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Qigong in cancer care: a systematic review and construct analysis of effective Qigong therapy

P. J. Klein¹ · Roger Schneider² · C. J. Rhoads³Received: 23 December 2015 / Accepted: 28 March 2016
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Abstract

Purpose This review (a) assesses the strength of evidence addressing Qigong therapy in supportive cancer care and (b) provides insights for definition of effective Qigong therapy in supportive cancer care.

Methods This mixed-methods study includes (a) a systematic review of randomized clinical trials (RCTs) following PRISMA guidelines and (b) a constant-comparative qualitative analysis of effective intervention protocols.

Results Eleven published randomized clinical trials were reviewed. A total of 831 individuals were studied. Geographic settings include the USA, Australia, China, Hong Kong, and Malaysia. Qigong therapy was found to have positive effects on the cancer-specific QOL, fatigue, immune function, and cortisol levels of individuals with cancer. Qigong therapy protocols varied supporting a plurality of styles. Qualitative analyses identified common programming constructs. Content constructs included exercise (gentle, integrated, repetitious, flowing, weight-bearing movements),

breath regulation, mindfulness and meditation, energy cultivation including self-massage, and emphasis on relaxation. Logistic constructs included delivery by qualified instructors, home practice, and accommodation for impaired activity tolerance.

Conclusions There is global interest and a growing body of research providing evidence of therapeutic effect of Qigong therapy in supportive cancer care. While Qigong therapy protocols vary in style, construct commonalities do exist. Knowledge of the common constructs among effective programs revealed in this research may be used to guide future research intervention protocol and community programming design and development.

Keywords Cancer · Qigong · Tai chi · Review · Qualitative · Construct analysis · Content analysis

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✉ P. J. Klein
kleinqpj@roadrunner.com

Roger Schneider
rschnei487@aol.com

C. J. Rhoads
cjrhoads@kutztown.edu

¹ S.U.N.Y. at Buffalo, Buffalo, NY, USA

² Village of Healing and Wellness, St Catharines, ON, Canada

³ Kutztown University, Kutztown, PA, USA

Introduction

Advances in treatment and management of cancer have resulted in growing numbers of cancer survivors [1]. However, debilitating effects of disease processes and side effects of subsequent management often have a sustained cost in loss of physical function; vitality; sense of well-being, self-efficacy, and quality of life; and economic consequence. Therefore, finding effective ways to support one through the cancer experience is an essential component of cancer care.

Physical activity is advocated for management of cancer-related fatigue [2, 3]. The potential benefit of exercise as an integral component of cancer rehabilitation has been validated [4]. Barriers to regular engagement in physical activity for individuals with cancer include fatigue and mobility impairments [5]. There is evidence suggesting that Qigong (pronounced: *chee-gong*) exercise therapy

(and Tai chi performed as Qigong) can mitigate the accelerated development of disability, falls, and cardiovascular disease from cancer treatment [6], yet Qigong therapy prescription is not standard practice in supportive cancer care.

Qigong

Therapeutic Qigong or *breath work* is an ancient Chinese discipline with origins in Eastern medicine. The purpose of its practice is for rejuvenation and healing. External Qigong involves the therapeutic transfer of energy from a skilled practitioner to another. Internal Qigong work, performed by the individual, involves both meditative postures and flowing, rhythmic movements incorporating breath regulation, mindful meditation (intent), and self-massage [7]. Theoretical foundations of Qigong include (a) psychoneuroimmunology: the study of interactions among behavioral, neural and endocrine, and immunologic processes of adaptation [8]; (b) relaxation response effect [9]; and (c) Eastern theories of energy cultivation or *breath work*, i.e., accumulation, storage, and circulation of *Qi* also known as vital energy within the bioelectric body [10, 11].

The restorative exercise art of Tai chi quan (also known as Tai chi) is akin to Qigong and a more familiar practice within the Western world. While Tai Chi Quan has foundations in martial arts, when it is performed for health with the intention of energy cultivation, it is a form of Qigong. Note, for the purposes of this article, the term Qigong therapy includes internal Qigong as well as traditional or modified Tai chi performed as therapeutic exercise.

Foundational research

In a recent extensive systematic review of therapeutic Tai chi, Yang et al. [12] examined over 500 studies investigating benefits of Tai chi as a form of internal Qigong. They reported that nearly 95 % of the studies found positive effects in one or more major outcomes studied with no evidence of serious adverse effects. The body of research addressing Qigong in cancer care is much more limited. Challenges for systematic review in the area of cancer care include a paucity of quality studies, plurality of Qigong interventions, and lack of consistency in choice of outcomes studied. Zeng et al., 2014 [13], offers the most comprehensive review of Qigong in cancer care to date. A total of 13 randomized clinical trials (RCTs) were included in that review. Nine of those RCTs provided sufficient data for pooled estimates of size of effect. The review concluded that *Qigong/tai chi had positive effects on the cancer-specific QOL, fatigue, immune function, and cortisol levels of individuals with cancer*. Six previous systematic reviews [13–18] including the Zeng article are summarized in Table 1.

Study justification

Qigong is a complex physical and internal exercise practice. Other than accepting the assertion that Tai chi can be performed as Qigong in therapeutic applications [19], there has been little systematic examination of effective research intervention protocols. A construct analysis of what constitutes effective Qigong therapy in cancer care could provide insights for stakeholders and serves as the major contribution of the current review. A systematic review of existing research is considered preliminary work to identifying effective protocols to be included in the qualitative analysis.

Purpose

The primary purpose of this review was to provide informative insights for definition and identification of effective Qigong therapy in supportive cancer care. A secondary purpose is to update the assessment of the body of evidence addressing Qigong therapy in cancer care.

The major research question is: What recommendations can be made regarding definition of effective Qigong therapy in cancer care?

