

ORIGINAL ARTICLE

A review of instruments to measure interprofessional collaboration for chronic disease management for community-living older adults

Sue Bookey-Bassett, Maureen Markle-Reid, Colleen McKey, and Noori Akhtar-Danesh

School of Nursing, Faculty of Health Sciences, McMaster University, Hamilton, Ontario, Canada

ABSTRACT

It is acknowledged internationally that chronic disease management (CDM) for community-living older adults (CLOA) is an increasingly complex process. CDM for older adults, who are often living with multiple chronic conditions, requires coordination of various health and social services. Coordination is enabled through interprofessional collaboration (IPC) among individual providers, community organizations, and health sectors. Measuring IPC is complicated given there are multiple conceptualisations and measures of IPC. A literature review of several healthcare, psychological, and social science electronic databases was conducted to locate instruments that measure IPC at the team level and have published evidence of their reliability and validity. Five instruments met the criteria and were critically reviewed to determine their strengths and limitations as they relate to CDM for CLOA. A comparison of the characteristics, psychometric properties, and overall concordance of each instrument with salient attributes of IPC found the Collaborative Practice Assessment Tool to be the most appropriate instrument for measuring IPC for CDM in CLOA.

ARTICLE HISTORY

Received 24 March 2015
Revised 6 October 2015
Accepted 18 November 2015

KEYWORDS

Chronic disease management; instruments; interprofessional collaboration; measurement; questionnaires

Introduction

It is acknowledged internationally that chronic disease management (CDM) for community-living older adults (CLOA) is an increasingly complex process (Institute of Medicine, 2008; World Health Organization, 2005). CDM for older adults, who are often living with multiple chronic conditions, requires coordination of various health and social services. Coordination is enabled through interprofessional collaboration (IPC) among individual providers, community organizations, and all health sectors (American Geriatric Society [AGS], 2006; Johansson, Eklund, & Gosman-Hedstrom, 2010; Markle-Reid, Browne, & Gafni, 2011; Trivedi et al., 2013). Qualitative evidence suggests that IPC has a positive impact on both older clients and providers; however, evidence measuring the effectiveness of IPC on explicit outcomes for older people is lacking (Barrett, Curran, Glynn, & Godwin, 2007; Baxter & Markle-Reid, 2009; Kharicha, Levin, Iliffe, & Davey, 2004; Trivedi et al., 2013).

Despite having different meanings, the terms “interprofessional collaboration,” “interdisciplinary collaboration,” and “multidisciplinary collaboration” are often used interchangeably in the literature (Reeves, Lewin, Espin, & Zwarenstein, 2010). Furthermore, measuring IPC is complicated because there are numerous conceptualizations and measures of IPC (Butt, Markle-Reid, & Browne, 2008; Orchard, King, Khalili, & Bezzina, 2012; Thannhauser, Russell-Mayhew, & Scott, 2010). Moreover, the psychometric properties of many of these existing instruments are not fully known, and existing measures of IPC have not been examined in terms of their relevance to CDM in older adults. Without knowing the

psychometric properties, the utility of these instruments for evaluating the effectiveness of IPC for community-based CDM in CLOA is unclear (Streiner & Norman, 2003; Thannhauser et al., 2010).

Therefore, the purpose of this article is (1) to critically review the psychometric properties of the existing instruments that measure IPC in order to determine the strengths and limitations of these measures as they relate to community-based CDM for CLOA and (2) to compare the dimensions of IPC within each of the instruments with the salient attributes of IPC, identified in the literature, to determine the tool with the best concordance. The findings from this analysis were then used to identify the most appropriate instrument (s) for measuring IPC for CDM in CLOA.

Background

As noted previously, numerous definitions of IPC are found in the literature. For this article, IPC is defined as follows:

Working together with one or more members of the healthcare team where each make a unique contribution to achieving a common goal, enhancing the benefits for patients. Each individual contributes from within the limits of their scope of practice. It is a process for communication and decision-making that enables the separate and shared knowledge and skills of different care providers to synergistically influence the care provided through changed attitudes and behaviours, all the while emphasizing patient-centred goals and values. (Health Canada, 2010, para. 3)

This definition was chosen as it is a well-cited and comprehensive definition of IPC that includes reference to common attributes of IPC cited in the literature (e.g., working together,

communication, decision-making). It is intended to be inclusive of diverse healthcare providers and applicable across various healthcare settings. This is relevant given that CDM for CLOA occurs in multiple settings (e.g., primary care offices, community centres, client homes) and often includes various professionals and non-professionals (AGS, 2006; Johansson et al., 2010; Nolte, 2005; Wagner, 2000).

Measurement of a concept requires a clear definition or an understanding of the key attributes of the concept (McDowell, 2006; Rodgers, 2000). Salient attributes are defined as the recurring characteristics of a concept found in the literature (Rodgers, 2000). It is important to note that the meaning of a concept develops over time and is influenced by practice context (Rodgers, 2000). Identifying the salient attributes of IPC that are specific to CDM for CLOA is, therefore, important for gaining a better understanding of IPC in this context, and can be used to guide the selection of an appropriate instrument to measure IPC. The relevant attributes of IPC in the context of CDM for CLOA were identified based on a review of the current interprofessional and CDM literature. The procedures used to identify the attributes are described further in the methods section.

Methods

To identify relevant attributes and instruments to measure IPC, a systematic literature search was performed, in consultation with a research librarian. Our literature search strategy involved using keywords such as “interprofessional collaboration,” “interdisciplinary collaboration,” “multiprofessional collaboration,” and “interprofessional working,” combined with “questionnaires,” “scales,” “instruments,” and “tools” along with “chronic disease management” and “community-living older adults” to search the CINAHL, MEDLINE, PsycINFO, Health and Psychological Instruments (HAPI), EMBASE databases, and the Cochrane Database of Systematic Reviews. The search was limited to English-language publications between the years 2000 and 2013, as the majority of IPC literature has been published since 2000. Grey literature was identified using Google and Google Scholar, and reference lists of retained articles were reviewed for additional relevant sources.

The search methods generated approximately 200 citations from multiple disciplines including nursing, medicine, and social sciences. After review to verify the presence or absence of an instrument to measure IPC, 45 documents were identified as having 12 instruments to measure IPC and were retained for further appraisal. The abstracts of the 155 excluded documents were then screened for their relevance for identifying attributes of IPC for CDM for CLOA. Search results are presented in Figure 1.

