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Quality of life of older women living with HIV: comparative assessment of physical and mental health-related markers using a large Canadian Sexual and Reproductive Health Cohort Study

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ABSTRACT

Objective: This study assessed and compared physical and mental health components of quality of life (QoL) for older and younger women living with HIV (WLWH).

Method: Using survey data from the Canadian HIV Women's Sexual and Reproductive Health Cohort Study, demographic, well-being, and physical and mental health-related QoL (HR-QoL) variables were compared between older (≥ 50 years) and younger (< 50 years) WLWH. As the only significantly different QoL component, bivariate analyses and linear regression were used to assess factors associated with physical HR-QoL of older women.

Results: The sample frame comprised 1,422 women (28.0% older women). Younger WLWH's mean age was 37.8 years (SD = 7.4) compared to older WLWH (55.8 years, SD = 5.3). Compared to younger WLWH, older WLWH had poorer physical HR-QoL (40.0 vs. 50.7; $p < 0.001$) but similar mental HR-QoL (42.7 vs. 42.1; $p > 0.001$). Older WLWH had lower social support ($p < 0.001$) with no significant differences in depressive symptoms or resilience. Resilience was associated with improved physical HR-QoL. Food insecurity, poorer mental HR-QoL and depressive symptoms were associated with poorer physical health.

Discussion: Compared to younger WLWH, older WLWH had poorer physical HR-QoL, which was associated with resilience, food insecurity and mental health factors, highlighting the complex interactions of health-related social-ecological factors impacting aging WLWH.

KEYWORDS: HIV; women, health-related quality of life, mental and physical health, resilience, depression, social support

Introduction

The epidemiology of human immunodeficiency virus (HIV) infection in North America is changing; an

increasing number of individuals are reaching old age with the advent of effective combination antiretroviral therapy (cART).¹ Several studies have demonstrated that the life expectancy of people living with HIV (PLHIV) is approaching that of the general population.²⁻⁴ As such, older individuals represent an

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increasing proportion of PLHIV. In 2014, 45% of Americans living with HIV were ≥ 50 years of age.⁵ By 2020, close to 70% of American individuals living with HIV will be ≥ 50 years of age.⁶

Women are increasingly accounting for a higher proportion of PLHIV worldwide but they have traditionally been under studied and underrepresented in clinical and experimental HIV research.^{7,8} Aging among women living with HIV (WLWH) is an important area to investigate as their aging is complicated by higher rates of mental health issues as well as menopause, which makes their HIV experience different from men because some menopausal symptoms can mask or mimic HIV.⁷⁻⁹ Therefore, characterizing the health status of older WLWH relative to their younger counterparts is important for this aging population and their care providers.

As HIV has transitioned into a chronic illness with effective treatment, health-related quality of life (HR-QoL), which encompasses aspects of both physical and mental health, has become a key clinical outcome for this population.¹⁰ Degroote, Vogelaers, and Vandijck¹¹ indicated that while HR-QoL is becoming an important outcome measure in HIV care, no consensus exists about its main determinants. In their narrative review of 49 studies, the authors reported that older age was generally associated with lower physical health for PLHIV¹²⁻¹⁴ and that physical health aging, characterized by deterioration of joints, bones and organs over time, is a crucial parameter to assess in this population.

It is also imperative that the impact of HIV infection on QoL, as it relates to mental health disorders, be recognized.¹⁵ Depression is a major, yet often under-identified and under-treated, health concern for PLHIV. WLWH are seven times more likely to be depressed than those who are not infected and those who are depressed are less likely to be taking HIV medications, adhere to their regimens and achieve virologic suppression.¹⁶ Poor adherence and disengagement from care are associated with increased morbidity and mortality.^{17,18}

Compared to younger people, older individuals living with HIV (≥ 50 years) often experience reduced QoL with respect to both physical and mental health. That being said, in their series of meta-analyses involving studies that examined the relationship between mental health outcomes and QoL in PLWH, Rueda et al.¹⁹ concluded that there is a paucity of data regarding differences between older and younger PLHIV, particularly women, with existing data often in conflict. A national US study found that older individuals with HIV (≥ 50 years) had reduced physical

functioning and greater physical limitations and comorbidities compared to those < 50 years of age; no differences were reported with respect to mental health outcomes such as depression and mental health.²⁰ However, other studies have found notable differences between older and younger PLHIV. One study reported that older WLWH had significantly higher diagnosis of depression compared to younger women.⁷ Others found that older WLWH (compared to younger WLWH) reported fewer depressive symptoms, with one explanation being that aging with HIV may foster a sense of optimism and self-acceptance over time, enabling a higher degree of coping, thereby improving QoL.²¹

