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Active social engagement and health among older adults: assessing differences by cancer survivorship status

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Abstract

Introduction The number of older adults who are cancer survivors is rapidly growing. Evidence is needed to inform interventions to support successful aging among older adults (including older adult cancer survivors). Active engagement with life, that is, spending time with family and/or close friends, may be related to health outcomes, but this concept remains understudied.

Methods We used survey data to assess active engagement among older adults (ages 50+ years) from seven mid-Atlantic US states ($n=2,914$), and geocoded their residence to collect collected measures of community availability of social interaction. Outcomes were physical and mental health-related quality of life (HRQoL), assessed with the SF-12. We used multivariable, multilevel linear regression to evaluate relationships between social interactions (i.e., "active engagement with life," or visiting with family and/or friends at least once per week and having at least three close friends, and community-level availability, measured with census tract-level park land and walkability and with county-level availability of social associations) and HRQoL. Finally, we explored differences in these relationships by recent cancer survivorship.

Results Overall, 1,518 (52.3%) participants were actively engaged. Active engagement was associated with higher physical HRQoL (estimate = 0.94, standard error [SE] = 0.46, $p = .04$) and mental HRQoL (estimate = 2.10, SE = 0.46, $p < .001$). The relationship between active engagement and physical HRQoL was stronger for recent cancer survivors (estimate = 4.95, SE = 1.84, $p < .01$) than for the general population (estimate = 1.10, SE = 0.43, $p = .01$). Community-level availability of social interaction was not associated with HRQoL.

Conclusion Our analysis demonstrated promising associations between active engagement with life and HRQoL among older adults, with large benefits for older cancer survivors. Additional research is needed on how active engagement is associated with better HRQoL, which can inform future policies and programs to optimize the aging process in the US.

Keywords Aging, Older adults, Health-related quality of life, Active engagement with life, Cancer, Cancer survivorship

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Older adults comprise one of the fastest-growing sub-categories of the cancer survivor population [1]. Cancer diagnoses among individuals ages 65+ years are expected to double in the next decade, and they will account for 67% of new cancer cases [2]. In addition, advances in screening, treatment, and supportive care have resulted in improved cancer outcomes, increasing the number of older adult cancer survivors [3]. Cancer diagnosis and treatment can negatively impact survivors' physical and emotional health for years [4], with consequences across several domains, e.g., relationships, finances, healthcare seeking, and activities of daily living [5].

For cancer survivors and other older adults, maintaining health is a crucial part of aging. The normal aging process is highly nuanced, including the distinction between "usual" and "successful" aging introduced by Rowe and Kahn [6–8] in the 1980s. Usual aging is characterized by non-pathological, age-related cognitive and physical losses, while successful aging harnesses lifestyle factors (e.g., healthy diet) and psychosocial processes (e.g., social support) to moderate the aging process. Successful aging is characterized by three measurable components: (1) minimal disease and disability, (2) high mental and physical functioning, and (3) "active engagement with life" [7, 9]. This latter component encompasses having high-quality social/interpersonal relationships and engaging in meaningful activity [8, 10, 11]. Active engagement in social relationships can provide a sense of belonging, social identity, and fulfilment [12], and suboptimal engagement has been associated with physical inactivity, prolonged sitting time, unhealthy sleep duration, perceived depression, poor self-rated health, and lower health-related quality of life (HRQoL) among older adults [12–14]. These relationships hold true for older cancer survivors, as well [15–18].

Supportive environments can foster active engagement with life among older adults. Community gerontology [19, 20] emphasizes the importance of the built and natural environment for shaping social interactions and individual behaviour [21]. A key aspect of the environment relevant to active engagement is the availability of 'third places' [22] (i.e., places outside of home or work, such as libraries and bowling alleys) for older adults to gather and interact [23, 24]. However, the relationship between community-level availability of venues for social interactions and individual-level active engagement, as well as the impact of these variables on health among older adults, is understudied. In particular, the impact of community- and individual-level social interactions on health among older cancer survivors is not well understood, especially in the context of their complex health needs [3, 4].

The purpose of this study is to examine the relationships among community-level availability of 'third places'

for social interaction, individual-level active engagement with life, and individual-level physical and mental HRQoL scores among older adults. Further, we contrasted these relationships for older cancer survivors compared to other older adults. The findings have implications for programs and policies to improve health and HRQoL among the growing population of older adults, including older cancer survivors.

Materials and methods

Data source

We conducted a secondary analysis of a dataset focused on social cohesion and health outcomes among adults ages 50+ years in seven mid-Atlantic states (Delaware, Maryland, Ohio, Pennsylvania, New Jersey, New York, and West Virginia). Eligibility criteria included being comfortable completing the survey in English and able to provide informed consent. Participants were recruited through the online survey research group Qualtrics in February–August 2021. Full details on study design, recruitment, and data collection are available elsewhere [25]. Overall, 2,966 participants completed the survey.