Attributes were identified from approximately 20 articles, including empirical studies of IPC (Duner, 2013; Sicotte, D’Amour, & Moreault, 2002), concept analyses and conceptual models of interprofessional and interdisciplinary collaboration in healthcare (Bronstein, 2003; Henneman, Lee & Cohen, 1995; Orchard, Curran, & Kabene, 2009; Petri, 2010; Sullivan, 1998), and research articles concerning CDM for CLOA (Markle-Reid et al., 2011; Sommers, Marton, Barbaccia, & Randolph, 2000). These articles were read with

a focus on the terms authors used to describe IPC. All articles were read several times by the first author to identify and code the major characteristics or attributes. A total of seven attributes were identified. These were as follows: (a) shared planning and decision-making (Baxter & Markle-Reid, 2009; Bronstein, 2003; D’Amour, Ferrada-Videla, San Martin-Rodriguez, & Beaulieu, 2005; Sommers et al., 2000), (b) interdependence and cooperation (Bronstein, 2003; Canadian Interprofessional Health Collaborative [CIHC], 2012; D’Amour et al., 2005; Petri, 2010), (c) partnership with trust and respect among team members (D’Amour et al., 2005; Henneman et al., 1995; Orchard et al., 2012), (d) shared power and leadership (D’Amour et al., 2005; Petri, 2010), (e) coordination and communication (Baxter & Markle-Reid, 2009; Moore et al., 2013; Sommers et al., 2000), (f) patient/family involvement (Bronstein, 2003; D’Amour et al., 2005; Markle-Reid et al., 2011; Moore et al., 2013; Schraeder et al., 2008), and (g) team evaluation (Baxter & Markle-Reid, 2009; Bronstein, 2003; Orchard et al., 2009).

To be considered for full review, the instruments had to measure key attributes of IPC at the team level and have published empirical evidence of reliability and validity. Streiner and Norman (2003) recommended the following criteria as the minimal accepted level of reliability. Internal consistency reliability coefficients for scales should exceed .8 and stability measures (e.g., test–retest) should be greater than .5 depending on the intended use of the instrument. In terms of acceptable validity, Streiner and Norman advised there should be an explicit statement regarding face and content validity based on some form of review by an expert panel as a minimum prerequisite for acceptance of a measure. In addition, empirical evidence of construct validity is necessary to confirm the tool is measuring what it is intended to measure. The required type of validity depends on the measurement purpose.

Team was inclusive of three or more different healthcare providers working together to provide care for a certain patient population. Instruments were excluded for any of the following reasons: (a) measured interprofessional education (IPE), (b) measured IPC among academic teams or students, (c) measured IPC at the interorganizational or interagency level, or (d) measured only nurse–physician collaboration.

To determine the instruments’ concordance with the identified attributes of IPC, namely shared planning and decision-making; interdependence and cooperation, partnership with trust and respect among team members, shared power and leadership, coordination and communication, patient and family involvement, and team evaluation, every item from each instrument was read and assessed to decide which attribute of IPC was being addressed (Kelly, O’Malley, Kallen, & Ford, 2005; Kimberlin & Winterstein, 2008). If it was unclear what attribute an item was measuring, the item was omitted from the analysis. This process was completed twice by the first author on two separate occasions to enhance rigour in assessment of the items.

Results

From the initial search, a total of 45 documents identified 12 instruments to measure IPC. Upon further review and

Literature Search Results

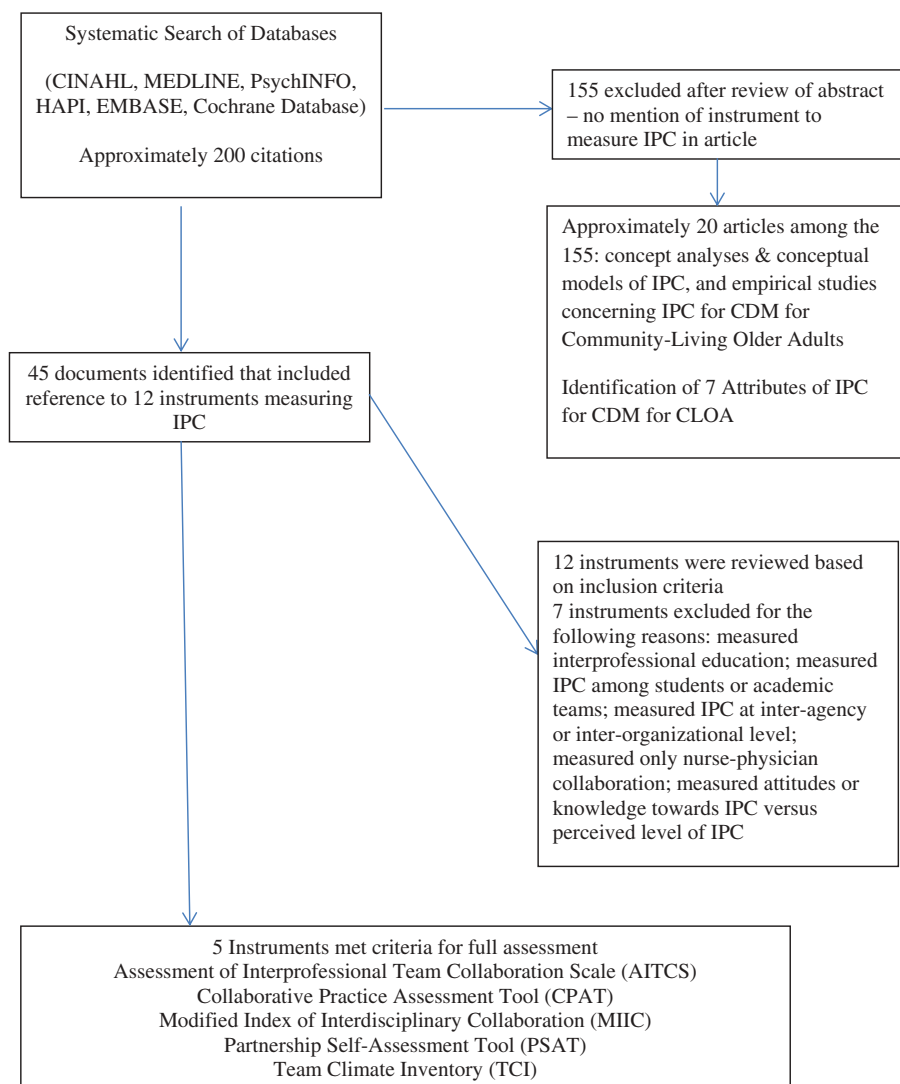


Figure 1. Literature search results.

appraisal, a total of five instruments satisfied the predetermined selection criteria and included the following: (a) the Assessment of Interprofessional Team Collaboration Scale (AITCS; Orchard et al., 2012), (b) the Collaborative Practice Assessment Tool (CPAT; Schroder et al., 2011), (c) the Modified Index of Interdisciplinary Collaboration (MIIC; Parker Oliver, Wittenberg-Lyles, & Day, 2007), (d) the Partnership Self-Assessment Tool (PSAT; Weiss, Anderson, & Lasker, 2002), and (e) the Team Climate Inventory (TCI; Anderson & West, 1994, 1998). Forward searches for each instrument were completed using the same electronic databases identified above to locate published articles describing the development, ongoing validation, and use of the instruments. This resulted in a total of 26 documents that were relevant to the five instruments.