Enabling research questions include the following:

1. What is the level of evidence assessing the benefits of Qigong or Tai chi performed as Qigong therapy in cancer care?
2. What benefits, if any, are observed in existing research?
3. What common constructs exist among intervention protocols of effective programming?

Methods

This mixed-methodology study involves (a) a systematic review of the literature and (b) a construct analysis of effective Qigong therapy in cancer care protocols. The systematic review of the available body of research follows PRISMA guidelines [20]. The construct analysis employs a constant-comparative model [21].

Search of literature

Two author/researchers (PK and RS) conducted independent computerized searches of PubMed and EBSCO resources using the terms *cancer*[title and abstract] AND *Qigong*[title and abstract] OR *cancer*[title and abstract] AND *tai chi*[title and abstract]. Filters included *clinical research, humans, and years: Jan 2000 through Jun 2015*. Recent topic-related literature reviews and reference lists

Table 1 Summary of systematic reviews ($N=6$) investigating Qigong or tai chi performed as qigong therapy in cancer care

Study	Type and no. of studies (no. of subjects studied)	Conclusions	Author-reported limitations
Pan et al., 2015 [14]	9 RCTs (322)	Short-term effects of Tai chi may benefit upper limb mobility in patients with breast cancer. No evidence of significant effect for pain, Interlukin-6, insulin-like growth factor, BMI, physical well-being, social or emotional well being, or general health-related quality of life in individuals with breast cancer	Small number of studies Small sample sizes (<15/group) in 7/9 studies Pluralism of interventions High potential for study bias
Zeng et al., 2014 [13]	9 RCTs (499) used in pooled data analyses	Improved cancer-specific QOL (5 RCTs pooled), fatigue (2 RCTs pooled), immune function, and cortisol levels No evidence of effect for depression, anxiety, or BMI and BFM	High heterogeneity in pooled groups High risk of bias in most studies
Yan et al., 2014 [15]	5 RCTs used in QOL analyses (407)	Lack of sufficient evidence of effect of tai chi on QOL in breast cancer survivors	Small number of studies Small sample sizes, variation in interventions Potential bias of studies
Oh et al., 2012 [16]	QOL: 3 RCTs, (238) 3 CCTs (302) Immune function and survival: 5 RCTs (380) 2 CCTs (248)	Larger RCTs found more robust evidence of positive effects of medical Qigong in improving QOL and fatigue as well as reducing inflammation.	Most studies (5/7) had small sample sizes and methodological limitations.
Lee et al., 2010 [17]	3 RCTs (61) 4 CCTs (252)	RCTs found no significant differences between tai chi groups and controls. All CCTs showed favorable effects.	No large RCTs included in review All CCTs had a high risk of bias. Publication bias exists. Potentially poor quality of data and poor reporting of results which were highly heterogeneous in virtually every aspect
Lee et al., 2007 [18]	4 RCTs (346) 5 CCTs (525)	Effectiveness of Qigong is not yet supported by evidence from rigorous clinical trials. Two studies suggested improved survival rates. A third study did not have sufficient data to adequately test survival rate effect.	Poor quality of existing studies

RCT randomized clinical trial, CCT controlled clinical trial, QOL quality of life

were hand examined to identify any additional studies that did not appear in computerized searches. A collated search list was then generated by consensus agreement between the two reviewers.

Study inclusion/exclusion criteria

Inclusion criteria were (a) RCTs, (b) sample type: individuals with cancer, and (c) main intervention: internal Qigong including exercise or Tai chi performed as Qigong therapy. Exclusions included pilot and exploratory studies, operationally defined as studies with <15 subjects per group at study inception, and any studies where full text in English language was not available. Titles and abstracts were read to initially

verify study classification as RCT, subject classification and main intervention as internal Qigong therapy. Next, independence of studies was assessed, so as not to inflate representation of effect or size of subjects studied. Then full-text research reports were accessed and reviewed to finalize study selections and to allow for data extraction.

Data abstraction

Within the systematic review of selected studies, augmented PICO data were extracted and described. Potential for bias was assessed. Effects were categorized and described by concept and frequency of study.

Identification of common constructs for the complex intervention of Qigong therapy in cancer care evolved inductively from review of Qigong intervention protocols proven to have effect.

Two author/researchers independently reviewed descriptions of study intervention protocols line by line using the constant-comparative method [21] of qualitative analysis. As a construct became apparent, the text was highlighted and a code was assigned. Text segments with similar codes were compared for congruence. Then, a collated list of constructs, category of construct, and frequency of construct use was generated.

Synthesis

Synthesis of the systematic review involved judgment of the strength of the body of evidence for quantity, quality, and consistency. Quantity and consistency of benefit were assessed on face value. Quality judgments were based on rigor of design, methodology, and potential for bias. An analysis of category of outcome, frequency of use, and statistical significance was generated to graphically display data synthesis.

Synthesis of the qualitative construct analysis involved translation of common constructs into recommendations for effective Qigong therapy in cancer care.

Results

Description of studies

The computerized search of PubMed yielded 22 topic-related clinical trial reports. A search of EBSCO and hand searches identified an additional five studies potentially eligible for review. Screening by inclusion and exclusion criteria resulted in selection of 11 study reports [22–32] generated from 10 independent RCT protocols (see Supplemental Data 1 for a listing of excluded RCTs). A collective total of 831 subjects were studied. Study sample sizes ranged from 32 to 162 subjects. Geographic origins of the studies include the USA, Australia, China, Hong Kong, and Malaysia. Clinical populations were heterogeneous which included individuals with breast cancer, prostate cancer, liver cancer, non-small cell lung cancer, and mixed populations of individuals with cancer. Approximately 50 % of the subjects were individuals experiencing or recovering from breast cancer. Timing of interventions ranged from early stage in treatment through recovery phase. In at least three of the studies reviewed, Qigong therapy was conducted while individuals were simultaneously receiving active treatment including radiotherapy [24], transcatheter arterial chemoembolization (TACE) [26], or chemotherapy [31]. Observation periods for studies ranged from 5–6 to 24 weeks. Supervised training frequency varied

from one to three times a week. Class durations ranged from 60 to 120 min. Table 2 summarizes study characteristics.

