The Journal of Frailty & Aging 15 (2026) 100126

Contents lists available at ScienceDirect

The Journal of Frailty & Aging

journal homepage: www.elsevier.com/locate/tjfa

Original Research

Preparation for healthy ageing: An integrated educational intervention for enhancing knowledge and self-efficacy in intrinsic capacity preservation, midlife condition management, and caregiving in midlife women

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ARTICLE INFO

Keywords:
caregiving
Intrinsic Capacity
health literacy
self-care
self-efficacy

ABSTRACT

Objectives: Midlife women often experience concurrent declines in intrinsic capacity (IC) and increasing caregiving responsibilities. This study evaluated the effectiveness of an educational intervention designed to enhance knowledge of IC preservation, self-care efficacy, and caregiving competencies among midlife women.
Methods: The *Pursuit of Wellness Program* was developed and evaluated through a multicentre mixed methods study. This program comprised nine modules addressing IC domains (cognitive, vitality, psychological) and six modules focused on priority midlife conditions (e.g., urinary incontinence). Each module integrated health education, self care practices, and caregiving training. Program's effectiveness was assessed using a mixed methods evaluation. Outcomes included pre- and post-changes in domain- or condition-specific knowledge (summative score range: 0–3) and self-care efficacy (visual analogue scale: 0–10), post-intervention caregiving confidence (Likert scale: 1–5), and qualitative feedback from program coordinators.
Results: A total of 690 women aged 50–64 years were assessed. Pre-tests revealed knowledge gaps in pain management, bladder health, and dementia care, with mean health knowledge scores ranging from 1.3–1.6. Post-intervention improvements were most significant for bladder health (+69.0%, $p<0.001$), followed by nutrition for muscle & bone health (+56.3%, $p<0.001$). Self efficacy increased significantly across all IC domains and midlife conditions ($ps<0.01$), while caregiving confidence reached from 68.7 to 89.3% agreement, highest for skin and bathing care (89.3%) and dementia support (86.3%). Qualitative findings from program coordinators ($n=18$) confirmed high participant engagement with nutrition strategies and stress management techniques, corroborating quantitative outcomes.
Conclusions: The program significantly enhanced knowledge related to IC preservation and management of midlife conditions, self-care practices, and caregiving competencies among midlife women. It addresses a critical gap by concurrently promoting IC preservation and caregiving proficiency during the midlife transition.

1. Introduction

Midlife represents a critical window for intervention in women's health. During this transitional period, women experience age-related physiological changes, including menopausal symptoms, metabolic dysfunction, progressive muscle loss, and mental health challenges, [1, 2] while often simultaneously assuming taking on caregiving responsibilities for ageing parents [3]. These dual burdens increase the likelihood of neglecting personal health needs, as competing demands divert attention from preventive care [4]. The resulting cumulative vulnerabilities may accelerate declines in intrinsic capacity (IC), encompassing physical and mental functions, and reduce the ability to sustain caregiving roles.

Introduced by the World Health Organization (WHO), IC is defined as the composite of an individual's physical and mental capacities that collectively determine healthy ageing trajectories [5]. This multidimensional construct encompasses five interdependent domains: cognitive, locomotor, vitality, sensory, and psychological [6]. To advance

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https://doi.org/10.1016/j.tjfa.2025.100126
Received 25 July 2025; Received in revised form 7 November 2025; Accepted 28 November 2025
Available online 29 January 2026

healthy ageing, the WHO developed the Integrated Care for Older People (ICOPE) framework, which provides evidence-based care pathways to proactively identify at-risk individuals and deliver targeted interventions for preserving IC and maintaining independence [7]. While this framework represents significant progress, optimal IC preservation requires not only accessible and structured health and social care services, but also sustained individual engagement in self-care behaviours.

Health literacy, the ability to access, understand, and apply health information, has emerged as a pivotal factor in fostering self-care behaviours. Evidence demonstrates that individuals with higher health literacy are more likely to engage in self-care behaviours that lead to better health outcomes [8]. In response to the growing demand for self-care management and caregiving skills, increasing attention has been directed toward health literacy-based strategies. However, current interventions often fail to address the complex needs of midlife women. Many existing programs adopt a fragmented approach, focusing on isolated issues (e.g., menopause management) without addressing holistic IC preservation or narrowly targeting caregiver burden while overlooking women's own ageing trajectories. This gap is critical, given strong evidence that maintaining IC at higher levels can potentially reduce the risk of disability in later life [9–11].

