersen's Model to (1) assess how current behaviors (lifestyle health behaviors and cancer prevention) are related to cancer future orientation; (2) control for population factors including history of cancer, CRC knowledge, stress, and FGLI status and (3) explore FGLI students' cancer protective health-related behavior intentions proximally and distally related to CRC cancer future orientation and their current external environment.

The Current Study

The objectives of this study are to: (1) explore college students' perceived lifetime CRC risk and consideration of future consequences for cancer (CFC-cancer) and associations with current health behaviors; (2) compare FGLI and Non-FGLI students' health behaviors and cancer-specific future orientations; and (3) explore student cancer prevention knowledge, attitudes and intentions given extent of CFC-Cancer. A sequential mixed methods study surveyed cancer future orientation and its association with current lifestyle health and cancer prevention behaviors among a sample of undergraduate students. Follow up interviews with students stratified by low, medium and higher CFC-Cancer scores explored their knowledge, attitudes and behavioral intentions related cancer prevention presently and distally. The specific aims for this dissertation study were as follows:

AIM 1: Assess and characterize cancer-specific future orientation among college students.

A web-based survey was administered to a random sample (N=2,100) of full-time undergraduate students stratified by first-generation student status. Previously validated measures assessed perceived CRC lifetime risk, lifestyle health behaviors (diet, physical activity, stress management, alcohol consumption, smoking tobacco, and sleep), cancer prevention behaviors (HPV vaccination and annual skin exam), and demographics. The consideration of future consequences scale was adapted to measure CFC-cancer based on the health-domain CFC scale.[28] Analyses controlled for chronic stress (early life) and current (perceived stress), family history of cancer history, and CRC knowledge. Hypotheses included:

H_1: Protective lifestyle health and cancer prevention behaviors will be positively associated with CFC-cancer.

H_1: Protective health and cancer prevention behaviors will be inversely associated with perceived lifetime CRC risk.

AIM 2: Determine whether CFC-cancer differs between FGLI and Non-FGLI students.

Bivarite tests and stratified liner regression models were administered to Aim 1 data to assess for significant differences in CFC-cancer and perceived CRC risk based on FGLI status. This aim had the following hypothesis:

H_1: FGLI students will have lower CFC-cancer scores than Non-FGLI students.

AIM 3: Explore students' health-related behavioral intentions given cancer-specific future orientation.

Semi-structured interviews were conducted with a sample (N=40) of students stratified by CFC-Cancer scores (low, medium and high). These interviews sought to understand students' behavioral health intentions for present and future behavior, how it relates to their cancer-specific future orientation, and what current contextual factors influence their intentions. Findings identified common themes regarding development of cancer risk reduction health behaviors for emerging adults.

Findings from this dissertation study support a paradigm shift for current cancer prevention efforts to begin earlier in the life course. Given that EOCRC lifestyle-related risk factors overall those for other cancers and chronic conditions including diabetes and cardiovascular disease this study has potential for greater public health impact. Implications for future research, clinical and public health practice will be highlighted with the aim of developing risk reduction behaviors among emerging adults.

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CHAPTER 2:
Emerging Adults' Consideration of their Future General and Colorectal-Specific Cancer Risk: A case to alter our primary prevention approach

The work presented in the remainder of this chapter is under review for publication as:

Knight Wilt, J., & Thomson, M.D. Emerging adults' consideration of their future general and colorectal-specific cancer risk: A case to alter our primary prevention approach. (under review) 2024.

ABSTRACT

Intro: Colorectal cancer (CRC) has a lengthy cellular mutation period and early onset (EOCRC) is linked to lifestyle-related factors. A primary prevention approach earlier in the life course is needed. Emerging adulthood (age 18-25) is a critical stage for shaping health trajectories, and future orientation influences health behavior decision making. Little is known about emerging adults' consideration of future cancer risk (CFC-Cancer), or perceived CRC risk. This study characterizes emerging adult CFC-Cancer, perceived CRC risk and how they relate to EOCRC lifestyle related factors and cancer prevention behaviors.

Methods: Cross-sectional survey of college students at a public university. Measures included demographics, current and chronic stress, cancer history and CRC knowledge. Previously validated measures for diet, sedentariness, smoking, alcohol consumption and stress management assessed adherence with lifestyle prevention guidelines. HPV vaccination and skin checks appraised cancer prevention. Outcomes included perceived CRC risk (0-100%) and CFC-Cancer adapted scale. Linear regression models examined perceived CRC risk and CFC-Cancer predictability.

Results: The sample (N=282) mean age=20, 77% female, 40% White, and 67% have history of cancer. CRC knowledge μ=14 and current stress was moderate. 18% completed both cancer prevention behaviors, and protective lifestyle behavior μ=8. Perceived CRC risk=28% and CFC-Cancer was moderate (μ=61). Both the CFC-Cancer $F(6)=7.22$, $p<0.001$ and perceived CRC risk $F(7)=3.49$, $p<0.01$ models were significant.

Conclusion: Emerging adults overestimate CRC risk but also have moderate CFC-Cancer. Accurate CRC knowledge provided to this group may help redirect CRC health trajectories through integration of protective lifestyle health behaviors and sustaining them into adulthood.

KEYWORDS: colorectal cancer, primary prevention, perceived risk, emerging adult

INTRODUCTION

Colorectal cancer (CRC) is increasingly diagnosed among younger adults not eligible for preventive screening. As many as 70% of early-onset colorectal cancer (EOCRC) cases have been linked to modifiable lifestyle factors.[1] CRC primary prevention encourages lifestyle integration of specific dietary and physical activity recommendations to reduce risk.[2] Precancerous cellular modifications begin as early as 10-20 years prior to CRC diagnosis.[3] Given this lengthy latency period, a CRC diagnosis made at age 45 would likely have mutation risk factors for colon polyps beginning as early as age 25-35.[3] Current CRC prevention efforts deploy interventions too late in life and focus on secondary (interception) rather than primary prevention.[4] Upstream, primary prevention that includes emerging adults (18-25 years) is needed for EOCRC risk reduction.[5]

During emerging adulthood elevated autonomy contributes to some of the most substantial changes to personal lifestyle health behaviors.[6] At conclusion of second year in college, a pattern of decreased physical activity and food diversity, along with increased alcohol consumption and sedentariness has been identified when compared to high school behaviors.[7] Longitudinal studies show engagement in health behaviors (i.e., diet, exercise, sleep, screen time, smoking and alcohol consumption) often group together as low-,moderate-, or high-risk.[6,7] College students who experience greater chronic stress and daily stressors have elevated risk for maladaptive health behaviors.[8] Furthermore these behaviors, protective and maladaptive, are sustained into adulthood and related to health outcomes.[6] In a cohort study, increasing leisure time physical activity between ages 20-24 years was associated with healthier diet, better sleep and overall self-rated health observed at age 60-64 years.[9] Thus lifestyle-related health behaviors established during this developmental stage shape trajectories for health outcomes including CRC.

Explorations of college student knowledge of cancer risk factors consistently find that students can correctly identify highly publicized health behaviors such as tanning, smoking, drinking alcohol, and HPV vaccination; but often miss dietary or sedentary risks.[10–12] HPV vaccination is recommended at ages 11-12 years, and dermatologist endorse annual skin exams beginning around age 20. These are the only clinical cancer prevention guidelines for emerging adults addressed in medical appointments which may contribute to their knowledge and perceived importance. Preventive behaviors for cervical and skins cancers are predicted by self-efficacy and knowledge, and perceived importance among college students (skin checks only).[13] Among college females, those who had greater cancer worry or perceive breast cancer to be a serious health risk were more likely to engage in higher levels of physical activity.[12] Students overestimate their general cancer risk which has been partially attributed to highly visible communications such as the breast cancer pink ribbon campaign.[14]

One mechanism that facilitates decisions to engage in preventive health behaviors is future orientation.[15] Future orientation is defined as "a time perspective that is focused on the future, especially on how to achieve one's desired goals".[15,16] Consideration of future consequences (CFC) operationalizes future orientation as the extent to which one's decisions are guided by future versus immediate consequences.[17] A meta-analysis identified that CFC predicts many lifestyle health behaviors among college students.[15] Future orientation also moderated the relationship between perceived stress and physical activity for students.[18] Both cervical and skin cancer prevention (i.e., HPV vaccination and sunscreen use) are positively related to CFC within this population.[15] Researchers adapted the CFC scale to assess proximal decision making in consideration of future health among college students and found that the new scale explained variance in diet and exercise behavior significantly more than general CFC scale.[19]

Prior research explored associations between emerging adults' CFC globally and cancer prevention behaviors for more proximal cancer concerns (i.e., cervical and skin); but has yet to investigate cancers traditionally considered a distal risk, like CRC. Given recent population trends and long latency of CRC, this risk may be less distal. Research on knowledge, perceived risk, and health behavior-based risk factors specific to CRC among this population is critical given EOCRC trends but is limited to date. Exploration of college students' future orientation pertaining to CRC is needed to understand how their consideration of future cancer risk (CFC-Cancer) may be associated with current behaviors that direct CRC health trajectories during a critical life course stage.

The present study objective was to characterize emerging adult CFC-Cancer and lifetime perceived CRC risk and assess how they relate to EOCRC lifestyle related risk factors and clinical cancer prevention behaviors. We hypothesized that protective clinical cancer prevention and lifestyle health behaviors are positively associated with CFC-Cancer, and inversely associated with perceived lifetime CRC risk. Furthermore, CFC-Cancer and perceived lifetime CRC risk will be positively related to CRC knowledge and cancer history (self or family), and negatively with stress (chronic and current).

MATERIALS & METHODS

Data Sample: A random sample (N=2,100) of full-time undergraduate students at a 4-year public institution aged 18 to 25 years were invited to participate in the study. An encrypted file containing contact information (name and school email) was uploaded into REDCap.[20,21] Students self-consented to the electronic survey via computer or mobile. A modified Dillman method that effectively improved Belgian college student survey response rates was utilized.[22] Invitations were delivered at the conclusion of the academic year, and non-responders received

up to eight reminders from May to August. Reminder content included survey completion time, current number of participants, and progress towards response rate goal. Completers received $5 Starbucks gift card and entered into a randomized drawing of Amazon gift cards ranging $10-$20 to incentivize participation; gift cards were distributed by email.

Measures: Students reported their age, sex at birth, race/ethnicity, employment (yes/no), first generation student status, year in school (first-, second-, third-, fourth-, or fifth-year plus) and cumulative GPA. Current stress was evaluated with the Perceived Stress Scale; scores range 0-40, higher scores indicate greater perceived stress.[23] Chronic stress was appraised with the Early Life Stress Questionnaire, asking students whether they experienced 17 various adverse childhood experiences; scores range 0-17, higher scores indicate more early life stress.[24] NCI's Screen to Save survey assessed CRC knowledge with 14 items for a score ranging 0-18 with higher score indicating greater knowledge.[25] Students were asked about having personal (yes/no) or family history of cancer (yes/no).

Given that these are the only two clinical cancer prevention guidelines relevant to emerging adults we asked one item for each behavior as to whether they adhered (yes/no). Their responses summed for an aggregate cancer prevention behavior score ranging from 0 to 2.

Lifestyle health behaviors associated with EOCRC including diet, sedentariness, smoking tobacco, and alcohol consumption were assessed with previously validated self-report measures.[26–28] Students were asked about frequency (i.e., Usually/Often, Sometimes, Rarely/Never) of meeting CRC protective dietary recommendations for fiber, fruits, vegetables, processed meats and fried foods.[26] Dietary behaviors were assessed for meeting CRC prevention guidelines by consuming ≥2 servings of fiber, fruits and vegetables per day and limiting

processed meats and fried food. Total hours spent sedentary during waking hours ranging from 0 to 20 was reported.[27] One item assessed whether participants abstain from smoking tobacco products (yes/no). Alcohol consumption was measured with two items, number of days consuming ≥ 1 drink in prior 30 days, and number of drinks consumed on those days to calculate average drinks per day; heavy drinking behavior for females was identified as ≥ 1 drink/day, and for males ≥ 2 drinks/day.[28]

Stress management and sleep were appraised as behavior-based constructs for controlling metabolic stress levels.[29] Nine items from the Inventory for assessment of stress management skills (IBSF) inventory of stress management skills were included to assess use of cognitive strategies, social support, and recognition of bodily tension to cope with stress, with higher scores indicating greater use of stress management behaviors.[23] The Brief Pittsburgh Sleep Quality Index was used to assess sleep latency, disturbance, and quality for a total sleep score ranging 0-12, with higher scores indicating better sleep.[30]

Health behaviors were dichotomized as to whether current prevention guidelines for diet,[31] sedentariness,[32] tobacco smoking, alcohol consumption,[31] sleep[33] and stress management[29] were met and then summed together for an aggregate protective health behavior score.

Three scales were used to examine study outcomes of future orientation related to cancer, and perceived CRC risk. Consideration of Future Consequences (CFC) is a fourteen item scale that appraises immediate versus future-orientated patterns in decision making.[17] Each item has a seven-point Likert response ranging from 1=”Not at all like me” to 7=”Very much like me,” which are summed together (range of 14-95) with higher scores indicating more future-oriented. Based on prior success adapting CFC to be health specific (CFC-Health),[19] we adapted the CFC scale to assess future consideration of cancer risk (CFC-Cancer).

Perceived lifetime CRC risk was evaluated by asking participants to use a sliding scale of 0% to 100% to indicate what they thought their lifetime risk of developing colorectal cancer would be. This measure was effectively used previously in a study of adults that assessed accuracy of perceived risk.[33] The percent measure for perceived risk can be compared to NCI's reported CRC risk for the general public, 4.1%.[34]

Analysis: Missingness was appraised and identified 9.4% of participants with ≥1 scale item missing. Multiple imputations were administered for scale items. Data was normally distributed. Students were asked general CFC items and CFC-Cancer to assess performance of the new scale and we report on correlation between these scales. A manuscript further assessing performance of the CFC-Cancer scale is under preparation. Composite scores for protective clinical cancer prevention and lifestyle health behaviors were generated by dichotomizing whether the participant met current prevention guidelines for individual items and then summed. All variables were descriptively analyzed. Performance of CFC-Cancer was evaluated by Cronbach's alpha and correlations with the original CFC scale. A Cronbach's alpha >0.70 was deemed acceptable.[35]

Bivariate correlation tests were applied to determine associations between sociodemographic variables, CRC knowledge, cancer history, stress, clinical cancer prevention and lifestyle health behavior scores with CFC-Cancer and perceived lifetime CRC. Interaction effects were created for significant associations between sociodemographic variables. Linear regression models were conducted to test hypotheses that clinical cancer prevention and lifestyle health behaviors predict CFC-Cancer and perceived CRC lifetime risk. Significant sociodemographic variables, cancer

history and CRC knowledge were controlled for in full models. Statistical analyses utilized $\alpha = .05$ to detect significance. SPSS 29 software was used.[36]

RESULTS

The survey had a 13% response rate with a final sample of 282 undergraduate students. Sample characteristics are displayed in Table 1. Respondents had an average age of 20 years and predominantly female (77%). Participants were mostly white (40%) with good representation from other racial/ethnic backgrounds including Asian (23%), Black (18%), and Hispanic (12%). Roughly two-thirds of students were upperclassmen (third year or higher) and employed during the school year. Most students (67%) had personal or family history of cancer, and the sample had a CRC knowledge score range 1-18, μ=14, SD=3. Early life stress experiences ranged from 0 to 15, μ=3.3, SD=2.7; majority (86%) reported at least one early-life stress experience, and 70% reported more than one. Current stress ranged 6-38, μ=21.0, SD=6.4; collectively the group reported moderate perceived stress (score=14-26). Table 2 displays the correlation matrix for sociodemographic variables, stress, cancer history, CRC knowledge, clinical cancer prevention score, lifestyle health behavior score, perceived CRC risk, and CFC-Cancer.

Clinical Cancer Prevention

Majority (72%) of the sample reported they had received the full HPV vaccination series. A sizeable proportion (17%) reported being unsure about their vaccination status. Less than a quarter (22%) reported participating in annual self- or healthcare provider skin examinations. Composite cancer prevention behavior scores ranged 0-2 with a quarter (25%) reporting neither behavior and 18% who reported completing both.

Lifestyle Health Behaviors

Dietary guideline adherence was as follows: fiber 35%, fruits 29%, vegetables 37%, processed meats 24% and fried foods 27%. A quarter of participants (23%) didn't meet any CRC protective diet habits, and 20% met ≥3 of the guidelines. 41% met guidelines for preventive sedentary time. Majority (95%) reported ≥1 type of stress management behavior. Cognitive exercises including perspective, balancing thoughts, knowledge, ease or confidence in coping were reported among 83% of the sample, with 65% reporting more than one. Half (55%) reported they could rely on social support for help, and 63% were aware of bodily tension increasing under stress. Approximately 29% of students appraised their sleep quality as good, and 31% reported getting ≥7 hours of sleep nightly. Among this sample only 7% met criteria for heavy drinking behavior, and the vast majority (83%) reported abstaining from smoking tobacco products. Composite protective lifestyle health behavior scores ranged 2-15, (μ=8, SD=3) and Cronbach's alpha was 0.65.

Consideration of Future Cancer Risk

CFC-Cancer had a range=21-95, (μ=61.4, SD=13.9 among the student sample. CFC-Cancer had a significant correlation with the CFC-General ($r(282)=0.63$, $p<0.001$), and yielded a higher Cronbach's Alpha (α=0.87) compared to CFC-General (α=0.84). These results indicate that the adapted CFC-Cancer scale has convergent validity and greater consistency compared to CFC-General. Correlation tests with sociodemographic variables and stress exposure identified significant associations with GPA ($r(282)=0.2$, $p<0.01$) and current perceived stress ($r(282)=-0.2$, $p<0.001$), thus these were included along with Cancer History and CRC knowledge as controls in linear regression models.

Perceived Lifetime CRC Risk

Perceived lifetime CRC risk had a wide range, 0-100, and (μ=28.4, SD=20.5. Average perceived lifetime CRC risk among students was 28.4%. Perceived risk had significant correlations with interaction effect between age*school (r r(282)=0.2, $p<0.001$), employment status (r(282)=0.2, $p<0.001$), and current perceived stress (r(282)=0.1, p=0.03). These variables along with Cancer History and CRC knowledge were included in perceived lifetime CRC risk linear regression models.

Full Models

The full model was significant, F(6)=7.22, $p<0.001$. Greater GPA, CRC knowledge and more protective lifestyle health behaviors were significantly associated with greater consideration of future cancer risk. Current stress was not a predictor in the presence of GPA, CRC knowledge and lifestyle health behaviors. CFC-Cancer = 34.61+2.54(GPA)+.83(CRC knowledge) +.97(lifestyle health behavior score). One unit increase in GPA yields a 2.54 increase in CFC-Cancer score. A unit increase in CRC knowledge results in a 0.83 increase in CFC-Cancer score, and each additional protective lifestyle health behavior results in a 0.97 increase in CFC-Cancer score. In the presence of GPA, CRC knowledge and lifestyle health behaviors, stress is not a significant predictor of CFC-Cancer. Parameter estimates for linear regression models are display in Table 3.

The full perceived lifetime CRC risk model is significant, F(7)=3.49, $p<0.01$. Again, current perceived stress was not a significant predictor of perceived CRC risk with the other variables present. School year*age interaction and work status were the only significant predictors; perceived lifetime CRC risk= .29(employment status)+.12(age*school year). Perceived lifetime

CRC risk score increased by .29 if students were employed, and .12 for each unit increase in school year* age. Parameter estimates are displayed in Table 3.