Then, we used data provided by Qualtrics to geocode participants' residence. Our analytic sample includes 2,914 participants (98.3%) who were successfully geocoded to a census tract and county within our target region.

Measures

Key study concepts were social interaction, cancer survivorship, sociodemographic characteristics, and health outcomes. These concepts were drawn from self-reported survey responses and geocoded data.

Social interaction

The primary measure of social integration was 'active engagement with life' [6], operationalized as (1) visiting with family and/or friends 1+ times per week and (2) having 3+ close friends [26]. Participants were coded as 'actively engaged' if they met both criteria, and all others were coded as 'not actively engaged.' Although this concept was originally proposed by Rowe and Kahn in the 1980s [6], relatively few studies have analyzed it empirically; however, among published studies, active engagement has been associated with better quality of life, even after adjusting for age-associated illness [26, 27]. In our sample, participants' reported frequency of visiting with friends and the number of close friends were weakly correlated ($r=0.14$, $p<0.001$).

In addition, we gathered census tract- and county-level measures reflecting the availability or potential for social interaction within a given community. At the census tract level, we included the percent of land defined as a park

(according to OpenStreetMap, potential range: 0–100%), as well as the walkability score developed by the Environmental Protection Agency (potential range: 1–20, with higher scores indicating greater walkability) [28]. At the county level, we included the number of social associations (e.g., civic associations, sports organizations, religious organizations) per 10,000 population, drawn from the County Health Rankings dataset (observed range: 2.7–28.9) [29].

Cancer survivorship

We assessed recent cancer survivorship status using one item from a modified Charlson Comorbidity Index [30]. The item asked, “As far as you know do you have any of the following health conditions at the present time? Cancer diagnosed in the past 3 years?” Participants who selected “yes” were categorized as cancer survivors, and participants who selected “no” were categorized as general population.

Sociodemographic characteristics

We assessed a number of sociodemographic characteristics based on their established relationships with health outcomes. These characteristics were sex (male or female), age group (<65 years or 65+ years), race/ethnicity (non-Hispanic White; non-Hispanic Black; Hispanic; or Other), sexual orientation (straight/heterosexual or lesbian, gay, or bisexual), marital status (married/living as married, widowed, or other), educational attainment (high school degree or less; greater than a high school degree but less than a 4-year college degree; or 4-year college degree or higher), and annual household income (\$0–49,999; \$50,000–99,999; or \$100,000 or more). We also assessed residential stability (i.e., having lived in the same house for <10 years or 10+ years). We categorized participants as urban or rural using the 2013 USDA county-level rural–urban continuum codes [31].

Health outcomes

We assessed physical and mental HRQoL using the SF-12 instrument, which has demonstrated adequate psychometric properties in several studies of the general population [32]. Participants responded to 12 items, which we used to generate the physical health T-score and the mental health T-score, separately, using standard scoring procedures. Scores range from 0 to 100, with higher scores indicating higher HRQoL.

Statistical analysis

First, to describe the sample, we generated summary statistics of the participants’ sociodemographic characteristics. Then, we assessed differences in these sociodemographic characteristics for participants who were categorized as

‘not actively engaged’ compared to ‘actively engaged’ using chi-square tests.

Next, we generated summary statistics for the physical and mental HRQoL scores. We estimated unadjusted associations for each sociodemographic characteristic and social interaction variable with each HRQoL score using bivariate linear regression models, adjusting for clustering by census tract. From these models, we report the effect estimate (est.) and standard error (SE) of each association.

In addition, we used moderation analysis procedures to evaluate whether the observed relationships varied for cancer survivors compared to other older adults. To do so, we added to the bivariate regression models a multiplicative interaction term for each sociodemographic characteristic and social interaction variable (separately) with cancer survivorship status. We used the Wald chi-square statistic to evaluate whether the interaction term contributed significantly to the explanatory power of the model. For interaction terms with $p < 0.10$ and for the interaction with active engagement (planned a priori), we probed the interaction by stratifying the data by cancer survivorship and re-estimating the association between the moderating variable and the HRQoL score.

Finally, we estimated adjusted associations between sociodemographic characteristics and social interaction variables with physical HRQoL and with mental HRQoL using multivariable linear regression models, adjusting for clustering by census tract.

Statistical analyses used a two-sided p -value of 0.05, except tests of interaction, which used a two-sided p -value of 0.10. Analyses were conducted with SAS version 9.4 (Cary, NC). Study procedures and analysis for this project were approved by the Penn State College of Medicine Institutional Review Board/Human Subjects Protection Office.