To address these gaps, we developed *The Pursuit of Wellness Program* through a two-step process. First, we conducted focus group interviews with 54 women aged 50–64 years to identify their health priorities and ensure a participant-centred design. Drawing on these empirical findings and the WHO ICOPE framework, we subsequently created a novel educational intervention that integrates three key components: (1) health education targeting IC domains and priority midlife conditions, (2) practical self-care skill-building, and (3) caregiving competency development.

This study adopted a mixed methods design to examine the program's effectiveness in enhancing (1) knowledge acquisition related to IC preservation and mangement of priority midlife health conditions, (2) self-efficacy in self-care, and (3) confidence in applying caregiving skills. By simultaneously strengthening women's capacities as both health-conscious individuals and competent caregivers, this program presents an innovative strategy to address the complex needs of women during the midlife transition.

2. Methods

Step 1. Focus group interviews

We conducted eight focus groups with midlife women (n = 54) who had previously participated in a multicomponent program focused on IC preservation. Participants were invited to discuss and list their top three health concerns currently affecting their quality of life. Trained research staff faciliated the focus groups through face-to-face interviews at participating women's health clinic and community elderly centres. A ranking exercise was then conducted to prioritize the identified health domains according to perceived importance.

Step 2. Evaluation of *The Pursuit of Wellness Program*

2.1. Study design and participants

We conducted a multicentre, mixed methods study in Hong Kong. Participants were recruited through six non-governmental organizations (NGOs), including one women's health clinic and five elderly centres. These organizations were engaged because they serve midlife women and regularly offer health promotion activities. Eligible women aged 50–64 years were invited to complete a baseline assessment administered by trained research staff (including a project officer and research assistants). Subsequently, participants attended at least one of the program modules (see subsequent section) and were reassessed upon completion. To obtain a comprehensive understanding of the program's effectiveness, qualitative feedback from program coordinators (n = 18) across the six NGOs was collected through semi-structured interviews.

2.2. Intervention

The program consisted of nine evidence-based modules delivered through a standardized blended learning approach. Each module incorporated three educational components including a 30–45-minute interactive health talk, an instructional video demonstrating core techniques, and a 60-minute interactive workshop featuring hands-on skills practice. Participants also received take-home reinforcement materials to faciliate continued learning and application. Module content was strategically developed to address nine health domains, covering three key IC domains (cognitive, vitality, psychological) and six priority midlife conditions (bladder health, digestive health, pain management, skin and bathing care, sleep optimization, frailty) (Table S1). To promote autonomy and enhance engagement, participants were encouraged to select modules according to their individual needs and interests, with completion of at least one module recommended. All modules were facilitated by healthcare professionals, including registered nurses, dietitians, and physiotherapists.

2.3. Outcome measures

The primary quantitative outcome was the pre- to post-intervention change in module-specific knowledge. Knowledge was assessed using three customized true/false questions per module (1 point per correct answer), yielding total scores ranging from 0 to 3; higher scores indicated better knowledge. The complete set of assessment questions is presented in Table S2. Secondary outcomes included two measures: (1) self-care efficacy, evaluated using a 10-point visual analogue scale (0 = no confidence to 10 = full confidence) to assess participants' confidence in managing their own health; and (2) caregiving self-efficacy, measured post-intervention using a 5-point Likert scale (1 = strongly disagree to 5 = strongly agree) to assess participants' perceived ability to support others' health needs. Baseline caregiving self-efficacy was not collected due to anticipated variability in participants' initial understanding of caregiving arising from diverse experience and backgrounds. To minimize response bias, the measure was introduced only post-intervention, after participants had received standardized contents. All assessments were administered by trained research staff, with caregiving evaluation focused specifically on newly acquired competencies.

Qualitative data were gathered through semi-structured interviews with all practice program coordinators. During each interview, coordinators were asked to reflect on their experiences with the program and their interactions with participants across four key domains: participant satisfaction, relevance of content to participants' needs, usefulness of materials, and perceived overall program value.