DISCUSSION

In this cross-sectional survey of emerging adults attending college, we found that students have moderate consideration of their future cancer risk when making health behavior choices, but overestimate their lifetime CRC risk. CRC knowledge and lifestyle health behaviors were significant predictors for consideration of future cancer risk but not with perceived lifetime CRC risk. As we predicted, current perceived stress had a significant negative association with perceived CRC risk, but was positively associated with CFC-Cancer, and was not a significant predictor for either outcome in the presence of other factors.

Students' had a wide range of perceived risk (0%-100%). On average participants perceived they had a 28% chance of CRC in their lifetime; this is seven times greater than general lifetime CRC risk (4%) based upon NCI data trends.[34] Incongruence between perceived lifetime risk and actual prevalence of cancer, cardiovascular disease, diabetes and obesity has been observed among college students before.[14] It's suggested that highly visible breast cancer campaigns may contribute to female students estimating they are more likely to get cancer than heart disease, the leading cause of death among women.[14] Younger age predicted higher perceived CRC risk in other studies.[37,38] CRC communications target those of screening age eligibility and consequently younger populations may be less informed about prevalence and overestimate their risk. It's possible that younger individuals see many years of life left or recall stories of younger celebrities who have been diagnosed and/or died from CRC, and perceive greater CRC risk compared to someone with fewer years left of life. Upperclassmen perceived a greater risk of

developing CRC in this study, and for cardiovascular disease[39] and diabetes[40] in other studies. Further investigation is needed to understand upperclassmen experiences that may foster greater apprehension of cancer and chronic diseases. The top three concerns among students include academic performance, pressure to succeed and post-graduation plans;[41] it may be that the approaching conclusion of studies realigns concerns for upperclassmen to include one's health.

Lifestyle behaviors did not predict perceived CRC risk among our sample of emerging adults, a finding similar to a recent study of middle-aged adults (45+ years);[38] however behaviors did predict CFC-Cancer. Students reporting more protective behaviors were more future orientated to reduce cancer risk when navigating health-related decisions. Overall, the sample had moderate consideration for their future cancer risk, which is significant considering that overall health ranks seventh among student concerns.[41] As of 2018, roughly 22% of those age 18-26 had completed HPV vaccination,[42] in our sample completion rate was 75% which may reflect that our college student sample had moderate CFC-Cancer. Our results suggest that while health may not be a main concern for students, they do still consider their future cancer risk when making choices. This supports investment in EOCRC efforts to improve lifestyle related health behaviors of college students which will also positively influence students' cancer-related future orientation and hopefully alter their health trajectory.

Lifestyle health behaviors are sensitive to stress as individuals' use exercise, eating, smoking and alcohol consumption as coping mechanisms[43] and college students are not immune to this effect.[8] It's been recommended that lifestyle behavior interventions should include stress management given this relationship.[43] Perhaps because our lifestyle health behavior variable included appraisal of stress management techniques we identified that perceived stress was not a predictor of CFC-Cancer in the presence of protective lifestyle health behaviors. This suggests

that students still consider future cancer risk when navigating health behavior decisions regardless of current or chronic stress and reinforces the argument that lifestyle health interventions should integrate stress management.

Limitations

The survey response rate was low but aligns with cross-sectional web-survey participation rates for college students which are averaging less than 20%.[22] The National College Health Assessment utilizes a stratified random sample and averages an 11% response rate across institutions,[44] and other studies have published with similar sample sizes. The survey was distributed at conclusion of at the academic year which may have contributed to lower response rate. As best practice, respondent demographics were compared to those of the university to verify representativeness of the undergraduate student body.[45] Regardless of low participation, a major strength of the present study was the high racial and ethnic diversity among participants. Given timing of the survey, self-reported health behaviors and perceived stress may not reflect those constructs under influence of student obligations during the academic year which would alter our predictive models. Self-report measures may over- or under-estimate lifestyle health behaviors; however, the study was intentional in selection of previously validated instruments tested among college students. Future studies could benefit from objective measures using ecological momentary assessments, wearable devices and/or biometrics. Education level has been identified as a risk factor for CRC, those with higher education are less likely to have a CRC diagnosis.[46] The present study utilized college enrolled emerging adults and thus their educational background may be a possible moderator for perceived CRC risk and CFC-Cancer. A broader emerging adult sample should be used in the future to assess whether outcomes differ

based on educational experiences that afford access to and opportunities to engage with health knowledge.

CONCLUSION

The life course paradigm proposes that 1) the longer someone engages in preventive behavior the greater likelihood it will be sustained, and 2) younger adults have greater likelihood of initiating preventive health behaviors through social transitions.[47] The present study's findings justify a paradigm shift for CRC primary prevention to adopt a life course perspective and introduce strategies to reach emerging adults. This period is a critical time for intervention given neuroplasticity and that brain development of cognitive processes, including behavior modification, reaches maturation around age 25.[48] CRC knowledge is a significant predictor for cancer related future orientation and thus evidence-based strategies to improve knowledge and reduce risk need to reach emerging adults. Recently, a cancer health education program yielded significant improvement in cancer knowledge, lifestyle health behaviors, cancer fear/fatalism, and family discussions about health among high school students;[49] this program could be replicated among emerging adults. CFC-Cancer is moderate during this life stage and thus if emerging adults are provided with accurate knowledge of how to reduce risk there it is likely they will implement those practices and sustain them into later adulthood. Furthermore, given that EOCRC modifiable lifestyle risk factors are common with many other chronic conditions there would be a significant public health impact with effective prevention strategies.

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TABLES

Table 1.1. Student Sample Characteristics	
Age	20 (SD=1.53)
Sex	
Female	216 (76.6%)
Male	62 (22.0%)
Missing	4 (1.4%)
Race	
White	115 (40.8%)
Asian	66 (23.4%)
Black	39 (18.8%)
Hispanic/Latino	33 (11.7%)
Bi/Multiracial	23 (8.2%)
Other	6 (2.2%)
Year in School	
First	38 (13.5%)
Second	48 (17.0%)
Third	81 (28.7%)
Fourth	85 (30.1%)
Fifth +	24 (8.5%)
No Response	6 (2.1%)
GPA	3.35 (SD=0.75)
Employed	176 (62.4%)
FG Status	77 (27.3%)
Cancer History	188 (66.7%)
CRC Knowledge Score	14.63 (SD=2.11)
Present Stress Score	20.99 (SD=6.26)
Chronic Stress Score	3.30 (SD=2.68)
CFC-Cancer	61.37 (SD=13.94)
Perceived Lifetime CRC Risk	28.41 (SD=20.54)

Table 1.2. Correlation matrix of CFC-Cancer, CRC risk, CFC, sociodemographic variables, stress, clinical cancer prevention and lifestyle health behaviors.

	CFC-Cancer	CRC Risk	CFC	Sex	Age	Race	GPA	School Year	Work	CRC Know.	Cancer History	Current Stress	Chronic Stress	Clinical Cancer Prevention Behaviors	Protective Lifestyle Health Behaviors
CFC-Cancer	1	.015	.625**	.089	.009	.032	.190**	.052	-.015	.194**	.093	-.201**	-.021	.101	.236**
CRC Risk	- -	1	-.107	.013	.214**	-.057	-.017	.191**	.209**	.003	.094	.114	.055	.051	-.084
CFC	- -	- -	1	.058	.010	.073	.267**	.078	-.034	.120*	.046	-.256**	-.007	.046	.280**
Sex	- -	- -	- -	1	.165**	-.029	.123*	.070	-.009	-.001	-.170**	-.140*	-.144*	-.185**	.151*
Age	- -	- -	- -	- -	1	-.005	-.128*	.723**	.11*	.028	.033	.045	.145*	-.046	.025
Race	- -	- -	- -	- -	- -	1	.114	-.083	-.039	.187**	.234**	.004	.107	.172**	-.022
GPA	- -	- -	- -	- -	- -	- -	1	-.126	-.074	.168**	.032	-.255**	-.113	.019	.007
School Year	- -	- -	- -	- -	- -	- -	- -	1	.176**	-.020	.065	-.021	.105	.015	.087
Work	- -	- -	- -	- -	- -	- -	- -	- -	1	-.151*	-.132*	.086	-.033	.056	-.080
CRC Knowledge	- -	- -	- -	- -	- -	- -	- -	- -	- -	1	.066	-.013	.081	.092	-.045
Cancer History	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	1	.037	.158**	.093	-.018
Current Stress	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	1	.242**	-.036	-.418**
Chronic Stress	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	1	.040	-.071
Clinical Cancer Prevention Behaviors	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	1	.089
Protective Lifestyle Health Behaviors	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	1

** p-value < 0.01
* p-value < 0.05

Table 1.3. Significant linear regression model parameter estimates for CFC-Cancer and Perceived CRC Risk.					
CFC-Cancer					
	Estimate	Std. Error	t	95% CI	p-value
Constant	34.61	7.38	4.69	(20.14, 49.09)	<0.001
GPA*	2.54	1.12	2.28	(0.35, 4.73)	0.02
CRC Knowledge**	0.83	0.28	2.95	(0.28, 1.38)	<0.01
Cancer History	2.33	1.67	1.40	(-0.94, 5.60)	0.16
Current Perceived Stress	-0.17	0.14	-1.22	(-0.46, 0.11)	0.22
Lifestyle Health Behavior***	0.97	0.30	3.29	(0.39, 1.55)	<0.001
Cancer Prevention Behavior	1.18	1.22	0.97	(-1.21, 3.56)	0.34
Perceived Lifetime CRC Risk and Lifestyle Health Behavior					
Constant	16.57	10.18	1.63	(-3.48, 36.62)	0.11
School Year*Age**	0.12	0.04	2.60	(0.03, 0.20)	0.01
Work*	0.29	0.12	2.45	(0.06, 0.52)	0.02
Cancer History	3.76	2.60	1.45	(-1.35, 8.87)	0.15
CRC Knowledge	-0.14	0.45	-0.31	(-1.02, 0.74)	0.76
Current Perceived Stress	0.27	0.21	1.27	(-0.15, 0.69)	0.21
Lifestyle Health Behavior	-0.44	0.45	-0.96	(-2.18, 5.20)	0.34
Cancer Prevention Behavior	1.51	1.87	0.81	(-2.78, 4.56)	0.42

*** p-value <0.001
** p-value < 0.01
* p-value < 0.05

CHAPTER 3:
Identifying differences in early onset colorectal cancer risk factors
and consideration of future cancer risk among college students

The reminder of this chapter has been submitted for publication as:

Knight Wilt, J., & Thomson, M.D. "Identifying differences in early onset colorectal cancer risk factors and consider of future cancer risk among college students". (under review) 2024.

ABSTRACT

Background: Colleges have seen a rise in students that are first generation or from low-income households (FGLI). Early onset colorectal cancer (EOCRC) incidence is higher among lower SES communities. Exposure to lifestyle-related risk factors across the lifespan influences EOCRC risk. This study compared consideration of future cancer risk (CFC-Cancer), perceived colorectal cancer (CRC) risk, CRC knowledge, and EOCRC risk factors based on FGLI status.

Methods: Students completed a survey online. FGLI was classified as first-generation student in university records or receipt of need-based financial assistance. Measures included perceived CRC risk, CFC-cancer, CRC knowledge, EOCRC lifestyle-related factors, HPV vaccination, and demographics. Bivariate tests assessed for significant differences between FGLI and Non-FLGI students across measures. Stratified linear regression models evaluated significant associations with outcomes of perceived CRC risk and CFC-Cancer based on FLGI status.

Results: The sample (N=282) was 46% FGLI. FGLI were significantly more Black and Hispanic, had greater perceived and chronic stress, and less HPV vaccinated. FGLI also had less CRC knowledge. Perceived CRC risk and CFC-Cancer did not differ. CFC-Cancer models revealed that CFC-Cancer is associated with CRC knowledge and stress management skills in both

groups. FGLI perceived CRC risk was significantly associated with being first generation student in extended family, being employed and bi/multi-racial identity.

Health Equity Implications: EOCRC disproportionally affects individuals from low-income or less educated backgrounds, and Black and Hispanic communities. FGLI represents these risk groups and have less CRC knowledge, highlighting a need for targeted risk reduction strategies to uplift health equity among emerging adults.

KEYWORDS: early onset colorectal cancer, primary prevention, health disparities, emerging adults

INTRODUCTION

Full-time enrollment in higher education has declined by 15% from Fall 2010 to Fall 2021; however, the rate of individuals from low-income households has been trending upwards.(1) The rate of bachelor degree seeking students that receive federal need-based financial assistance (i.e. Pell grant) rose from 27% in Fall 2003 to 40% in Fall 2020.(2) Among Pell Grant recipients, 63% are considered first generation students, defined as child of parents who did not complete a 4-year degree.(2,3) Income and education are two social drivers of health related to cancer disparities.(4) Greater colorectal cancer (CRC) incidence and worse survival outcomes are found in neighborhoods with low-income and less education.(5) Older CRC patients from these communities have 19% higher all-cause mortality compared to the highest socioeconomic group even after controlling for race.(6)

To comprehensively address disparities in cancer burden, focus is needed on how social drivers affect the continuum of cancer prevention. Among youth, less healthcare utilization and adverse health outcomes have been linked to lower parental income and education.(7,8) College students who are first generation or from low-income households (FGLI) have a history of exposure to these factors that may influence healthcare use and outcomes prior to emerging adulthood. One study found that first generation students rated their health as “fair to poor” more often than non-first-generation students.(9) In the same study, FGLI students have significantly poorer quality sleep and work more hours for income, but also participate in heavy alcohol consumption less often compared to Non-FGLI students. College students who receive financial aid and have financial independence are at greater risk for food insecurity compared to students with familial financial support.(10)

The Public Health Exposome(11) and Stress Process Model(12) center cumulative exposure to health risk factors (social drivers of health and stress) across the life course as affecting health outcomes and disparities. Thus, exposure to less advantageous social drivers early in the life course shapes an individual's CRC and early-onset (EOCRC) risk trajectories. The Life Course Health Development(13) framework poses that health trajectories can be redirected during critical life development stages and engaging in preventive behaviors at a younger age has better odds for continuity. Emerging adulthood (age 18-25 years) is a critical developmental stage when individuals experience dynamic and complex biopsychosocial maturation(14) and have greater likelihood of initiating protective health behaviors compared to older adults.(15) Upon transitioning to a new college campus environment and entering emerging adulthood, there is opportunity to leverage campus resources and deploy programs to modify lifestyle health behaviors among FGLI to align with CRC primary prevention.(14,16)

Social drivers can indirectly affect risk factors, screening and treatment through their role on cognitive decision-making processes. Future orientation, thoughts about future self or outcomes, is one such decision-making process.(17) Consideration of future consequences (CFC) operationalizes future orientation as the extent to which people consider distant versus immediate consequences of behavioral choices.(18) CFC can mediate the relationship between income status and colorectal screening among eligible adults; participants with low-income have lower CFC and less colorectal screening attendance.(19) Among college students, lower CFC scores were associated with greater perceived barriers to get HPV vaccination including provider access and financial cost.(20) In a study of college men, family income moderated the mediating relationship that CFC had on conformity to masculine norms and engagement in health promoting behaviors.(21) Decision-making literature proposes that decision-making processes

for individuals from low-socioeconomic backgrounds are influenced by resource scarcity, environmental instability, and subjective social status; thus choices are driven by proximal context rather than distal outcomes.(22)

In a longitudinal study, exposure to adverse events, such as violence, in adolescence was associated with greater perceived stress and worse future orientation in young adulthood.(23) One study identified first-generation students had greater collegiate stress exposure, including work intensity, financial strain, as well as basic needs and housing insecurity compared to continuing-generational students.(24) FGLI students experience these and unique stressors compared to their peers such as learning the "hidden curriculum" the implicit language, values and norms of higher education,(25) and navigating financial aid and institutional resources.(26) Stress among first-generation students has been significantly associated with availability of institutional supports including advisors, mentors, teachers, and a sense of belonging on campus, this was not the case for continuing-generation students.(27) Considering that FGLI students experience greater stress during college, and greater stress has been associated with less future orientation, it merits investigation whether stress, current and early life events, for FGLI are related to their CFC for health outcomes like CRC risk.

Presently life course health development and social inequality research need further exploration in redirecting health trajectories among individuals from disadvantaged backgrounds.(28) A review of US college student healthcare-seeking behavior recommends that future research explore specific student population needs, including students who are FGLI.(29) This merits investigation to inform future strategies that shape equitable utilization of campus resources that support cancer risk reduction. In our study we previously established that college students have moderate consideration of future cancer risk (CFC-Cancer); however, FGLI

students may consider future cancer-related consequences of current health behaviors less than their peers because they may be more oriented to focus on immediate needs and resources. Thus, the purpose of this investigation was to explore and characterize potential differences between FGLI and Non-FGLI students regarding their perceived CRC risk, CFC-Cancer, and known EOCRC risk factors. We hypothesized that FGLI students would have greater current and chronic stress compared to their peers and consequently lower CFC-Cancer scores.

MATERIALS & METHODS

Data Sample: A web survey was distributed to a random sample (N=2,100) of emerging adults enrolled full-time at a large urban university. The sample was provided by the university's Division of Student Affairs and stratified by first-generation student status to reflect the institution's student population demographic. Pell grants are federal financial aid packages awarded to students of exceptional financial need to cover cost of attending college.(30) Receipt of Pell Grant is not recorded in the university's registrar system and thus the research team was unable to stratify by this variable. Names, school affiliated email and basic demographics on file with the registrar including first-generation status, age, race and sex were uploaded into REDCap for project management.(31,32) Survey distribution, consenting and follow-up process is described in a prior manuscript (under review).(33) Briefly, students were invited via email to participate in a one-time electronic survey. Distribution and follow-up was guided by a modified Dillman method previously successful with Belgian students,(34) and occurred between May thru August 2023. Completers received a $5 Starbucks e-gift card and were entered into a prize drawing for Amazon e-cards ranging $10-20 distributed by email. The survey took

approximately 16 mins to complete. The study protocol was reviewed and determined to be exempt status by the institutional review board (HM20026461).

Measures: Survey measures have been comprehensively described in the study's first paper. In addition to demographics provided by registrar, participants self-reported gender identity, year in school, cumulative GPA and employment status (yes/no). Income status was assessed with one item about whether they receive need-based financial assistance (i.e. a Pell Grant) for tuition costs (yes/no). Participants who were listed as first-generation in registrar records or indicated that they receive need-based financial assistance were classified as FGLI. Complementary measures were used to capture self-reported first-generation student status and perceived financial hardship. Participants identified as first-generation status by reporting parent's highest level of completed education, and extended family (grandparent, aunt/uncle) highest level of completed education, ranging from less than high school/GED to doctoral/professional degree. Those with parents or extended family who completed less than a Bachelor's Degree were classified as first generation respectively. Perceived financial hardship was assessed with two previously validated items(35) including their family's financial situation as a child/teenager and current (self) financial situation. Response options included experiencing extreme financial hardship, experiencing some financial hardship, having enough money, or having more than enough money; experiencing extreme or some hardship was categorized as hardship, and enough or more than enough as financially secure.