Results

Among the 2,914 participants, 189 (6.6%) were recent cancer survivors (Table 1). Participants were predominantly non-Hispanic White (78.2%), straight/heterosexual (96.2%), and married/living as married (60.4%). Most participants (71.1%) had lived in the same home for 10+ years, and 63.2% lived in an urban county.

Overall, 1,383 (47.7%) participants were categorized as ‘not actively engaged,’ and 1,518 (52.3%) were categorized as ‘actively engaged’ (Table 1). Compared to participants who were not actively engaged, participants who were actively engaged lived in census tracts with lower percent park land and lower walkability scores (both $p < 0.05$). Active engagement also varied by participant sex, age group, race/ethnicity, marital status, educational attainment, and annual household income (all $p < 0.05$).

Table 1 Descriptive statistics for analytic sample of older adults (ages 50+ years) in seven mid-Atlantic states ($n = 2,914$), stratified by active engagement with life

	Overall		Not actively engaged ($n = 1,383$)		Actively engaged ($n = 1,518$)		<i>p</i>
	mean	SE	mean	SE	mean	SE	
Percent of park land (census tract)	8.10	0.57	8.84	0.73	7.45	0.56	0.03
Walkability score (census tract)	10.34	0.12	10.54	0.15	10.17	0.13	0.01
Social associations (county)	10.12	0.12	9.97	0.15	10.25	0.13	0.06
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>p</i>
Recent cancer survivorship							0.40
General population	2,658	93.4	1,261	93.8	1,388	93.0	
Cancer survivor	189	6.6	83	6.2	104	7.0	
Sex							0.04
Male	1,234	42.4	558	40.4	670	44.2	
Female	1,676	57.6	824	59.6	845	55.8	
Age group							<.01
50–65 years	1,208	41.5	614	44.5	587	38.7	
65+ years	1,702	58.5	767	55.5	929	61.3	
Race/ethnicity							<.001
Non-Hispanic White	2,278	78.2	1,015	73.4	1,251	82.4	
Non-Hispanic Black	312	10.7	187	13.5	125	8.2	
Hispanic	97	3.3	52	3.8	45	3.0	
Other	227	7.8	129	9.3	97	6.4	
Sexual orientation							0.84
Straight/heterosexual	2,786	96.2	1,320	96.3	1,458	96.4	
Lesbian, gay, or bisexual	109	3.8	51	3.7	54	3.6	
Marital status							<.001
Married/living as married	1,758	60.4	796	57.6	956	63.0	
Widowed	313	10.7	136	9.8	174	11.5	
Other	842	28.9	451	32.6	387	25.5	
Educational attainment							<.01
High school degree or less	684	23.5	360	26.1	317	20.9	
Less than college degree	1,021	35.1	476	34.5	544	35.9	
College degree or higher	1,204	41.4	545	39.5	656	43.2	
Annual household income							<.001
\$0–49,999	1,280	44.0	691	50.0	582	38.5	
\$50,000–99,999	974	33.5	436	31.6	535	35.4	
\$100,000 or more	652	22.4	254	18.4	396	26.2	
Residential stability							0.05
< 10 years	838	28.9	420	30.5	413	27.3	
10+ years	2,064	71.1	955	69.5	1,102	72.7	
Rurality							0.81
Urban	1,841	63.2	872	63.1	964	63.5	
Rural	1,073	36.8	511	36.9	554	36.5	

Social interaction and physical HRQoL

On average, participants' physical HRQoL score was 46.45 ($SE = 0.22$). In bivariate analysis, physical HRQoL was higher for actively engaged participants (mean = 47.10, $SE = 0.29$) compared to not actively engaged participants (mean = 45.74, $SE = 0.33$)

(est. = 1.36, $SE = 0.44$, $p < 0.01$; Table 2, Fig. 1). In addition, physical HRQoL was positively associated with census tract-level walkability and negatively associated with county-level social associations (both $p < 0.01$; Table 2). Physical HRQoL also varied by recent cancer survivorship, marital status, educational attainment,