Potential for bias

All studies exhibit some potential for bias. Figure 1 describes assessment of risk of bias by study. The potential for bias for the collective research is judged as *plausible bias that raises some doubt about results*. This judgment improves on judgments of *high risk of bias* declared in previous reviews.

Outcomes studied

A wide array of outcomes were studied. All, but two studies, [26, 31], demonstrated effect in one or more major outcomes studied. Non-biological outcomes studied included domains of fatigue, quality of life (QOL), depression, mood, anxiety, distress, sleep quality, cognition, systolic blood pressure, and survival rate. Biological marker outcomes studied included multiple measures of mediation of inflammation and immune function. Outcomes found to have the strongest evidence of demonstrated effect were fatigue and general QOL. While assessment of benefit for mediation of inflammatory response and immune function was conflicted, some evidence of effect is suggested. Figure 2 provides a gestalt representation of the breadth of potential benefits and trends in research findings. (Table 2 presents outcomes studied, tools, and statistical results for individual studies.) (Fig. 3).

Qigong protocols

Ten intervention protocols were identified among the 11 study reports included in this review. Interventions varied among protocols. Specific styles or forms included Medical Qigong [29,30], Gou Lin Qigong [23, 26], Tai Chi Chih [22, 26], Qigong/Tai Chi Easy™ [28], Kuala Lumpur Qigong [29], 8-Form Tai Chi [31], and the standardized International 24-movement Tai Chi form. Examples of adapted modern systems of Qigong/Tai chi exercise designed specifically to be easy to learn and to perform include Qigong/Tai Chi Easy™ [33], Tai Chi Chih [34], and 8-Form Tai Chi [35]. Descriptions of all intervention protocols, as reported in the literature, are provided in Table 3.

Eight out of the 10 protocols were found to be effective for one or more major outcomes studied. Using the constant-comparative method of analysis, descriptions of effective protocols were qualitatively analyzed for common constructs. Constructs were categorized into two major categories as *content* or *logistic*. Content constructs addressed exercises or techniques performed as Qigong therapy. All effective intervention protocols employed some variation of slow exercise described and practiced as gentle, integrated, repetitious, flowing, weight-bearing movements. Each referred to a

Table 2 PICO study characteristics of RCTs investigating Qigong therapy in cancer care: Jan 2000 through Jun 2015 ($N=11$ studies)

<i>Studies</i>	<i>Subjects' geographic setting</i>	<i>Intervention</i>	<i>Major finding(s)</i>
Campo et al. 2015 [22] ^a	<i>Subjects</i> 63 senior female cancer survivors <i>Geographic setting</i> United States	12 weeks (60 min, 3 times/week) of Tai Chi Chih (TCC) or Health Education control classes (HEC)	TCC group was found to have significantly lower postintervention. Systolic blood pressure: TCC adjM = 119.00, SE = 2.81; HEC adjM = 132.57, SE = 3.06; $p = .002$; and Salivary cortisol levels as log-transformed area-under-the-curve (AUC): TCC adjM = 24.65, SE = 1.52; HEC adjM = 29.95, SE = 1.56; $p = .02$ No significant changes in awakening inflammatory cytokines (TCC adjM = 0.37, SE = 0.13, HEC adjM = 0.46, SE = 0.13; $p = 0.63$); nor Diurnal (TCC $b = -0.69$, HEC $b = -0.59$; $p = 0.28$)
Campo et al., 2014 [23]	<i>Subjects</i> 40 senior prostate cancer survivors <i>Geographic setting</i> United States	12 weeks (60 min, 2 times/week) Qigong exercise or light exercise and stretching.	Qigong group had significant improvements in FACIT level of fatigue, and distress. Qigong Mdn = 5.0, range -3 to 30; stretching Mdn = 0, range -22 to -9; $p < 0.02$ Distress (BSI-18): large-sized between group effects favoring the Qigong group Depression, Cohen's $d = -0.8$; Somatization, Cohen's $d = -0.8$; Anxiety, Cohen's $d = -1.1$; Global severity index, Cohen's $d = -1.2$
Chen et al. 2013 [24]	<i>Subjects</i> 96 breast cancer survivors receiving radiotherapy <i>Geographic setting</i> Shanghai, China	5–6 weeks (40 min, weekly) Guolin Qigong classes or wait-list	Depressive symptoms CES-D decreased over time favoring the Qigong: $F(4, 367) = 10.91$, $p = 0.001$ Women who had elevated depressive symptoms (CES-D) in the Qigong group had significantly less fatigue: Brief Fatigue Inventory (BFI) $F(3, 275) = 4.25$, $p = 0.01$; and better QOL FACT-G $F(3, 275) = 3.03$, $p = .002$; but no significant changes in sleep disturbance, Pittsburg Sleep Quality Index (PSQI), nor cortisol slopes
Irwin et al. 2014 [25] ^a	<i>Subjects</i> 90 breast cancer survivors with insomnia <i>Geographic setting</i> Los Angeles, CA	3 months (120 min, weekly) with 1 h of Tai Chi Chih (TCC) or cognitive behavioral therapy (CBT)	Reduced expression of genes encoding proinflammatory mediators (IL-6/TNF) were reduced with TCC vs. CBT ($p = 0.001$); Levels of IL-6 and TNF combined were reduced with TCC vs. CBT ($p < 0.02$) No significant changes in cellular inflammatory responses as C-reactive protein: $F(1, 53.6) = 2.60$, $p = 0.11$, effect size = 0.36
Lam 2004 [26]	<i>Subjects</i> 57 (44 per protocol) advanced liver cancer patients receiving transcatheter arterial chemoembolization (TACE) <i>Geographic setting</i> Queen Mary Hospital, Hong Kong	6 weeks (120 min, 2 times weekly) of Guolin Qigong (GQ), then home-based practice for 18 additional weeks or usual care (UC)	In the per-protocol set, 5 (27.8 %) subjects in QG group and 10 (38.5 %) subjects in control group died during the study. Between-group comparisons for survival rate were not statistically significant. Significant differences in QOL favoring GQ were found: FACT-G group covariate estimate 3.28 (SE 3.25), $p = 0.036$; between-group, $p = 0.022$. Social/family well being—improved as a time effect in both groups with greater improvement in Qigong group: group