2.4. Data analysis

Descriptive statistics were used to summarize participant characteristics, with means and standard deviations (±SD) reported for continuous variables and frequencies (%) for categorical variables. The prevalence of self-reported health concerns was analyzed using frequency distributions and ranked by percentage. Baseline health knowledge scores were calculated for each module, with mean ± SD reported. Pre- and post-intervention knowledge scores and self-care efficacy (expressed as percentages) were compared using paired t-tests, or Wilcoxon signed-rank tests when normality assumptions were not met. Percentage improvements were calculated accordingly. To account for multiple comparisons across modules, p-values were adjusted using the Holm-Bonferroni method. Caregiving confidence was summarized descriptively as the percentage of participants who selected a score of "4" or "5" on the post-intervention Likert scale, indicating agreement that their caregiving self-efficacy had improved. A sensitivity analysis

was performed using data from participants' first attendance to account for potential variations in motivation and engagement levels. All quantitative analyses were conducted using SPSS (version 28), with statistically significance set at $p < 0.05$. Qualitative data were transcribed and analyzed thematically to identify recurring patterns in participant feedback.

3. Results

Part 1. Pre-program focus group interviews

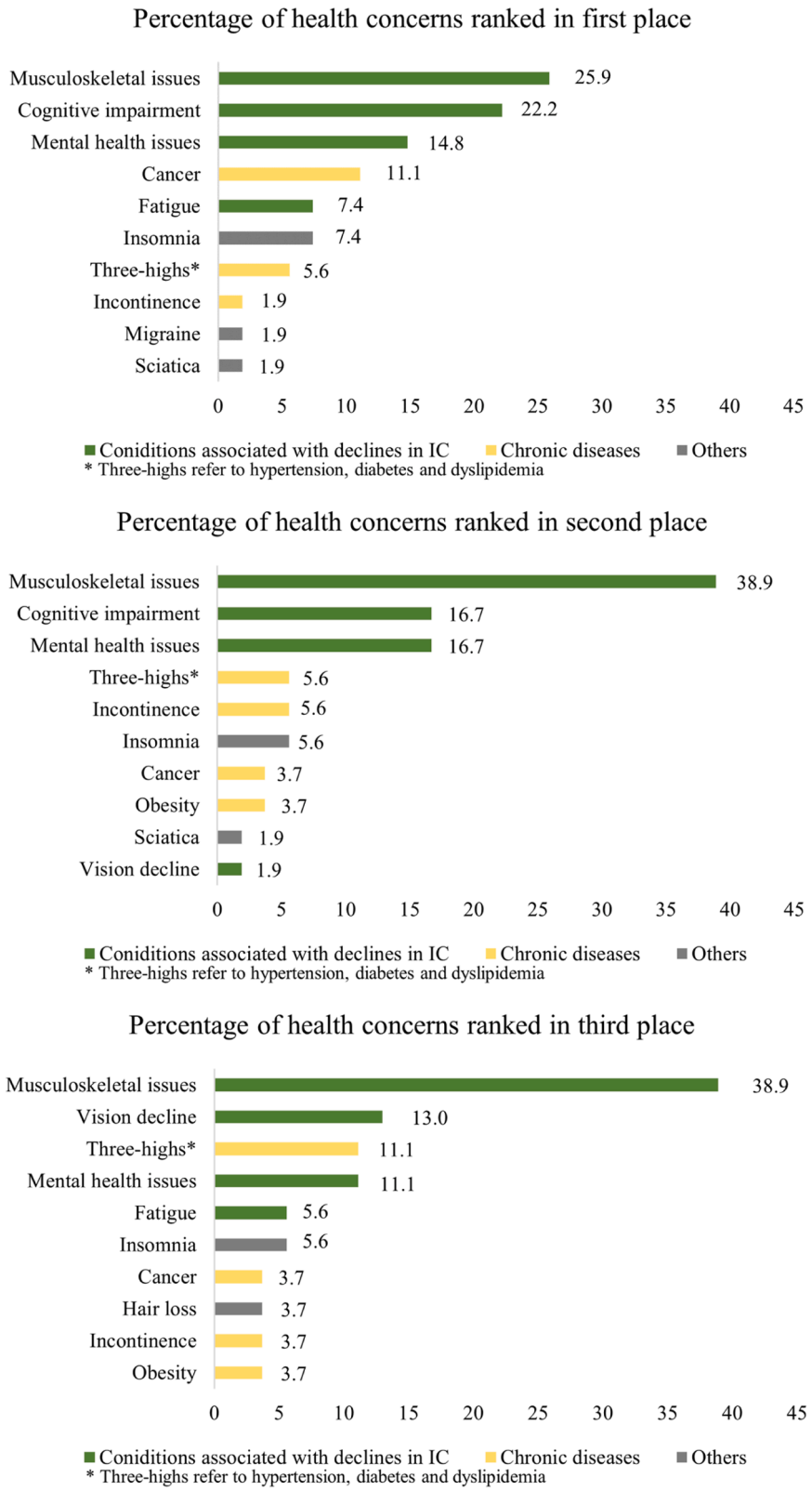

Figure 1. Top three health concerns ranked by participants (N=54).

3.1. Predominant health concerns

Musculoskeletal issues represented the most frequently reported primary health concern (ranked first by 25.9% of participants), followed by cognitive decline (22.2%). These conditions maintained consistent priority across rankings. Mental health issues were moderately reported (14.8%), whereas typical midlife conditions such as urinary incontinence and chronic pain were among the least frequently cited concerns (ranked first by <5.0%). Cosmetic concerns such as hair loss were the least frequently cited (ranked third by 3.7%) (Figure 1).

Part 2. Evaluation of The Pursuit of Wellness Program

3.2. Characteristics of participants

The main study enrolled 690 midlife women aged 50 to 64 years, 61.6% of whom were aged 60–64 years. Participants were predominantly well-educated, with 94.3% having completed secondary education or higher (Table 1). Among them, 600 (87.0%) attended only one module, while 68 (9.9%) attended two, 18 (2.6%) attended three, and four (0.6%) attended four modules. Notably, no attrition was observed throughout the program.