A focus on the QoL of WLWH respects Lazarus et al.'s conceptualization of the "fourth 90,"²² an extension of the 2016 World Health Organization (WHO) approach to HIV,²³ which contains 15 global targets, one being the 90-90-90-target. This refers to 90% of PLWHIV being tested and diagnosed, on treatment, and virally suppressed. Lazarus et al. argued that the WHO's groundbreaking strategy does not yet address the issue of promoting well-being and QoL of PLWHIV, hence the "fourth 90." By 2021, 90% of PLWHIV should have good HR-QoL meaning virally suppressed PLWHIV can "relegate their HIV infection to the periphery of their life."^{22 (p3)}

There is a discernible gap in the literature regarding HR-QoL outcomes between older and younger WLWH.^{24,25} This study was guided by two research questions: 1. What are the differences in HRQoL between older and younger WLWH? 2. What are the variables that correlate with better HRQoL for older WLWH? The variables chosen for this study arose from the literature reviewed for the research questions and were informed by an ecological approach. Moreover, the social ecological framework was used as a lens for examining aging with HIV. The ecological approach comprises five levels, which assumes that variables vary from proximal to distal but are interconnected.^{26,27}

Methods

Study population

This study involved an analysis of the data from the Canadian HIV Women's Reproductive Health Cohort (CHIWOS), a multi-site, prospective, community-based study. It included self-identified women ≥ 16 years of age living with HIV in three Canadian provinces (Ontario, Quebec, and British Columbia). A complete description of CHIWOS can be found at the study's website (www.chiwos.ca). Participants ($N = 1,422$) completed a baseline questionnaire

between August 2013 and March 2015.²⁸ The full cohort was included in the present analysis, with participants categorized as older (≥ 50 years of age) or younger (< 50 years of age) WLWH based on self-reported age at time of interview.

Data collection and instrument

CHIWOS was founded on the principles of both community-based research and meaningful engagement of and partnership with WLWH.²⁸ Accordingly, WLWH were involved in all research stages and some were trained and supported to function as peer research associates (PRAs). Utilizing non-random sampling methods, PRAs assisted in the recruitment of potential participants.^{28,29} Explained elsewhere,²⁸ an original CHIWOS questionnaire was designed by a national team of experts in HIV and women's health. They combined established validated scales with unique questions crafted by the CHIWOS research team, creating a questionnaire that was pilot tested and subsequently revised. The final questionnaire comprised nine sections dealing with demographics and socioeconomic status, medical and HIV disease information, health care utilization, sexual and reproductive health, stigma and discrimination, substance use, and HR-QoL.²⁸

PRAs administered this baseline questionnaire in person using either a laptop or computer, in English or French, at collaborating HIV clinics, community organizations, AIDS-service organizations, or in women's homes. Some rural or remote-area participants chose to complete the survey via phone or Skype. All participants provided written, voluntary informed consent (oral consent with a study team member present as a witness for surveys conducted by phone or Skype) and received a \$50 CAD honorarium.

The study was approved by research ethics boards at Women's College Hospital in Ontario, Simon Fraser University in British Columbia, University of British Columbia/Providence Health, and McGill University Health Centre in Quebec.

Study measures

The research design involved two primary outcome measures as well as three well-being measures and other covariates (i.e., demographics, food security, and clinical variables).

Primary outcome measures

All variables were self-reported. The two primary outcomes of interest were physical and mental health components of HR-QoL, measured using the 12-item

Short Form Survey (SF-12), encompassing eight subdomains.^{30,31} It is one of the best measures of HR-QoL, and despite its brevity to complete, it provides robust results that could be translated into a utility, if needed.³²

The CHIWOS data were scored using the Medical Outcome Trust scoring method,³³ with all 12 items scored on a scale of 0–100. The eight subscale items were averaged together to create eight subscale scores, each of which was standardized using a z-score transformation, then normed to Canadian female population means and standard deviations. Regarding the health and physical HR-QoL scores (Cronbach's alpha: 0.815 and 0.817, respectively), each was calculated by adding the relevant subscale z-scores. The latter were multiplied by varimax-rotated factor scoring coefficients, and transformed to t-scores with a mean of 50 and a standard deviation of 10. The item sample mean was used to replace a missing item. Those participants missing more than one item were excluded from analysis.³⁴