Current stress was assessed with the Perceived Stress Scale (PSS-10)(36) and chronic stress was measured using the Early Life Stress Questionnaire (ELSQ).(37) High scores for both scales indicate greater stress. Cancer history was assessed by asking whether the student had a family

history of cancer (yes/no). NCI's Screen to Save survey assessed CRC knowledge regarding screening and risk factors with higher score indicating greater knowledge.(38) Performing annual skin exams (yes/no) and completing the HPV vaccination series (yes/no) were asked as clinical cancer prevention behaviors. Lifestyle health behaviors were appraised with previously validated self-report measures for diet (REAP-S),(39) daily sedentary time (IPAQ-SF),(40) heavy alcohol consumption,(41) and hours of sleep (B-PSQI),(42) plus one item to capture avoidance of smoking tobacco (yes/no). Evidence-based cutoffs for sedentary time (< 7 hours/day)(43) and sleep (7-9 hours/night) were utilized to classify students as meeting prevention guidelines.(44) Stress management was appraised with nine items from the Inventory for Assessment of Stress Management Skills(45) which indicates greater stress management skills with higher scores; the full scale scores range from 9 to 45.

Outcomes of interest for perceived lifetime risk of CRC and CFC-Cancer were appraised with three measurements. Using measures from a perceived CRC risk study,(46) students were asked to rate their risk of getting CRC in the future as very low, somewhat low, moderate, somewhat high, or very high; and to indicate their perceived lifetime risk of getting CRC on a scale of 0% to 100%. The categorical item responses were merged as low (very low and somewhat), moderate, and high (very high and somewhat high) perceived risk. CFC-Cancer was measured by adapting the general CFC scale(47) to reflect consideration of future cancer risk when making current health-related decisions.

Analysis: Multiple imputations were utilized for missing individual scale items for the outcome of CFC-Cancer. Data was normally distributed from preliminary analyses. All variables were assessed descriptively among the full sample and then comparatively by FGLI and Non-FGLI

student status. Chi-squares and t-tests detected significant differences among independent variables: sociodemographic variables, stress, cancer history, CRC knowledge, clinical cancer prevention, lifestyle health behavior, stress management; and outcomes: perceived CRC risk, and CFC-Cancer between FGLI and Non-FGLI. Bivariate correlations were administered separately for the two groups to identify associations between independent variables with outcomes of perceived CRC risk, and CFC-Cancer. Demographic variables and behaviors that showed significant associations with outcomes were included in linear regression models along with CRC knowledge, stress and cancer history as covariates. Stratified models were used to evaluate and compare CFC-Cancer for FGLI and Non-FGLI students. Statistical analyses utilized $\alpha = .05$ to detect significance. SPSS 29 software was used.(48)

RESULTS

Among the sample of participants (N=282), 27.3% were first-generation according to Registrar records and 40.1% indicate receiving need-based financial assistance; in total 46% met FGLI criteria (n=130). Student respondents had a mean age of 20 years (SD=1.5), were predominantly female at birth (77%) and identified as women (69%), while over half were upper classmen (third year plus) (67%) and employed while taking coursework (62%). There was diverse racial representation among respondents, 41% white, 23% Asian, 19% Black, 12% Hispanic, and 8% bi/multiracial. The sample had moderate current stress with a mean score of 21 (SD=6.3), and a mean chronic stress score of 3.3 (SD=2.7) indicating an average of three early life stress events. FGLI and Non-FLGI comparative analyses reflect several significant differences regarding sociodemographic variables and stress experienced. Non-FGLI was composed of more white students ($x2=11.6$, $p<.001$), while FLGI had significantly more Black ($x2=5.09$, $p=.02$) and

Hispanic (x2=6.36, p=.01) students. Cumulative GPA was lower for FGLI compared to Non-FLGI (t=-3.23, mean diff=0.28 p<.001) and more FGLI students reported being employed (x2=10.48, p<.01). More FGLI also reported familial (x2=68.66, p<.001) and self (x2=58.29, p<.001) financial hardship, and greater current stress (t=1.97, diff=1.5, p=.05) and chronic stress (t=3.82, diff=1.25 p<.001) compared to Non-FGLI. Sample characteristics and significant differences between FGLI and Non-FGLI students are displayed in Table 1.

Two-thirds of the sample had a history of cancer (67%). CRC knowledge mean score was 14.6 (SD=2.1) for the sample; but FGLI had significantly less knowledge (t=-3.37, diff=1.1, p<.001). FGLI students also had lower scores for clinical cancer prevention (t=-3.12 diff=1.86, p<0.01) including fewer individuals that completed the HPV vaccination series (64%) compared to Non-FGLI (79%) (X2=7.92, p<.01). The mean score for lifestyle health behaviors was 7.9 (SD=3.0) and did not differ between the two groups. Upon review of each individual item in the composite score, the only difference detected between FGLI and Non-FLGI was consumption of fried foods. Significantly more FGLI students (37%) reported never/rarely eating fried foods compared to Non-FGLI (18%) (X2=12.2, p<.001). Scores for stress management skills did not differ between the two groups (FGLI: mean=27.3 (SD=6.4); Non-FGLI: mean=27.3 (SD=5.5)).

Perceived CRC risk did not differ between FGLI and Non-FGLI students. The FGLI group had a slightly higher mean score of 30 (SD=21.48) compared to Non-FGLI 27 (19.7) but the difference was not significant (p=.23). Majority of both groups believed that their risk of getting CRC in the future was low, FGLI 70%, Non-FGLI 73%. Both FGLI and Non-FGLI students had moderate CFC-Cancer scores, 60.0 (SD=17.0) and 62.6 (SD=16.4) respectively, which did not significantly differ from one another, p=.19.

Bivariate Correlations within Groups

Within the FGLI student group lifetime perceived CRC risk was associated with being first-generation among extended family (r=.206, p=.033), self-financial hardship (r=.178, p=.047), bi/multi-race (r=.244, p=.005) and employment status (r=.293, p<.001). CFC-Cancer had an association with stress management skills (r=.337, p<.001), familial-financial hardship (r=.191, p=.030), and current stress (r=-.254, p=.004). Among the Non-FGLI group perceived CRC risk had associations with school year (r=.263, p=.001) and employment status (r=.193, p=.017). CFC-Cancer within Non-FGLI was associated with stress management (r=.239, p=.004), CRC knowledge (r=.259, p=.001), and cumulative GPA (r=.206, p=.012). These significant correlations were included in respective linear regression models for both groups.

Linear Regression Models within Groups

The model predicting perceived lifetime CRC risk within FGLI students was significant, F(8)=3.84, p<.001. Perceived lifetime CRC risk = 12.69 + 10.55(FG extended family) + 7.91(self-financial hardship) + 15.06(Bi/Multiracial) + 0.48(employed) + .20(current stress) - .83(chronic stress) + .37(CRC knowledge + 1.58(cancer history). Significant predictors included FG extended family, self-financial hardship, and bi/multiracial. Being FG extended family status added 10.55 points to their perceived risk score, while bi/multiracial status added 15.06, and employed contributed 0.56. The CFC-Cancer model was also significant for FGLI students, F(6)=4.45 (p<0.001), CFC-Cancer = 36.91 + .68(stress management) – 4.77(familial-financial hardship) – .23(current stress) – .16(chronic stress) + .87 (CRC knowledge) +2.67 (cancer history). Stress management behavior and colorectal cancer knowledge were the only significant predictors in the full model. For every unit increase in stress management skills there was a

reciprocal increase in CFC-Cancer score by 0.68 points, and each additional point of CRC knowledge had a .87 increase in CFC-Cancer score.

The full model for perceived lifetime CRC risk among Non-FGLI students was significant, $F(6)=3.32$, $p<0.01$; Perceived CRC risk = -.81 + 3.74(school year) + .24(employment) + .40(current stress) – .03(chronic stress) + .29(CRC knowledge) + 5.54(cancer history). School year and work status were the only significant predictors in the model. For each increase in school year perceived CRC risk increased by 3.74 points among Non-FGLI students and being employed added .24 to perceived CRC risk. The model for predicting CFC-Cancer among this group was also significant, $F(6)=3.32$, $p<0.01$; CFC-Cancer = 20.29 + .55 (stress management skills) + 2.53 (GPA) + .03 (current stress) + .43 (chronic stress) + 1.03 (CRC knowledge) + 2.37 (cancer history); stress management skills and CRC knowledge were the only two significant estimates in the model. Each unit increase in stress management skills had a reciprocal .56 increase in CFC-Cancer, and each point increase in CRC knowledge score had a 1.03 increase in CFC-Cancer score.

DISCUSSION

In our analysis of potential differences in CFC-Cancer score and lifetime perceived CRC risk between FGLI and Non-FGLI students we found no significant difference. When we administered stratified models we identified that the two groups have different variables associated with either outcome. Perceived lifetime CRC risk was associated with employment status in both FGLI and Non-FGLI, but FGLI students' perceived risk was also associated with socioeconomic factors of extended family first generation student status and current self-financial hardship, and bi/multiracial identity. This pattern was seen again in predicting CFC-

Cancer within the groups as stress management and CRC knowledge were associated with CFC-Cancer score. Bivariate correlations detected that familial-financial hardship was associated with FGLI CFC-Cancer score but this variable was insignificant in the full regression model. There were significant differences observed in FLGI knowledge of CRC, stress experienced, and clinical cancer prevention, notably less uptake of HPV vaccination among FGLI students. Overall, the FGLI group reflected more EOCRC disparities including higher representation of underserved racial minority groups, less advantageous socioeconomic status (family income and education).

The likelihood of EOCRC, before age 50, is 100% higher for Hispanics and 50% higher for Non-Hispanic Blacks compared to Non-Hispanic Whites.(49) Furthermore, Hispanics and Blacks have lower 5-year survival rates for Stage III (68% and 80% respectively) and IV (12% and 22%) patients compared to Whites (Stage III: 97%, Stage IV: 74%).(49) FGLI students were made up of significantly more Black and Hispanic individuals, indicating a greater risk of EOCRC among FGLI students. A study of EOCRC racial disparities found that CRC incidence among Black individuals was not diminished in light of SES (education, income, neighborhood deprivation), access to healthcare or healthy lifestyle factors.(50) Thus even though our Black and Hispanic study participants are receiving a higher level of education their elevated risk for EOCRC is not mitigated. It is vital that FGLI students are informed about CRC screening practices as they are likely eligible to screen sooner. This is a significant need given that our study identified that FGLI students had lower CRC knowledge compared to Non-FGLI which contributes to the unequal distribution of benefits resulting from early integration of risk reduction strategies.

A meta-analysis found an elevated risk of CRC among individuals with HPV(51) and the CDC estimates that around 91% of anal/rectal cancers incidences each year were probably caused by HPV.(52) The HPV vaccine was primarily developed to prevent cervical cancer but can also prevent other cancers related to HPV.(51) In our study FGLI students were significantly less likely to have completed the HPV vaccination series compared to Non-FGLI. Uptake of HPV vaccination has many contributing factors for emerging adults including access to vaccination through their parents/guardians prior to attending college since recommended vaccination age is 11-12 years. This access has many contributing factors including the parents' healthcare utilization, insurance coverage, perceived safety of the vaccine, and vaccination beliefs.(53) The increased autonomy of emerging adulthood provides an optimal time to promote uptake of the vaccination before the recommended age of 26. For FGLI students that rely more on institutional resources providing the vaccine series through the institution is of vital importance and a pivotal opportunity to redirect their health trajectories for cancer risk.

FGLI students reported greater current and chronic stress, an EOCRC risk factor, compared to Non-FGLI. The Stress Process Model outlines that social determinants of health influence an individual's level of stress exposure which in turn effects mental and physical health outcomes; but this relationship is mediated and moderated by social support and personal resources (i.e. stress management skills).(12) Individuals from underserved racial/ethnic and socioeconomic groups have greater accumulated stress experiences but the effect this has on their health outcomes are somewhat mitigated by social and personal resources. Interestingly we observed this when modeling CFC-Cancer for FGLI students when the association with current stress was diminished in the presence of stress management skills. Our findings suggest that enhancing

stress management skills among FGLI students can improve their CFC-Cancer and ultimately their EOCRC/CRC risk trajectories.

Limitations

Ideally our study would have had a larger sample size, but the data met assumptions of normality for our analyses, and there was excellent racial diversity among participants. Within the institution a third of students are FG and a third are eligible for financial need-based funding. A limitation of the Registrar system at time of implementing the present study was that financial aid status was not integrated into student records. As a consequence, we stratified our participant pool by the one criteria (FG status) and ultimately acquired a similar rate in our sample, 27%. FGLI students were identified as having significantly higher current and chronic stress based upon the self-report measures. Future research could benefit from adding a biomarker of stress to compare stress levels based upon how it has been oxidized in the body, a greater risk for EOCRC.

CONCLUSION

Overall, our findings suggest that FGLI students may consider their future cancer risk to the same extent as their peers, but as a group they have more risk factors for CRC/EOCRC. Since FGLI students rely heavily on institutional resources and support systems, colleges and universities are in a unique position to uplift health equity. Lifestyle health behavior related risk reduction strategies for CRC overlap many other cancers and chronic diseases and have been linked to better academic performance.(54) One study had success at persuading individuals with lower CFC to participate in CRC screening when messages conveyed short-term positive

consequences and long-term negative consequences.(55) This can be modeled in communications to emerging adults in college to promote positive short-term outcomes (i.e. academic performance) of engaging in CRC prevention now and consequently reduce risk for a negative outcome, CRC, in the future. Identifying opportunities to educate FGLI students about these strategies and improve opportunities for uptake can have a broader impact on their academic success and health trajectories for long-term health outcomes.

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TABLES

Table 2.1. Student Sample Characteristics by FGLI Status				
	Full	FGLI	Non-FGLI	Difference
	N=282	N=130 (46%)	N=152 (54%)	
Age	20 (SD=1.53)	20 (SD=1.61)	20 (SD=1.44)	t=1.74 (p=.08)
Sex at Birth				
Female	216 (76.6%)	103 (79%)	117 (77%)	X^2=.21 (p=.65)
Male	62 (22.0%)	27 (21%)	35 (23%)	
Missing	4 (1.4%)			
Gender Identity				
Woman	195 (69.1%)	90 (69.8%)	105 (70.0%)	X^2=.90 (p=.83)
Man	62 (22.0%)	27 (20.9%)	35 (23.3%)	
Non-binary	14 (5.0%)	8 (6.2%)	6 (4.0%)	
Other	8 (2.8%)	4 (3.1%)	4 (2.7%)	
Missing	3 (1.1%)			
Race				
White	115 (40.8%)	39 (30%)	76 (50%)	X^2=11.61 (p<.001)***
Asian	66 (23.4%)	29 (22%)	37 (24%)	X^2=.16 (p=.69)
Black	39 (18.8%)	25 (19%)	14 (9%)	X^2=5.09 (p=.02)*
Hispanic/Latino	33 (11.7%)	22 (17%)	11 (7%)	X^2=6.36 (p=.01)*
Bi/Multiracial	23 (8.2%)	11 (8%)	12 (8%)	X^2=.03 (p=.86)
Other	6 (2.2%)	4 (3%)	2 (1%)	X^2=1.04 (p=.31)
Year in School				
First	38 (13.5%)	17 (13%)	21 (14%)	X^2=.03 (p=.86)
Second	48 (17.0%)	19 (15%)	29 (19%)	X^2=.99 (p=.32)
Third	81 (28.7%)	41 (32%)	40 (26%)	X^2=.93 (p=.33)
Fourth	85 (30.1%)	37 (28%)	48 (32%)	X^2=.32 (p=.57)
Fifth +	24 (8.5%)	13 (10%)	11 (7%)	X^2=.69 (p=.41)
Missing	6 (2.1%)			
GPA	3.35 (SD=0.75)	3.20 (SD=.77)	3.48 (SD=.70)	t=-3.23 (p<.001)***
Employed	176 (62.4%)	94 (72%)	82 (54%)	X^2=10.48 (p<.01)**
Registrar FG Status	77 (27.3%)	77 (59%)	0 (0%)	X^2=123.85, (p<.001)***
Parent FG	93 (34.1%)	82 (65.6%)	11 (7.4%)	X^2=102.08 (p<.001)***
Extended Family FG	50 (20.2%)	39 (36.4%)	11 (7.9%)	X^2=30.71 (p<.001)***
Pell Grant Recipient	113 (40.1%)	113 (87%)	0 (0%)	X^2=220.47 (p<.001)***
Familial-financial hardship	123 (44.4%)	92 (71.1%)	32 (21.5%)	X^2=68.66 (p<.001)***
Self-financial hardship	118 (43.1%)	85 (68.0%)	33 (22.1%)	X^2=58.29 (p<.001)***
Present Stress Score	20.99 (SD=6.26)	21.79 (SD=6.30)	20.30 (SD=6.18)	t=1.97 (p=.05)*
Chronic Stress Score	3.30 (SD=2.68)	4.00 (SD=2.84)	2.75 (SD=2.43)	t=3.82 (p<.001)***
* p-value < 0.05 ** p-value < 0.01 *** p-value < 0.001				

Table 2.2. Cancer history, knowledge, prevention behaviors and consideration of future cancer by FGLI Status				
	Full	FGLI	Non-FGLI	Difference
Cancer History	188 (66.7%)	85 (65%)	103 (68%)	X2=.18 (p=.67)
CRC Knowledge Score	14.63 (SD=2.11)	13.4 (SD=3.14)	14.5 (SD=2.44)	t=-3.37 (p<.001)***
Clinical Cancer Prevention	0.94 (SD=0.65)	0.81 (SD=0.65)	1.05 (SD=0.63)	t=-3.12 (p<0.01)**
HPV Vaccinated	203 (72%)	83 (64%)	120 (79%)	X2=7.92 (p<.01)**
Skin Exams	61 (22%)	22 (17%)	39 (26%)	X2=3.48 (p=.08)
Lifestyle Health Behaviors	7.90 (SD=2.95)	7.93 (SD=3.11)	7.88 (SD=2.82)	t=0.14 (p=.89)
Fruits ≥ 2 servings/day	82 (29.1%)	36 (27.7%)	46 (30.3%)	X2=.23 (p=.69)
Vegetables ≥ 2 servings/day	103 (36.5%)	44 (33.8%)	59 (38.8%)	X2=.75 (p=.46)
Fiber ≥ 2 servings/day	97 (34.4%)	42 (32.3%)	55 (36.1%)	X2=.47 (p=.53)
Fried Foods rarely/never	76 (27.0%)	48 (36.9%)	28 (18.4%)	X2=12.2 (p<.001)***
Red/Processed Meats rarely/never	68 (24.1%)	29 (22.3%)	39 (25.7%)	X2=.43 (p=.58)
Sedentary < 7 hrs/day	115 (40.8%)	57 (43.8%)	58 (38.2%)	X2=.94 (p=.40)
Avoid heavy alcohol use	261 (92.6%)	117 (90.0%)	144 (94.7%)	X2=2.28 (p=.17)
Avoid smoking	235 (84%)	107 (82%)	128 (85%)	X2=0.30 (p=.62)
Sleep ≥ 7 hours/day	10 (3.5%)	6 (5%)	4 (3%)	X2=0.81 (p=.52)
Stress management techniques	27.29 (SD=5.92)	27.31 (SD=6.37)	27.27 (SD=5.54)	t=0.07 (p=0.95)
Perceived Lifetime CRC Risk	28.41 (SD=20.54)	30.00 (SD=21.48)	27.07 (SD=19.66)	t=1.19 (p=.23)
Low Risk	196 (69.5%)	86 (69.9%)	110 (73.3%)	X2=1.28 (p=.30)
Moderate Risk	62 (22.0%)	30 (24.4%)	32 (21.3%)	X2=0.17 (p=.77)
High Risk	15 (5.3%)	7 (5.7%)	8 (5.3%)	X2=0.002 (p=1.00)
CFC-Cancer	61.37 (SD=13.94)	59.97 (SD=16.98)	62.57 (SD=16.37)	t=-1.56 (p=.19)