Table 2 (continued)

<i>Studies</i>	<i>Subjects' geographic setting</i>	<i>Intervention</i>	<i>Major finding(s)</i>
			covariate estimate 2.25 (SE 0.94), $p = 0.022$ No significant differences for other domains within the SF-36 nor immune biological markers were found.
Larkey et al. 2015 [27] ^a	<i>Subjects</i> 87 postmenopausal, fatigued breast cancer survivors <i>Geographic setting</i> USA	12 weeks (60 min, 2 times/week) Qigong/Tai Chi Easy (QG/TCE) or sham Qigong	Fatigue symptom inventory decreased significantly in QG/TCE group postintervention ($p = 0.005$) and at 3 months follow-up ($p = 0.024$) Both showed medium size effect (0.56 and 0.43, respectively) Sleep quality and depression improved in both groups with no significant between-group differences
Loh et al. 2014 [28] ^a	<i>Subjects</i> 95 women with breast cancer <i>Geographic setting</i> University of Malaya Medical Centre, Malaysia	8 weeks (90 min, weekly) of Kuala Lumpur Qigong (QG), or line dancing, or usual care (UC)	Significant marginal improvements in QOL FACT-B scores at 8 weeks in the QG compared to line dancing: mean diff = 6.67 (0.03 to 13.3), and QG to UC: mean diff = 7.13 (0.35 to 13.9) No significant differences among groups in fatigue or distress measures FACIT-F QG compared to line dancing: mean diff = 0.74, (-2.62 to 4.11), and QG to UC: mean diff = 2.15 (-1.19 to 5.49); DASS 21: depression $p = 0.49$, Anx $p = 0.81$, Stress $p = 0.13$
Oh et al. 2012 ^a [29]	<i>Subject</i> 81 individuals with cancer (subset of Oh et al. 2010) <i>Geographic setting</i> Sidney, Australia	10 weeks (90 min, 2 times/week) of medical Qigong (MQ: gentle exercise and meditation) two 90-min sessions/week and home practice or usual care	MQ group improved in cognitive function, FACT-Cog (mean diff = 7.78, $t_{51} = -2.532$, $p = 0.014$) QOL FACT-G (mean diff = 12.66, $t_{45} = -5.715$, $p = 0.001$); and Reduced biomarkers of inflammation CPR (mean diff = -0.72, $t_{45} = -2.92$, $p = 0.042$)
Oh et al. 2010 [30]	<i>Subjects</i> 162 individuals with cancer <i>Geographic setting</i> Sidney, Australia	10 weeks (90 min, 2 times/week) of medical Qigong, two 90-min sessions/week, and home practice of MQ or usual care	Regression analysis indicated that the MQ group had improved QOL ($t_{144} 5.761$, $p < 0.001$), Fatigue ($t_{153} 5.621$, $p < 0.001$), Profile of mood state ($t_{122} = 2.346$, $p = 0.021$), and Biomarkers of inflammation CPR ($t_{99} 2.042$, $p < 0.044$).
Robins et al. 2013 [31] ^a	109 women with cancer during chemotherapy treatment <i>Geographic setting</i> Virginia, USA	5–6 weeks (90 min, weekly) 8-Movement Tai Chi, spiritual growth group, or usual care	No evidence of effect for QOL, perceived stress, neuroendocrine mediators, nor attenuation of immunosuppression
Wang et al. 2013 [32]	<i>Subjects</i> 32 men with non-small cell lung cancer <i>Geographic setting</i> Shanghai, China	16 weeks (60 min, 3 times a week) Training in International 24-Movement Tai chi or no intervention	Tai chi exercise significantly diminished the magnitude of the decreased T1/T2 and Tc1/Tc2 ratios, mediated immune suppression ($p < 0.01$ for both) in the natural course of recovery in lung cancer survivors. Cortisol levels increased in the control group ($p < 0.05$), but not in Tai chi group.

^a Recent study not included in Zeng et al. [8] review

specific stylized form. Only one of those protocols employed a traditional Tai chi form [32]. However, dynamic Tai chi postures were included as adapted exercise in most protocols.

Meditation/mindfulness training was described in six of eight protocols. Training in breath regulation was described in five of eight effective protocols. Reference to energy cultivation

	Random Sequencing	Allocation concealment	Participant/personnel blinding	Assessor blinding	Incomplete data bias	Selective reporting bias	Other bias
Campo et al. 2015 [22]	●	○	○	?	●	●	●
Campo et al. 2014 [23]	●	○	○	○	●	●	●
Chen et al. 2013 [24]	●	●	○	?	●	●	●
Irwin et al. 2014 [25]	●	●	○	?	●	●	●
Lam, 2004 [26]	●	●	○	●	●	●	●
Larkey et al. 2015 [27]	●	●	◐*	●	●	●	●
Loh et al. 2014 [28]	●	●	○	○	○	●	●
Oh et al. 2012 [29]	●	?	○	?	○	●	●
Oh et al. 2010 [30]	●	?	○	?	○	●	●
Robins et al. 2013 [31]	●	?	○	?	○	●	●
Wang et al. 2013 [32]	?	?	○	?	●	●	●

Fig. 1 Risk of bias summary for 10 study protocols assessing effects of Qigong therapy in cancer care

wasevidentinfourofeightprotocols.Referencetorelaxationor arousalstatewasmadeinthreeofeightprotocols.Someformof massage or tapping stimulation was specifically described in twoofeightprotocols.