3.3. Baseline health knowledge

Baseline assessment of the full sample (n = 690; total attendance = 806) revealed considerable variation in health knowledge across key domains prior to the intervention (scored 0–3) (Table 2). The lowest pre-intervention scores were observed for *Pain Management* (mean = 1.3), *Bladder Health and Incontinence Care* (1.6), *Cognitive Health and Dementia Care* (1.6), and *Nutrition for Muscle & Bone Health* (1.6), indicating notable knowledge gaps in these essential midlife health areas. Moderately low scores were observed for *Digestive Health* (1.8), *Sleep Optimization* (1.9), and *Skin, Hair, and Bathing Care* (2.0). In contrast, participants demonstrated relatively higher baseline knowledge of *Well-being & Behavioural Support* (2.1) and *Frailty Prevention and Management* (2.3), likely reflecting greater public awareness of these topics.

3.4. Program effects on health knowledge

The program demonstrated significant improvements across nearly all measured domains (Table 2). Most notably, *Bladder Health and Incontinence Care* knowledge increased by 69.0% (from a mean score of 1.6 to 2.7, $p<0.001$), followed by *Nutrition for Muscle & Bone Health* (56.3% increase; 1.6 to 2.5, $p<0.001$) and *Skin, Hair, and Bathing Care* (40.0% increase; 2.0 to 2.8, $p<0.001$). *Pain Management*, which began with the lowest baseline score (1.3), improved by 46.2% to 1.9 ($p<0.001$). *Digestive Health* showed the smallest change (1.8 to 1.9, $p=0.289$), while all other domains achieved post-intervention scores above 1.9, with *Skin, Hair, and Bathing Care* reaching the highest level (2.8). Table 2 also presents detailed pre-post comparisons for each knowledge sub-domain.

Table 1
Socio-demographic characteristics of participants (N=690).

Characteristics	n (%)
Age	
50-54	80 (11.6)
55-59	185 (26.8)
60-64	425 (61.6)
Educational level	
Primary or below	39 (5.7)
Secondary	394 (57.1)
Tertiary	257 (37.2)

Note. Percentages may not sum to 100 due to rounding.

Although most sub-domains demonstrated significant improvement, two areas, including early detection of cognitive impairment and digestive health symptom management, showed slight reductions in post-intervention scores. Qualitative feedback from program coordinators revealed that participants particularly valued the *Nutrition for Muscle & Bone Health* module for its practical, actionable strategies to prevent and manage the sarcopenia and osteoporosis through lifestyle adaptations, with participants reporting improved understanding of healthy eating practices.