Two subscales used in the CHIWOS study were derived from the eight subdomains: (a) physical health (physical functioning, role physical, bodily pain, and general health perceptions), with possible scores ranging from: 1.31 to 74.67; and (b) mental health (vitality, social functioning, mental health, and role emotional), with possible scores ranging from –1.67 to 77.22. Higher scores indicate better physical or mental HR-QoL.³⁴

Other well-being scales

Three well-being measures were included: resilience, depression, and social support. *Resilience* was assessed with a 10-item Resiliency Scale. Each item was scored on a 7-point Likert scale from 1 (disagree), to 7 (agree). A total score was obtained by calculating the sum of item scores, with overall scores ranging from 10 to 70. The tool measures personal competence and self- and life-acceptance, with higher scores indicating higher resilience.³⁵ *Depression* was assessed using the Center for Epidemiologic Studies Depression (CESD) 10-item Scale (CES-D 10), with scores ranging from 0 to 30. Higher scores in CES-D 10 indicated higher levels of depression and a cutoff score of > 10 was considered indicative of "probable depression."^{36,37} Finally, *social support* was assessed with a 4-item Abbreviated Social Support Instrument (ASSI), adapted from the Medical Outcome Study-Social Support Scale (MOS-SSS). The latter contains four subscales: emotional/information, tangible, affectionate, and positive social interaction.³⁸ Scores can range

from 4 to 20, with each item receiving a score on a scale of 1–5. Higher scores indicated higher positive social support.³⁹

Other covariates

Socio-demographic variables included age (in years), education level (less than high school vs. high school or higher), ethnicity (White; African, Caribbean, or Black; Indigenous; and Other ethnicities), immigration status (Canadian citizen vs. non-Canadian citizen), number of financial dependents, annual household income in Canadian dollars (<\$20,000, \$20,000–40,000, >\$40,000), relationship status (legally married/common-law/in a relationship; single; separated/divorced/widowed), number of dependents, and food insecurity. Food insecurity was derived from three statements focused on experiences in the last 12 months: fears of running out of food, experiences with running out of food, and inability to eat balanced meals. Scores ranged 0–6; scores of 0–1 were coded as secure and 2–6 were coded as insecure.

Clinical variables included initiation of antiretroviral therapy (ART) (ever use vs. never been on ART), current ART use, most recent CD4 count (<200 cells/mm³ vs. 200–500 cells/mm³ vs. >500 cells/mm³), most recent viral load (self-report of virologic suppression vs. not-suppressed [suppression being viral load <50 copies/mL]), ART adherence (based on self-reported best estimate of ART use in past 1 month: ≥90% vs. <90%), history of Hepatitis C, history of Hepatitis B, and access to HIV care (received HIV care within past one year vs. not). The various antiretroviral (ARV) regimens that the women were on included: ARV backbone.

(Truvada or Tenofovir/3TC; Kivexa or Abacavir/3TC; Combivir or AZT/3TC; Trizivir; no neocleoside reverse transcriptase inhibitor (NRTI) backbone; and 3rd agent (non-neocleoside reverse transcriptase inhibitor (NNRTI); boosted protease inhibitor (PI); unboosted PI (ie - no ritonavir); integrase inhibitor (II) – includes Stribild, Genvoya, Isentress, Tivicay; Non NRTI backbone regimen (other regimens); and no 3rd Agent in NRTI backbone-containing regimen). Also number of participants that selected any antiretroviral (PI, NNRTI, II) or were not currently on any antiretroviral/no access to HIV care, were measured. All clinical data were self-reported and then verified by the research team using viral load results. One province in the study validated the self-reported undetectable viral loads with laboratory data.⁴⁰

Statistical analysis

Baseline characteristics and scores on HR-QoL measures were summarized with means and standard deviations (SD) for continuous variables and frequencies and proportions for categorical variables. Bivariate analyses (Students *t*-test for continuous variables and Chi-square for categorical variables) were performed to identify the differences between older vs. younger WLWH. Preliminary analysis revealed that physical health was the only component of HR-QoL that differed between older and younger WLWH; therefore, we assessed correlates of physical HR-QoL scores among older WLWH (≥50 years). Unadjusted and adjusted linear regressions were conducted to estimate regression coefficients of factors associated with physical HR-QoL among older WLWH, controlling for socio-demographic factors. Backward stepwise selection method was used to determine the final model. *p* values of <0.05 were considered statistically significant for all analyses. Missing responses were excluded. All statistical analyses were performed using Stata, version 14.0.⁴¹

Results

Baseline characteristics

Of the 1,422 women included in the analysis, the majority (72.0%) were younger WLWH (aged <50 years), and 398 (28.0%) were older WLWH (≥50 years). Baseline characteristics for younger and older WLWH are summarized in Table 1. The mean age of the younger WLWH was 37.8 years (SD = 7.4) compared to 55.8 years (SD = 5.3) for older women.