Logistic constructs address delivery management. All studies engaged experienced instructors certified or trained in the specific styles or forms of Qigong therapy employed in the respective study protocols. Three

protocols described the instructor as a *Qigong master*. Home practice was reported in six of eight protocols. Home practice aids, described as *DVDs* or *compact disc*, were distributed in four of eight protocols. Some portion of the exercises were practiced as seated or accommodation for seated exercises were provided in three of eight protocols. Qigong therapy protocol constructs identified in the analysis and their frequency of use are presented in Fig. 3. (Details of the data management process are available in Supplemental Data 2.)

Discussion

Enabling question 1. What is the level of evidence supporting benefit of Qigong or Tai chi performed as Qigong in cancer care?

Judgment of level of evidence was made by consideration of quantity, quality, and consistency of existing research. The growing body of research identified in this review provides additional evidence that Qigong is a beneficial exercise in cancer care, strengthening previous conclusions of Zeng et al. [14]. In contrast to the Zeng review, an additional six recently published RCTs were included in the current review, and eight small pilot studies were excluded. Nine of the 11 study reports (8 of 10 independent studies) had positive findings supporting a judgment of consistency in findings. While a potential for risk of bias still exists in all studies, improved rigor of design has controlled this threat somewhat. The

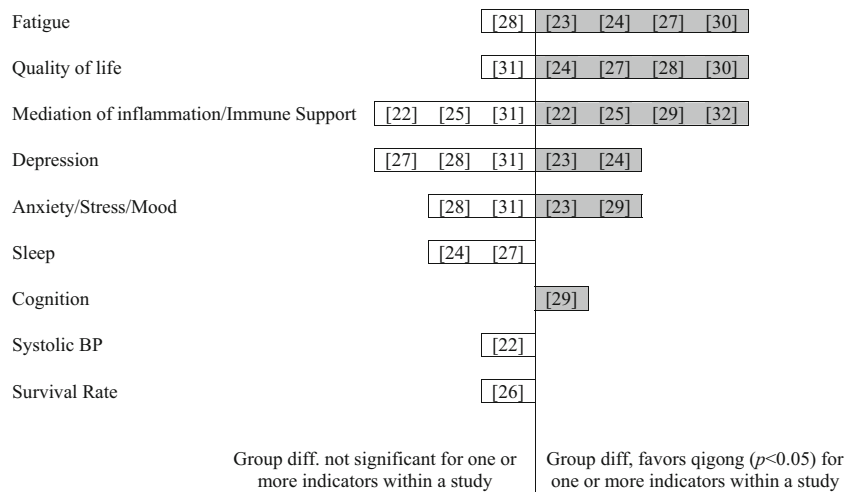


Fig. 2 Outcomes studied from 10 published RCTs investigating the effects of Qigong therapy in cancer care by category, frequency, significance, and referent study. Notes: individual study statistics are presented in Table 2. Management of data is presented in Supplementary Data 2–Table 2a. To control for multiple publication bias, for Oh et al., 2012 [29], only data on cognition are represented. Campo et al. 2015 [22] is represented twice for *Mediation of*

Inflammation/Immune support because changes in salivary cortisol were significant, while changes in awakening or diurnal cytokines did not change significantly. Irwin et al. 2013 [25] is represented twice in *Mediation of Inflammation/Immune support* because proinflammatory mediators (IL-6 and TNF) were reduced, while CRP did not change significantly

Fig. 3 Content and logistic constructs identified through constant-comparison analysis and frequency of use extracted from data reported in eight effective intervention protocols for Qigong therapy in cancer care

CONSTRUCTS	Studies by reference #								
	[22]	[23]	[24]	[25]	[27]	[28]	[29,30]	[32]	
Content									
Gentle/integrated/repetitious/flowing/weight-bearing exercises	X	X	X	X	X	X	X	X	
Stylized exercises	X	X	X	X	X	X	X	X	
Meditation/mindfulness	X	X	X	X	X		X		
Breath regulation		X	X	X			X	X	
Energy cultivation		X	X		X		X		
Relaxation				X	X		X		
Self-massage	X		X						
Logistic									
Qualified instructor	X	X	X	X	X	X	X	X	
Home practice		X	X	X	X	X	X		
Home practice aid		X	X		X	X			
Accommodation for seated exercises	X	X					X		

reduction in potential for bias is attributed to improved quality of study design and increased detail in reporting the method of random sequencing and concealment of allocation, as well as comparative analyses of dropouts within the most recent studies. One study used a double-blind (subject and assessor) design [27]. Due to the requirement of a trained instructor, no Qigong instructors could be blinded to the intervention. This design characteristic will continue to confound blinding in any future research.

Enabling question 2. What benefits, if any, were observed?

Qigong therapy appears to have potential for both psychological and biological effects. Multiple studies confirm that Qigong therapy can reduce fatigue and improve QOL. Mediation of inflammatory response and immune function is suggested. These are important findings within this particular clinical population. Minimization of fatigue symptoms and improved QOL can have great meaning in the day-to-day life of one who is experiencing cancer. While exercise, in general, is recommended in management of cancer, Qigong therapy may have added value as compared to other exercise modalities. A major Cochrane review of traditional Western exercise interventions on health-related QOL of various cancer survivors concluded no statistically significant changes in QOL among the benefits of exercise for individuals with cancer [36]. The Cochrane review included 40 trials and 3694 participants.