* p-value < 0.05
** p-value < 0.01
*** p-value < 0.001

Table 2.3. Significant linear regression model parameter estimates for stratified models					
FGLI students (N=130)					
Perceived Lifetime CRC Risk F(8)=3.84, p<.001					
	Estimate	Std. Error	t	95% CI	p-value
Constant***	12.69	10.29	1.23	(-7.47, 32.86)	.22
First-gen extended family**	10.55	3.92	2.69	(2.86, 18.23)	<.01
Self-financial hardship	7.91	3.94	2.00	(.17, 15.64)	.04
Bi/Multiracial*	15.06	6.68	2.26	(1.97, 28.14)	.02
Employed*	.48	.25	1.95	(-.003, .97)	.05
Current stress	.20	.30	.67	(-.39, .79)	.50
Chronic stress	-.83	.70	-1.18	(-2.20, .55)	.24
CRC knowledge	.37	.57	.64	(-.76, 1.49)	.52
Cancer history	1.58	3.79	.42	(-5.85, 9.01)	.68
CFC-Cancer F(6)=4.45 (p<0.001)					
Constant***	36.91	10.84	3.40	(15.66, 58.16)	<.001
Stress management skills**	.68	.21	3.18	(.26, 1.10)	<.01
Familial-financial hardship	-4.77	2.76	-1.73	(-10.18, .64)	0.08
Current stress	-.23	.22	-1.03	(-.65, .20)	.30
Chronic stress	-.16	.46	-.35	(-1.06, .74)	.73
CRC knowledge*	.87	.39	2.23	(.10, 1.63)	.03
Cancer history	2.67	2.52	1.06	(-2.28, 7.61)	.29
Non-FGLI Students (N=152)					
Perceived lifetime CRC Risk F(6)=3.32, p<0.01					
Constant	-.81	11.94	-.07	(-24.21, 22.59)	.95
School year**	3.74	1.37	2.72	(1.05, 6.43)	<0.01
Work*	.24	0.12	1.98	(.003, .49)	0.04
Current stress	.40	.26	1.55	(-.11, .90)	.12
Chronic stress	-.03	.68	-.05	(-1.36, 1.30)	.96
CRC knowledge	.29	.68	.43	(-1.04, 1.62)	.67

Cancer history	5.54	3.43	1.62	(-1.18, 12.26)	.11
CFC-Cancer $F(6) = 4.05$, $p<0.001$					
Constant	20.29	12.48	1.62	(-4.32, 44.90)	.11
Stress management skills*	.56	0.24	2.35	(.09, 1.02)	.02
GPA	2.53	1.68	1.51	(-.76, 5.82)	.13
Current stress	.03	.22	.13	(-.41, .47)	.90
Chronic stress	.43	.46	.93	(-.47, 1.34)	.35
CRC knowledge*	1.03	.47	2.22	(.12, 1.94)	.03
Cancer history	2.37	2.30	1.03	(-2.14, 6.89)	.30

*** p-value <0.001
** p-value < 0.01
* p-value < 0.05

CHAPTER 4:
"And if I start now, I can prevent that": College students challenge current cancer prevention efforts to begin earlier in life course

The remainder of this chapter is under review for publication as:

Knight Wilt, J., & Thomson, M.D. "And if I start now, I can prevent that": College students challenge current cancer prevention effort to begin earlier in life course. (under review) 2024.

ABSTRACT

Introduction: Globally there is a rise of cancer incidence and mortality among individuals younger than age-based prevention screening practices. Several early onset cancers including colorectal have been linked to lifestyle-related risk factors. Emerging adulthood is the life stage that sees some of the greatest changes to health behaviors with implications for future health outcomes. Overall college students (18-25 years) have moderate consideration of future cancer risk (CFC-Cancer) when navigating current health behavior choices. This study compared cancer prevention knowledge, attitudes and behavioral intentions for the present and future in a subset of students with low, medium and high CFC-Cancer scores.

Methods: Qualitative interviews were used to explore knowledge and behavioral intentions for cancer prevention among a sample of college students. We identified a stratified sample (N=43) of high CFC-Cancer (n=16), medium CFC-Cancer (n=14) and low CFC-Cancer (n=13) who agreed to complete a 60 minute interview on Zoom. Interviews were transcribed verbatim and transcripts were coded using an iterative, line by line approach. Group comparisons were completed after coding was complete.

Results: Students with high CFC-Caner have the highest knowledge of colorectal cancer screening and lifestyle risk factors. 54% of those with low CFC-Cancer and 87% with high CFC-

Cancer highlight their current health behavioral intentions are lowering their cancer risk. Most students want more cancer education regardless of CFC-Cancer level to know how they can reduce their risk of cancer. Differences in preferred information sources (indirect vs direct) were identified for low versus higher CFC-Cancer, respectively.

Conclusion: Students' knowledge, interest in and preferred sources of cancer information is related to their CFC-Cancer scores. This could be used to tailor information content and delivery modality. Delivering this content through means that facilitate internal reflection such as individualized appointments may be more effective for improving CFC-Cancer and associated cancer risk reduction behaviors.

BACKGROUND

Cancer diagnoses and death among individuals too young to qualify for preventive population screening guidelines continue to rise globally.[1] Trends in early onset colorectal cancer (EOCRC) predict a 90% and 120% increase from year 2000 to 2030 for colon and rectal cancers respectively among those 20-34 years old.[2] Early onset cases tend to have delayed self and provider symptom appraisals leading to delayed diagnoses and more advanced staging.[3,4] EOCRC has been linked to lifestyle-based risk factors including, obesity, diet, physical activity, alcohol use, smoking tobacco and stress.[5,6] Colon polyps have a 10-20 year growth period prior to becoming invasive meaning that lifestyle risk factors during emerging adulthood (age 18-25 years) could reduce risk.[7]

The period of emerging adulthood encompasses some of the most substantial changes to personal lifestyle health behaviors.[8] Emerging adults enrolled in college navigate newfound independence and autonomy as they move away from parental oversight and gain greater responsibility for daily lifestyle choices. These lifestyle health behaviors are often sustained into adulthood, and relate to health outcomes.[8] Among an Australian cohort, increasing leisure time physical activity during emerging adulthood was associated with healthier dietary patterns, better sleep and overall self-rated health observed at age 60 to 64 years.[9] Another longitudinal study found that 39% of emerging adults with mostly protective behavior patterns sustained their behaviors in young adulthood (26-31 years), 25% adopted more protective behaviors, and only 12% changed to higher risk behaviors.[8] Thus health related behaviors, including EOCRC risk factors, that are established during emerging adulthood have strong potential to be sustained later in life and reduce colorectal cancer risk.

Being more future-goal oriented when making behavioral decisions, measured as consideration consequences (CFC), has been linked to better health promoting lifestyle behaviors among college students.[10] In a group of Norwegian students a health tailored CFC scale (CFC-Health) was stronger in explaining diet and physical activity outcomes compared to the general CFC scale.[11] In our previous work we identified that college students have moderate consideration of future cancer risk (CFC-Cancer) when navigating current health behavior choices.[1] Furthermore, higher CFC-Cancer scores were associated with more health promoting behaviors related to EOCRC risk factors of diet, sedentariness, alcohol use, smoking, and stress management.[1]

Behavioral intentions have also been endorsed as a key predictor of health behavior.[2,3] The Theory of Planned Behavior proposes that behavioral intentions are predicted by psychosocial variables including attitudes, norms and self-efficacy.[12] Among college students, skin cancer protective behavior was significantly associated with intention to limit sun exposure, sunscreen self-efficacy, social norms, perceived benefits of skin protection, and knowledge.[13] Students enrolled in a sedentary intervention mentioned that positive attitudes and benefits were associated with improved physical activity intention; but that academic requirements and work schedules were barriers to enact intentions.[14]

These variables outside of the students control reflect the constructs of skills and environmental factors in the integrative model of behavioral prediction.[14] The expanded model identifies health behavior as directly related to behavioral intention, and moderated by skills and environmental factors. A systematic review integrative model quantitative studies identified that very few studies assessed skills and environmental factors.[15] This is a significant gap in our

understanding of student behaviors given the changes in environment and autonomy experienced by emerging adults in college.

The rise in EOCRC signals the need for an earlier approach to prevention that targets individuals earlier in the life course prior to invasive polyp growth. Greater CFC-Cancer is associated with more health promoting lifestyle behaviors,[1] and thus there may be differences in behavioral intentions, psychosocial or environmental factors experienced among students across CFC-Cancer levels. Investigating these potential differences can identify barriers and facilitators for future interventions with the aim of increasing CFC-Cancer and consequently engagement in EOCRC primary prevention. The purpose of this study is to explore college students' knowledge, attitudes, health behavioral intentions for the present and future related to perceived risk of cancer, and factors that influence enacting those intentions. Furthermore, we compare these findings across the spectrum of Low, Medium and High CFC-Cancer scores.

MATERIALS & METHODS

Data Sample: A stratified sample of full-time enrolled college students between ages 18 and 25 who had completed a web-based survey were recruited to participate in follow-up interviews. Survey measures have been described in a prior manuscript (cite aim1 paper). Briefly, they included a cancer-specific adapted version of the consideration of future consequences scale to assess CFC-Cancer, current perceived stress, knowledge of colorectal cancer, sociodemographic variables, and student characteristics (i.e., program of study, GPA, etc.).

For this study, students were stratified into three groups based upon their CFC-Cancer score. Groups were categorized as Low CFC-Cancer, Medium CFC-Cancer and High CFC-Cancer using the sample's mean CFC-Cancer score (μ=61) and one standard deviation around the mean

(SD=14) to delineate polarized groups for comparison across groups. Low CFC-Cancer included individuals with scores ranging 21-54 (n=96), Medium CFC-Cancer 55-67 (n=86), and High CFC-Cancer 68-95 (n=100). Within each group participants were randomly sorted to create a rolling recruitment roster and the first 20 individuals were invited to participate in an interview. Students were sent an email invitation which included a link to schedule an interview appointment time if they chose to participate. Up to three reminders were distributed to these individuals before moving on to invite the next person on the roster. In total 125 students across low (n=39), medium (n=49) and high (n=37) were invited, and final sample included 13 Low CFC-Cancer, 16 Medium CFC-Cancer, and 14 High CFC-Cancer participants.

After scheduling an interview time, students were sent a calendar invite and confirmation email that included a research information sheet outlining the study's purpose and procedure. Interviews took place on HIPAA compliant Zoom to accommodate busy student schedules and all but one participant elected to have the camera on which enhanced participant-interviewer rapport. The research information sheet was reviewed at the beginning of each interview and any questions answered prior to acquiring verbal consent to participate and beginning to record the session. Interviews lasted approximately 60 minutes and recordings were transcribed verbatim for analysis. Students were compensated for their time with a $20 gift card. The study protocol was reviewed and determined exempt by the university's Institutional Review Board (HM20026461).

Interview Guide: The semi structured interview guide was developed with input from undergraduate students. Open-ended questions guided by the integrative model of behavioral prediction[16] asked about knowledge, attitudes and perceptions related to cancer prevention and health behavior intentions. Participants were asked about their cancer prevention, lifestyle and

healthcare utilization behaviors and behavioral intentions as a student, and for five-years in the future. Students then reflected on how these relate to their own future cancer risk. Participants were asked to describe barriers and facilitators for enacting behavioral intentions and to provide recommendations for campus resources to support sustainability of health promoting behaviors.

Analysis: Survey responses containing sociodemographic variables were pulled for each interview participant to run descriptive analysis of the full sample and for each group. SPSS 28 was utilized for descriptive statistical analyses.[17] Interviews were transcribed verbatim and uploaded into MAXQDA 2024 for analysis.[18] Principles of the Grounded Theory approach were utilized to assess transcripts individually and then across groups for comparison. A set of transcripts were initially open coded to develop a codebook which was iteratively revised over the course of the project. The research team reviewed the final set of codes and interview notes to make observation of emergent themes. MAXQDA's compare groups analysis feature was used to assess frequency of these themes across the three groups.

RESULTS

Participants

Characteristics of the full sample and by group are displayed in **Table 1**. Mean age was 20 years (SD=1.5) and the majority identified as female (81%). A quarter were first year students and 40% were fourth or fifth year. Programs of study included engineering, health professions, Humanities, Arts, Business, Government, Nursing, and Life Sciences. Around a third (30%) received need-based financial assistance and 20% were first generation college students. The full sample had moderate current stress (mean=20.5). Less than half lived in campus housing, half worked at least part-time while in school, and a little over half (56%) have a family history of

cancer. Mean CRC knowledge score was 14.5, and majority (74%) believe their likelihood of getting CRC in the future is low or very low. Characteristics across groups were similar. Only GPA was identified as a significant difference, $F(2)=3.792$, $p=.03$.

Themes

Four themes were identified: existing cancer knowledge, integrating cancer preventive action during college, cancer prevention will be easier in the future, and challenge status quo of cancer prevention. Existing cancer knowledge and integrating cancer preventive action during college both contain subthemes.

Existing cancer knowledge. When asked about current knowledge of cancer three subthemes emerged across student interviews. These included risk factors, prevention and detection, and information sources. Summaries and exemplar quotations are displayed in **Table 2**.

Risk factors – students mentioned knowledge of genetic and familial risk for cancer most frequently in the High group followed by Medium and Low (Low: 8%, Medium: 44%, and High: 57%). Environmental exposures to carcinogens, water and air contamination, and use of products like topical skincare, plastics, and cookware were identified as risks and mentioned were commonly mentioned across all groups (Low: 54%, Medium: 56%, and High 50%). Several students across CFC-Cancer groups demonstrated knowledge of lifestyle related health behaviors related to cancer risk. Behaviors mentioned mostly commonly included smoking and sun exposure (Low: 62%, Medium: 75%, and High: 71%), but also less commonly, diet, physical activity, and stress (Low: 39%, Medium: 50% and High 71%). When comparing groups' collective knowledge of risk factors and primary prevention, the High CFC-Cancer group had

higher genetic and lifestyle related risk factors knowledge while the Medium group had slightly more knowledge of environmental exposures and products compared to High participants.

Prevention and detection – when asked about knowledge of cancer screenings students discussed knowledge of screening guidelines for breast, skin, and gynecological cancers; colorectal cancer was the least mentioned among students (16%). All participants in the High CFC-Cancer group mentioned clinical cancer screening during their interviews, (Low: 69%, Medium: 63%, and High: 100%). Majority were unclear of specifics other than knowing at a certain age there are specific clinical tests for some cancers. The cancers that students most mentioned across interviews included breast (63%), skin (61%), and lung (51%). A few individuals identified self-exams to detect cancer for breast, skin and testicular cancer (Low: 46%, Medium: 25% and High: 36%). When probed about knowledge of the HPV vaccine, three-quarters of students across all groups reported not being aware that it helped prevent cancers caused by HPV (Low: 72%, Medium: 64%, and High: 85% High).

Information sources – among half of the Low group and a third of the High group mentioned their cancer knowledge coming from family, this occurred much less often among the Medium participants (Low: 54%, Medium: 12%, High: 36%). Almost a quarter of Low CFC-Cancer participants received information from a required physical education or health course in high school, this was the case among less than 10% of High and Medium participants (Low: 20%, Medium: 6%, High: 7%). Medium CFC-Cancer participants mentioned cancer information coming from social media more than other participants (Low: 7%, Medium: 42%, High: 21%). Medium and High group participants received their information from news or other media outlets more than those in the Low CFC-Cancer group (Low: 13%, Medium: 24%, High: 36%).

A small portion of Medium and High participants mentioned college course work that covered cancer as a subject matter (Low: 7%, Medium: 18%, High: 14%).

Integrating cancer preventive action during college. This theme represented student discussions around their current cancer prevention practices, health promoting behavioral intentions, and making time in one's current schedule to engage in those activities. Table 3 describes this theme, its three subthemes and provides quotations from students.

Current cancer preventive efforts. Majority of participants recounted currently engaging in cancer preventive behaviors related to skin, lung, breast, or gynecological cancers. These behaviors included regular use of sunscreen, limiting sun exposure; abstaining from tobacco products or secondhand smoke exposure; self-exams for detecting lumps in breasts; and participating in regular gynecological exams. Majority of participants brought up currently engaging in cancer prevention behaviors across all groups (Low: 77%, Medium: 69%, High: 79%). Most commonly skin (Low: 39%, Medium: 63%, High: 57%) and lung (Low: 31%, Medium: 25%, High: 36%) cancer prevention actions were reported. Furthermore, participants expressed a belief that their current health behavioral intentions contribute to lowering their future cancer risk. This was observed among most High CFC-Cancer participants, followed by Low and Medium (Low: 54%, Medium: 56%, and High: 86%). There were two emergent subthemes when students discussed integrating cancer prevention as busy college students, these include future health starts now, and integration facilitators.

Future health status starts now. During interviews multiple students discussed a concern about their future health status, including preventing future health complications. Future health complications noted included cardiovascular disease, diabetes, chronic pain, and cancer. There was mention of needing to start now in their current stage of life to care for their future health.

Some specially mentioned needing be proactive about cancer prevention in the present. This subtheme was brought up equally across High and Low participants, and less in the Medium group, (Low: 69%, Medium: 56%, High: 64%).

Prevention integration facilitators. There were several factors that students referenced assisted their ability to integrate preventive behaviors in the present. Half of the participants across all groups mentioned a health promoting preference such as not liking alcohol and eating fresh fruits and vegetables. Students referenced having their own independence and living space as a facilitator to implementing their health behavior intentions (Low: 46%, Medium: 25%, and High: 50%). Intentionally scheduling in time for health such as physical activity or food preparation was also mentioned in about half of the High and Low group participants (Low: 54%, Medium: 44%, and High: 43%). Social support from family and peers to perform preventive behaviors was endorsed among majority of the High group, half of the Low group and less than a third of the Medium group (Low: 54%, Medium: 38%, and High: 71%). Some students even mentioned that knowledge of someone with a history of cancer was a positive influence to integrate preventive health behaviors now (Low: 39%, Medium: 25%, and High: 43%).

Cancer prevention will be easier after college. This theme reflected students' belief that preventive cancer behaviors will be easier to implement five years from now. Table 4 describes this theme and contains student interview excerpts. Participants mentioned that due to their competing priorities as a college student their personal health often fell on the "backburner" (Low: 62%, Medium: 44%, and High: 57%). Students discussed having more finances, time, comprehensive health insurance or other resources in five years to engage in cancer preventive actions after completing academic studies. This was observed most in the Low group but also

among some individuals in High and Medium, (Low: 77%, Medium: 31%, and High: 21%). Future intentions included seeking out regular preventive healthcare (Low: 69%, Medium: 81%, and High: 79%) and wanting to partake in self or clinical cancer screenings (Low: 23%, Medium: 38% and High: 36%). Many discussed intentionality around sustaining health behaviors like diet, physical activity, sleep, stress management, abstaining from tobacco products, and limiting alcohol use that they established while in college, or engaging in them more consistently, in the future (Low: 69%, Medium: 63% and High: 64%).

Challenge status quo of cancer prevention. Across interviews students mentioned wanting to know more about cancer and how to reduce risk during their current stage of life. **Table 4** outlines this theme and contains student interview quotes from each group. Several students expressed a desire to learn more about how to prevent cancer (Low: 69%, Medium: 63%, High: 86%); some even remarked that participating in the present study piqued interest in cancer prevention (Low: 54%, Medium: 13%, High: 14%). When discussing what they would like to know more about student interests included cancer biology, risk factors, prevention strategies, and screening tests (Low: 62%, Medium: 44%, High: 86%). Some mentioned a need to learn more about how current health behaviors influence future health, to understand health insurance and how to access preventive healthcare (Low: 39%, Medium: 38%, High: 14%). There were two opposing educational platforms for which students expressed preference. Indirect means included receiving print materials, emails, or visiting a webpage or campus event. Direct means recommended included courses, seminars or individualized appointments. Indirect means were slightly more preferred among the Low CFC-Cancer group (Low: 39%, Medium: 31%, High: 43%), while direct means were the preference among the Medium and High groups (Low: 31%, Medium: 50%, High: 86%).