There were differences between older and younger WLWH with respect to several sociodemographic characteristics, including education, household income, citizenship status, ethnicity, and relationship status (see Table 1). Older women were more likely to be Caucasian (*p* < 0.001), Canadian citizens (*p* < 0.001), have completed high-school education (*p* < 0.01), and live below the poverty line (annual household income <\$20,000 Canadian) (*p* < 0.05). Older women were more likely to report their marital status as separated, widowed or divorced, whereas younger women were more likely to report that they were single (never-married) or in a current relationship (*p* < 0.001).

There were also differences between older and younger WLWH with respect to clinical characteristics (see Table 1). Older women were more likely to have ever initiated ART (*p* < 0.001) and currently be receiving ART (*p* < 0.001). They reported higher rates of ART adherence (*p* < 0.01), virologic suppression (*p* < 0.001), and engagement in HIV care (*p* < 0.01). They were also more likely to have a

Table 1 Baseline characteristics of older (≥ 50 years) and younger women (< 50 years) living with HIV in Canada

Variable	Full Cohort Mean (SD) /N (%) N = 1422	Older Women Mean (SD) /N (%) N = 398	Younger Women Mean (SD) /N (%) N = 1024	P value (t-test or Chi-square)
Sociodemographic Factors				
Age (years)	42.83 (10.63)	55.81 (5.25)	37.78 (7.42)	<0.001
Education				<0.01
<i>Less than high school</i>	227 (16.04)	81 (20.40)	146 (14.34)	
<i>High school or higher</i>	1188 (83.96)	316 (79.60)	872 (85.66)	
Racial/ethnic background				<0.001
<i>African/Caribbean/Blacks</i>	418 (29.40)	92 (23.12)	326 (31.84)	
<i>Caucasian</i>	584 (41.07)	208 (52.26)	376 (36.72)	
<i>Indigenous</i>	318 (22.36)	68 (17.09)	250 (24.41)	
<i>Other</i>	102 (7.17)	30 (7.54)	72 (7.03)	
Immigration status				<0.001
<i>Canadian citizen</i>	1153 (81.37)	349 (87.91)	804 (78.82)	
<i>Non-Canadian citizen</i>	264 (18.63)	48 (12.06)	216 (21.18)	
Household gross yearly income				<0.05
<i>Less than \$20,000</i>	901 (65.34)	265 (68.65)	636 (64.05)	
<i>\$20,000-\$40,000</i>	284 (20.59)	82 (21.24)	202 (20.34)	
<i>Greater than \$40,000</i>	194 (14.07)	39 (10.10)	155 (15.61)	
Marital status				<0.001
<i>Legally married/common-law/in a relationship but not living together</i>	454 (32.11)	80 (20.15)	374 (36.77)	
<i>Single</i>	689 (48.73)	172 (43.32)	517 (50.84)	
<i>Separated/divorced/widowed</i>	271 (19.17)	145 (36.52)	126 (12.39)	
Number of dependents	1.10 (1.92)	0.87 (2.02)	1.19 (1.88)	<0.01
Food insecurity	2.54 (2.07)	2.48 (2.14)	2.56 (2.05)	0.521
Clinical Factors				
Ever taken ART	1245 (87.74)	383 (96.23)	862 (84.43)	<0.001
Currently taking ART status	1175 (82.63)	371 (93.22)	804 (78.52)	<0.001
Detectable viral load	204 (15.68)	31 (8.29)	173 (18.66)	<0.001
Most recent CD4 count				0.919
<i><200 cells/mm³</i>	76 (6.55)	21 (6.10)	55 (6.73)	
<i>200-500 cells/mm³</i>	387 (33.33)	116 (33.72)	271 (33.17)	
<i>>500 cells/mm³</i>	698 (60.12)	207 (60.17)	491 (60.10)	
Hepatitis C	451 (31.87)	158 (39.80)	293 (28.78)	<0.001
Hepatitis B	119 (8.47)	51 (13.04)	69 (6.71)	<0.001
>90% adherence to ART in last month	971 (82.64)	324 (87.33)	647 (80.47)	<0.01
Access to HIV care in last year	1310 (93.44)	380 (96.94)	930 (92.08)	<0.01
ARV agents count	2.27 (2.19)	2.47 (2.34)	2.18 (2.12)	<0.05
ARV backbone				0.208
<i>Truvada or Tenofovir/3TC</i>	662 (59.96)	194 (56.23)	468 (24.11)	
<i>Kivexa or Abacavir/3TC</i>	272 (24.64)	89 (25.80)	183 (24.11)	
<i>Combivir or AZT/3TC</i>	35 (3.17)	9 (2.61)	26 (3.43)	
<i>Trizivir</i>	14 (1.27)	6 (1.74)	8 (1.05)	
<i>Combinations of NRTIs</i>	61 (5.53)	21 (6.09)	40 (5.27)	
<i>No NRTI backbone</i>	60 (5.43)	26 (7.54)	34(4.48)	
3rd agent				<0.01
<i>NNRTI</i>	390 (35.33)	130 (37.68)	260 (34.26)	
<i>Boosted PI</i>	339 (30.71)	83 (24.06)	256 (33.73)	
<i>Unboosted PI (ie - no ritonavir)</i>	86 (7.79)	38 (11.01)	48 (6.32)	
<i>Integrase inhibitor - includes Stribild, Genovia, Isentress, Tivicay</i>	184 (16.67)	56 (16.23)	128 (16.86)	
<i>Non NRTI backbone (other regimens)</i>	60 (5.43)	26 (7.54)	34 (4.48)	
<i>No 3rd Agent with NRTI backbone</i>	44 (3.99)	12 (3.48)	32 (4.22)	
Number of participants that selected any ARV from PI	509 (46.11)	160 (46.38)	349 (45.98)	0.903
Number of participants that selected any ARV from NNRTI	416 (37.68)	143 (41.45)	273 (35.97)	0.082
Number of participants that selected any ARV from II	239 (21.65)	83 (24.06)	156 (20.55)	0.190
Other Quality of Life Measures				
Resiliency*	62.17 (8.07)	62.57 (6.95)	62.01 (8.47)	0.242
Depressive Symptoms (CESD > 10 vs. \leq 10)	664 (48.57)	185 (48.68)	479 (48.53)	0.959
Social Support (MOS-SSS)** (Score range 4-20)	14.15 (4.44)	13.24 (4.50)	14.50 (4.36)	<0.001