The potential biological benefit of mediation of inflammatory response, if supported in future study, may have profound

clinical significance in immunoprevention of cancer. This supposition is based on the link between chronic inflammation and suppression of the immune response [37]. These findings partially validate the work of Chen and Yeung, 2002 [38], who reviewed over 50 studies through 20 years of Qigong and cancer research in China. These researchers concluded that those performing Qigong showed more improvement or had a better survival rate than those individuals receiving conventional treatment methods alone.

A comprehensive meta-analysis, while ideal, was not feasible for analysis of the current research because independent studies often measured different outcomes, and those that investigated a common outcome did not necessarily use either the same measurement tool or the method of statistical reporting. Hopefully, meta-analyses will be feasible in future reviews as more comparable data are generated.

Enabling question 3. What common constructs exist among intervention protocols of effective programming?

Review of the descriptions of effective Qigong protocols identified key common elements of practice validating previously published expert opinion [7]. Content constructs include exercise characterized as gentle, integrated, repetitious, flowing, weight-bearing movements that can accommodate varying levels of activity tolerance. Additional content constructs included breath regulation, mindfulness and meditation, energy cultivation including self-massage, and emphasis on relaxation.

No conclusions can be suggested regarding superiority of one Qigong style or form over another. Rather, a plurality of

Table 3 Descriptions of 10 intervention research protocols for Qigong/Tai Chi in cancer care

Study	Description of intervention	Instructor training home practice
Campo et al. 2015 [22]	<i>Tai Chi Chih (TCC)</i> Each session began with a 20-min warm-up that consisted of a seated meditation, self-massage of acupressure points, and light stretching, followed by 30 min of TCC (19 simple, repetitive, non-strenuous movements and one standing pose) and 10 min of closing movements. Each week, one to two new movements were added until the entire form was practiced during the last 3 weeks. Participants were informed that all movements could be performed seated, if needed.	<i>Instructor:</i> certified TCC instructor <i>Home practice:</i> not reported
Campo et al. 2014 [23]	<i>Qigong for prostate cancer survivors</i> Sessions began with a 5-min meditative focus on the breath, followed by sitting exercises, then standing movements, and ended with 5-min meditative focus on the breath. Sitting exercises include opening of the nine gates, muscle change exercises, and cavity presses. Standing exercises include collecting energy of heaven and earth, rocking chair, Tai chi ruler, hands skimming on water, pushing and pulling space, and cloud hands. Integrated eccentrically based muscular focus uses body weight for resistance for strengthening and muscle lengthening. As the study progressed, a larger proportion of time was spent performing the standing movements than the sitting exercises.	<i>Instructor:</i> Qigong Master and his certified instructors <i>Home practice:</i> DVD provided
Chen et al. 2013 [24]	<i>Guolin Qigong</i> consisted of several breathing and moving exercises. Also known as “walking qigong” Each session had three parts: (1) <i>Preparation exercise:</i> relaxation (gentle breathing and meditation: 4 min), synchronizing the breath with slow shallow squatting movements (3 min), and synchronizing the breath with gentle arm movements in front of the abdomen (opening and closing of the <i>dantian</i> : 3–6 min); (2) <i>Main exercise:</i> participants walked in a circle synchronizing their breathing, arm movements, and steps focusing on the movement of their body with the goal of calming one’s mind, relaxing various parts of the body and the mind, and revitalizing the “life-force,” i.e., <i>qi</i> . This was first done slowly and then fast using wind-like breathing (18 min); and (3) <i>Ending exercise:</i> breathing exercises, opening and closing of the <i>dantian</i> , and self-massage (3–6 min).	<i>Instructor:</i> government-licensed traditional Chinese medicine doctor and Qigong master, trained at the Shanghai University of Traditional Chinese Medicine with 30 years of clinical experience <i>Home practice:</i> DVD provided
Irwin et al. 2015 [25]	<i>T'ai Chi Chih</i> integrates physical, psychosocial, emotional, spiritual, and behavioral elements through mindful exercise. Using a manualized approach, each session provided objectives and learning activities related to sequentially learning a specific set of 20 exercises with verification of skill attainment weekly. The first 8 weeks emphasized mastery of single forms through multiple repetitions in class and at home; latter weeks focused on class consolidation of daily practice routines with natural breathing integrated into all sessions. TCC emphasized arousal-related responsiveness through performance of repetitious, non-strenuous, slow-paced movement.	<i>Instructor:</i> certified in TCC <i>Home practice:</i> diary review assessed frequency and duration of home practice between sessions and at follow-up
Lam 2004 [26]	<i>Goulin Qigong</i> (Queen Mary Hospital, Hong Kong) Subjects attended 12, 2-h Qigong classes in 6 weeks (2 classes/week), followed by 18 weeks of home practice. The Qigong skills of the patients were evaluated at weeks 6 and 24 by both the Qigong instructor and the patient. A total of nine items related to the form (arm, leg, head, and trunk control), breathing (method, rhythm, depth), and relaxation (absence of interference, perception of energy, postexercise rest). To achieve a mindful state, the Qigong instructor asked subjects to clear their minds and to focus on a single entity.	<i>Instructor:</i> certified in style <i>Home practice:</i> subjects were instructed to practice Qigong for 3.5–5 h/day. Actual reported 1.8 ± 1.6 h/day.
Larkey et al. 2015 [27]	<i>Qigong/Tai Chi Easy</i> A set of 10 QG/TCE movements drawn from the Tai Chi Easy™ practices, and the “Vitality Method” series of Qigong exercises ^a were chosen based on the purported properties to improve overall Qi balance, vitality, and mental alertness, to be taught using the	<i>Instructor:</i> the QG/TCE instructor was trained in the study protocol and described as a registered nurse with additional certifications in