Table 2 Associations between social interaction, cancer survivorship, and sociodemographic characteristics with physical health-related quality of life scores among older adults (ages 50+ years) in seven mid-Atlantic states (n = 2,914)

	mean	SE	Bivariate models			Multivariable model		
			est	SE	p	est	SE	p
<i>Social interaction</i>								
Active engagement (individual)								
Not actively engaged	45.74	0.33	(ref)			(ref)		
Actively engaged	47.10	0.29	1.36	0.44	< .01	0.94	0.46	0.04
Percent of park land (census tract)								
Walkability score (census tract)			-0.01	0.02	0.48	-0.02	0.02	0.27
Social associations (county)			0.17	0.06	< .01	0.03	0.07	0.67
<i>Cancer survivorship</i>								
Recent cancer survivorship								
General population	46.88	0.22	(ref)			(ref)		
Cancer survivor	42.03	0.93	-4.85	0.95	< .001	-4.75	1.02	< .001
<i>Sociodemographic characteristics</i>								
Sex								
Male	46.64	0.32	(ref)			(ref)		
Female	46.28	0.29	-0.35	0.43	0.41	0.29	0.47	0.54
Age group								
50–65 years	46.18	0.35	(ref)			(ref)		
65+ years	46.64	0.28	0.46	0.44	0.30	0.05	0.47	0.91
Race/ethnicity								
Non-Hispanic White	46.42	0.25	(ref)			(ref)		
Non-Hispanic Black	45.74	0.62	-0.68	0.67	0.32	0.63	0.77	0.41
Hispanic	46.46	1.22	0.04	1.24	0.97	0.37	1.47	0.80
Other	47.73	0.65	1.32	0.70	0.06	0.56	0.72	0.43
Sexual orientation								
Straight/heterosexual	46.51	0.22	(ref)			(ref)		
Lesbian, gay, or bisexual	44.46	1.19	-2.06	1.21	0.09	-0.89	1.18	0.45
Marital status								
Married/living as married	47.17	0.27	(ref)			(ref)		
Widowed	43.80	0.69	-3.37	0.75	< .001	-2.49	0.88	< .01
Other	45.93	0.41	-1.25	0.48	< .001	-0.23	0.57	0.69
Educational attainment								
High school degree or less	44.42	0.46	(ref)			(ref)		
Less than college degree	44.73	0.38	0.31	0.58	0.60	-0.39	0.66	0.55
College degree or higher	49.07	0.28	4.65	0.54	< .001	2.45	0.66	< .001
Annual household income								
\$0–49,999	43.93	0.34	(ref)			(ref)		
\$50,000–99,999	47.74	0.35	3.81	0.48	< .001	2.48	0.58	< .001
\$100,000 or more	49.34	0.38	5.41	0.50	< .001	2.81	0.67	< .001
Residential stability								
< 10 years	44.87	0.41	(ref)			(ref)		
10+ years	47.11	0.25	2.24	0.48	< .001	1.59	0.52	< .01
Rurality								
Urban	47.52	0.26	(ref)			(ref)		
Rural	44.62	0.36	-2.91	0.44	< .001	-1.77	0.52	< .001

Est. estimate, SE standard error, ref reference category

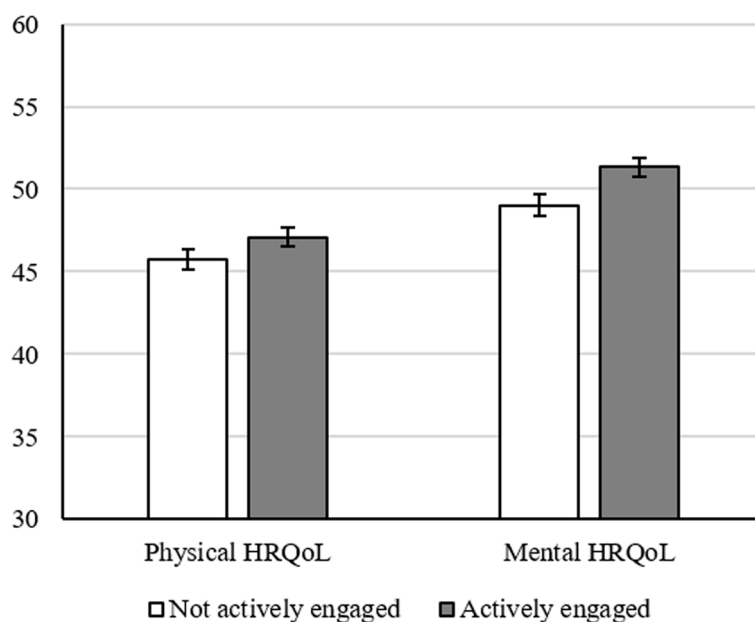


Fig. 1 Physical and mental health-related quality of life (HRQoL) scores by ‘active engagement with life’ among older adults (ages 50+ years) in seven mid-Atlantic states ($n=2,914$) (error bars indicate 95% confidence intervals)

annual household income, residential stability, and rurality (all $p < 0.001$).