3.5. Program effects on self-care efficacy

Participants also reported substantially increased confidence in self-care after the intervention. Baseline confidence scores ranged from 6.8 to 7.3 across domains, with the most significant improvements observed in *Nutrition for Muscle & Bone Health* (7.2. to 8.2, $p<0.001$), *Well-being & Behavioural Support* (7.0 to 8.0, $p<0.001$), and *Cognitive Health & Dementia Care* (7.2 to 8.1, $p<0.001$). Confidence in *Sleep Optimization* rose from the lowest baseline (6.8) to 7.4 ($p<0.01$), while all final confidence scores exceeded 7.4, with six areas surpassing 8.0 (Table 3). These quantitative gains aligned with qualitative observations, where program coordinators highlighted the efficacy of the *Well-being & Behavioural Support* module, noting strong participant engagement with the breathing techniques for daily stress management.

3.6. Program effects on efficacy in caregiving

Quantitative outcomes also demonstrated strong improvements in caregiving efficacy across all training modules (68.7% to 89.3% agreement), with the greatest improvements seen in *Skin, Hair, and Bathing Care* (89.3%), *Cognitive Health & Dementia Care* (86.3%), and *Well-being & Behavioural Support* (84.5%). *Bladder Health & Incontinence Care* (84.4%), *Nutrition for Muscle & Bone Health* (83.5%) and *Sleep Optimization* (81.1%) modules also performed well. The *Pain Management* module showed moderate improvements, with 68.7% agreement, indicating an important area for further enhancement (Table 3). These quantitative gains were substantiated by qualitative reports in which program coordinators observed participants applying relevant caring techniques. Notably, participants particularly valued the modules' content for being both clearly understandable and practically applicable, factors that likely contributed to the high efficacy scores.

3.7. Findings from the sensitivity analysis

A sensitivity analysis using data from participants' first attendance only revealed consistent results across health knowledge, self-care efficacy, and caregiving self-efficacy (Tables S3–S4).

4. Discussion

This study demonstrates the efficacy of *The Pursuit of Wellness Program* in enhancing midlife women's capacity to preserve IC across cognition, vitality, and psychological domains, manage priority midlife conditions, and develop essential caregiving competencies. The program's robust effects, particularly in underrecognized yet critical areas like bladder health, reveal that integrated health education interventions addressing both personal IC preservation and caregiving applications can potentially produce synergistic improvements in health literacy and self-efficacy. Such programs support women's dual roles during the midlife transition by simultaneously promoting their own healthy ageing trajectories while preparing them to meet the complex demands of caregiving in ageing populations.

4.1. Addressing critical knowledge gaps

The baseline assessment revealed substantial knowledge gaps in

Table 2
Knowledge scores and percentage of correct response in individual questions before and after intervention by module.

Module	Knowledge score					% of correct response					
	Mean ± SD					Question 1		Question 2		Question 3	
	Pre	Post	Difference	Adj. p	Cohen's *d* (95% CI)	Pre	Post	Pre	Post	Pre	Post
Module 1: Cognitive Health and Dementia Care (n=80)	1.6 ± 1.1	2.0 ± 0.9	0.4 ± 1.0	0.001	0.41 (0.18, 0.63)	50.0	86.3	50.0	35.0	85.8	78.8
Module 2: Nutrition for Muscle & Bone Health (n=103)	1.6 ± 0.8	2.5 ± 0.6	0.9 ± 0.9	<0.001	0.97 (0.73, 1.20)	53.4	95.2	79.6	89.3	28.2	65.1
Module 3: Well-Being & Behavioural Support (n=84)	2.1 ± 0.8	2.7 ± 0.6	0.6 ± 0.8	<0.001	0.76 (0.52, 1.01)	64.3	90.5	52.4	83.3	96.4	95.2
Module 4: Bladder Health & Incontinence Care (n=64)	1.6 ± 1.0	2.7 ± 0.6	1.2 ± 1.1	<0.001	1.09 (0.78, 1.40)	70.3	93.8	39.1	89.1	46.9	89.1
Module 5: Digestive Health (n=105)	1.8 ± 0.9	1.9 ± 0.8	0.1 ± 0.9	0.289	0.10 (-0.09, 0.30)	49.5	39.1	51.4	62.9	81.9	90.5
Module 6: Pain Management (n=99)	1.3 ± 0.9	1.9 ± 1.0	0.6 ± 0.9	<0.001	0.64 (0.42, 0.85)	64.7	79.8	42.4	67.7	25.3	44.4
Module 7: Skin, Hair, and Bathing Care (n=75)	2.0 ± 0.8	2.8 ± 0.5	0.9 ± 0.9	<0.001	0.92 (0.65, 1.19)	74.7	97.3	44.0	90.7	80.0	96.0
Module 8: Sleep Optimization (n=90)	1.9 ± 0.9	2.2 ± 0.9	0.3 ± 1.1	0.005	0.33 (0.12, 0.54)	75.6	71.1	44.4	64.4	66.7	87.8
Module 9: Frailty Prevention and Management (n=106)	2.3 ± 0.8	2.6 ± 0.6	0.3 ± 0.7	<0.001	0.45 (0.25, 0.65)	85.9	94.3	64.2	72.6	76.4	89.6