ART, antiretroviral therapy; ARV, antiretroviral; NRTI, nucleoside reverse transcriptase inhibitor; NNRTI, non-nucleoside reverse transcriptase inhibitor; PI, protease inhibitor; II, integrase inhibitor.

*For resiliency, $n = 1413$ (396 older women; 1,017 younger women);

**For social support, $n = 1,367$ (380 older women; 987 younger women)

Table 2 Measures of health related quality of life of women living with HIV enrolled in CHIWOS for full cohort and by age [older (≥50 years) and younger women (<50 years)], n = 1422

Quality of Life Measure	Score*			p value
	Total Cohort	Older women (≥50 years)	Younger women (<50 years)	
Health-Related Quality of Life-Physical Health (SF-12a) (Score range 1.3-74)	44.11 (14.31)	38.74 (15.61)	46.20 (13.19)	<0.001
Health-Related Quality of Life-Mental Health (SF-12b) (Score range 1.6-77)	41.76 (14.07)	42.32 (14.07)	41.54 (14.35)	0.353

Table 3 Unadjusted and adjusted linear regressions of factors associated with physical health-related quality of life among older women (n = 399)

Variable	Unadjusted Coefficient (95% CI)	p	Adjusted Coefficient (95% CI)*	p
Sociodemographic Factors				
Age (years)			Not Selected	
50-54 (ref)	1			
55-59	0.08 (-3.49 to 3.64)	0.966		
60-64	0.46 (-4.54 to 5.45)	0.857		
65-69	4.23 (2.99-11.45)	0.250		
70-74	0.55 (-8.60 to 9.70)	0.906		
Education	-1.71 (-5.54 to 2.12)		Not Selected	
(Less than high school vs. High school or higher (ref))		0.381		
Racial/ethnic background			Not Selected	
Caucasian (ref)	1			
Black	3.73 (-0.10 to 7.57)	0.056		
Indigenous	-1.81 (-6.11 to 2.50)	0.410		
Other	-4.28 (-10.23 to 1.68)	0.159		
Marital status			Not Selected	
Legally married/common-law/ in a relationship, not living together (ref)	1			
Single	2.81 (-1.35 to 6.96)	0.185		
Separated/divorced/widowed	3.41 (-0.87 to 7.69)	0.118		
Number of dependents	0.13 (-0.65 to 0.91)	0.749	Not Selected	
Food insecurity	-1.40 (-2.11 to -0.68)	<0.001	-1.31 (-1.98 to -0.64)	<0.001
Other HRQOL Measures				
HRQOL-Mental Health (SF-12b)	-0.14 (-0.25 to -0.03)	<0.05	-0.52 (-0.64 to -0.39)	<0.001
Resiliency	0.46 (0.24-0.68)	<0.001	0.48 (0.26-0.72)	<0.001
Depressive symptoms (CESD > 10)	-7.47 (-10.54 to -4.50)	<0.001	-11.36 (-14.92 to -7.80)	<0.001
Social Support (MOS-SSS)	0.22 (-0.13 to 0.57)	0.211	Not Selected	