In exploratory moderation analysis of differences in these relationships by recent cancer survivorship, we found evidence for one interaction. The relationship between active engagement and physical HRQoL depended on cancer survivorship status (interaction $p=0.05$). Specifically, among the general population, physical HRQoL was higher for actively engaged versus not actively engaged participants (mean = 47.40, $SE=0.29$, and mean = 46.29, $SE=0.34$, respectively; bivariate est. = 1.10, $SE=0.43$, $p=0.01$), and among cancer survivors, this relationship was even stronger (mean = 44.29, $SE=1.22$, and mean = 39.34, $SE=1.40$, respectively; bivariate est. = 4.95, $SE=1.84$, $p < 0.01$) (Fig. 2A; for multivariable estimates stratified by cancer survivorship status, see Supplementary Table S1).

In multivariable analysis, active engagement was associated with higher physical HRQoL, even after adjusting for cancer and sociodemographic characteristics (est. = 0.94, $SE=0.46$, $p=0.04$) (Table 2). Physical HRQoL was negatively associated with recent cancer survivorship (est. = -4.75, $SE=1.02$, $p < 0.001$). In addition, physical HRQoL was higher for participants with greater educational attainment, household income, and residential stability, and it was lower for widowed participants and rural participants, compared to their reference groups (all $p < 0.01$).

Social interaction and mental HRQoL

On average, participants’ mental HRQoL score was 50.22 ($SE=0.22$). In bivariate analysis, mental HRQoL was higher for actively engaged participants (mean = 51.33, $SE=0.28$) compared to not actively engaged participants (mean = 49.03, $SE=0.33$) (est. = 2.30, $SE=0.43$, $p < 0.001$; Table 3, Fig. 1). None of the other social interaction variables was associated with mental HRQoL in bivariate analysis. Mental HRQoL varied by recent cancer survivorship, sex, age group, race/ethnicity, sexual orientation, marital status, annual household income, residential stability, and rurality (all $p < 0.05$).

In exploratory moderation analysis of differences in these relationships by recent cancer survivorship, we found evidence for one interaction. The relationship between residential stability and mental HRQoL depended on cancer survivorship status (interaction $p=0.10$). Specifically, among the general population, mental HRQoL was higher for participants who had been living in the same home for 10+ years compared to <10 years (mean = 51.11, $SE=0.26$, and mean = 49.17, $SE=0.45$, respectively; est. = 1.93, $SE=0.48$, $p < 0.001$), and among cancer survivors, this relationship was even stronger (mean = 49.98, $SE=1.08$, and mean = 44.56, $SE=1.71$, respectively; est. = 5.42, $SE=1.94$, $p < 0.01$). We also probed the interaction for active engagement (interaction $p=0.16$), finding that, mental HRQoL was higher for actively engaged versus not actively