Table 3 (continued)

Study	Description of intervention	Instructor training home practice
	principles of Meditative Movement ^b . The QG/TCE teaching emphasized slow, fluid movements, breathing in rhythm with the motion, and clearing the mind to create a relaxed, meditative experience.	Holistic Nursing, yoga, and meditation. <i>Home practice:</i> DVD and/or written instructional manual as per subject preference
Loh et al. 2014 [28]	<i>Kuala Lumpur Qigong</i> 10-min warm-up followed by 70 min of main exercise and a 10-min cool down. Qigong systems included a progression through Peng Qi Guan Ding Fa, Zhi Neng Qigong, and Xin Bing Zhuan Zhuang. Minor movements such as Kai He La Qi, Dun Quiang, and Chen Qi were also added.	<i>Instructor:</i> qualified Qigong master <i>Home practice:</i> a compact disc was provided and practice was recorded by a logbook.
Oh et al. 2010 [29]; Oh et al. 2012 [30]	<i>Medical Qigong</i> Each session began with a 15-min discussion of health issues. Each session consisted of 30-min gentle stretching and body movement in standing postures to stimulate the body along the energy channels, 15-min movement in seated posture (Dao Yin exercise for face, head, neck, shoulders, waist, lower back, legs, and feet), and 30-min meditation including breathing exercises on the basis of energy channel theory in Chinese medicine, including natural breathing, chest breathing, abdominal breathing, breathing for energy regulation, relaxation, feeling the Qi (nature's/cosmic energy), and visualization.	<i>Instructor:</i> Chinese medicine practitioner with >20 years experience of Qigong <i>Home practice:</i> recorded by diary
Robins et al. 2013 [31]	<i>8-Movement Form Tai Chi</i> Each class begins with sitting forgetfulness meditation and a body scan, then <i>QG Warm Up Exercises</i> . This was followed by progressive training in a focused short form of Tai chi training involving 8 movements. The sequence of movements was focused on developing each individual's skills in balancing, focused breathing, gentle physical posturing and movement, and the active use of consciousness for relaxation. The intervention concluded with the following <i>Cool Down Exercises: Ren Chong breathing meditation focuses the breath to nourish the blood and promote healthy circulation. Back of head and neck rubdown to quiet the mind for focused breathing and class closure.</i> Concepts of energy theory were discussed (e.g., 5 elements, ongoing change, and transformation)	<i>Instructor:</i> foundations in Yang style. Researcher-developed Qigong program ^b <i>Home practice:</i> Training video/ DVDs were provided for ongoing practice.
Wang et al. 2013 [32]	<i>24-Movement Tai Chi</i> The Tai chi group performed Tai chi breath exercise and Zhao and Zhao's International 24 standardized movements ^c . Each Tai chi session was preceded by a 10-min warm-up period (i.e., low-back and hamstring stretches, gentle calisthenics, and balance training) followed by a 10-min cool-down period.	<i>Instructor:</i> expert Tai chi practitioner with >20 years of experience <i>Home practice:</i> not reported

^a Larkey LK, Jahnke R, Etnier J, Gonzalez J (2009) Meditative movement as a category of exercise: Implications for research. *Journal of Physical Activity & Health*. 6(2):230–238

^b Robins JLW, Elswick RK, McCain NL (2012) The Story of the Evolution of a Unique Tai Chi Form: Origins, Philosophy, and Research. *J Holistic Nur* 30(3):134–146. doi:10.1177/0898010111429850

^c Zhao C, Zhao D. Tai Chi for Health: (2006) The 24 Simplified Forms. Agilceed Books. ISBN: 9780976118312

adapted Qigong exercise is supported. This finding is similar to what has been observed in previous reviews [12, 13, 19]. Campo et al. used two different styles of Qigong therapy, Tai chi Chih [22] and a Qigong program designed by a Qigong master [23], and found positive results for each. While Guolin Qigong, used in two studies [24, 26], often includes repetition of gentle exercise patterns and self-massage, it is primarily a stylized walking program. The minimal use of choreographed, traditional, family Tai chi forms in study protocol designs may

be relevant to clinical applications for *cancer care*. Qigong exercises are easier to perform as compared to traditional Tai chi forms and include repetitive exercises that are easily adapted. Additionally, mindfulness, relaxation, breath regulation, and intent are more readily mastered when learning and performing relatively simple movements as compared to more complex movement patterns.

A recent meta-analysis of Qigong and depression found that Qigong exercise practice, but not the more traditional

Tai chi practice, proved effective in reducing depression [39]. This suggests that when working with individuals who are experiencing depression, such as is often the case for those experiencing cancer, emphasizing breath control and mindful movement rather than perfection of movement pattern may garner the best results.

Logistical considerations include instruction by qualified instructors, home practice, and accommodation for compromised activity tolerance. Beyond instructor training in Qigong style and energy cultivation, knowledge of special considerations associated with this specific clinical population is advised. Exercises are likely needed to be adapted for individuals with physical limitation [5]. Equally important, psychosocial aspects of clinical groups are also a consideration. Individuals may initially experience fear about joining a group where others may not survive cancer [40]. On the more positive side, targeted group classes have the potential to serve as peer social support, if programming vision and mission incorporates this goal.

Primary question: what recommendations can be made regarding future prescription of Qigong therapy and development of Qigong programming in cancer care?

The word “*Qigong*” is unfamiliar to most Westerners, so to offer the recommendation that individuals with cancer may benefit from practice of Qigong does little to assist the public, health professionals, or service providers unless further definition is provided. Given what information is available, preliminary evidence-based recommendations for structure of Qigong therapy in cancer care are offered in the following.