*Adjusted for age, education level, ethnicity, marital status and number of dependents.

history of viral hepatitis than were younger WLWH ($p < 0.001$). Examining the specific ART regimens that the women were taking, older women reported higher ARV agents count as compared to younger women ($p < 0.05$). Significant differences were also reported between the two groups on the 3rd agent ($p < 0.01$). No other significant differences in terms of ART regimens between the two groups were reported (see Table 1).

Measures of health-related quality of life

With respect to the primary outcome of physical health, older WLWH reported lower scores on the SF-12 physical-health domain than younger WLWH. There were no significant differences between older and younger WLWH with respect to mental HR-QoL (see Table 2).

Measures of other well-being factors

Older WLWH reported lower levels of social support than younger WLWH (mean MOS-SSS score 13.2 vs. 14.5, $p < 0.001$) (see Table 3). There were no significant differences between older and younger WLWH with respect to their resilience ($p = 0.2$) or depression scores ($p = 0.9$).

Correlates of physical HR-QoL in older women

Unadjusted and adjusted linear regressions were conducted to estimate the coefficients of factors associated with physical HR-QoL among older WLWH in Canada (Table 3). Resilience was positively associated with physical HR-QoL among older WLWH (Acoef: 0.5, 95% CI: 0.3-0.7, $p < 0.001$). Poorer mental HR-QoL (Acoef: -0.5, 95% CI: -0.6 to -0.4), food insecurity (Acoef: -1.3, 95% CI: -2.0 to -0.6,

$p < 0.001$), and having a depression score over 10 on the CES-D scale (Acoef: -11.4 , 95%CI: -14.9 to -7.8 , $p < 0.001$) were associated with poorer physical HR-QoL.

Discussion

Our results augment the nascent literature regarding outcome measures of HR-QoL for older WLWH. In summary, we found that while physical HR-QoL was lower for older than younger WLWH, there was no difference for mental HR-QoL. Also, older WLWH scored lower than younger WLWH on measures of social support but did not differ with respect to resilience or depressive symptoms. Our results demonstrated that for older WLWH, depression, poorer mental HR-QoL and lower resilience were associated with lower physical HR-QoL. Logie et al.⁴² also reported that resilience is associated with improved HR-QoL. In our study, social support was not statistically correlated with physical health of older WLWH. Food insecurity emerged as an important factor associated with physical HR-QoL.

The mental and physical HRQoL scores for the general Canadian population are markedly higher than those found in our study of WLWH, with the former being 49.7 and 50.9, respectively.⁴³ The lower scores observed in our study, relative to the general population, point to inequities in health and clinical outcomes of PLHIV, although this needs to be corroborated with a comparison group. The CHIWOS cohort physical HRQoL was 44.1 compared to 49.7 for the general female population (5.6 points lower). The differential was even higher for older WLWH, who scored 38.94. The CHIWOS cohort mental HRQoL was 41.7 compared to 50.9 for the general female population (9.2 points lower). The differential was a bit lower for older WLWH, who scored 42.32. Both physical and mental quality of life are compromised when living and aging with the chronic disease of HIV, especially for older women, and especially for physical health.