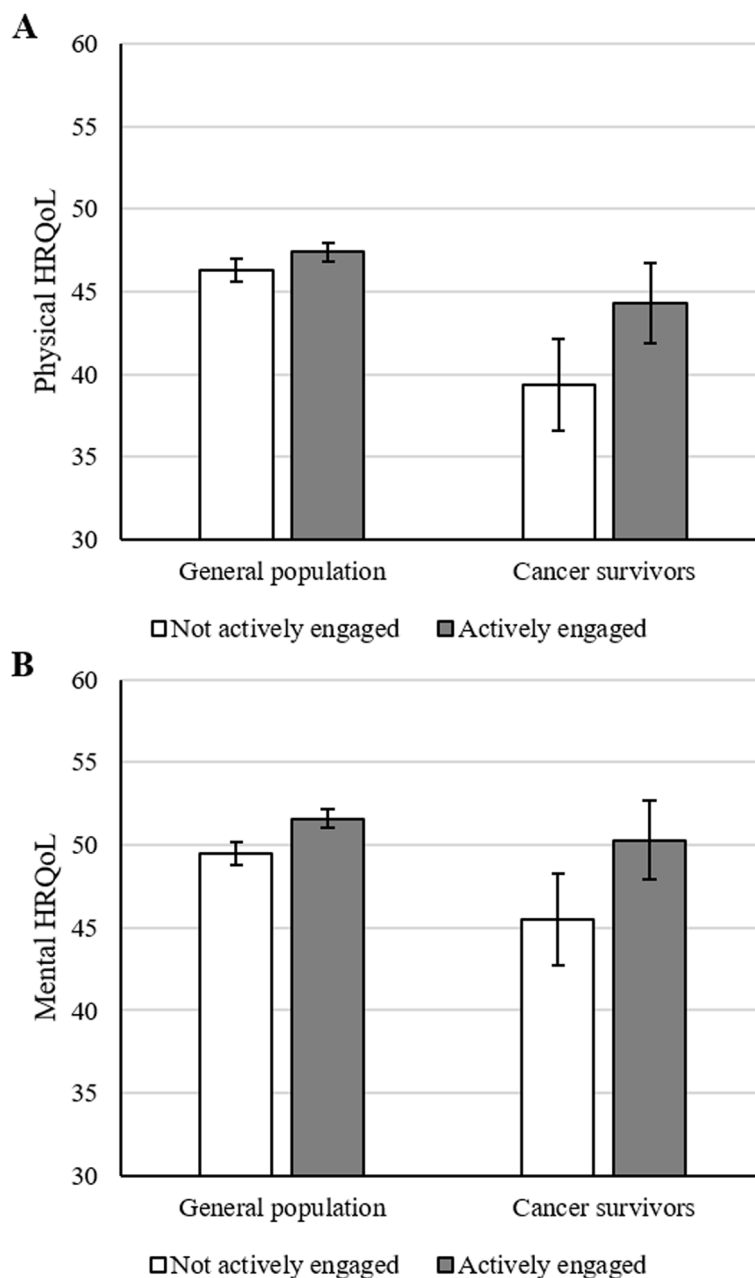


Fig. 2 Physical (panel A) and mental (panel B) health-related quality of life (HRQoL) scores by ‘active engagement with life’ and recent cancer survivorship status among older adults (ages 50+ years) in seven mid-Atlantic states ($n = 2,914$) (error bars indicate 95% confidence intervals)

engaged participants, both among the general population (mean = 51.59, $SE = 0.28$, and mean = 49.47, $SE = 0.35$, respectively; $est. = 2.11$, $SE = 0.44$, $p < 0.001$) and among cancer survivors (mean = 50.31, $SE = 1.15$, and mean = 45.48, $SE = 1.48$, respectively; $est. = 4.83$, $SE = 1.84$, $p < 0.01$) (Fig. 2B).

In multivariable analysis, active engagement was associated with higher mental HRQoL, even after adjusting for cancer and sociodemographic characteristics ($est. = 2.10$,

$SE = 0.46$, $p < 0.001$) (Table 3). None of the other social interaction variables was associated with mental HRQoL in multivariable analysis. Mental HRQoL was negatively associated with recent cancer survivorship ($est. = -2.96$, $SE = 1.03$, $p < 0.01$). In addition, mental HRQoL was higher for participants in the older age group, with non-Hispanic Black or Other race/ethnicity, and with greater household income, and it was lower for participants who were female or with ‘other’ marital status (all $p < 0.05$; Table 2).

Table 3 Associations between social interaction, cancer survivorship, and sociodemographic characteristics with mental health-related quality of life scores among older adults (ages 50+ years) in seven mid-Atlantic states (n = 2,914)

	mean	SE	Bivariate models			Multivariable model		
			est	SE	p	est	SE	p
<i>Social interaction</i>								
Active engagement (individual)								
Not actively engaged	49.03	0.33	(ref)			(ref)		
Actively engaged	51.33	0.28	2.30	0.43	< .001	2.10	0.46	< .001
Percent of park land (census tract)								
Walkability score (census tract)			-0.02	0.01	0.24	-0.02	0.01	0.16
Social associations (county)			-0.13	0.07	0.06	-0.06	0.07	0.42
<i>Cancer survivorship</i>								
Recent cancer survivorship								
General population	50.56	0.22	(ref)			(ref)		
Cancer survivor	48.14	0.95	-2.42	0.96	0.01	-2.96	1.03	< .01
<i>Sociodemographic characteristics</i>								
Sex								
Male	51.60	0.32	(ref)			(ref)		
Female	49.22	0.29	-2.38	0.43	< .001	-1.50	0.48	< .01
Age group								
50–65 years	47.87	0.36	(ref)			(ref)		
65+ years	51.89	0.27	4.03	0.46	< .001	3.74	0.50	< .001
Race/ethnicity								
Non-Hispanic White	50.12	0.25	(ref)			(ref)		
Non-Hispanic Black	50.32	0.67	0.19	0.71	0.79	2.27	0.79	< .01
Hispanic	47.90	1.26	-2.22	1.28	0.08	0.08	1.50	0.96
Other	51.97	0.70	1.84	0.74	0.01	2.37	0.85	< .01
Sexual orientation								
Straight/heterosexual	50.33	0.22	(ref)			(ref)		
Lesbian, gay, or bisexual	47.48	1.30	-2.85	1.31	0.03	-1.68	1.41	0.23
Marital status								
Married/living as married	51.48	0.26	(ref)			(ref)		
Widowed	48.85	0.71	-2.62	0.75	< .001	-2.40	0.86	< .01
Other	48.09	0.45	-3.39	0.52	< .001	-2.27	0.58	< .001
Educational attainment								
High school degree or less	50.04	0.47	(ref)			(ref)		
Less than college degree	49.50	0.39	-0.54	0.61	0.38	-1.59	0.65	0.01
College degree or higher	50.96	0.31	0.92	0.56	0.10	-1.26	0.65	0.05
Annual household income								
\$0–49,999	48.18	0.37	(ref)			(ref)		
\$50,000–99,999	51.65	0.36	3.48	0.53	< .001	1.76	0.61	< .01
\$100,000 or more	52.04	0.38	3.87	0.52	< .001	1.67	0.69	0.01
Residential stability								
< 10 years	48.56	0.44	(ref)			(ref)		
10+ years	50.92	0.26	2.35	0.51	< .001	0.94	0.53	0.08
Rurality								
Urban	50.77	0.26	(ref)			(ref)		
Rural	49.27	0.38	-1.51	0.46	< .01	-0.34	0.54	0.53