The PSAT and the TCI have multiple versions. There are two versions of the PSAT. The English version of the PSAT-S has not been validated; therefore, we evaluated the longer, original 67-item version of the PSAT. There are three versions of the TCI with 61, 38, or 14 items (Anderson & West, 1998).

Although all versions of the TCI have been cited in the literature, the 38-item version is the most often cited and is the version used in this analysis.

Psychometric evaluation of the instruments

Review of the selected instruments was guided by the methodological criteria identified by Streiner and Norman (2003). This included assessment of the instruments' reliability (i.e., test-retest, internal consistency, responsiveness) and validity (i.e., face, content, construct, predictive, criterion, discriminant). A description of the tool including its history of development, theoretical base, and ease of use was also included in the review. All five instruments are self-administered questionnaires appropriate to measure different aspects of collaboration or collaborative practice among healthcare team members. The developers of the instruments represent multiple disciplines inclusive of nursing, social work, public health, organizational psychology, and interprofessional teams. The

instruments vary in their theoretical base, number of items, and the terms used to describe the domains or subscales of IPC being measured. A summary of these results is shown in [Table 1](#) and the psychometric properties for each instrument are discussed below. The instruments are discussed in alphabetical order.

Assessment of Interprofessional Team Collaboration Scale

The AITCS is a newer instrument. At the time of this review, only one study had provided initial evidence of the AITC's reliability and validity (Orchard et al., 2012). Face and content validity were rigorously established at development. Items were constructed based on a review of the literature inclusive of conceptual models of collaboration followed by consultation with 24 IPE experts who reviewed the items for clarity, comprehensiveness, and content validity (Orchard et al., 2009). The AITCS was tested on a convenience sample of 125 health practitioners from seven healthcare teams practicing in various settings (e.g., orthopaedic, general surgery, acute mental health, palliative and long-term care) in two Canadian provinces. Internal consistency, determined by Cronbach's α coefficient, for the overall scale was high at .98, and for each subscale ranged from .80 to .97.

Exploratory and confirmatory factor analysis (CFA) tests resulted in a three-factor solution demonstrating initial support for construct validity. The final outcome was a 37-item instrument measuring three factors: partnership/shared decision-making (19 items), cooperation (11 items), and coordination (7 items). Published data concerning sensitivity, predictive, criterion, and discriminant validity are not currently available. To date, there is no published evidence documenting its use in community-based health and social care teams, therefore this is an area for further testing of the instrument. The developers suggest the AITCS has potential utility for both practice and research and can be used as an ongoing performance assessment of team practice and as a tool to identify areas for enhancing collaborative practice (Orchard et al., 2012).

Collaborative practice assessment tool

Developed in 2009, the CPAT is increasingly being used by researchers as a reliable and valid measure of perceived levels of team collaboration (Byrnes et al., 2012; Paterson, Medves, Dalgarno, Riordan, & Grigg, 2013; Pfaff, Baxter, Ploeg, & Jack, 2014). Reliability tests of internal consistency from two pilot tests were within recommended values with Cronbach's α coefficients for all subscales ranging from .73 to .84 on the first pilot test and .67 to .89 on the second pilot test indicating moderate reliability. Alpha was low at .67 for the four-item decision-making and conflict management subscale. Both pilot tests were conducted with a wide variety of healthcare and non-healthcare professionals in various sites including family practice teams, a geriatric assessment team, and a palliative care team in Southern Ontario (Schroder et al., 2011). In a study of 514 newly graduated Ontario nurses, Pfaff and colleagues reported an overall reliability score of .95 with Cronbach's α coefficients for the subscales ranging between .72 and .92.

Initial face and content validity were well established by Schroder and colleagues (2011). Items were developed based on constructs of collaboration identified in the literature and expert opinion from practitioners in medicine, nursing, occupational therapy, administration, as well as patients. Two groups of researchers have used the CPAT to evaluate the impact of an educational intervention on collaborative practice. Paterson and colleagues (2013) reported significant changes in all eight domains of the CPAT when comparing pre and post intervention scores, thus indicating the instrument demonstrates responsiveness/sensitivity. Similarly, Byrnes and colleagues (2012) indicated the CPAT detected changes in scores pre and post IPE intervention among 82 professional and non-professional members of healthcare teams.

Construct validity was confirmed in two pilot studies. Exploratory factor analysis in the first pilot test with a sample of 42 respondents indicated that factors measuring eight aspects of collaborative practice explained approximately 50% of the variance in respondents' answers. The second pilot test included 111 respondents and used CFA to establish validity and reliability of the CPAT in its final form of 56 items with three qualitative questions providing the user with a more comprehensive understanding of IPC. These questions are included at the bottom of [Table 1](#).

Modified index of interdisciplinary collaboration

The psychometric properties of the MIIC are not as strong as Bronstein's (2002) original scale, the Index of Interdisciplinary Collaboration (IIC). Parker Oliver, Wittenberg-Lyles, & Day (2007) established face and content validity of the MIIC by modifying the language of the original IIC so that the instrument was suitable for all hospice workers not just social workers. Reliability tests of internal consistency, measured by Cronbach's α , have been within acceptable ranges with overall scores of .94 and subscale scores ranging between .77 and .87 (Kobayashi & McAllister, 2013; Parker Oliver et al., 2007). Bronstein (2002) reported evidence of construct validity for the original IIC as a multidimensional scale, however; similar results for the MIIC were not reported by Parker Oliver and colleagues (2007). Although the original IIC demonstrated test-retest reliability and convergent validity, similar measures are not available for the MIIC. The instrument is easily administered; however, some items require reverse coding.

Several researchers have used the MIIC in studies examining interdisciplinary collaboration in hospice settings with a wide variety of healthcare professionals; however, further data regarding the validity of the instrument have not been reported (Kobayashi & McAllister, 2013; Parker Oliver, Wittenberg-Lyles, & Day, 2006; Wittenberg-Lyles, Parker Oliver, Demiris, & Regehr, 2010). Therefore, further testing to determine additional forms of validity is warranted. The items of the MIIC appear to be applicable to healthcare teams in other settings; however, no evidence of its use outside of hospice environments was found in the literature.

Partnership self-assessment tool

Initial and ongoing testing indicates good reliability and validity for the PSAT. Face and content validity were rigorously

Table 1. Summary of instruments' defining characteristics and psychometric properties.