Note: Modules 1–3 target three intrinsic capacity domains (cognitive, vitality, and psychological) whereas modules 4–9 target priority midlife conditions.

Table 3
Self-care efficacy before and after intervention and caregiving confidence by module.

Module	Self-care efficacy					Caregiving confidence
	Mean ± SD					% reporting agreement with improvement
	Pre	Post	Difference	Adj. p	Cohen's *d* (95% CI)	
Module 1: Cognitive Health and Dementia Care (n=80)	7.2 ± 1.4	8.1 ± 1.2	0.9 ± 1.0	<0.001	0.91 (0.65, 1.17)	86.3
Module 2: Nutrition for Muscle & Bone Health (n=103)	7.2 ± 1.5	8.2 ± 1.4	1.0 ± 1.0	<0.001	0.97 (0.74, 1.20)	83.5
Module 3: Well-Being & Behavioural Support (n=84)	7.0 ± 1.8	8.0 ± 1.40	0.9 ± 1.1	<0.001	0.85 (0.60, 1.10)	84.5
Module 4: Bladder Health & Incontinence Care (n=64)	7.3 ± 1.5	8.1 ± 1.6	0.8 ± 1.4	<0.001	0.59 (0.32, 0.85)	84.4
Module 5: Digestive Health (n=105)	7.3 ± 1.5	7.9 ± 1.6	0.6 ± 1.0	<0.001	0.52 (0.32, 0.73)	80.0
Module 6: Pain Management (n=99)	6.9 ± 1.6	7.7 ± 1.5	0.8 ± 1.0	<0.001	0.82 (0.59, 1.05)	68.7
Module 7: Skin, Hair, and Bathing Care (n=75)	7.1 ± 1.8	8.0 ± 1.6	0.8 ± 0.9	<0.001	0.88 (0.61, 1.15)	89.3
Module 8: Sleep Optimization (n=90)	6.8 ± 1.7	7.4 ± 2.0	0.6 ± 1.7	0.001	0.35 (0.14, 0.57)	81.1
Module 9: Frailty Prevention and Management (n=106)	7.3 ± 1.3	8.2 ± 1.2	0.9 ± 0.9	<0.001	0.93 (0.70, 1.16)	78.3

Note: Modules 1–3 target three intrinsic capacity domains (cognitive, vitality, and psychological) whereas modules 4–9 target priority midlife conditions.

several critical health domains, with particularly low scores in *Pain Management, Bladder Health and Incontinence Care*, and *Cognitive Health & Dementia Care*. These results highlight important unmet needs in health education regarding age-related changes that commonly affect midlife women. The significant post-intervention improvements, most notably in *Bladder Health and Incontinence Care* and *Nutrition for Muscle & Bone Health*, demonstrate the program's effectiveness in addressing these gaps. These quantitative improvements aligned with participants' enthusiastic participation in the *Nutrition for Muscle & Bone Health* module. This success likely stems from its dual emphasis on evidence-based education and practical application, particularly for topics that are frequently stigmatized or overlooked in standard health education [12]. However, persistent challenges remain in certain areas. Participants demonstrated ongoing difficulties with cognitive health literacy, particularly in recognizing early cognitive impairment symptoms, indicating a need for targeted content enhancements. Similarly, digestive health education requires reinforcement, especially on recognizing of when common symptoms may indicate more serious concerns and understanding the long-term effects of frequent medication use for digestive issues.