DISCUSSION

Students with High CFC-Cancer had greater knowledge of lifestyle-related risk factors for cancers like EOCRC and majority believed that their current behavioral intentions were contributing to risk reduction compared to the other groups. Majority of students across all three groups mentioned currently enacting preventive cancer actions, mostly using sunscreen and avoiding smoking or secondhand smoke exposure. Given high visibility of national campaigns like the truth initiative to reduce teen smoking,[4] and pink ribbon for breast cancer awareness,[5] it's not surprising that breast and lung were among the top three cancers that students had knowledge of. Colorectal cancer was only brought up in a handful of interviews even though it is actually the second leading cancer-related cause of death among men and women in the United States.[19] This finding is somewhat surprising considering recent high-profile deaths of younger adults from CRC. Following celebrity cancer disclosures, media coverage often endorses cancer screenings and there is a subsequent increase in seeking out cancer prevention resources and services;[6,7] however this was not the case among a sample of college women.[8] It's possible that emerging adults do not internalize these secondary prevention messages since they do not meet age-based screening guidelines recommended in media coverage.

Over half of all participants expressed a belief that their future health begins to be shaped now and a desire to learn more about how to prevent cancer. This is significant given that current prevention efforts begin too late and focus on secondary prevention methods like age-based screening for early detection.[20] Instead we should prioritize primary prevention efforts to modify environmental and lifestyle-related risk factors which will have greater public health impact beyond EOCRC.[21] This algins perfectly with the life course health development framework which suggest that 1) younger age at initiation of preventive health behavior improves

continuity; and 2) emerging adults have a greater likelihood of initiating protective behaviors compared to older populations.[22] Furthermore this meets the expressed goal of students that wish to sustain or improve consistency of the lifestyle related health behaviors for health promoting sleep, diet, physical activity, skin care, stress management, and limiting alcohol and smoking tobacco.

Students believe that it will be easier to carry out cancer prevention actions five years in the future when they have more time and resources. Given longitudinal findings of sustained health promoting behaviors and positive health outcomes later in life, beginning now has strong potential for sustainability and consistency later.[9,10] In all three groups students mentioned independent living space, scheduling time for health activities and social support as facilitators for carrying out their health promoting behavioral intentions. Social support was highly endorsed in the group that has greater CFC-Cancer, and perhaps it is a strength that supports their ability to be future oriented to prevent cancer. This supports findings from a study of government leaders in which perceived social support indirectly moderated the relationship between leader's future orientation and intentions for investing in public health efforts.[11] More future oriented leaders had greater intentions for investing funds in public health initiatives which was moderated by higher perceived social support.

Throughout interviews participants expressed wanting to know more about cancer and how it can be prevented. Currently the only clinical prevention efforts to emerging adults are HPV vaccination, skin checks and cervical cancer screening for females. Majority of participants didn't know that HPV vaccination helps to prevent a virus that can cause six types of cancers and felt that this is something that should be more visible. This aligns with a study of HPV knowledge among a racially and ethnically diverse college student sample where only 20% of

participants knew that HPV could cause cancer.[12] Given our prior findings that first generation or low-income student participants were significantly less vaccinated, there is a clear need for more patient-provider education about the benefits of vaccination.[13] College health centers can be doing more to aid students in catching-up on HPV vaccination status. In one study students recommended that colleges communicate vaccination benefits and potential risks, current guidelines, research of effectiveness, and availability at the campus health center and local clinics.[14]

Annual physicals are common among adolescents and several interview participants continue to have them, plan to sustain or increase the behavior to stay on top of their health. These appointments are a crucial opportunity for healthcare providers to focus on primary prevention efforts by assessing and advising lifestyle-related health behaviors to reduce risk. There are already existing dietary, substance use and physical activity primary prevention recommendations for colorectal cancer that can be used as a framework to assess and advise modifications during annual appointments.[15] A pilot study in the UK found that a brief lifestyle-related cancer risk assessment and intervention during annual appointments was feasible from the point of providers and patients endorsed that the content was motivational for behavior change.[16] In the present study the group high CFC-Cancer preferred direct educational opportunities like one-on-one appointments to learn more about how they can reduce their cancer risk. Perhaps offering a brief intervention modeled after the UK pilot could improve CFC-Cancer scores for those with less consideration of their cancer risk and motivate activation of cancer prevention behaviors.

Limitations

There are several limitations to make note of for this study. Firstly, participants chose to complete the initial survey, invited to a follow-up interview and then self-selected to participate. This indicates that the sample may reflect a group of emerging adult college students more interested in health and cancer prevention compared to their peers that chose not to participate. However, by stratifying the sample by CFC-Cancer score groupings we have ensured representation of students that are currently less future oriented regarding cancer prevention. Social desirability may have influenced responses about intentions for engaging in health-related behaviors presently and five years in the future. During the opening of the interview the researcher informed each participant that the purpose was to learn more about their attitudes and experiences, and that there was no such thing as a right or wrong answer. This was done to encourage honest self-reflections and curb socially desirable responses. Without prompting over half of the low CFC-Cancer group expressed an elevated interest in cancer prevention after participating in the study. This may reflect verbal recognition of the Hawthorne effect, in that research participation could unintentionally create behavior change from engaging with the study material.[23] Perhaps providing more opportunities for exposure to cancer prevention and control research and education among emerging adults could increase uptake of risk reduction strategies.

CONCLUSION

As evident from these student perspectives, emerging adulthood is not too young to begin discussing cancer risk reduction strategies. Regardless of whether college students have high or low CFC-Cancer guiding their current health-related behaviors, they want to know more about cancer and how to reduce risk. Based upon our findings, a pivotal opportunity to begin discussing risk reduction is during HPV vaccination appointments so that adolescents and young adults are more informed about the benefits of the immunotherapy. Given widespread

observations of EOCRC and other cancers we are at pivotal point globally to shift our cancer prevention efforts to a primary prevention paradigm with an earlier life course framework. Providing direct opportunities for cancer primary prevention education and activities within academic, clinical and research settings during emerging adulthood can increase awareness and cancer risk reduction behaviors; ultimately impacting global trends.

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TABLES.

Table 3.1. Full interview sample and by group characteristics				
	Full Sample	Low CFC-CANCER	Mean CFC-CANCER	High CFC-CANCER
	N=43	N=13	N=16	N=14
Age	20 (SD=1.5)	20 (SD=1.5)	20 (SD=1.4)	19 (SD=1.4)
Sex				
Male	18.6% (8)	15.4% (2)	12.5% (2)	28.6% (4)
Female	81.4% (35)	84.6% (11)	87.5% (14)	71.4% (10)
Race/Ethnicity				
Asian	34.9% (15)	30.8% (4)	43.8% (7)	28.6% (4)
Black	11.6% (5)	7.7% (1)	12.5% (2)	14.3% (2)
Latino	4.7% (2)	7.7% (1)	0%	7.1% (1)
White	41.9% (18)	53.8% (7)	31.3% (5)	42.9% (6)
Bi/Multiracial	4.7% (2)	0%	6.3% (1)	7.1% (1)
Other	2.3% (1)	0%	6.3% (1)	0%
Year in school				
First year	25.6% (11)	23.1% (3)	18.8% (3)	35.7% (5)
Second year	14.0% (6)	15.4% (2)	12.5% (2)	14.3% (2)
Third year	20.9% (9)	15.4% (2)	25.0% (4)	21.4% (3)
Fourth year +	39.6% (14)	46.2% (6)	43.8% (7)	28.6% (4)
GPA*	3.5 (SD=0.7)	3.1 (SD=0.6)	3.6 (SD=0.6)	3.7 (SD=0.6)
Program of study				
Arts	11.6% (5)	7.7% (1)	12.5% (2)	14.3% (2)
Business	7.0% (3)	7.7% (1)	12.5% (2)	0%
Engineering	4.7% (2)	0%	6.3% (1)	7.1% (1)
Government	9.3% (4)	23.1% (3)	0%	7.1% (1)
Health professions	11.6% (5)	15.4% (2)	6.3% (1)	14.3% (2)
Humanities	58.1% (25)	53.8% (7)	56.3% (9)	64.3% (9)
Life sciences	7.0% (3)	7.7% (1)	6.3% (1)	7.1% (1)
Nursing	4.7% (2)	7.7% (1)	6.3% (1)	0%
Double major	14% (6)	23.1% (3)	6.3% (1)	14.3% (2)
First Generation college student	20.9% (9)	30.8% (4)	25.0% (4)	7.1% (1)
Need-based financial aid recipient	30.2% (13)	46.2% (6)	31.3% (5)	14.3% (2)
Employed ≥ part-time while in school	51.2% (22)	61.5% (8)	50.0% (8)	42.9% (6)
Live in campus housing	39.5% (17)	53.8% (7)	31.3% (5)	35.7% (5)
Current perceived stress	20.5 (SD=5.7)	22.6 (SD=6.1)	20.4 (SD=5.5)	18.8 (SD=5.3)
Family history of cancer	55.8% (24)	61.5% (8)	43.8% (7)	64.3% (9)

CRC knowledge	14.5 (SD=2.4)	14.9 (SD=1.3)	13.7 (SD=3.0)	15.2 (SD=2)
Perceived likelihood of CRC in future				
Very Low	32.6% (14)	46.2% (6)	31.3% (5)	21.4% (3)
Low	41.9% (18)	38.5% (5)	43.8% (7)	42.9% (6)
Moderate	20.9% (9)	7.7% (1)	18.8% (3)	35.7% (5)
High	2.3% (1)	7.7% (1)	0%	0%
* p−value ≤ .05				

Table 3.2. Existing Cancer Knowledge Theme		
Existing Cancer Knowledge: Exhibiting existing knowledge of cancer prevention and control.		
Risk factors subtheme: Exhibiting knowledge of genetic, familial, environmental or lifestyle-related cancer risk factors.	Low CFC-Cancer	"I know like avoiding cancerous products. Like there's chemicals in some of the like the foods that we eat that like are like, Oh, warning this and that. I know like they always have warnings selling cigarettes, some hair products like hairspray and stuff like that." -Female, Age 18
	Medium CFC-Cancer	"And sometimes even genetics, if like my grandparents, both my grandmother's had cancer at some point in their life. So I think it could be genetic or it depends on like, old age or something." -Female, Age 20
	High CFC-Cancer	"I know that heredity, heredity, heredity, so like family risk plays plays a role in that as well. And I also believe exposure, like exposure to certain types of chemicals, workplace chemicals, or even and I consider like smoking to be a type of exposure to you know, those types of harmful chemicals. So I feel like these kind of are the four main things. So family risk, diet, exercise. And then exposure." -Male, Age 20
Prevention and detection subtheme: Exhibiting knowledge of cancer screenings, self-exams or immunotherapy.	Low CFC-Cancer	"So. All I know is that like, you can really should check your own your like your genitals to see if there's any lumps. " -Male, Age 21
	Medium CFC-Cancer	"Um, I think the only one that I'm like really aware of is the breast cancer screenings… and maybe skin cancer, I just, I don't really know, the screening precautions. I just know what to look for. Like, if you have a particular mole that's like, different color, it's not symmetrical and it just popped out of nowhere." -Female, Age 21
	High CFC-Cancer	"I do know that you get them at a certain age, especially for women, you have to do the, like your Pap smears and your mammograms. And then for men, I think it's prostate exams. And and then if in general, if you find like a weird lump,

		you go and get it checked out. Or if you have like a mole or anything, you get that checked out as well." -Female, Age 18
Information sources subtheme: Mention of sources for existing and seeking out new cancer-related knowledge.	Low CFC-Cancer	"Yeah, most likely, like maybe like, during the PE [physical education] in high school, or health. Yeah, class in high school. And maybe my family. They will talk about it with me." -Female, Age 19
	Medium CFC-Cancer	"Um, typically, I'll see it on a social media like TikTok or Instagram. But if it's something that I want to verify, before repeating, you know, I will Google that and try and find a reputable, reputable source like WebMD." -Female, Age 18
	High CFC-Cancer	"In in a strange way. I kind of have to attribute Grey's Anatomy to that… I keep getting episodes about random types of cancer…And so that has caused an increased awareness." -Female, Age 19

Table 3.3 Integrating Cancer Prevention Theme		
Integrating Cancer Prevention: Description of preventive cancer behaviors and attitudes as a college student.		
Current cancer prevention efforts subtheme: Mention of current health behaviors that align with cancer prevention recommendations.	Low CFC-Cancer	"I do avoid like any kind of smoke inhalation like I've always like I've been offered like a cigarette or like weed and I can't, I won't do that. " -Female, Age 21
	Medium CFC-Cancer	"I'm putting on sunscreen. I'm like sunscreen crazy fanatic… I always put on sunscreen, at least like in the morning… I'm definitely like, very strict about wearing sunscreen." -Female, Age 21
	High CFC-Cancer	"I've been trying to use healthier products, like really good sunscreen, maybe deodorants that don't have all these chemicals in it, as well as food, I tried to stay away from non-organic things. Of course, that's hard for a student." -Female, Age 18
Future health status starts now subtheme: Exhibiting importance in developing health promoting practices now to shape future health.	Low CFC-Cancer	"Yeah, I think my intention overall is just to set myself up to be healthy as I get older. I don't get to a point where I just feel burned out and tired." -Female, Age 18
	Medium CFC-Cancer	"Like, it's best to start early while you're young, to get these issues fixed out rather than when you are older. Because it just save you a long time, save you just overall in the long time when you are older. " -Female, Age 23
	High CFC-Cancer	"Well, I think it's important because I want to stay healthy, and I want to live a long, long life. And I don't want to get to a point where I'm old, and I'm dealing with many diseases and conditions. And if I start now, I can prevent that sort of regretting it later." -Female, Age 18
Prevention integration facilitators subtheme: Mention of factors that support carrying out current cancer prevention efforts.	Low CFC-Cancer	"Um, I really, truly think I just woke up and realized… I'm not going to be in high school again, where I'm not going to be in a position ever in my life where somebody is taking care of me, I have to take care of me. And so now I'm like,

		Yeah, nobody else is gonna do it. So I have to." -Female, Age 21
	Medium CFC-Cancer	"And I'm also grateful that I have a good like, study schedule, and I know my habits pretty well. So I plan a lot time for these activities without having to do like, I don't know whether I'll have time to do this or not, like I know that I have time to put it into my schedule " -Female, Age 18
	High CFC-Cancer	"I would say for in terms of easier, I would say other people that are also health conscious health minded. So the social peer aspect of it helps a lot." -Male, Age 20

Table 3.4. Cancer Prevention After College & Challenge Status Quo Themes		
Cancer Prevention will be Easier after College: Discussion of how carrying out cancer prevention behaviors will be easier five years in the future.	Low CFC-Cancer	"because I guess in five years, I'll not be on my parents' stuff [health insurance] so I definitely think that's something to think about in terms of like making sure I have a doctor or …at least like a doctor's office like a primary care physician that I can like contact if I need help" -Female, Age 20
	Medium CFC-Cancer	"I do think that like, certain things cost more money. So like I like I feel like to live a healthier lifestyle that it does cost a lot of money to do that." -Female, Age 22
	High CFC-Cancer	"but like five years down the line, when like I have an established career…And you're just kind of like set, you're where you want to be in life. I think it'll be easier to start focusing on yourself more" -Female, Age 20
Challenge Status Quo of Cancer Prevention: Mention of desire to receive cancer prevention education earlier in the life course as an emerging adult.	Low CFC-Cancer	"But there's no general guidelines set in place that say…these are some preventative measures. Those are things you kind of have to go looking for and a lot of time people don't do that type of research" -Female, Age 20
	Medium CFC-Cancer	"But then there's so many different types of cancers that you can get, but I feel like they're not usually as readily talked about. So it's a put a little bit more publicity towards them and gave preventative factors that you could do for them. I think that could help quite a bit because it would inform students of just different daily habits that they could change in their lives." -Female, Age 19
	High CFC-Cancer	"And like look more into like, what do I need to be doing [cancer prevention] that isn't like crystal clear. Like obviously, like smoke, don't smoke, like that's clear. Eat good. Try to exercise like those are like good things to do. But I want to see if I can find like, there's other things I need to be doing that could like help me." -Female, Age 18

CHAPTER 5.
OVERALL DISCUSSION

INTRODUCTION

Across three manuscripts, this dissertation study explored college students' consideration of their future cancer risk when navigating current health behavior choices within the context of lifestyle-related risk factors for early-onset colorectal (EOCRC). The general consideration of future consequences (CFC) scale, a measure of the extent to which someone is immediate or future outcome oriented when making proximal behavior decisions,[1] was adapted for this study to measure the extent to which an individual considers their future cancer risk when making choices related to health behavior in the present (CFC-Cancer). Chapter 2 described college students' perceived lifetime risk of colorectal cancer (CRC), CFC-Cancer and how these outcomes relate to CRC knowledge, family history of cancer, and EOCRC lifestyle-related risk factors including current diet, sedentariness, alcohol use, smoking tobacco, stress management behaviors, perceived stress and chronic stress exposure.[2] Next given what is known about CRC and EOCRC disparities driven by socioeconomic variables,[3,4] Chapter 3 explored differences in perceived CRC risk, CFC-Cancer and EOCRC risk factors by first-generation and/or low-income (FGLI) student status. Finally, Chapter 4 was a comparison of knowledge, attitudes and behavioral intentions for cancer risk reduction now and five years in the future across students that rarely, sometimes or often consideration their future cancer risk when making health related decisions (i.e., low, medium or high CFC-Cancer).

Briefly students overestimated their lifetime CRC risk, which was positively associated with year in school, upper classmen perceived greater CRC risk. The sample had moderate consideration of future cancer risk when navigating proximal health-related choices, meaning they sometimes consider their future cancer risk and try to influence their level of risk with day-

to-day health behavior. FGLI group significantly differed from Non-FGLI with lower CRC knowledge and characteristics reflected EOCRC high risk groups including Black, Hispanic, and lower income.[4,5] Over two-thirds of participants wanted more cancer risk reduction education as college students. The following presents a synthesis of the study's results in relation to our current understanding of emerging adult health behaviors, EOCRC risk factors, and primary prevention strategies. This dissertation provides evidence to support earlier engagement of emerging adults in EOCRC risk reduction strategies. Furthermore, these findings endorse a necessary shift in our current cancer primary prevention paradigm that begins earlier in the life course of health development for broader public health impact.

INTEGRATION OF FINDINGS

Emerging adults consider cancer risk and integrate health promoting behaviors

The present study found that emerging adults enrolled in college full-time sometimes consider their future cancer risk when navigating proximal health-related behavior choices. Domain specific adaptations of the CFC scale have been identified as a better predictor of behaviors under investigation than the general CFC scale.[6] A health specific CFC scale (CFC-Health) was developed and found to predict diet and physical activity behaviors better than the general scale among college students.[7] The present study adapted the health CFC scale to measure consideration of future cancer risk when making health-related behavior decisions (CFC-Cancer). The CFC-Cancer scale had convergent validity with the general CFC scale ($r=0.63$, $p<.001$) and comparatively greater consistency ($\alpha=0.87$ versus $\alpha=0.84$) in this sample.