Dimensions	AITCS	CPAT	MIIC	PSAT	TCI
Development	Orchard et al. (2012) from literature and field experts	Developed 2009 at Queen's University as part of an action research project (Schroder et al., 2011)	Developed 2007 (Parker-Oliver et al., 2007) Modification of original IIC by Bronstein (2002)	Developed 2002 by public health specialists (Weiss, Anderson & Lasker, 2002)	Developed 1994 by organizational psychologists (Anderson & West, 1994)
Purpose	Measures IPC among team members Evaluates collaboration within teams across various practice settings	Enables teams to assess their perceptions of collaborative practice Assesses the degree to which healthcare practitioners collaborate with one another	Measures perceptions of individual team members and their experience with collaboration	Measures partnership synergy (outcome of collaboration) and other dimensions of the partnership process	Evaluates within team functioning at the level of the group/work team
Target population	Healthcare teams	Healthcare teams	Healthcare teams	Generic community-based health partnerships in existence for at least six months with at least five partners	Generic organization-based professional teams
Theoretical base	Based on a conceptual framework identifying three barriers to collaborative practice: organizational structuralism, power relationships, and role socialization	Based on constructs of collaboration identified in the literature and a review of existing tools to assess perceptions of teamwork and collaboration in healthcare	Based on Bronstein's model of inter-disciplinary collaboration (2003) based on four theoretical perspectives	Based on the partnership synergy framework Measures key indicators for successful collaboration (Weiss, Anderson, & Lasker, 2001)	Based on four-factor theory of climate for innovation (Anderson & West, 1998)
# of items and design	37 Five-point Likert-type scale	56 Seven-point Likert-type scale Plus 3 qualitative questions*	42 Five-point Likert-type scale	67 17 items—dichotomous yes/no 50 items—five-point Likert-type scale	Three versions with 61, 38, or 14 items (38-item version discussed) Five- or seven- point Likert-type scale
Subscales	Partnership Cooperation Coordination	Mission, meaningful purpose, goals General relationships Team leadership General role responsibilities and autonomy Communication and information exchange Decision-making and conflict management Community linkages and coordination of care Patient involvement	Interdependence Flexibility Newly created professional activities Collective ownership of goals Reflection on process	Synergy Leadership Efficiency Administration and management Non-financial resources Financial and capital resources Decision-making Benefits of participation Drawbacks of participation Comparing benefits and drawbacks Satisfaction with participation	<i>Five-factor model</i> Vision Participative safety Support for innovation Task orientation Interaction frequency <i>Four-factor model</i> Participative safety and interaction frequency are combined
Time to complete (min)	10–15	20	15–20	15	15
Reliability Test–retest	No data	No data	Original IIC—Test–retest correlation was .824 ($p < .01$)	No data	No data
Internal consistency	Cronbach's α for subscales = .80–.90 Overall score ($\alpha = .98$)	Pilot test #1—EFA seven domains; 42 items Cronbach's $\alpha = .73$ –.84 Pilot test #2 CFA—56 items; eight domains Cronbach's $\alpha = .67$ –.89 (Schroder et al., 2011). Pfaff et al. (2013) Overall score ($\alpha = .95$) Cronbach's $\alpha = .72$ –.92 for domains	Original IIC, overall Cronbach's $\alpha = .92$ and all subscales Cronbach's α over .75 MIIC—overall Cronbach's $\alpha = .935$ Subscales range .77–.87 (Kobayashi & McAllister, 2013; Parker Oliver et al., 2007)	Initial study: items within each factor highly correlated Cronbach's $\alpha = .83$ –.97 (Weiss et al., 2002)	Five studies Cronbach's $\alpha = .80$ –.96 (Agrell & Gustafson, 1994; Anderson & West, 1998; Loo & Loewen, 2002; Poulton & West, 1999; Watts et al., 2007)

(Continued)

Table 1. (Continued).

Dimensions	AITCS	CPAT	MIIC	PSAT	TCI
Responsiveness/ sensitivity	Further testing required	One study reported significant change in all domains (Paterson et al., 2013)	No data	No data	One study did not show change (Loo & Loewen, 2002) One study did show significant change (Watts et al., 2007)
Validity Face and content	Yes	Yes	Yes	Yes	Yes
Construct	CFA three factors Partnership/shared decision-making Cooperation Coordination Further testing of hypotheses required	EFA and CFA in pilot tests with positive results	IIC CFA four subscales as described above MIIC—factor analysis not done due to small sample size Convergent validity for original IIC	EFA with positive results (Weiss et al., 2002)	Three studies reporting positive results of EFA and CFA (Anderson & West, 1998; Kivimaki et al., 1997; Ragazzoni, Baiardi, Zotti, Anderson, & West, 2002)
Predictive	No data	No data	No data	No data	Demonstrated in three studies—predicts team innovation (Agrell & Gustafson, 1994; Anderson & West, 1996; Forrester, 1995)
Criterion	No data	No data	No data	Two studies (Browne et al., 2004; Weiss et al., 2002)	Five studies compared TCI scores to external evaluations and results positively correlated (Agrell & Gustafson, 1994; Anderson & West, 1996; Burningham & West, 1995; Mathisen, Einarsen, Jorstad, & Bronnick, 2004; West, Smith, Feng, & Latham, 1998)
Discriminant	No data	No data	No data	One study (Weiss et al., 2002)	Two studies (Bain et al., 2001; Williams & Laungani, 1999)

Note. AITCS = Assessment of Interprofessional Team Collaboration Scale; CPAT = Collaborative Practice Assessment Tool; MIIC = Modified Index of Interdisciplinary Collaboration; PSAT = Partnership Self-Assessment Tool; TCI = Team Climate Inventory; EFA = exploratory factor analysis; CFA = confirmatory factor analysis.

*Qualitative questions for CPAT: (1) What does your team do well with regards to collaborative practice? (2) In your practice, what are the most difficult challenges to collaboration? (3) What does your team need help with to improve collaborative practice?

established when the tool was initially developed. Items were created based on an extensive review of the literature and measures, input from experts, and members of several community health agencies. The results of reliability testing of internal consistency have consistently been within reasonable ranges (Cronbach's $\alpha = .82-.97$) for the subscales (Cramm & Nieboer, 2012; Weiss et al., 2002).

Evidence of construct validity was demonstrated through exploratory principal components factor analysis with promax rotation on all subscales of the PSAT. These analyses yielded single factor solutions for each of the 11 subscales, suggesting that each subscale measured a single underlying concept (Weiss et al., 2002). Construct validity of the synergy scale was tested by examining the relationship of this scale to the Working Together Instrument, measuring five dimensions of collaboration (Chrislip & Larson, 1994). The two scales were highly correlated ($r = 0.71, p < 0.01$). Exploratory principal components analysis on all of the items in both scales resulted in two separate factors: synergy and collaborative group performance (Weiss et al., 2002). These results supported the correlation findings indicating that the scales measured similar constructs but they were not identical (Weiss et al., 2002). Details describing how the scales were compared (e.g., data transformation) were not described by the authors and, therefore, these results should be interpreted cautiously.