Est. estimate, SE standard error, ref reference category

Discussion

In this secondary data analysis of older adults in seven mid-Atlantic states, we examined the relationships among community-level availability of resources for social interaction, individual-level active engagement with life, and individual-level physical and mental HRQoL scores. Findings suggest that actively-engaged older adults experience better health compared to older adults who are not actively engaged. In the final models, active engagement was associated with higher mental HRQoL (+2.10 points, $p < 0.001$), which represents a clinically-significant difference for this outcome [33]. The association between active engagement and physical HRQoL was smaller, but still meaningful (+0.94 points, $p = 0.04$). Our findings demonstrate the importance of the concept of “active engagement with life” [7, 9] for maintaining HRQoL in older adulthood, which can lead to improved clinical outcomes, such as reduced depressive and gastrointestinal symptoms [34]. For recent cancer survivors, the relationship between active engagement with life and physical HRQoL was even stronger than for the general population (interaction $p = 0.05$). Supporting older cancer survivors’ HRQoL is crucial, because poor HRQoL has been associated previously with frailty, pain, and fatigue [35]. However, meso-level variables – reflecting the availability of ‘third places’ for community members to interact – were not related to older adults’ HRQoL in the final models. These findings have implications for community care for older adults, including older cancer survivors, to support successful aging. Future qualitative research is needed to identify facilitators and barriers to active engagement with life among older adults, as well as intervention studies evaluating the causal relationship between active engagement and HRQoL/clinical outcomes.

The concept of “active engagement with life” [7, 9] and its relevance to health outcomes, is not well studied [9], and additional research is needed to clarify its importance. To date, most research into active engagement and health has focused on elderly samples (ages 60+ years) [36–38], which limits insights into the earlier phases of the aging process. Although the current study included participants as young as 50 years, additional research is needed to understand longitudinal and life course influences on the relationship between active engagement and health across younger decades. Interestingly, in our sample, active engagement was more common among the 65+ year age group than the 50–65 year age group, which resonates with existing literature demonstrating that senior adults (ages 65+) cultivate vibrant and satisfactory social relationships [39]. Another explanation for this age difference in active engagement is that social well-being improves physiological functioning and survival into

older age [40, 41]. Further, some research indicates that active engagement may hold more or less importance for aging across different cultural groups [42] or nations [43–46]. For example, Mjelde-Mossey and colleagues [46] suggest that, in traditional Chinese culture, older adults maintain highly-integrated and valued relationships with their family members, which could impact the relationship between active engagement and health. In the current study, we identified differences in active engagement across several sociodemographic characteristics (e.g., sex, race/ethnicity, educational attainment). Cross-cultural studies of the psychometric properties of active engagement measures could quantify these differences in response patterns and their implications for health. In addition, additional research is needed on how the relationship between active engagement and health differs from other concepts capturing dimensions of social life, such as loneliness. While active engagement is measured in terms of people’s social behaviors (i.e., having and spending time with family and friends [26]), loneliness refers to people’s perceptions about the quality of their social activities [47, 48]. These concepts are distinct but interrelated, and increasing “active engagement” may be especially challenging for people experiencing loneliness [47, 49]. Active engagement, loneliness, and other dimensions of social life may impact health through shared mechanisms, such as psychological processes related to stress perception [47]. Finally, it should be noted that we hypothesized a process by which active engagement leads to higher HRQoL, but the reverse relationship is also possible, i.e., that people with higher HRQoL may be more willing and able to actively engage with their social contacts. Future studies should parse the temporality of this relationship. In summary, active engagement with life has demonstrated promising associations with health outcomes in the current study, but additional research is needed to identify for whom and how this concept impacts health.