Considering future cancer risk more often when navigating health choices was associated with greater knowledge of CRC, higher academic GPA and more protective health behaviors.

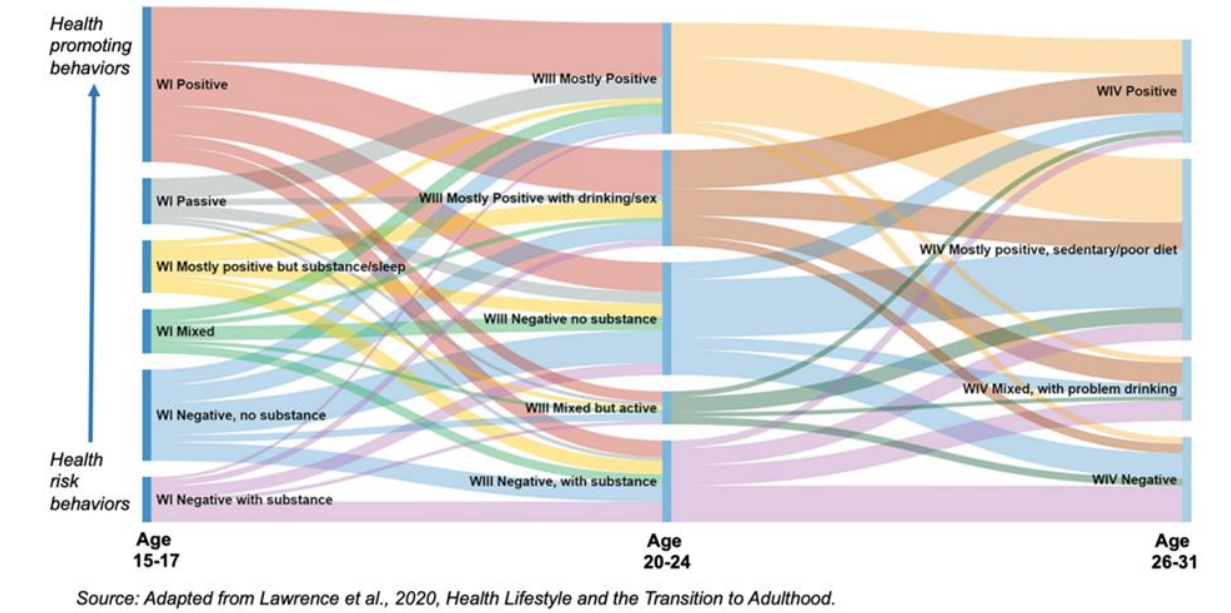
Regarding EOCRC lifestyle-related health behaviors, majority of survey participants reported meeting at least one CRC preventative dietary guideline, abstained from smoking tobacco products, avoided heavy alcohol consumption, and implemented at least one type of stress management behavior. Many (86%) of those that often consider their future cancer risk when navigating choices for health behavior (i.e. high CFC-Cancer) believed that their current behaviors were aiding to reduce their future cancer risk now as an emerging adult. Contrarily, majority (77%) that rarely consider their future cancer risk (i.e. low CFC-Cancer) believe that cancer preventative actions will be easier five-years in the future when they have more time, finances, health insurance and control over their day-to-day routine. GPA was the only significant difference detected between low and high CFC-Cancer participants with high CFC-Cancer having higher cumulative GPAs.

Other observational studies have identified that current emerging adults from Generation Z (born 1997-2012), engage in less risky health behaviors and have greater consideration of personal health compared to prior generations.[8–10] Twenge's initial investigation identified a generational difference regarding desire for autonomy among the Gen Z cohort which has contributed to a decline in risky health behaviors during adolescence.[8] As such this generational cohort was less likely than prior generations to engage in high risk alcohol consumption, substance use, or sexual activities prior to entering college as emerging adults. A study by the American Heart Association and American Diabetes Association found the majority (75%) of Gen Z participants were worried about their personal health preventing them from experiencing all they would like to accomplish in life.[9] Comparative analysis across generations revealed that Gen Z was the most conscious of how their health could impact their life experiences.[9] A qualitative focus group study identified that Gen Z perceived greater collective pressure to "have

it all together" - to balance and achieve higher standards for education, work, relationships and health compared to prior generations.[10] This pressure to perform has fueled a need for control and contributed to a cohort being more future orientated rather than driven by short-term pleasures.[10]

Lifestyle-related health behaviors tend to group together as protective or risk inducing across the life course.[11] **Figure 1** illustrates how health behavior patterns tended to group together and flux over the life course in a large longitudinal cohort study from adolescence (age 15-17) to young adulthood (age 26-31).[11] Emerging adulthood, age 18 to 25 years, is a development life stage full of biopsychosocial change, including elevated autonomy over health-related behaviors.[12] As such health behavior patterns are sensitive to these changes and shift a great deal, both positively and negatively, during this life stage which influence behavioral pattern trajectories for young adulthood.

Figure 1. Health lifestyles across adolescence, emerging adulthood and young adulthood



Source: Adapted from Lawrence et al., 2020, Health Lifestyle and the Transition to Adulthood.

Emerging adulthood has been described as the most unstable stage of life with exponential changes in education, work, relationships and living arrangements which have a bidirectional

relationship with perceived stress.[13,14] According to data from the National College Health Assessment, perceived stress among college students has continued to rise from 2010 to 2023.[15,16] These trends are significant given that chronic stress is a lifestyle related risk factor for EOCRC.[2] The present study identified that stress management behaviors, like reaching out to social support, have a significantly positive association with considering future cancer risk to inform health behavior decisions. Thus, encouraging emerging adults to practice stress management behaviors more regularly may also improve choosing lifestyle health behaviors that will reduce future cancer risk. A cohort study of Australian emerging adult lifestyle-related health behaviors found that those with more protective behaviors had lower stress, depression and anxiety.[17] EOCRC risk reduction strategies should leverage the reciprocal relationship between perceived stress and lifestyle-related health behaviors.[18] Health-related choices for students with lower CFC-Cancer are guided by short-term benefits rather than long-term cancer risk. Engaging in health promoting lifestyle behaviors could motivate students with lower CFC-Cancer to integrate EOCRC risk reduction strategies for the stress relief benefits that align with their short-term health needs.

Cancer prevention education needs to begin earlier in the life course

In the present student college students expressed a desire to learn more about cancer and lifestyle-related risk reduction strategies that can begin integrating now. Education about cancer risk reduction was endorsed across majority of interview participants whether they rarely, sometimes or often consider their future cancer risk when navigating current health choices. Health behavior decisions guided by desire to reduce future cancer risk was associated greater CRC knowledge and health promoting lifestyle behaviors. Thus, providing more opportunities to

learn about EOCRC risk factors may increase thought given to reducing future cancer risk and engagement in risk reduction health behaviors.

A public school-based cancer health curriculum provided to high school students yielded significant improvements in cancer knowledge, fruit consumption, sedentary screen time, attitudes of fear and fatalism, and family discussions about cancer.[19] This educational intervention had both intrapersonal and interpersonal benefits for cancer prevention knowledge through diffusion of course content into family support systems. Given the powerful influence of peers on health behaviors of emerging adults, adapting this content for a college course could also have multiple benefits. A college course was one recommendation from this study's interview participants. Some liberal studies colleges and universities have a required general health course component. A review of these courses identified immediate positive effects regarding knowledge, lifestyle related health behaviors, and mental health.[20] Furthermore, college alumni that partook in a required health course during undergraduate studies have sustained health promoting knowledge and behaviors, and had better health outcomes.[21]

When asked about resources and strategies that could support uptake of risk reduction behaviors, high CFC-Cancer interview participants recommended required health courses or individualized appointments with a healthcare provider or advisor. This endorsement reinforces that individualized feedback and education fosters reflection and internalization. A pilot study found that college students assigned to receive skin cancer education, UV photo and genetic testing had consistently better preventive behavior change at one month follow-up compared to groups that received just education or education plus UV photo or testing.[22] Thus providing opportunity for personalized feedback induced greater internalization of cancer preventive behavior change for college students. Given high CFC-Cancer participants made this

recommendation in the present study, it's possible that application of this approach with low CFC-Cancer participants may improve their CFC-Cancer and EOCRC lifestyle related health behaviors.

Cancer health equity opportunities for first generation and/or low-income students

Education and income are well-known social drivers of health that effect cancer outcomes.[23] Individuals with lower household income and education achievement experience a greater burden of EOCRC incidence and mortality compared to others even after controlling for race/ethnicity.[24,25] The Public Health Exposome suggests that health disparities are driven by cumulative exposure to biopsychosocial risk factors across the lifespan.[26] College students who are first generation in their family to attend college or from low-income households (FGLI) have exposure to these social drivers of health early in their life course that could adversely affect their EOCRC risk.

The present study found the FGLI students had significantly greater perceived stress and chronic stress exposure, and lower CRC knowledge and HPV vaccination rates compared to Non-FGLI. As stated previously, stress is an EOCRC risk factor, this includes perceived stress.[2] FGLI student have experienced significantly greater chronic stress as measured by adverse childhood experiences this student group has a greater risk compared to Non-FGLI. In stratified models CRC knowledge was significantly associated ($p=.03$) with CFC-Cancer for FGLI and Non-FGLI students; but FGLI students have significantly lower CRC knowledge scores. From a clinical primary prevention perspective FGLI students reported significantly less HPV vaccination and HPV creates an elevated risk for CRC.[27] Parents and guardians of FGLI students

may represent underserved populations and up until emerging adulthood many youth do not have autonomy over their own healthcare utilization for vaccination.[28]

The FGLI student sample in this dissertation study had significantly more Black and Hispanic participants compared to Non-FGLI. Investigation of EOCRC racial disparities found that Blacks have 50%, and Hispanics 100% greater chance of being diagnosed with EOCRC before age 50 compared to Non-Hispanic Whites.[5] Once diagnosed, Blacks and Hispanics also have worse 5-year survival rates for EOCRC compared to Non-Hispanic Whites.[5] One study found that regardless of education, income, healthy lifestyle and healthcare access, Blacks still have an elevated CRC risk compared to other races.[29] Even though Black FGLI students are working towards higher education and income obtainment they still have an elevated CRC risk compared to their peers. Findings from this study identify health disparities existing within the undergraduate student population that are often overlooked for health equity initiatives. With FGLI students having significantly lower CRC knowledge and more EOCRC risk factors there is a need to target this group for risk reduction strategies that will uplift health equity and address disparities through an upstream life course health development approach.

STRENGTHS & LIMITATIONS

The present study has several limitations and strengths. Notably the survey response rate was low (13%) compared to population level surveys; however, an 11% response rate is the average colleges have achieved annually for the National College Health Assessment.[16] Timing of data collection at onset and during the summer months may have contributed to a lower response rate than if it had occurred during the academic year when students are more engaged. Even though the response rate is not optimal, distribution of data acquired met standards for normal

distribution to perform statistical analyses. A major asset is the racial and ethnic diversity of the acquired student sample considering EOCRC disparities experienced by minorities, and the representativeness of the university's student enrollment demographics. The collaborative relationship with the Division of Student Affairs provided access to a stratified sample of undergraduate students for the research team plus new knowledge and recommendations for administrators. This practice should be an example for ongoing college health and wellbeing related studies in academia.

Given that students self-selected to participate in the survey and follow-up interviews; the sample obtained may reflect biased interest in health or cancer related research. There are always limitations to self-reported health behavior measures including over or underestimating behaviors for social desirability, and accurate recall. However, given the project scope the use of wearable devices or ecological momentary assessments to acquire more objective measures was not feasible.

Findings from this student sample are not generalizable across institutions of higher education as enrolled student demographic profiles and campus cultures vary greatly even within physical proximity. Even so these findings provide necessary preliminary understanding of emerging adult's CFC-cancer and how it relates to current health choices. While the adapted consideration of future consequences scale to assess CFC-Cancer yielded significant validity, further testing of the scale is merited to determine reliability among other study populations and contexts.

IMPLICATIONS AND RECOMMENDATIONS

Clinical Practice

A meta-analysis of adolescent annual physical examinations deemed them as not being cost effective with little value in identifying existing or progressing abnormalities,[30] which is a secondary or tertiary prevention approach. Given that adolescents and emerging adults are typically in good health, annual physicals should be viewed as a primary prevention approach to assess lifestyle related health risks for cancer and other chronic diseases and counsel risk reduction strategies to sustain good health in the future. The American College of Preventive Medicine recommends that adolescent wellness exams include biometrics and dyadic discussion to guide personal growth, social and academic competence, emotional wellbeing, risk reduction, and violence and injury prevention.[31] Providing this patient-provider dialogue beginning in adolescence also fosters opportunity to exercise health autonomy earlier during the life course while individuals still have built in support systems through family and school. A benefit is that emerging adults have prior experience navigating their own health-related decisions before leaving these support systems to pursue college, careers or enlist in the military.

A study in the UK recently piloted acceptability and feasibility of providing a brief personalized cancer risk assessment and lifestyle behavior management intervention through primary care health check appointments with adults age 40-74 years.[32] Patients found the information motivational, and providers supported that the intervention fit well within the appointment's parameters and guided behavior change conversations. This model could be adapted to assess personal cancer risk of emerging adults and advise lifestyle-related risk reduction strategies during annual physical appointments. Furthermore, assessing lifestyle related risk factors aligns with current innovative cancer risk work that recommends screening guidelines based on risk assessments rather than age-based parameters. In fact use of personal risk scores composed of lifestyle and environmental factors and genetic testing has been

recommended as a better practice to guide CRC screening than age-based guidelines given the global epidemic of EOCRC.[33]

Public Health Practice

The present study found that interview participants were most familiar with cancers that have highly visible campaigns such as breast, lung and skin. CRC prevention communication need to broaden beyond those eligible for age-based screening to reach younger populations. The purpose of this approach is to create awareness of lifestyle-related risk factors to encourage risk reduction strategies and to educate about EOCRC symptoms that may otherwise experience appraisal delays from patients and providers. EOCRC campaign materials can educate the broader public so that the symptoms are recognizable among social networks that will encourage seeking healthcare appraisal.[34]

Among a sample of rural college students, females had more knowledge of cancer risk factors (smoking tobacco, family history, obesity and HPV vaccination) compared to males.[35] Additionally, White students were more likely to agree that aging, obesity and sedentariness were risk factors compared to Non-White peers. These findings indicate both gender and racial disparities in cancer risk knowledge among emerging adults and a need for cancer prevention campaigns tailored to reach these groups. Feedback from participants from the skin cancer prevention pilot highlighted the need to include emerging adult testimonials and in visual aspects of communication materials rather than older adults.[36] Given that many interview participants referenced getting cancer information from social media platforms like TikTok it's also imperative that EOCRC communications diversity across communication channels to be highly visible for greater impact.

Research

There are several recommendations for ongoing research from this dissertation study. Notably the forementioned recommendations for clinical and public health practice will require pilot testing of new interventions with college students. Furthermore, successful findings should be adapted for emerging adults not enrolled in four-year institutions of higher education. Scale up of these interventions should aim to reach emerging adults enrolled in two-year community colleges, enlisted in the military, and employed in the community. Collaborations with healthcare facilities where emerging adults seek care, such as community health and urgent care centers, would benefit these future research endeavors.

Currently cancer prevention efforts begin too late in the life course primarily focused on downstream approaches like early detection guided by age-based guidelines rather than upstream primary prevention.[37] Upstream approaches have been deemed difficult to measure effectiveness given latency of desired health outcomes compared to downstream interventions.[38] One review of cost-effectiveness of primary prevention for lifestyle-related risk factors for breast cancer found that almost half of interventions were highly likely to be cost-effective.[39] Future research needs to investigate cost effectiveness of primary prevention for lifestyle related risk factors for EOCRC to prove return on investment in upstream approaches.

Beyond implementation science and cost effectiveness analyses, research should seek to engage emerging adult in cancer prevention and control research to provide exposure. Engagement in research projects can create awareness and likelihood of engaging in risk reduction behaviors. Interview participants in the present study stated that their participation increased their interest in cancer risk reduction. Opportunities to engage with and inform cancer

prevention and control research has benefits for non-academic community members, including emerging adults. This also reinforces the NCI's National Cancer Plan goal to engage every person because "every person with cancer or at risk for cancer has an opportunity to participate in research or otherwise contribute to the collective knowledge base."[40]

CONCLUSION

This dissertation study was an innovative interrogation of the extent to which emerging adults enrolled in college are future-oriented regarding cancer prevention and their perceived risk of CRC. Findings from this study indicate that current emerging adults sometimes consider their cancer risk when navigating day-to-day health-related choices and that they desire to be informed about cancer risk reduction. These implications support a report of policies and principles for youth health and well-being which highlight the power of prevention and life-course equity.[41] Engagement of emerging adults in EOCRC prevention efforts as participants and informants should be a priority to increase exposure to EOCRC prevention and to develop relevant strategies. Given the global rise of early onset cancers, including EOCRC, that have been linked to lifestyle-related factors it is essential that prevention efforts take a life course health development approach. Furthermore, EOCRC lifestyle-related factors are also risks for other cancers and chronic diseases. It is necessary that we shift our current cancer prevention paradigm to include emerging adults in CRC primary prevention giving them a chance to begin risk reduction for better lifelong health and public health impact.

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APPENDIX A. Survey Email Invitation

Email Subject Line: An Invite to Participate in Student Research

Greetings [First Name],

I hope that this finds you well at the conclusion of the academic year. My name is Jacqueline Knight Wilt, I am a PhD Candidate in Virginia Commonwealth University's Social and Behavioral Sciences program in the School of Medicine. I am contacting you to invite your participation in my dissertation study, "*Exploring emerging adults' consideration of future cancer risk reduction: Opportunity for shifting prevention paradigms?*"

Prior to my doctoral studies I worked in a college health center providing preventive health support to students such as yourself. The purpose of this study is to understand how and the extent to which college students consider their future health, including cancer risk, related to their preventive health behaviors. Findings will inform services, resources, and communications to support your preventive health provided by VCU campus partnerships with University Student Health Services.

The study includes a survey and follow-up interviews with a subset of students that participate in the survey. You have been randomly selected from among the VCU undergraduate student population that is age 18-25 years to be invited to participate in the survey. It should take around 15 minutes to complete the survey. Your participation in this survey is voluntary.

As a student myself I know how busy you are and value your time. As a small token of my gratitude for your participation, you will receive a $3 Starbucks e-gift card, and be entered into a prize drawing for Amazon e-gift cards ranging $10-$20.

If you are interested in participating, you may open the survey in your web browser by clicking the link below:
College Student Consideration of Future Cancer Risk

If the link above does not work, try copying the link below into your web browser:
https://redcap.vcu.edu/surveys/?s=zcbYEZA7maxYTE5x

This link is unique to you and should not be forwarded to others.

This study is considered research and is covered under VCU IRB HM20026461.

If you have any questions about the study, please contact myself, or the Principal Investigator, Maria Thomson, PhD.

Thank you for your time you consideration of this request, it is greatly appreciated.

APPENDIX A. Survey Email Invitation

Warmly,

Jacqueline Knight Wilt, PhD Candidate
knightwij@vcu.edu

Maria Thomson, PhD
Principal Investigator
Maria.thomson@vcuhealth.org

APPENDIX B. Survey Email Invitation Reminder

Email Subject Line: An Invite to Participate in Student Research Reminder

Good evening [First Name],

I hope you are enjoying your summer. My name is Jacqueline Knight Wilt, I am a PhD candidate in Virginia Commonwealth University's Social and Behavioral Sciences program in the School of Medicine. I recently contacted you to tell you that the survey for my dissertation study, "***Exploring emerging adults' consideration of future cancer risk reduction: Opportunity for shifting prevention paradigms?***" would be closing shortly. I am happy to inform you that the survey remains open if you'd like to participate.