Discriminant validity was noted by Browne and colleagues (2004) who correlated scores on the Human Services Integration Measure, a less related measure of partnership structure, with scores on the PSAT. Weak correlations were found with the components ($r = .13-.36$). Butt and colleagues (2008) report further evidence of the PSAT's discriminant validity. Confirmation of convergent validity for the Dutch PSAT's (long version) with 22 Dutch disease management partnerships was demonstrated through high correlations of the partnership dimensions with partnership synergy ($r = .51-.62, p < .001$) and chronic illness care ($r = .34-.47, p < .001$) (Cramm, Strating, & Nieboer, 2011).

Team climate inventory

The TCI has the greatest longevity and has been validated in many populations, countries, and organizational contexts including hospital and community-based health and social services, and primary care. Face and content validity were rigorously established at the time of development. Items were chosen from the literature and other published measures of climate based on their relevance to West's four-factor theory of climate for innovation (Anderson & West, 1998).

Ongoing reliability tests of internal consistency from five studies (Table 1) have consistently been within acceptable ranges with items being moderately to strongly correlated

with each other (α coefficients ranging from .80 to .96). Two studies report mixed results on the TCI's sensitivity or ability to measure change in scores (Loo & Loewen, 2002; Watts, Lindqvist, Pearce, Drachler, & Richardson, 2007).

Regarding criterion validity, one study compared the TCI scores with those on the Team Production Questionnaire and found a positive correlation ($r = .14-.54$); however, the sample size was small, and not all correlations were statistically significant; therefore, it was concluded that the TCI may be measuring similar but also different constructs (Agrell & Gustafson, 1994). In their review of the TCI, Butt and colleagues (2008) reported several other studies that compared TCI scores to external evaluations of the innovativeness of the teams with the TCI scores and found good concordance providing evidence for criterion validity (Streiner & Norman, 2003).

Evidence for construct validity was reported by Butt and colleagues (2008) noting several researchers have tested the 38-item TCI using exploratory and CFA and have found mixed results for whether the TCI contains four or five factors (Kivimäki et al., 1997). Two studies provide evidence for adequate between-group discriminant validity (Bain, Mann, & Pirola-Merlo, 2001; Williams & Laungani, 1999). Additional studies indicate the TCI is predictive of team innovation (Anderson & West, 1996). Recent studies have reported higher TCI scores being associated with aspects of quality of care; however, the relationship between TCI scores and quality of care is not fully understood (Goh & Eccles, 2009).

Assessment of instrument concordance with attributes of IPC

The salient attributes of IPC, described earlier, reflect current conceptualizations of IPC in the context of CDM for CLOA. Therefore, assessing the instruments' concordance with these attributes is a useful approach for determining an instrument that best fits the researcher's conceptualization of IPC in order to measure the concept (Butt et al., 2008).

The instruments vary in their degree of concordance with the stated attributes of IPC. The results of this analysis are displayed in Table 2. This analysis revealed that the items in the AITCS and the CPAT demonstrate better concordance with the identified attributes, with 90% of the items measuring the stated attributes. The instruments reflecting less concordance with the stated attributes are the MIIC (69%), PSAT (84%), and TCI (76%) suggesting they are measuring other concepts. The PSAT and TCI do not have items matching the attribute of patient and family involvement, which is increasingly viewed as an essential component of IPC in the context of CDM for CLOA (Markle-Reid et al., 2011; Schraeder et al., 2008). Unlike the AITC and the CPAT, the MIIC and the TCI do not include items measuring the attribute of shared power and leadership. Only three of the instruments contain items to measure patient or family involvement limiting our knowledge of these aspects of IPC.

Discussion

Overall, the five instruments reflect different conceptualizations and measures of IPC. All instruments demonstrate good reliability, face, content, and construct validity with the TCI having the most robust psychometric properties. However, the five instruments demonstrated diverse levels of concordance in measuring the selected attributes of IPC indicating they are not equally suitable for use in the context of CDM for CLOA. Although the instruments were reviewed in terms of their psychometric properties and concordance with the identified attributes of IPC, they were not evaluated specifically with regard to their use in studies pertaining to CDM for CLOA. This is because few studies on CDM for CLOA to date have incorporated measurement of IPC as part of the research design. In addition, none of the instruments reviewed were developed specifically for measuring IPC in the context of CDM for CLOA. Therefore, the purpose of this review was to determine from existing instruments one that is most relevant to measure IPC in this context.

Table 2. Concordance of instruments with attributes of IPC.

Attribute	AITCS item # (37 items)	CPAT item # (56 items plus 3 qualitative questions)	MIIC item # (42 items)	PSAT item # (67 items)	TCI item # (38 items*)
Shared planning & decision-making (goals)	1, 7, 8, 11, 25, 34, 35, 22, 30	27, 28, 29, 31, 33 1-8, 47, 49	31, 32, 42	28, 42, 43, 44	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11
Interdependence & cooperation	16, 3, 18, 26, 35, 15	26, 3, 34, 35	1, 3, 4, 6, 7, 8, 9, 10, 11, 12, 13, 40	18, 20, 63-65	15
Partnership (commitment) (trust & respect among team members)	4, 5, 19, 31	9, 10, 13, 14, 15, 16	26, 29	15, 16	14, 17, 18, 20
Shared power & leadership	2, 27, 28,	17-25, 32		10, 11, 12, 13	
Coordination and communication	20, 22, 23, 24, 33	36, 37, 38, 39, 40, 41, 42-45	5, 15, 16, 33	14, 9, 24, 25, 26, 32	16, 19, 58, 59, 60, 61
Patient & family involvement	10, 12, 13, 17, 29, 36, 37	52, 53, 54, 55, 56	25, 30		
Evaluation of team performance	6, 32	25	2, 28, 34, 35, 41	31, 66, 67	42, 43, 44, 45, 46, 47
# of items matched to attributes (%)	34 (92%)	50 (90%)	29 (69%)	56 (84%)	29 (76%)

Note. AITCS = Assessment of Interprofessional Team Collaboration Scale; CPAT = Collaborative Practice Assessment Tool; MIIC = Modified Index of Interdisciplinary Collaboration; PSAT = Partnership Self-Assessment Tool; TCI = Team Climate Inventory.

*Items as numbered in Anderson and West (1998).

Several limitations are shared across and between the instruments. Researchers are reminded that although overall scale values for Cronbach's α for all instruments exceed Streiner and Norman's (2003) recommended value of .8, values for some of the subscales within the instruments are below .7. Cronbach's α is dependent upon the number of items in a subscale; therefore, subscales with more items have higher Cronbach's α values (Streiner & Norman).