Our result, that older WLWH have poorer physical HR-QoL than younger WLWH, corroborates prior studies.^{11–15, 17, 20} A lower physical health score for older WLWH may reflect compromised physical health that occurs with the natural aging process¹¹ in combination with HIV complications.¹⁴ Brennan and Karpiak¹⁷ proposed that the challenges of aging increase the level of stress beyond what is usually experienced by older WLWH. PLHIV often feel that natural aging circumstances leave them vulnerable to, and make it more difficult to fight the effects of, HIV and AIDS.^{12,13,15} Nokes et al.²⁰ observed that older individuals with HIV (≥ 50 years) experience reduced

physical functioning and greater physical limitations and comorbidities than younger WLWH. The majority (93%) of older WLWH in our study were currently taking ART, with older women reporting higher ARV agents count as compared to younger women. AIDSinfo⁴⁴ commented on the adverse effect of ART on PLHIV's physical health, with potential damage to their renal, liver, cardiovascular, metabolic, and bone health. This damage is more prevalent in and pressing for older PLHIV because their immune recovery is compromised and they face an increased risk of non-HIV health crises. These comments are tempered with the fact that, currently, ART is the best treatment for PLWHIV to sustain viral suppression, maintain higher CD4 count, and possibly delay, prevent or reverse some non-AIDS-defining complications. It is the only approach that helps reduce mortality and AIDS-related morbidity.⁴⁵

We also found that the physical HR-QoL of older WLWH was significantly associated with multi-level factors, including intrapersonal (depression, mental HR-QoL and resilience) as well as structural (food security) factors. Other studies holding food insecurity as an independent variable have found that people who are depressed are three times more likely to be food insecure.^{46,47} Depression among older PLHIV is often under-recognized and under-treated.^{9, 37, 47} The Mental Health Foundation⁴⁸ acknowledged that a cycle can be established wherein the chronic physical condition (e.g., HIV) causes mental stress and the latter exacerbates physical health. Depression may result in reduced ART adherence, which in turn impacts physical health, morbidity and mortality.⁴⁹ WLWH in our study reported high rates of depression across age groups. Moreover, they reported low social support, which would be expected to correlate with higher rates of depression. However, it is possible that their high resilience scores contributed to being less depressed. Also, their SF-12 mental health domain scores reflect moderately high mental health, which may also be a factor explaining how their scores are higher than other studies. The women in our study had high levels of adherence and virologic suppression, likely bolstering mental health, although causation cannot be inferred.

Physical and mental HR-QoL were negatively associated, adjusting for socio-demographic factors. This result contradicts the well-established association between mental and physical health for people living with chronic conditions like HIV, who usually require treatment for mental and physical health deterioration.^{50,51} Future studies should explore the correlation between physical and mental health for older WLWH, who, in this analysis, had, at baseline, moderately high

mental HR-QoL scores, indicating that their mental health state may not have been debilitating, and likely did not present challenges with respect to day-to-day functioning as would be expected. A key take away is that researchers need to be cognizant of how they operationalize their variables because most HR-QoL instruments do not capture all key determinants, and comprise different dimensions.¹¹ Additionally, most women in this study scored high on the Resiliency Scale,⁵² which may mitigate the negative effects of mental HR-QoL on physical HR-QoL to some extent. For older women in our study, physical HR-QoL was significantly, positively, associated with resilience, corresponding with previous studies. The more resilient WLWH are, the higher their physical HR-QoL. The lack of age differences for resilience was unexpected because, compared to younger WLWH, older WLWH may be more resilient because they can draw from and make sense of life experiences.^{21, 53} Research on this topic is lacking^{53,54} making our study a valuable contribution. Knowledge of their resilience facilitates others to help WLWH age successfully² thereby contributing to attainment of the “fourth 90,” HRQoL for PLWHIV

Our study found that social support was not significantly associated with physical health for older WLWH,¹¹ but older WLWH reported less social support than younger WLWH.³¹ Related to mental HR-QoL, Logie et al.⁵⁵ reported that social support mediated the relationship between HIV-related stigma and mental HR-QoL, accounting for nearly 25% of the effect. Lack of social support indicates a sense of not having access to others who can provide companionship or assistance, or a situation that can negatively impact activities of daily living and mobility.^{12, 15} Johnson et al.⁵⁶ reported that half (49%) of WLWH in Western countries (including Canada) (aged 44.0 ± 10.8) did not have regular social support. Siemon et al.²¹ found, through interviews, that older WLWH were likely to be socially isolated. Through cognitive interviews, Audet et al.⁵⁷ found that social isolation complicated HIV treatment because it can lead to hopelessness or feelings of loss of control, which in turn can lower ART adherence and motivation to remain in HIV care. Social isolation can also exacerbate and predispose people to immune dysfunction, cardiovascular disease and suicide,^{12, 15} contributing to poorer physical health.