4.2. Conceptual pathway linking capacity enhancement to health behaviours

Enhancing health knowledge in areas such as *Bladder Health and Incontinence Care* and *Nutrition for Muscle & Bone Health* suggests a potential pathway through which education can be translated into tangible behaviour change. Strengthening these domains not only improves women's understanding of age-related health risks but also equips them with the confidence and motivation to adopt sustainable, health-promoting practices. For example, improved nutrition knowledge supports the adoption of dietary strategies that preserve muscle mass and bone strength, while greater awareness of bladder health reduces barriers to addressing sensitive issues and encourages proactive self-management. Together, these gains in knowledge serve as both prerequisites and catalysts for behaviour change, enabling women to move beyond abstract awareness and integrate consistent self-care practices into daily life.

4.3. Discrepancy between perceived health concerns and knowledge needs

An interesting finding emerged in the comparison between participants' self-reported health concerns and baseline knowledge levels. While osteoporosis and musculoskeletal issues ranked among the top concerns, consistent with existing data on midlife women's health priorities, [13] urinary incontinence was among the least cited concerns despite showing one of the largest knowledge deficits. This discrepancy suggests that women may underestimate the prevalence and impact of urinary incontinence [14] and certain age-related health issues, highlighting the need for interventions that address both factual knowledge and health risk perception. On the other hand, the substantial proportion of mental health and cognitive-related concerns reflects increased societal awareness of psychological wellbeing.

4.4. Enhancing self-efficacy in self-care and caregiving capacity

The consistent improvements in self-efficacy across all domains provide compelling evidence of the intervention's psychological impact. Most notably, *Bladder Health & Incontinence Care* showed the largest gains, followed by *Nutrition for Muscle & Bone Health*. These findings suggest that practical, skills-based education may effectively address the "knowledge-confidence gap" inherent in health behaviour change, [15]

underscoring the intervention's potential to translate knowledge into actionable confidence. Qualitative findings further reinforced these results, with participants frequently describing increased confidence in managing osteoporosis and preventing sarcopenia. The caregiving outcomes were also significant, with *Skin, Hair, and Bathing Care* and *Cognitive Health & Dementia care* achieving the highest confidence levels. These results demonstrate the efficacy of the program's integrated approach, which combines personal health knowledge with practical caregiving skills, offering targeted support for midlife women at the intersection of personal and familial health management.

4.5. Implications

This program demonstrates that an IC-focused approach can effectively address midlife women's dual roles as both care recipients and caregivers. The program's design, which simultaneously targeted IC domains (cognitive, vitality, and psychological), priority midlife conditions, and common caregiving challenges through both personal health and caregiving contexts, yielded significant improvements in knowledge and self-efficacy. Three key insights emerge: First, the nutrition modules' exceptional outcomes highlight how IC-supportive strategies achieve dual benefits when skills bridge personal and caregiving applications. For instance, protein optimization techniques addressed participants' own vitality preservation (sarcopenia prevention) while equipping them to manage relatives' muscle loss, demonstrating the broader potential of IC-focused education. Second, engagement patterns reveal that bladder health and IC domains serve as optimal gateways for health education. Content addressing urinary incontinence and malnutrition in the context of musculoskeletal health showed both strong participation (data not shown) and significant improvements from low baseline scores, suggesting that the *Bladder Health & Incontinence Care* and *Nutrition for Muscle & Bone Health* modules represent critical leverage points. Third, the results advocate for systemic integration of IC-focused educational interventions. In this regard, further efforts are needed to facilitate targeted educational programs addressing midlife concerns, including declines in IC, and explicitly translating IC preservation principles into practical caregiving applications. This approach offers particular value for ageing societies by simultaneously optimizing midlife women's own IC trajectories, and strengthening their capacity to support functional maintenance in ageing relatives.