One limitation is that conceptualizations of IPC varied among the tools, and various terms were used to describe the different domains of IPC. For example, the AITCS has three subscales (i.e., partnership, cooperation, coordination), whereas the MIIC has five subscales (i.e., interdependence, flexibility, newly created professional activities, collective ownership of goals, reflection on process). This inconsistency creates confusion around the meaning and measurement of IPC. This also limits understanding of the concept in terms of how IPC relates to other concepts such as teamwork and how they are operationalized and evaluated in practice and research.

All instruments in this review are self-report questionnaires. Despite possessing good psychometric properties, self-report data especially from cross-sectional study designs must be interpreted with caution. Data collected at one point in time may be useful in providing a sense of the respondents' perceptions of the phenomenon being studied (IPC), but do not allow for confident causal conclusions (Spector, 1994). This can only provide a limited understanding of the concept (Streiner & Norman, 2003). Using multiple methods (e.g., longitudinal designs) or sources of data such as observation or feedback from leaders can increase the confidence with which conclusions can be drawn from a set of data (Cresswell & Plano Clark, 2011; Spector, 1994).

In addition to the general limitations described above, specific limitations were noted for some of the instruments. Although the MIIC demonstrated acceptable reliability and validity, and good concordance with the attributes, it has not been used outside of hospice settings. Therefore, its utility in primary or community care settings for CDM in CLOA is limited and would require further testing to determine reliability and validity in this population.

The PSAT has good psychometric properties and was developed for use by various types of collaborative partners including providers at the front line level; however, the language used in the items appears more suitable for assessing more formally established collaborative partnerships at the organizational or agency level. Furthermore, a prerequisite for using the PSAT is that it requires partnerships to have existed for at least 6 months and have at least five partners, limiting its use with smaller teams of community providers who may not have worked together for this period of time. There is no evidence of responsiveness for the PSAT, and it does not include items to assess patient involvement in IPC. Therefore, the PSAT has limited utility for measuring IPC among providers providing CDM for community-living older adults. Despite the strong psychometric properties of the PSAT, the CPAT is more consistent with current conceptualizations of IPC for CDM for CLOA.

The AITCS and the CPAT have both shown good initial reliability and validity when used with various groups of healthcare providers in multiple practice settings and also demonstrate higher concordance with the salient attributes of IPC for CDM in CLOA. However, the AITCS is still very new and at the time of this review had less published evidence of reliability and validity than the CPAT. Further testing of the AITCS for responsiveness is necessary if a researcher wants to use the AITCS to measure change in level of IPC over time. Depending on the intended use of the AITCS, further testing to determine predictive and discriminant validity may be warranted.

Based on its concordance with the selected attributes, and high levels of reliability and validity for use in primary care and geriatric settings, the CPAT is the most appropriate instrument for measuring IPC among a team of community-based healthcare and other providers working with chronic disease populations (e.g., CLOA) from both a nursing practice and a research perspective. Further testing of the CPAT to support predictive and criterion validity is recommended. Researchers are encouraged to include evidence of psychometric testing of instruments when publishing study results to increase the knowledge of the instrument's overall quality and utility for use with specific populations (Streiner & Norman, 2003; Thannhauser et al., 2010).

Further validation of the CPAT in similar populations in different geographic areas would increase the generalizability of the instrument (Kelly et al., 2005). In addition, the CPAT includes collection of both quantitative and qualitative data providing the user with a more comprehensive understanding of the concept of IPC. The CPAT is appropriate for use in practice, continuing education, performance assessment, evaluation of team practices, and research.

The CPAT can be used in practice by CDM teams to determine perceived level of collaborative practice. Scores on the eight different dimensions could provide teams with information regarding their areas of strength and areas for further development. Strategies such as professional development education can then be developed to improve collaborative practice (Schroder et al., 2011). Teams could also use the CPAT to periodically assess their collaborative practices in conjunction with their overall performance in meeting client and service outcomes.

CLOA living with multiple chronic conditions often require services from multiple health and community providers. Given the CPAT has been validated for use with both professionals and non-professionals, it is an appropriate choice for researchers to measure the level of collaboration among team members. Few studies to date have quantified IPC in the context of CDM for CLOA. Therefore, little is known about the unique relationships between the level of IPC and specific clinical outcomes for older adults and providers. Further research to understand how IPC relates to quality of care for this population is warranted. Use of the CPAT along with additional methods and sources of data collection (e.g., observation of CDM teams, interviews with older adults and their caregivers, interviews with leadership staff) would provide a more comprehensive understanding of

IPC and provide further evidence of the CPAT's utility for measuring IPC in this population.

Longitudinal studies are needed to further explore the CPAT's responsiveness to change and demonstrate construct validity by testing hypotheses. Construct validity cannot be proven definitively; it is an ongoing process in which testing contributes to our understanding of the construct (Streiner & Norman, 2003). Both reliability and validity are not inherent properties of an instrument but rather the interaction of the scale, the population being tested, and the conditions (Keszai, Novak, & Streiner, 2010).

There are a number of limitations of this review: (a) the review was conducted by a single author allowing for potential bias in the findings, (b) the review was based on the available published literature, and (c) quality scoring of articles was not performed which may impact the overall validity of the findings. The attributes were identified from multiple sources in the current IPC and CDM literature; however, a concept analysis of IPC in the context of CDM for CLOA would verify the attributes (Rodgers, 2000).

Conclusion

This article provides a critical analysis and summary of five measures of IPC. Based on an analysis of the psychometric properties and assessment of concordance with salient attributes of IPC, the CPAT was found to be the most appropriate instrument for measuring IPC for CDM in CLOA. Using a reliable and valid instrument that is concordant with a chosen definition and conceptualization of IPC is recommended to support the integrity of study results, and to further the knowledge and understanding of the impact of IPC on outcomes for CLOA.

Declaration of interest

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of this article.