Qigong therapy in cancer care should include the following:

1. Qigong therapy exercises incorporating slow, gentle, integrated, repetitious, flowing, weight-bearing movements (Integrated movements involve coordination of arm, spine and trunk, leg and weight shift involvement.)
2. Dedicated practice in mindfulness and meditation (clearing and calming of the mind with intention on the flow of movement)
3. Instruction in breath regulation to induce calmness and relaxation response effect (slowing and deepening of respiration, emphasis on controlled exhalation, timing of inhalation on opening movements and exhalation on closing movement)
4. Inclusion of energy cultivation techniques including self-massage
5. Provision of exercise accommodation for individuals experiencing fatigue or mobility impairment

6. Instruction delivered by an instructor qualified in the Qigong style or form taught. One with additional knowledge of energy cultivation and special considerations for individuals with cancer
7. Provisions for home practice with instructional aids

Early adoption of innovation

Given the increased strength of evidence of effect elucidated in this report, the question emerges as to *While we will continue to seek further research knowledge, when is there enough evidence to act?* There is a growing population of cancer survivors. There is evidence that Qigong therapy has some relevant benefits for individuals experiencing cancer. The question of when to translate research to practice may be partially addressed in economic analysis. The cost-effectiveness of a therapeutic intervention is the ratio of the cost of the intervention to a relevant measure of its benefit-to-risk ratio. When a low-cost program with no or minimal adverse effects is weighed against known evidence of effect, then a case can be made for early adoption of programming innovation. In the case of Qigong therapy in cancer care, two decision criteria for early adoption of innovation can be met. The current review validates and strengthens previous research providing evidence of benefit. Secondly, an extensive 2015 review of over 150 eligible clinical trials found no evidence of serious adverse effects from practice of therapeutic Tai chi [41]. The third criterion, cost/benefit, is partially met. There are no published studies assessing the cost/benefit of Qigong therapy in cancer care. However, cost data do exist in other clinical areas. In a recent comparative report [42], the average cost of delivering an effective fall prevention Tai chi program was US\$104.02 per participant for a 26-week course with an estimated return on investment of 509 % for each dollar invested. An estimate of the base cost of delivering Qigong therapy in cancer care is US\$10–\$15 per session/participant plus US\$50 for a training DVD, based on 10–15 participants/group session. These cost estimates extrapolate to US\$310–\$440/participant cost for 6 months of once weekly group Qigong therapy.

Limitations

The following limitations are acknowledged. We are still relatively early in the study of Qigong therapy in cancer care. The literature search was limited to English language. A well-known publishing bias toward studies with positive results does exist. Potential threats to bias, while reduced in recent studies, still exist in all studies. Only 5 of 10 study protocols used an active control. Summary study representation using a voting method of *significant vs. not significant* findings, as is

the case in Fig. 2, risks a potential type I error for smaller studies. Further, study size and methodological rigor are not weighted in voting method comparisons. Also, validity of result comparisons was further challenged by heterogeneity of subjects, inconsistency in type, and stage of disease and cancer treatment, as well as length of study.

Construct analysis within Qigong protocols was limited by the level of detail in published descriptions. For example, only two of eight effective intervention protocols specifically referred to self-massage. And yet, variations of self-massage are likely to have been used in all protocols, just not listed specifically in protocol descriptions. For example, within theoretical foundations of reflexology and Eastern medicine, any exercise that involves slow controlled weight-shifting, as often occurs in standing Qigong practice, is a form of self-massage. Through this systematic progression of pressure on the sole of the foot, there is self-stimulation of a micro-system of all major organs, as well as energy gates and acupressure points that are located on the sole of the foot.

Future research

Though it is a worthy goal to aspire to translate research into practice, more questions for future applied research may have been raised than were answered by this review. Future research questions for adoption of innovation include the following. Which cancer populations might benefit most, at what time in the cancer process, and in what way? What frequency and duration of practice is optimal? How do we stimulate adoption of Qigong therapy into standard practice as integrative cancer care? Can an evidence-based, cost/benefit evaluation be calculated? How do we train a sufficient number of qualified instructors to meet a global need? What instructor knowledge and personal qualities are most desirable? On a parallel note, a fuller understanding of the potentially confounding variable of external Qigong (transfer of energy from one person to another) that might be expressed by the Qigong instructor or the group could be explored. All descriptions of protocols were silent on this issue, and little research investigates the phenomenon of external Qigong [43].

As pertains to the various findings on mediation of inflammatory response/immune support, we believe that the findings provide justification for future study. However, the broad spectrum of types of cancer, stages of the various cancers, and timing of study make it difficult to evaluate the clinical significance of any changes in biochemical markers observed in the studies reviewed. In future study, limiting study populations to improve homogeneity and adjusting study design to allow for a longer period of observation may provide more valuable information in this area.

Conclusions

There is growing and consistent research evidence that the practice of Qigong has relevant benefits for managing fatigue and improving QOL for individuals with cancer. A plurality of effective Qigong styles is supported. Common constructs of effective Qigong therapy in supportive cancer care have been identified. Content constructs include slow exercise (gentle, integrated, repetitious, flowing, weight-bearing movements), breath regulation, mindfulness and meditation, energy cultivation including self-massage, and an emphasis on relaxation. Logistic constructs include instruction by qualified instructors, home practice, and accommodation for compromised activity tolerance. Evidence-based definition of effective Qigong therapy can guide researchers in the design of Qigong protocols for future study, practitioners in adapting programming, and the public and healthcare professionals in identifying potentially effective Qigong therapy as supportive cancer care.

Compliance with ethical standards

Conflict of interest All authors declare that they have no conflict of interest.

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