Prior to my doctoral studies I worked in a college health center providing preventive health support to students such as yourself. The purpose of this study is to understand how and the extent to which college students consider their future health, including cancer risk, related to their preventive health behaviors. Findings will inform services, resources, and communications to support your preventive health provided by VCU campus partnerships with University Student Health Services.

The study includes a survey and follow-up interviews with a subset of students that participate in the survey. This is a third reminder that you have been randomly selected from among the VCU undergraduate student population that is age 18-25 years to be invited to participate in the survey. Your participation in this survey is voluntary.

To date **208 students have comlpeted the survey**, which means **we are 34% towards our target** sample size. It has taken an **average of 18 minutes for participants to complete the survey**. The survey will remain open for participation until **beginning of August**.

As a student myself I know how busy you are and value your time. As a small token of my gratitude for your participation, you will receive a $5 Starbucks e-gift card, and be entered into a prize drawing for Amazon e-gift cards ranging $10-$20.

If you are interested in participating, you may open the survey in your web browser by clicking the link below:
College Student Consideration of Future Cancer Risk

If the link above does not work, try copying the link below into your web browser:
https://redcap.vcu.edu/surveys/?s=ALVW5G4n8rHA4TNY

This link is unique to you and should not be forwarded to others.

This study is considered research and is covered under VCU IRB HM20026461.

If you have any questions about the study, please contact myself, or the Principal Investigator, Maria Thomson, PhD.

APPENDIX B. Survey Email Invitation Reminder

Thank you for your time you consideration of this request, it is greatly appreciated.

Warmly,

Jacqueline Knight Wilt, PhD Candidate
knightwij@vcu.edu

Maria Thomson, PhD
Principal Investigator
Maria.thomson@vcuhealth.org

APPENDIX C. Survey Research Participant Information Sheet

RESEARCH PARTICIPANT INFORMATION SHEET

STUDY TITLE: Exploring emerging adults' consideration of future cancer risk reduction: Opportunity for shifting prevention paradigms?

VCU INVESTIGATORS: Maria Thomson, PhD, and Jacqueline Knight Wilt, PhD Candidate

You are being invited to participate in a research study about college students' (1) consideration of future cancer risk, and (2) current preventive health factors including behaviors and stress exposure. This is a dissertation study for a PhD student in VCU's Department of Health Behavior and Policy with support from University of Student Health Services and TRiO Student Support Services. Your participation is voluntary.

WHAT WILL HAPPEN IF I CHOOSE TO PARTICIPATE?

This study includes a survey and follow-up interviews with a random subset of participants. If you decide to participate in this survey, you will be asked questions about your colorectal cancer perceived risk, knowledge, decision making, cancer prevention, day-to-day health behaviors, and stress experiences. Following the survey, you may be randomly selected and receive a request to participate in a 45-minute follow-up interview, your participation in the interview will be voluntary as well. The data will be used to understand the extent to which college students consider future health risk and will inform development of preventive health support services, resources, and communications.

WILL I BE PAID TO PARTICIPATE IN THE STUDY?

You will receive a $5 Starbucks e-gift card for completing the survey and entered into a prize drawing for Amazon e-gift cards ranging from $10 to $20. Your e-gift card will be sent to your VCU email.

WHOM SHOULD I CONTACT IF I HAVE QUESTIONS ABOUT THIS STUDY?

The investigators listed below are the best person(s) to contact if you have any questions, complaints, or concerns about your participation in this research study:

Jacqueline Knight Wilt, PhD Candidate
knightwij@vcu.edu
(804) 495-1318

OR

Maria Thomson, PhD
Principal Investigator
Maria.thomson@vcuhealth.org
(804) 628 - 2640

APPENDIX D. Survey Instrument

College Student Consideration of Future Cancer Risk

Thank you for agreeing to participate in this research study.

Some items on this survey will ask about perceived cancer risk and cancer risk factors.

Cancer risk is the chance that a person will get cancer.Cancer risk factors are things that increase the chance of developing cancer.Please read through the questions carefully as some have instuctions for how to answer using the response options provided.

For each of the statements below, please indicate the extent to which the statement is or is not characteristic of you.

If the statement is extremely uncharacteristic of you (not at all like you) select "1 - Not at all like me"; if the statement is extremely characteristic of you (very much like you) select "7 - Very much like me". Use the numbers in the middle if you fall between the endpoints.

	1 - Not like me at all	2	3	4	5	6	7 - Very much like me	Prefer not to answer
I consider how things might be in the future, and try to influence those things with my day to day behavior.	○	○	○	○	○	○	○	○
Often I engage in a particular behavior in order to achieve outcomes that may not result for many years.	○	○	○	○	○	○	○	○
I only act to satisfy immediate concerns, figuring the future will take care of itself.	○	○	○	○	○	○	○	○
My behavior is only influenced by the immediate (i.e., a matter of days or weeks) outcomes of my actions.	○	○	○	○	○	○	○	○
My convenience is a big factor in the decisions I make or the actions I take.	○	○	○	○	○	○	○	○
I am willing to sacrifice my immediate happiness or wellbeing in order to achieve future outcomes.	○	○	○	○	○	○	○	○
I think it is important to take warnings about negative outcomes seriously even if the negative outcome will not occur for many years.	○	○	○	○	○	○	○	○

I think it is more important to perform a behavior with important distant consequences than a behavior with less important immediate consequences.	○	○	○	○	○	○	○	○
I generally ignore warnings about possible future problems because I think the problems will be resolved before they reach crisis level.	○	○	○	○	○	○	○	○
I think that sacrificing now is usually unnecessary since future outcomes can be dealt with at a later time.	○	○	○	○	○	○	○	○
I only act to satisfy immediate concerns, figuring that I will take care of future problems that may occur at a later date.	○	○	○	○	○	○	○	○
Since my day-to-day work has specific outcomes, it is more important to me than behavior that has distant outcomes.	○	○	○	○	○	○	○	○
When I make a decision, I think about how it might affect me in the future.	○	○	○	○	○	○	○	○
My behavior is generally influenced by future consequences.	○	○	○	○	○	○	○	○

The following statements are similar to what you just answered but are related to cancer risk.

For each of the statements below, please indicate the extent to which the statement is or is not characteristic of you.

If the statement is extremely uncharacteristic of you (not at all like you) select "1 - Not at all like me"; if the statement is extremely characteristic of you (very much like you) select "7 - Very much like me". Use the numbers in the middle if you fall between the endpoints.

	1 - Not like me at all	2	3	4	5	6	7 - Very much like me	Prefer not to answer
I consider my future cancer risk, and try to influence my level of risk with my day to day health behavior.	○	○	○	○	○	○	○	○
Often I engage in a particular health behavior in order to achieve cancer prevention outcomes that may not result for many years.	○	○	○	○	○	○	○	○
I only act to satisfy immediate concerns; my future cancer risk is of less importance.	○	○	○	○	○	○	○	○
My health behavior is only influenced by the immediate (i.e., a matter of days or weeks) outcomes of my actions.	○	○	○	○	○	○	○	○
My convenience is a big factor in the health behavior decisions and choices I make.	○	○	○	○	○	○	○	○
I am willing to sacrifice my immediate happiness or wellbeing in order to prevent having cancer in the future.	○	○	○	○	○	○	○	○
I think it is important to take warnings about health behavior cancer risk factors seriously even if a positive cancer diagnosis will not occur for many years.	○	○	○	○	○	○	○	○

I think it is more important to perform a behavior with important distant consequences, such as cancer prevention, than a behavior with less important immediate consequences.	○	○	○	○	○	○	○	○
I generally ignore warnings about health behavior related cancer risk factors because I think I can improve my health behaviors before they reach crisis level.	○	○	○	○	○	○	○	○
I think that sacrificing something unhealthy now is usually unnecessary since my future cancer risk can be dealt with at a later time.	○	○	○	○	○	○	○	○
I only act to satisfy immediate concerns, figuring that I will take care of my health behavior related to cancer risk at a later date.	○	○	○	○	○	○	○	○
Since my day-to-day work has specific outcomes, it is more important to me than health behavior related to cancer risk that has distant outcomes.	○	○	○	○	○	○	○	○
When I make a decision, I think about how it might affect my cancer risk in the future.	○	○	○	○	○	○	○	○
My health behavior is generally influenced by future cancer risk.	○	○	○	○	○	○	○	○

The following questions ask about your cancer prevention behaviors, cancer history, colorectal cancer knowledge, and perceived risk.

The Human Papillomavirus (HPV) vaccine (i.e., Gardasil, Silgard, or Cervarix) is recommended, but usually not required, and is given in a series of 2 or 3 based on age.

Have you completed the HPV vaccine series?

- ◯ Yes
- ◯ No
- ◯ Don't know/Unsure
- ◯ Prefer not to answer

An annual skin exam performed by yourself or a health care provider is recommended to screen for skin cancer. During a skin exam the skin is checked for moles, birthmarks, or other pigmented areas that look abnormal in color, size, shape, or texture.

Do you participate in annual skin exams?

- ◯ Yes
- ◯ No
- ◯ Prefer not to answer

The American Cancer Society recommends avoiding tobacco smoke to reduce risk of lung cancer.

Do you avoid smoking tobacco products?

- ◯ Yes
- ◯ No
- ◯ Prefer not to answer

Have you ever been diagnosed with cancer?

- ◯ Yes
- ◯ No
- ◯ Prefer not to answer

Have any of your family members ever been diagnosed with cancer?

- ◯ Yes
- ◯ No
- ◯ Unsure/Don't know
- ◯ Prefer not to answer

For each of the following items, select the answer that you believe is correct.

Colorectal cancer starts in what part of the body?

- ◯ Liver
- ◯ Stomach
- ◯ Small Intestine
- ◯ Colon and/or rectum
- ◯ Prefer not to answer

A stool test (FIT/FOBT) checks stool (poop) for?

- ◯ Blood
- ◯ Fat
- ◯ Tumors
- ◯ Polyps
- ◯ Prefer not to answer

Which of these are risk factors for colorectal cancer? [Check all that are correct]

- ☐ Poor diet
- ☐ Smoking/tobacco use
- ☐ Lack of physical activity
- ☐ Heavy drinking (alcohol consumption)
- ☐ Overweight/obesity
- ☐ Prefer not to answer

In general, a colonoscopy should be performed every 10 years starting at age:

- ◯ 25
- ◯ 35
- ◯ 45
- ◯ 55
- ◯ Prefer not to answer

In general, a stool (poop) test (FIT or FOBT) should be done every year starting at age:	◯ 25 ◯ 35 ◯ 45 ◯ 55 ◯ Prefer not to answer
Lynch Syndrome is a disorder that runs in families and increases chances of developing colorectal cancer.	◯ True ◯ False ◯ Prefer not to answer
The earlier that colorectal cancer is found, the greater the chances of survival.	◯ True ◯ False ◯ Prefer not to answer
Even if someone has NO symptoms, they may still have colorectal cancer.	◯ True ◯ False ◯ Prefer not to answer
Polyps are growths in the lining of the colon or rectum that can develop into colorectal cancer.	◯ True ◯ False ◯ Prefer not to answer
A colonoscopy can be used to find polyps in the colon and rectum.	◯ True ◯ False ◯ Prefer not to answer
A diet high in red meats and processed meats (lunch meat, hot dogs) increases chances of developing colorectal cancer.	◯ True ◯ False ◯ Prefer to answer
It is okay to skip colorectal cancer screening if someone does not have any symptoms.	◯ True ◯ False ◯ Prefer not to answer
Chances of developing colorectal cancer are higher if an immediate family member has it or has had it.	◯ True ◯ False ◯ Prefer not to answer
Increasing physical activity will NOT lower chances of developing colorectal cancer.	◯ True ◯ False ◯ Prefer not to answer
The next two questions will ask what you think your personal risk is for developing colorectal cancer sometime in your life.	
How likely do you think it is that you will develop colorectal cancer in the future?	◯ Very low ◯ Somewhat low ◯ Moderate ◯ Somewhat high ◯ Very high ◯ Prefer not to answer
On a scale of 0% to 100%, what do you think your lifetime risk of developing colorectal cancer would be? [Use the slider to indicate your response]	0% 50% 100% *(Place a mark on the scale above)*

The following section will ask about your typical physical activity, eating and drinking habits, sleeping patterns, and stress management.

During the past 30 days, how many days did you have at least one alcoholic beverage (drink)?

One drink is equivalent to a 12-ounce beer, a 5-ounce glass of wine, one shot of liquor, or a drink with at least one shot of liquor.

- ◯ 0
- ◯ 1
- ◯ 2
- ◯ 3
- ◯ 4
- ◯ 5
- ◯ 6
- ◯ 7
- ◯ 8
- ◯ 9
- ◯ 10
- ◯ 11
- ◯ 12
- ◯ 13
- ◯ 14
- ◯ 15
- ◯ 16
- ◯ 17
- ◯ 18
- ◯ 19
- ◯ 20
- ◯ 21
- ◯ 22
- ◯ 23
- ◯ 24
- ◯ 25
- ◯ 26
- ◯ 27
- ◯ 28
- ◯ 29
- ◯ 30
- ◯ Prefer not to answer

On the days when you have a beverage with alcohol, about how many drinks did you have?

- ◯ 1
- ◯ 2
- ◯ 3
- ◯ 4
- ◯ 5
- ◯ 6
- ◯ 7
- ◯ 8
- ◯ 9
- ◯ 10
- ◯ More than 10
- ◯ Prefer not to answer

Vigorous physical activities refer to activities that take hard physical effort and make you breathe much harder than normal like heavy lifting, digging, aerobics, or fast bicycling.

During the last 7 days, on how many days did you do vigorous physical activities?

- ◯ 0
- ◯ 1 day
- ◯ 2 days
- ◯ 3 days
- ◯ 4 days
- ◯ 5 days
- ◯ 6 days
- ◯ 7 days
- ◯ Prefer not to answer

How much time did you usually spend doing vigorous physical activities on one of those days?
Choose the best answer.

- ◯ 15 minutes
- ◯ 30 minutes
- ◯ 45 minutes
- ◯ 1 hour
- ◯ 1 and a half hours
- ◯ 2 hours
- ◯ 2 and a half hours
- ◯ 3 hours
- ◯ 4 hours
- ◯ 5 hours
- ◯ 6 hours
- ◯ 7 hours
- ◯ 8 hours
- ◯ 9 hours
- ◯ 10 hours
- ◯ 11 hours
- ◯ 12 hours
- ◯ Prefer not to answer

Moderate activities refer to activities that take moderate physical effort and make you breathe somewhat harder than normal like carrying light loads, bicycling at a regular pace, or doubles tennis. Do not include walking.

During the last 7 days, on how many days did you do moderate physical activities?

- ◯ 0
- ◯ 1 day
- ◯ 2 days
- ◯ 3 days
- ◯ 4 days
- ◯ 5 days
- ◯ 6 days
- ◯ 7 days
- ◯ Prefer not to answer

How much time did you usually spend doing moderate physical activities on one of those days?
Choose the best answer.

- ◯ 15 minutes
- ◯ 30 minutes
- ◯ 45 minutes
- ◯ 1 hour
- ◯ 1 and a half hours
- ◯ 2 hours
- ◯ 2 and a half hours
- ◯ 3 hours
- ◯ 4 hours
- ◯ 5 hours
- ◯ 6 hours
- ◯ 7 hours
- ◯ 8 hours
- ◯ 9 hours
- ◯ 10 hours
- ◯ 11 hours
- ◯ 12 hours
- ◯ Prefer not to answer

Think about the time you spent walking in the last 7 days. This includes at work and at home, walking to travel from place to place, and any other walking that you have done solely for recreation, sport, exercise, or leisure.

During the last 7 days, on how many days did you walk for at least 10 minutes at a time?

- ◯ 0
- ◯ 1 day
- ◯ 2 days
- ◯ 3 days
- ◯ 4 days
- ◯ 5 days
- ◯ 6 days
- ◯ 7 days
- ◯ Prefer not to answer

How much time did you usually spend walking on one of those days?

- ◯ 15 minutes
- ◯ 30 minutes
- ◯ 45 minutes
- ◯ 1 hour
- ◯ 1 and a half hours
- ◯ 2 hours
- ◯ 2 and a half hours
- ◯ 3 hours
- ◯ 4 hours
- ◯ 5 hours
- ◯ 6 hours
- ◯ 7 hours
- ◯ 8 hours
- ◯ 9 hours
- ◯ 10 hours
- ◯ 11 hours
- ◯ 12 hours
- ◯ Prefer not to answer

Think about the time you spent sitting on weekdays during the last 7 days. Include time spent at work, at home, while doing course work and during leisure time. This may include time spent sitting at a desk, visiting friends, reading, or sitting, or lying down to watch television.

During the last 7 days, how much time did you spend sitting on a week day?

- ◯ 0 hours
- ◯ 1 hour
- ◯ 2 hours
- ◯ 3 hours
- ◯ 4 hours
- ◯ 5 hours
- ◯ 6 hours
- ◯ 7 hours
- ◯ 8 hours
- ◯ 9 hours
- ◯ 10 hours
- ◯ 11 hours
- ◯ 12 hours
- ◯ 13 hours
- ◯ 14 hours
- ◯ 15 hours
- ◯ 16 hours
- ◯ 17 hours
- ◯ 18 hours
- ◯ 19 hours
- ◯ 20 hours
- ◯ Prefer not to answer

In an average week, how often do you:	Usually/Often	Sometimes	Rarely/Never	Does not apply to me	Prefer not to answer
Eat less than 2 servings of whole grain products a day? Serving = 1 slice of 100% whole grain bread; 1 cup whole grain cereal/high fiber cereals/oatmeal, 3-4 whole grain crackers, ½ cup brown rice/whole wheat pasta	◯	◯	◯	◯	◯
Eat less than 2 servings of fruit a day? Serving = ½ cup or 1 med. fruit or ¾ cup 100% fruit juice	◯	◯	◯	◯	◯
Eat less than 2 servings of vegetables a day? Serving = ½ cup vegetables, or 1 cup leafy raw vegetables.	◯	◯	◯	◯	◯
Use regular processed meats (like bologna, salami, corned beef, hotdogs, sausage or bacon) instead of low fat processed meats (like roast beef, turkey, lean ham; low-fat cold cuts/hotdogs)?	◯	◯	◯	◯	◯
Eat fried foods such as fried chicken, fried fish, French fries, fried plantains, etc.?	◯	◯	◯	◯	◯

During the past month, how many hours of actual sleep did you get at night?

◯ More than 7 hours
◯ 6 - 7 hours
◯ 5 - 6 hours
◯ Less than 5 hours
◯ Prefer not to answer

During the past month, how long (in minutes) has it usually taken you to fall asleep each night?

◯ 15 minutes or less
◯ 16 - 30 minutes
◯ 31 - 60 minutes
◯ More than 60 minutes
◯ Prefer not to answer

During the past month, how often have you had trouble sleeping because you wake up in the middle of the night, or early morning?

◯ Not during the past month
◯ Less than once a week
◯ Once or twice a week
◯ Three or more times a week
◯ Prefer not to answer

During the past month, how would you rate your sleep quality overall?

◯ Very good
◯ Fairly good
◯ Fairly bad
◯ Very bad
◯ Prefer not to answer

For each of the statements below, please indicate the extent to which the statement is or is not characteristic of you.

If the statement is extremely uncharacteristic of you (not at all like you) select "1 - Not at all like me"; if the statement is extremely characteristic of you (very much like you) select "5 - Very much like me". Use the numbers in the middle if you fall between the endpoints.