References

- Agrell, A., & Gustafson, R. (1994). The Team Climate Inventory (TCI) and group innovation: A psychometric test on a Swedish sample of work groups. *Journal of Occupational Psychology*, 67, 143–151.
- American Geriatric Society. (2006). Interdisciplinary care for older adults with complex needs: American Geriatrics Society position statement. *Journal of the American Geriatrics Society*, 54, 849–852.
- Anderson, N., & West, M. (1994). *The team climate inventory*. Manual and users' guide. Windsor, UK: NFER-Nelson.
- Anderson, N., & West, M. (1996). The team climate inventory: The development of the TCI and its applications in teambuilding for innovativeness. *European Journal of Work and Organizational Psychology*, 5, 53–66.
- Anderson, N., & West, M. (1998). Measuring climate for work group innovation: Development and validation of the Team Climate Inventory. *Journal of Organizational Behavior*, 19, 235–258.
- Bain, P., Mann, L., & Pirola-Merlo, A. (2001). The innovation imperative: The relationships between team climate, innovation, and performance in research and development teams. *Small Group Research*, 32, 55–73.
- Barrett, J., Curran, V., Glynn, L., & Godwin, M. (2007). *CHSRF Synthesis: Interprofessional collaboration and quality primary healthcare*. Ottawa, ON: Canadian Health Services Research Foundation. Retrieved from: http://www.cfhi/cass.ca/Migrated/PDF/SynthesisReport_E_rev4_FINAL.pdf
- Baxter, P., & Markle-Reid, M. (2009). An interprofessional team approach to fall prevention for older home care clients "at risk" of falling: Health care providers share their experiences. *International Journal of Integrated Care*, 9(28), 1–12.
- Bronstein, L. (2002). Index of interdisciplinary collaboration. *Social Work Research*, 26(2), 113–123.
- Bronstein, L. (2003). A model for interdisciplinary collaboration. *Social Work*, 48(3), 297–306.
- Browne, G., Roberts, J., Gafni, A., Byrne, C., Ketyzia, J., & Loney, P. (2004). Conceptualizing and validating the human services integration measure. *International Journal of Integrated Care*, 19(4), 1–12.
- Burningham, C., & West, M. (1995). Individual, climate and group interactions processes as predictors of work team innovation. *Small Group Research*, 36, 106–117.
- Butt, G., Markle-Reid, M., & Browne, G. (2008). Interprofessional partnerships in chronic illness care: A conceptual model for measuring partnership effectiveness. *International Journal of Integrated Care*, 8(14), 1–14.
- Byrnes, V., Riordan, A., Schroder, C., Chapman, C., Medves, J., Paterson, M., & Grigg, R. (2012). South eastern interprofessional collaborative learning environment (SEIPCLE): Nurturing collaborative practice. *Journal of Research in Interprofessional Practice and Education*, 2(2), 168–186.
- Canadian Interprofessional Health Collaborative. (2012). *An inventory of quantitative tools measuring interprofessional education and collaborative practice outcomes. A report by the Canadian Interprofessional Health Collaborative (CIHC)*. Retrieved from <http://rcrc.brandeis.edu/pdfs/Canadian%20Interprofessional%20Health%20Collaborative%20report.pdf>
- Chrislip, D., & Larson, C. (1994). *Collaborative leadership: How citizens and civic leaders can make a difference* (1st ed.). San Francisco, CA: Jossey-Bass.
- Cramm, J. M., & Niebor, A. P. (2012). In the Netherlands, rich interaction among professionals conducting disease management led to better chronic care. *Health Affairs*, 31, 2493–2500. doi:10.1377/hlthaff.2011.1304
- Cramm, J. M., Strating, M. H., & Niebor, A. P. (2011). Development and validation of a short version of the Partnership Self-Assessment Tool (PSAT) among professionals in Dutch disease management partnerships. *BMC Research Notes*, 4, 224.
- Creswell, J., & Plano Clark, V. (2011). *Designing and conducting mixed methods research* (2nd ed.). Thousand Oaks, CA: Sage.
- D'Amour, D., Ferrada-Videla, M., San Martin-Rodriguez, L., & Beaulieu, M. (2005). The conceptual basis for interprofessional collaboration: Core concepts and theoretical frameworks. *Journal of Interprofessional Care*, 19(Suppl 1), 116–131.
- Duner, A. (2013). Careplanning and decision-making in teams in Swedish elderly care: A study of interprofessional collaboration and professional boundaries. *Journal of Interprofessional Care*, 27, 246–253.
- Forrester, R. H. (1995, July). *Team climate and innovation: An empirical study*. Paper presented at the Fourth European Congress of Psychology, Athens, Greece.
- Goh, T., & Eccles, M. (2009). Team climate and quality of care in primary health care: A review of studies using the TCI in the UK. *BMC Research Notes*, 2, 222. doi:10.1186/1756-0500-2-222
- Health Canada. (2010). *Interprofessional collaboration*. Retrieved from <http://www.hc-sc.gc.ca/hcs-sss/hhr-rhs/strateg/p3/index-eng.php>
- Henneman, E., Lee, J., & Cohen, J. (1995). Collaboration: A concept analysis. *Journal of Advanced Nursing*, 21, 103–109.
- Institute of Medicine Committee on the Future of Health Care Workforce for Older Americans. (2008). *Retooling for an aging America: Building the health care workforce*. Washington, DC: The National Academies Press.
- Johansson, G., Eklund, K., & Gosman-Hedstrom, G. (2010). Multidisciplinary team-working with elderly persons living in the community: A systematic literature review. *Scandinavian Journal of Occupational Therapy*, 17, 1010–1116.
- Kelly, A. P., O'Malley, K. J., Kallen, M. A., & Ford, M. E. (2005). Integrating validity theory with the use of measurement instruments in clinical settings. *Health Services Research*, 40, 1605–1619.