Our results have several implications for HIV health care and service providers, especially doctors and HIV and infectious disease clinicians. First of all, when treating the physical symptoms of HIV and AIDS, health care providers should consider the connections

between physical health and resilience, and depression and mental health and provide a network of referrals for appropriate support and coordinated treatment. Secondly, aging successfully in the context of HIV infection is challenging. Our results suggest that, in combination, aging and HIV may increase physical pain and lower physical function, thereby reducing HR-QoL, but this needs to be corroborated with a comparison group. Previous studies have also suggested that physical health is directly and negatively affected by the prolonged use of ART, as it may increase the incidence of comorbidities¹⁵ with ART a key determinant of HR-QoL.¹¹ The majority (93%) of older WLWH in our study were currently taking ART, yet self-reported a moderate physical health score, which may in fact decline over time, intimating a need for due diligence on the part of health care providers.

Thirdly, our study intentionally focused on resilience, an under-researched aspect of HR-QoL, finding that as resilience increased so did self-reported physical HR-QoL.^{58,59} Service and health care providers need to appreciate that fostering hardiness and resilience among WLWH can help them adapt to the disease and age more successfully.² Resilience for older WLWH could be fostered if doctors and HIV clinicians (service providers) assessed for, and made appropriate referrals around, food security, housing, social support, and mental health.^{25, 46} Fourthly, food insecurity correlated significantly with physical HR-QoL. Future studies should focus on the intervening power of food insecurity since the majority (67%) of Canadians living with HIV are food insecure.^{46,47}

The limitations for this study inspired recommendations for future research. The cross-sectional design did not allow examining for causation. Longitudinal studies could further explore both correlates and causations of HR-QoL. The self-report measures may have been influenced by social desirability biases. The purposive, non-random sample may have been biased to include women already accessing HIV care, therefore experiencing higher levels of resilience and physical functioning. On the other hand, the research team over sampled women experiencing multiple forms of marginalization, including younger women. This research design decision may have led to the inclusion of WLWH with less access to resources to bolster HR-QoL. Although the CHIWOS sample frame is quite large (from three provinces), it does not represent all older WLWH in Canada. HR-QoL for WLWH may be different in other regions of Canada. QoL measures could be reassessed to determine changes over time as these women age with HIV. Qualitative studies could explore what aging

with HIV means for the QoL of this population. The absence of a comparison group limits study conclusions, meaning future studies could include a comparison group of aging women.

Conclusion

Both the demographic profile and the paradigm of the HIV epidemic have shifted over the last four decades such that HIV is now considered to be a chronic disease. With improvements in life expectancy, older individuals make up an increasing proportion of PLWHIV. Research and health-care priorities must also evolve to facilitate successful aging with HIV and help care providers to achieve the “fourth 90” – HR-QoL for PLWHIV.²² The results affirm several positive findings, including no decrease in mental health QoL along with high resilience, levels of adherence, and engagement in care. Conversely, results demonstrate that older Canadian WLWH in this study have poorer physical HR-QoL and social support than younger women. The physical health of older women with HIV was impacted by resilience, mental health, food security, and depressive symptoms stressing the link between psychosocial and structural factors and physical health (i.e., the social ecological connections). Furthermore, aging without sufficient social support can compromise disease prognosis and well-being. Results from this study provide a window to understanding the experiences of older WLWH and their care needs. Future studies are required in order to further guide healthcare providers as they, along with PLWHIV, navigate the changing landscape of the HIV epidemic and aim for the “fourth 90.”²²

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Author Contribution

RKH is responsible for paper conceptualization, directed and supervised the data analysis and wrote the paper. NA contributed to paper revisions and editing. YW performed statistical analyses. ML is senior author and contributed to paper revisions. ML, AK and AdP helped to plan the study, including the instrumentation. TC and KW helped in administering study questionnaire. CL, AK, AdP, BH, and WT provided feedback.

Disclosure statement

No potential conflict of interest was reported by the authors.

Data availability statement

Data are available from the Women's College Research Institute Women and HIV Research Program Data Access Coordinator for researchers and students who meet the criteria for access to confidential data. The current Data Access Coordinator is Angela Underhill and she can be reached at angela.underhill@wchospital.ca. The criteria for access to the confidential data includes 1) being added as a CHIWOS researcher or student to the research ethics board (REB) application and 2) signing a CHIWOS Data Sharing and Collaboration Agreement. The de-identified data set cannot be publicly shared at this point as we do not have community or REB approval to do so. Co-authorship is a requirement for data access as per the CHIWOS authorship policy (www.chiwos.ca) which includes the requirement that the ICMJE authorship criteria be met by all authors.

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