	1 - Not at all like me	2	3	4	5 - Very much like me	Prefer not to answer
I can easily stop and re-examine my thoughts to gain a new perspective.	○	○	○	○	○	○
It's easy for me to decide how to cope with whatever problems arise	○	○	○	○	○	○
When problems arise I know how to cope with them.	○	○	○	○	○	○
I am confident about being able to choose the best coping responses for hard situations.	○	○	○	○	○	○
I can come up with emotionally balanced thoughts even during negative times	○	○	○	○	○	○
It's easy for me to go to people in my life for help or support when I need it.	○	○	○	○	○	○
I can ask people in my life for support or assistance whenever I need it.	○	○	○	○	○	○
I notice right away whenever my body is becoming tense.	○	○	○	○	○	○

The following questions ask about your feelings over the last month.

In the last month, how often have you...

	Never	Almost never	Sometimes	Fairly often	Very often	Prefer not to answer
been upset because of something that happened unexpectedly?	○	○	○	○	○	○
felt that you were unable to control the important things in your life?	○	○	○	○	○	○
felt nervous and stressed?	○	○	○	○	○	○
felt confident about your ability to handle your personal problems?	○	○	○	○	○	○
felt that things were going your way?	○	○	○	○	○	○
found that you could not cope with all the things that you had to do?	○	○	○	○	○	○
been able to control irritations in your life?	○	○	○	○	○	○
felt that you were on top of things?	○	○	○	○	○	○
been angered because of things that happened that were outside of your control?	○	○	○	○	○	○
felt difficulties were piling up so high that you could not overcome them?	○	○	○	○	○	○

The following questions ask past experiences from your childhood that may have been difficult for you.

Please indicate if you experienced any of the following experiences as a child or teenager (birth - age 17 years).

	No	Yes	Prefer not to answer
Born premature	◯	◯	◯
Adopted	◯	◯	◯
Surgery/hospitalization	◯	◯	◯
Major illness (self)	◯	◯	◯
Bullied/social rejection	◯	◯	◯
Physical abuse	◯	◯	◯
Sexual abuse	◯	◯	◯
Emotional abuse	◯	◯	◯
Poverty	◯	◯	◯
Natural disaster	◯	◯	◯
Destroyed home	◯	◯	◯
Parents divorced	◯	◯	◯
Separation from family	◯	◯	◯
Severe family conflict	◯	◯	◯
Death (parent/sibling)	◯	◯	◯
Major illness in family	◯	◯	◯
Domestic violence	◯	◯	◯

This section will ask about you and your family's educational and financial experiences.

What is your year in school?

- ◯ 1st year undergraduate
- ◯ 2nd year undergraduate
- ◯ 3rd year undergraduate
- ◯ 4th year undergraduate
- ◯ 5th year or more undergraduate
- ◯ Prefer not to answer

Which academic unit is your program of study in?
[Check all that apply if you have more than one major]

- ☐ College of Engineering
- ☐ College of Health Professions
- ☐ College of Humanities and Sciences
- ☐ School of the Arts
- ☐ School of Business
- ☐ School of Dentistry
- ☐ School of Education
- ☐ School of Government and Public Affairs (L. Douglas Wilder)
- ☐ School of Media and Culture (Richard T. Robertson)
- ☐ School of Nursing
- ☐ School of Social Work
- ☐ School of World Studies
- ☐ VCU Life Sciences
- ☐ Prefer not to answer

What is your approximate cumulative grade average?

- ◯ A+
- ◯ A
- ◯ A-
- ◯ B+
- ◯ B
- ◯ B-
- ◯ C+
- ◯ C
- ◯ C-
- ◯ D+
- ◯ D
- ◯ D-
- ◯ F
- ◯ Prefer not to answer

Where do you currently live while attending school?

- ◯ Campus or university housing
- ◯ Off-campus or other non-university housing
- ◯ Prefer not to answer

What is the highest level of education completed by either of your parents (or guardians)?

- ◯ Did not finish high school
- ◯ High school diploma or GED
- ◯ Attended college but did not complete degree
- ◯ Associate's degree (AA, AS, etc.) or trade/technical training
- ◯ Bachelor's degree (BA, BS, etc.)
- ◯ Master's degree (MA, MS, MFA, MBA, MPP, MPA, MPH, etc.)
- ◯ Doctoral or professional degree (PhD, EdD, JD, MD, etc.)
- ◯ Don't know
- ◯ Prefer not to answer

What is the highest level of education completed by a member of your extended family (i.e., grandparent, aunt/uncle, cousin)?	◯ Did not finish high school ◯ High school diploma or GED ◯ Attended college but did not complete degree ◯ Associate's degree (AA, AS, etc.) or trade/technical training ◯ Bachelor's degree (BA, BS, etc.) ◯ Master's degree (MA, MS, MFA, MBA, MPP, MPA, MPH, etc.) ◯ Doctoral or professional degree (PhD, EdD, JD, MD, etc.) ◯ Don't know ◯ Prefer not to answer
Please indicate the response that best describes your family's financial situation when you were a child/teenager?	◯ Experienced extreme financial hardship ◯ Experienced some financial hardship ◯ Had enough money ◯ Had more than enough money ◯ Prefer not to answer
Do you currently work while attending school?	◯ Yes ◯ No ◯ Prefer not to answer
Please indicate the response that best describes your current financial situation.	◯ Experiencing extreme financial hardship ◯ Experiencing some financial hardship ◯ Having enough money ◯ Having more than enough money ◯ Prefer not to answer
Do you receive need-based financial assistance (i.e., Pell Grant) for your tuition costs?	◯ No ◯ Yes ◯ Don't know/Unsure ◯ Prefer not to answer

This last part of the survey will help us understand your personal characteristics.

What is your current age?

- ◯ 18
- ◯ 19
- ◯ 20
- ◯ 21
- ◯ 22
- ◯ 23
- ◯ 24
- ◯ 25
- ◯ 26
- ◯ Prefer not to answer

What sex were you assigned at birth?

- ◯ Male
- ◯ Female
- ◯ Intersex
- ◯ Prefer not to answer

Which term do you use to describe your gender identity?

- ◯ Woman or Female (includes cis- or transgender female)
- ◯ Man or Male (includes cis- or transgender male)
- ◯ Non-binary
- ◯ Gender fluid
- ◯ Intersex
- ◯ Agender
- ◯ Other
- ◯ Prefer not to answer

How do you usually describe yourself? (Please select ALL that apply)

- ☐ American Indian or Native Alaskan
- ☐ Asian or Asian American
- ☐ Black or African American
- ☐ Hispanic or Latino/a/x
- ☐ Middle Eastern/North African (MENA) or Arab Origin
- ☐ Native Hawaiian or Other Pacific Islander Native
- ☐ White
- ☐ Biracial or Multiracial
- ☐ My identity is not listed above
- ☐ Prefer not to answer

Email Subject Line: Follow-Up Interview Invite

Hi [First Name],

I hope that this finds you well. My name is Jackie Knight Wilt, I am a PhD candidate in Virginia Commonwealth University's Social and Behavioral Sciences program. Firstly, I'd like to thank you for your participation in the survey component of my dissertation study, "*Exploring emerging adults' consideration of future cancer risk reduction: Opportunity for shifting prevention paradigms?*"

At this time, I am reaching out to invite you to participate in a follow-up interview. You may recall that the purpose of this study is to understand how and the extent to which college students think about their future health, including cancer risk.

You have been randomly selected from among those that completed the survey to participate in a follow-up interview. The purpose of the interview is to learn more about your thoughts, attitudes and intentions regarding health behaviors, your future health, and factors that influence enacting your health goals as a VCU student. The interview will last about 30 minutes, take place on VCU Zoom, be recorded, and transcribed verbatim. Your participation in this interview is voluntary.

As a student myself I know how busy you are and value your time. As a small thank you for your participation, you will receive a $20 Amazon e-gift card.

If you are interested in participating, you may reserve your interview time slot. If the link does not work copy and paste this URL into your web browser: https://www.signupgenius.com/go/805084FABA82BAAF49-interview

If the times allotted do not fit your schedule, please reply to this email so you and I can coordinate a time that works for you.

This study is considered research and is covered under VCU IRB HM20026461.

If you have any questions about the study, please contact myself, or the Principal Investigator, Maria Thomson, PhD.

Thank you for your time and consideration of this request, it is greatly appreciated.

Warmly,

Jacqueline Knight Wilt, PhD Candidate
knightwij@vcu.edu

Maria Thomson, PhD
Principal Investigator

APPENDIX E. Interview Email Invitation

mthomson2@vcu.edu

APPENDIX F. Interview Email Invitation Reminder

Email Subject Line: Follow-Up Interview Invite

Hi [First Name],

I hope that this finds you well. My name is Jacqueline Knight Wilt, I am a PhD candidate in Virginia Commonwealth University's Social and Behavioral Sciences program in the School of Population Health. Firstly, I'd like to thank you for your participation in the survey component of my dissertation study, "*Exploring emerging adults' consideration of future cancer risk reduction: Opportunity for shifting prevention paradigms?*"

At this time I am reaching out as a reminder that you've been invited to participate in a follow-up interview. You may recall that the purpose of this study is to understand how and the extent to which college students consider their future health, including cancer risk, related to their preventive health behaviors. Findings will inform services, resources, and communications to support your preventive health provided by VCU campus partnerships with University Student Health Services.

You have been randomly selected from among those that completed the survey to participate in a follow-up interview. The purpose of the interview is to learn more about your health behavior intentions, how those relate to consideration of your future health, and factors that influence enacting your current health intentions as a VCU student. The interview will last about 30 minutes, take place on VCU Zoom, be recorded, and transcribed verbatim. Your participation in this interview is voluntary.

As a student or recent graduate I know how busy you are and value your time. As a small thank you for your participation, you will receive a $20 Amazon e-gift card.

If you are interested in participating, you may reserve your interview time slot. If the link does not work copy and paste this URL into your web browser: https://www.signupgenius.com/go/805084FABA82BAAF49-interview

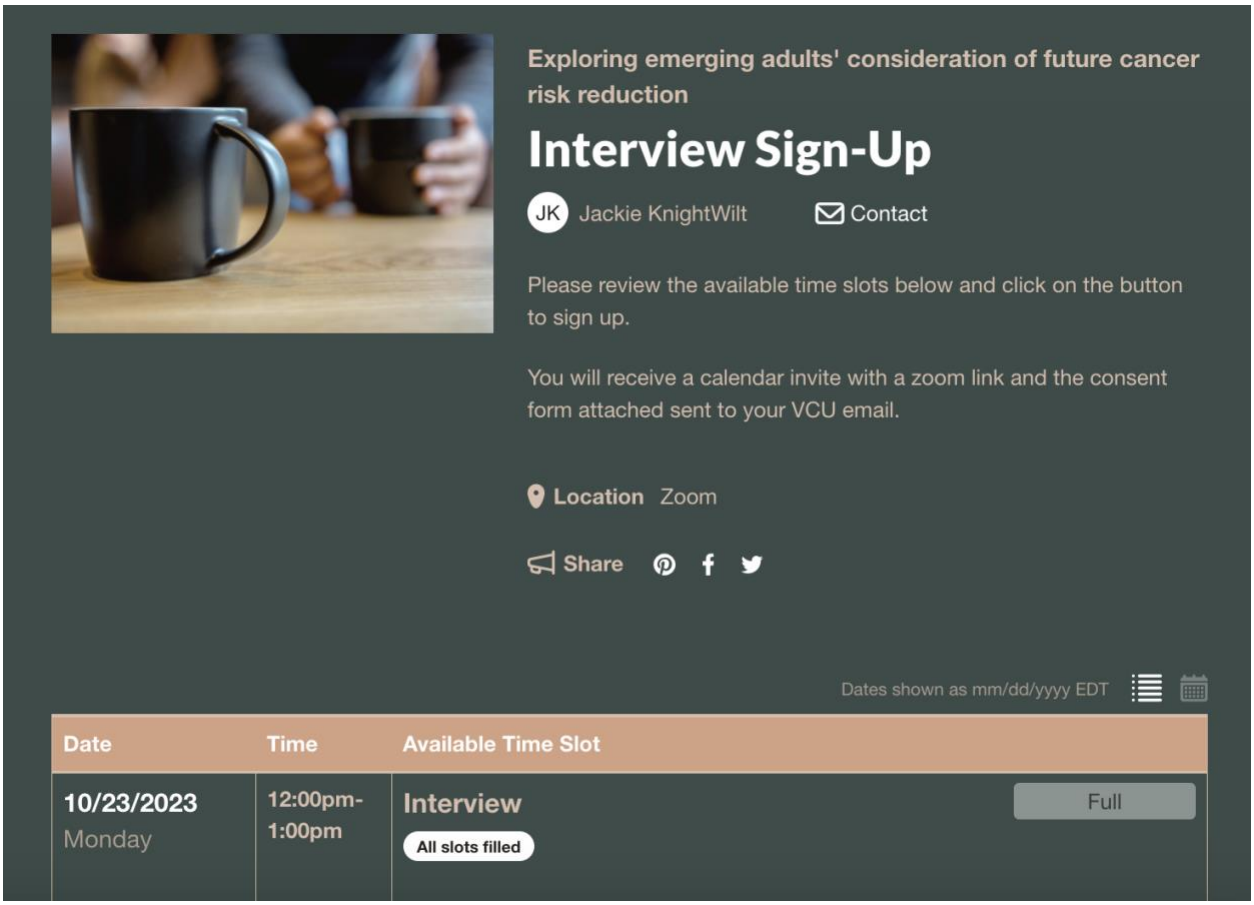
Additional times have been added since I contacted you two weeks ago. If the times allotted do not fit your schedule please reply to this email so we can coordinate a different time for your interview.

Warmly,

Jacqueline Knight Wilt, PhD Candidate
knightwij@vcu.edu

Maria Thomson, PhD
Principal Investigator
mthomson2@vcu.edu

APPENDIX G. Interview Scheduler



APPENDIX H. Interview Research Participant Information Sheet

RESEARCH PARTICIPANT INFORMATION SHEET

STUDY TITLE: Exploring emerging adults' consideration of future cancer risk reduction: Opportunity for shifting prevention paradigms?

VCU INVESTIGATORS: Maria Thomson, PhD, and Jacqueline Knight Wilt, PhD Candidate

You are being invited to participate in a research study about college students' (1) consideration of future cancer risk, and (2) current preventive health factors including behaviors and stress exposure. This is a dissertation study for a PhD student in VCU's Department of Health Behavior and Policy with support from University of Student Health Services and TRiO Student Support Services. Your participation is voluntary.

WHAT WILL HAPPEN IF I CHOOSE TO PARTICIPATE?

This study includes a survey and follow-up interviews with a random subset of participants. If you decide to participate in this interview, you will be asked questions about your health behavior intentions, how those relate to consideration of your future health, and factors that influence enacting your current health intentions. The interview will last about 45 minutes, take place on VCU Zoom, be recorded, and transcribed verbatim.

WILL I BE PAID TO PARTICIPATE IN THE STUDY?

You will receive a $20 Amazon e-gift card for participating in the interview. Your e-gift card will be sent to your VCU email.

WHOM SHOULD I CONTACT IF I HAVE QUESTIONS ABOUT THIS STUDY?

The investigators listed below are the best person(s) to contact if you have any questions, complaints, or concerns about your participation in this research study:

Jacqueline Knight Wilt, PhD Candidate
knightwij@vcu.edu
(804) 495-1318

OR

Maria Thomson, PhD

Principal Investigator

Maria.thomson@vcuhealth.org

(804) 628 - 2640

APPENDIX I. Interview Guide

College Student Cancer Future Orientation Interview Guide

Thank you for agreeing to participate in this interview. The purpose of the following questions is to understand more about your health-related behavior intentions and what you think about your future cancer risk. There are no right or wrong answers, I am interested in your thoughts and experiences. The interview should last about 45 minutes and I will be recording it to make sure I get everything that you tell me correctly. This recording will be destroyed once it is transcribed, and your name will not be associated with the recording or transcript. Are you ready to begin?

1. **Can you begin by telling me a little about yourself and experience as a VCU student?**
   PROBES: How is your coursework going? What is your social life like? What are your regular activities?

2. **What do you know about cancer prevention and screenings?**
   PROBES: What are some ways people can lower their risk of getting cancer? What have you heard about cancer screenings? What have you heard about vaccines?

3. **When you think about your health-related behaviors before becoming a VCU student, how does it compare to your current behaviors?**
   PROBES: How about your lifestyle health behaviors like eating, exercising, sleeping, drinking? What about cancer prevention? How about seeking out healthcare services?

4. **Could you tell me about your health behavior intentions while you're here at school, whether you'd like to maintain or change them and how?**
   PROBES: How about your lifestyle health behaviors? What about cancer prevention? How about seeking out healthcare services?

5. **What factors influence your current health behavior intentions while you're here at school?**
   PROBES: How do you balance being a student and your health behavior intentions? What supports your intentions/actions? What hinders your intentions/actions?

6. **Thinking about five years from now when you transition into early adulthood – what are your health behavior intentions, whether you'd like to maintain or change them and how?**

PROBES: How about your lifestyle health behaviors? What about cancer prevention? How about seeking out healthcare services?

7. **So, when you think about your health behavior intentions, how do they relate to your perceived risk of getting cancer in the future?**
   PROBES: What about your current intentions? How about your intentions for the future?

8. **What resources or services at VCU could help prepare you to transition your health behavior intentions when you graduate?**

9. **Thank you for participating today. Is there anything that you'd like to share that I haven't asked about?**

APPENDIX J. Findings One Pager

EXPLORING EMERGING ADULTS' CONSIDERATION OF FUTURE CANCER RISK REDUCTION: OPPORTUNITY FOR SHIFTING PREVENTION PARADIGMS?

Summary of Dissertation Findings

To what extent do students consider their future cancer risk?

- 67% of students have family history of cancer
- 77% average score for colorectal cancer knowledge
- 72% HPV vaccinated
- Moderate consideration of future cancer risk
  - Related to GPA, protective lifestyle health behaviors and colorectal cancer knowledge

Do first-generation/low-income (FGLI) students consider their future cancer risk differently?

- FGLI students 19% Black and 17% Hispanic/Latino
- Higher present and chronic stress
- Less HPV vaccinated (64%)
- Lower CRC knowledge
- Similar consideration of future cancer risk
  - Related to stress management skills and colorectal cancer knowledge

What are students thoughts about their health behavior intentions given their future cancer risk?

- Group with High consideration of cancer risk had greatest knowledge of cancer screening and lifestyle health risk factors.
- 87% of High consideration group believe their current health behaviors will help reduce their cancer risk; only 54% in the Low group.
- Students want cancer prevention education.
- Low consideration group prefers indirect education (i.e., email, flyer), while High group preferred direct (i.e., seminar/appointments).

AT A GLANCE

Survey Participants

- N=282, 13% response rate
- 77% female at birth
- 41% White, 23% Asian, 19% Black
- 67% Upperclassmen
- 27% First-Gen Student, 40% Need-based financial aid; 46% FGLI

Interview Participants

- N=43, 34% response rate
  - Low (n=13), Medium (n=14), High (n=16) consideration of cancer risk
- 81% female at birth
- 42% White, 30% Asian, 12% Black
- 21% First-Gen Student, 30% Need-based financial aid, 37% FGLI

Jackie Knight Wilt

PhD Candidate
Dissertation Defense: July 12, 2024

Over 10 years of experience in health promotion and social science mixed methods research that informs evidence-based practices. Skilled in applying the collective impact framework to enact public health approaches that support health equity.