We extended our analysis of active engagement and HRQoL by incorporating meso-level variables capturing availability of social interaction in participants’ communities. In bivariate models, census tract-level walkability and county-level social associations were associated with physical HRQoL, but these relationships lost statistical significance in the adjusted multivariable models. This could suggest that other variables in the adjusted models (e.g., active engagement with life) contribute to the relationship between these meso-level variables and physical HRQoL. For example, walkability may be associated with greater active engagement, which in turn contributes to better physical HRQoL. More broadly, these findings provide qualified support for community gerontology frameworks that emphasize the importance

of environmental factors for health among older adults [19, 20]. That is, some of the environmental factors we assessed were associated with physical HRQoL among older adults in the bivariate analyses, but lost statistical significance after controlling for individual-level factors, suggesting that these latter factors are more immediately related to HRQoL. Future longitudinal and qualitative research studies should examine how meso-level factors influence HRQoL and other health outcomes.

The observed association between active engagement and HRQoL outcomes was greater for recent cancer survivors compared to other older adults (physical HRQoL: interaction $p=0.05$; mental HRQoL: interaction $p=0.16$). Consistent with our findings, prior research suggests that social support is associated with reduced mortality, depression, and anxiety among older cancer survivors [50]. Active engagement may be particularly important for older cancer survivors compared to other older adults as a result of the new and multiple social support needs of cancer survivorship. For example, cancer survivors often require social support for survivorship care planning, travelling to and from medical appointments, and managing emotional and physical symptoms related to cancer treatment during their reintegration into the community after treatment [51, 52]. However, over two-thirds of older adult cancer survivors report one or more unmet social support needs [53]. Additional research is needed to investigate changes in older adult cancer survivors' social needs during acute and long-term survivorship, and to develop interventions targeting HRQoL through active engagement with life and social support. This area of research will become increasingly important as the number of older cancer survivors increases dramatically in the coming decades [1, 2, 54].

Importantly, the results described above are in addition to demonstrated differences in HRQoL by participants' sociodemographic characteristics. In the final multivariable model, physical HRQoL varied by marital status, educational attainment, household income, residential stability, and rurality. Similarly, mental HRQoL varied by sex, age group, race/ethnicity, marital status, educational attainment, and household income. Many of these relationships are well-established in the research literature on older adults and on cancer survivors [55–57]. The implications of the findings from the current study, however, emphasize that experiences of individual- and community-level social engagement are not adequate to completely overcome the impact of social determinants of health for HRQoL among older adults. In particular, certain socioeconomic indicators, that is, education and income, were associated with both physical and mental HRQoL. These factors can impact quality of life through several mechanisms, such as impacting a person's access

to health-promoting resources and opportunities [58], and our findings indicate that these pathways persist into older adulthood.

Limitations and strengths

This study has limitations. Study implications are limited by potential bias in self-reported survey data [59] and a regional, non-representative sample of older adults. Another limitation is that the data leveraged recent cancer status, which may be a time period when active engagement with life and a supportive social environment impacts cancer survivors' transition from active treatment to survivorship and reintegration into the community [60]. The limited, self-reported nature of cancer survivorship also precludes analysis of cancer type, time since diagnosis, impacts of cancer treatment, remission status, and other important factors that could influence survivorship outcomes. Given these limitations, our findings should be considered hypothesis-generating and should be used to inform more nuanced analyses of the cancer survivorship process. Further, data collection occurred through an online interface, which limits the sample to older adults with access and familiarity with digital surveys. Strengths of this study include the analysis of a large, geocoded sample of older adults. Further, this study represents a novel examination of a relatively understudied concept, i.e., active engagement in life, by cancer survivorship status and in concert with other multilevel variables that impact health among older adults.

Conclusions

In conclusion, active social engagement was positively associated with physical and mental HRQoL among older adults (ages 50+) in the mid-Atlantic region of the US. The positive relationship between active engagement and physical HRQoL was even stronger for recent cancer survivors compared to other older adults. Given the rapidly increasing population of cancer survivors and older adults in the US, evidence-based, community-located interventions are needed to support health among this population. Research, policy, and community development efforts could create opportunities for older adults to meaningfully engage with their friends and family as a way to optimize health outcomes for older adults.

Supplementary Information

The online version contains supplementary material available at <https://doi.org/10.1186/s12955-024-02281-8>.

Supplementary Material 1. Supplementary Table S1. Multivariable associations between individual-, census tract-, and county-level variables with physical health-related quality of life scores among older adults, stratified by cancer survivorship status.

Authors' contributions

All authors contributed to the study conception and analysis. Data collection, study management, and formal analysis were performed by J.M. All authors contributed to the first draft of the manuscript, commented on previous versions of the manuscript, and read and approved the final manuscript.

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Availability of data and materials

Deidentified survey data are available upon request from the first author.

Declarations

Declarations

Ethics approval and consent to participate: Study procedures and analysis for this project were approved by the Penn State College of Medicine Institutional Review Board/Human Subjects Protection Office (protocol number 16024).

Informed consent was obtained from all participants included in the study.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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