4.6. Strengths and limitations

This study benefits from a comprehensive evaluation of IC-related knowledge, confidence, and caregiving skills across multiple domains, contributing valuable insights into midlife health education. However, several limitations should be considered when interpreting the findings. First, the sample was highly educated, with 94.3% of participants having completed secondary education or higher. This may limit the generalizability of results to broader populations of midlife women, particularly those with lower educational attainment. Individuals with higher education levels often have greater access to health information and services, which may influence their baseline knowledge, perceptions, and engagement with the program. However, it is noteworthy that substantial IC knowledge gaps existed even within this well-educated group, underscoreing the need for widespread IC educational strategies. Second, the assessment tools used may have constrained measurement depth, The three-question true/false format for knowledge assessment may not fully capture the complexity of health knowledge constructs related to IC preservation. Similarly, the 10-point visual analogue scale for self-efficacy, while commonly used, lacks established clinical cut-points, limiting interpretability. The post-intervention measure of caregiving confidence was also limited by the absence of baseline data, making it difficult to assess change over time or determine whether reported confidence aligns with actual caregiving competence. Third, the study did not include follow-up data beyond immediate post-intervention period, restricting the ability to evaluate long-term impact. It remains unclear whether participants were able to apply the knowledge and skills gained to daily life, including personal behavioural modification and caregiving practices. Moreover, the extent of knowledge retention and impacts on participants' own IC trajectories remain unknown, limiting the broader implications of the findings. Fourth, the absence of behaviour outcome measures is also a limitation. Although improvements in knowledge and self-reported efficacy were observed, there is no direct evidence that participants implemented learned behaviours, changed their health practices, or experienced improved outcomes. Fifth, variation in module attendance introduces potential selection bias. While allowing participants to self-select modules was intended to enhance real-world applicability and promote autonomy, it may have introduced selection bias and increased outcome variability. To address this, a sensitivity analysis was conducted using data from participants' first attendance. The results were generally consistent with the main findings, suggesting that the observed improvements are unlikely to be attributable to self-selection effects. Finally, while various factors such as baseline differences and participant demographics (e.g., age, education level) may have influenced the observed outcomes, the study design did not allow for full statistical control of these variables across all analyses. As a result, residual confounding may exist, and caution is warranted when interpreting the program effects. Taken together, these limitations highlight the need for future research to build on this foundation. Longitudinal studies should assess the durability of program effects at 6-to-12-month intervals and examine improvements in self-care practices and clinical outcomes, such as dietary quality, activity levels, IC, frailty index, and healthcare utilization. Additionally, alternative study designs, such as random assignment, should be considered to minimize selection bias and strengthen causal inference.

5. Conclusion

While the pragmatic design of the study may limit its contribution to the evidence base, our findings provide valuable insights into midlife women's health concerns and demonstrate the potential of *The Pursuit of Wellness Program* to enhance health knowledge regarding specific IC domains and priority midlife conditions, strengthen self-efficacy for maintaining IC and managing midlife conditions through daily self-care practices, and develop caregiving competencies during this critical life transition. These outcomes highlight the program's unique dual capacity to simultaneously support personal health preservation and caregiver competency development, providing actionable evidence to inform targeted health education initiatives, community-based programs addressing concurrent self-care and caregiving needs, and policies supporting women's health during midlife transitions.

Declaration of generative AI and AI-assisted technologies in the writing process

I have not used any AI at all.

CRediT authorship contribution statement

Ruby Yu: Writing – review & editing, Writing – original draft, Methodology, Conceptualization. **Matthew Yu:** Writing – review & editing, Formal analysis. **Cecilia Tong:** Writing – review & editing, Project administration, Data curation. **Florence Ho:** Writing – review & editing, Supervision, Funding acquisition. **Angel Hui:** Writing – review & editing, Supervision, Project administration. **Emily Lui:** Writing – review & editing, Resources, Project administration. **Jean Woo:** Writing – review & editing, Supervision, Conceptualization.

Declaration of interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgements

We would like to express our gratitude to The Hong Kong Jockey Club Charities Trust for funding the study under Jockey Club 'Shining Journey 50+' Women Wellness Programme. We would also like to thank our project partners, namely Jockey Club CADENZA Hub, Lok Sin Tong, St. James' Settlement, The Family Planning Association of Hong Kong, The Hong Kong Society for Rehabilitation, and Tung Wah Group of Hospitals. In addition, we are grateful to the project participants for their contribution to the study.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.tjfa.2025.100126.

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