- Keszei, A., Novak, M., & Streiner, D. (2010). Introduction to health measurement scales. *Journal of Psychosomatic Research*, 68, 319–323.
- Kharicha, K., Levin, E., Iliffe, S., & Davey, B. (2004). Social work, general practice and evidence-based policy in the collaborative care of older people: Current problems and future possibilities. *Health and Social Care in the Community*, 12(2), 134–141.
- Kimberlin, C., & Winterstein, C. (2008). Validity and reliability of measurement instruments used in research. *American Journal of Health-System Pharmacy*, 65, 2276–2284. doi:10.2146/ajhp070364
- Kivimäki, M., Kuk, G., Elovainio, M., Thomson, L., Kalliomäki-Leavanto, T., & Heikkilä, A. (1997). The Team Climate Inventory (TCI) - four or five factors? Testing the structure of the TCI in samples of low and high complexity jobs. *Journal of Occupational and Organizational Psychology*, 70, 375–389.
- Kobayashi, R., & McAllister, C. (2013). Similarities and differences in perspectives on interdisciplinary collaboration among hospice team members. *American Journal of Hospice and Palliative Care*, 31, 825–832.
- Loo, R., & Loewen, P. (2002). A confirmatory factor analytic and psychometric examination of the Team Climate Inventory: Full and short versions. *Small Group Research*, 33(2), 254–265.
- Markle-Reid, M., Browne, G., & Gafni, A. (2011). Nurse-led health promotion interventions improve quality of life in frail older home care clients: Lessons learned from three randomized control trials in Ontario, Canada. *Journal of Evaluation in Clinical Practice*, 19, 118–131. doi:10.1111/j.1365-2753.2011.01782.x
- Mathisen, G., Einarsen, S., Jorstad, K., & Bronnick, K. (2004). Climate for work group creativity and innovation: Norwegian validation of the team climate inventory (TCI). *Scandinavian Journal of Psychology*, 45, 383–392.
- McDowell, I. (2006). *Measuring health: A guide to rating scales and questionnaires*. (3rd ed.). New York, NY: Oxford University Press.
- Moore, A., Nair, K., Patterson, C., White, J., House, S., Kadhim-Saleh, A., & Riva, J. (2013). Physician and nurse perspectives of an interprofessional and integrated care-based program for seniors. *Journal of Research in Interprofessional Practice*, 3(1), 103–121.
- Nolte, J. (2005). Enhancing interdisciplinary collaboration in primary health care in Canada. Retrieved from <http://www.eicp.ca/en/resources/pdfs/enhancing-interdisciplinary-collaboration-in-primary-health-care-in-canada.pdf>
- Orchard, C., Curran, V., & Kabene, S. (2009). Creating a culture for interdisciplinary collaborative professional practice. *Medical Education Online*, 10. doi:10.3402/meo.v10i.4387
- Orchard, C., King, G., Khalili, H., & Bezzina, M. (2012). Assessment of Interprofessional Team Collaboration Scale (AITCS): Development and testing of the instrument. *Journal of Continuing Education in the Health Professions*, 32(1), 58–67.
- Parker Oliver, D., Wittenberg-Lyles, E., & Day, M. (2006). Variances in perception of interdisciplinary collaboration by hospice staff. *Journal of Palliative Care*, 22(4), 275–279.
- Parker Oliver, D., Wittenberg-Lyles, E., & Day, M. (2007). Measuring interdisciplinary perceptions of collaboration on hospice teams. *American Journal of Hospice and Palliative Medicine*, 24(1), 49–53.
- Paterson, P., Medves, J., Dalgarno, N., Riordan, A., & Grigg, R. (2013). The timely open communication for safety project. *Journal of Research in Interprofessional Practice and Education*, 3(1), 22–42.
- Petri, L. (2010). Concept analysis of interdisciplinary collaboration. *Nursing Forum*, 45(2), 73–82.
- Pfaff, K., Baxter, P., Ploeg, J., & Jack, S. (2014). A mixed methods exploration of team and organizational factors that may predict new graduate nurse engagement in collaborative practice. *Journal of Interprofessional Care*, 28, 142–148. doi:10.3109/13561820.2013.851072
- Poulton, B., & West, M. (1999). The determinants of effectiveness in primary health care teams. *Journal of Interprofessional Care*, 13, 7–18.
- Ragazzoni, P., Baiardi, P., Zotti, A., Anderson, N., & West, M. (2002). Italian validation of the team climate inventory: A measure of team climate for innovation. *Journal of Managerial Psychology*, 17(4), 325–336.
- Reeves, S., Lewin, S., Espin, S., Zwarenstein, M., (2010). *Interprofessional teamwork for health and social care*. Oxford, UK: Blackwell Publishing Ltd.
- Rodgers, B. L. (2000). Concept analysis: An evolutionary view. In B. L. Rodgers & K. A. Knafl (Eds.), *Concept development in nursing: Foundations, techniques, and applications*. (2nd ed., pp. 77–102). Philadelphia, PA: W. B. Saunders.
- Schraeder, C., Fraser, C., Clark, I., Long, B., Shelton, P., Waldschmidt, V., ... Lanker, W. (2008). Evaluation of a primary care nurse case management intervention for chronically ill community-dwelling older people. *Journal of Nursing and Healthcare of Chronic Illness*, 17, 407–417.
- Schroder, C., Medves, J., Paterson, M., Byrnes, V., Chapman, C., O'Riordan, A., ... Kelly, C. (2011). Development and pilot testing of the collaborative practice assessment tool. *Journal of Interprofessional Care*, 25, 189–195.
- Sicotte, C., D'Amour, D., & Moreault, M. (2002). Interdisciplinary collaboration within Quebec community health centres. *Social Sciences & Medicine*, 55, 991–1003.
- Sommers, L., Marton, K., Barbaccia, J., & Randolph, J. (2000). Physician, nurse and social worker collaboration in primary care for chronically ill seniors. *Archives of Internal Medicine*, 160, 1825–1833.
- Spector, P. (1994). Using self-report questionnaires in OB research: A comment on the use of a controversial method. *Journal of Organizational Behavior*, 15(8), 385–392.
- Streiner, D., & Norman, G. (2003). *Health measurement scales: A practical guide to their development and use* (3rd ed.). New York, NY: Oxford University Press Inc.
- Sullivan, T. J. (1998). *Collaboration: A health care imperative*. New York, NY: McGraw-Hill.
- Thannhauser, J., Russell-Mayhew, S., & Scott, C. (2010). Measures of interprofessional education and collaboration. *Journal of Interprofessional Care*, 24, 336–349.
- Trivedi, D., Goodman, C., Gage, H., Baron, N., Scheibl, F., Iliffe, S., ... Drennan, V. (2013). The effectiveness of inter-professional working for older people living in the community: A systematic review. *Health and Social Care in the Community*, 21(2), 113–128.
- Wagner, E. (2000). The role of patient care teams in chronic disease management. *BMJ*, 320, 569–572.
- Watts, F., Lindqvist, S., Pearce, S., Drachler, M., & Richardson, B. (2007). Introducing a post-registration interprofessional learning programme for healthcare teams. *Medical Teacher*, 29, 443–449.
- Weiss, E., Anderson, R., & Lasker, R. (2001). *Findings from the national study of partnership functioning: Report to the partnerships that participated*. New York, NY: Academy of Medicine.
- Weiss, E., Anderson, R., & Lasker, R. (2002). Making the most of collaboration: Exploring the relationship between partnership synergy and partnership functioning. *Health Education and Behavior*, 29, 683–698.
- West, M., Smith, H., Feng, W., & Lawthorn, R. (1998). Research excellence and departmental climate in British universities. *Journal of Occupational and Organizational Psychology*, 71, 261–281.
- Williams, G., & Laungani, P. (1999). Analysis of teamwork in an NHS community trust: An empirical study. *Journal of Interprofessional Care*, 13, 19–28.
- Wittenberg-Lyles, E., Parker Oliver, D., Demiris, G., & Regehr, K. (2010). Interdisciplinary collaboration in hospice team meetings. *Journal of Interprofessional Care*, 24, 264–273. doi:10.3109/13561820903163421
- World Health Organization. (2005). *Preparing a health care workforce for the 21st Century: The challenge of chronic conditions*. Geneva, Switzerland: Author. Retrieved from http://www.who.int/chp/knowledge/publications/workforce_report.pdf

Copyright of Journal of Interprofessional Care is the property of Taylor & Francis Ltd and its content may not be copied or emailed to multiple sites or posted to a listserv without the copyright holder's express written permission. However, users may print, download, or email articles for individual use.