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Review

The use of the Patient Assessment of Chronic Illness Care (PACIC) instrument in diabetes care: a systematic review and meta-analysis

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Abstract

Purpose: The Patient Assessment of Chronic Illness Care (PACIC) was created to assess whether provided care is congruent with the Chronic Care Model, according to patients. We aimed to identify all studies using the PACIC in diabetic patients to explore (i) how overall PACIC scores varied across studies and (ii) whether scores varied according to healthcare delivery, patient and instrument characteristics.

Data sources: MEDLINE, Embase, PsycINFO, CINAHL and PubMed Central (PMC), from 2005 to 2016.

Study selection: Studies of any design using the PACIC in diabetic patients.

Data extraction and synthesis: We extracted data on healthcare delivery, patient, and instrument characteristics, and overall PACIC score and standard deviation. We performed random-effects meta-analyses and meta-regressions.

Results: We identified 34 studies including 25 942 patients from 13 countries, mostly in North America and Europe, using different versions of the PACIC in 11 languages. The overall PACIC score fluctuated between 1.7 and 4.2, with a pooled score of 3.0 (95% confidence interval 2.8–3.2, 95% predictive interval 1.9–4.2), with very high heterogeneity ($I^2 = 99\%$). The PACIC variance was not explained by healthcare delivery or patient characteristics, but by the number of points on the response scale (5 vs. 11) and the continent (Asia vs. others).

Conclusion: The PACIC is a widely used instrument, but the direct comparison of PACIC scores between studies should be performed with caution as studies may employ different versions and the influence of cultural norms and language on the PACIC score remains unknown.

Key words: PACIC, diabetes, systematic review, meta-analysis, Chronic Care Model

Introduction

The Chronic Care Model is a widely used evidence-based framework developed to guide healthcare systems for the delivery of high-quality care for patients with chronic diseases [1]. The Patient Assessment of Chronic Illness Care (PACIC) instrument assesses whether care is congruent with the Chronic Care Model, according to patients [2]. In a context of increasing attention towards program evaluation and the consideration of patient-reported outcomes and

experiences measures (PROMS [3, 4] and PREMS [5]), the PACIC is increasingly used in clinical studies and evaluations of healthcare services and has been described as 'the most appropriate instrument to measure the experience of people receiving integrated chronic care' in a review of 31 instruments published in 2009 [6].

Up to now, studies using the PACIC have shown mixed results regarding the association of the overall score and healthcare delivery and patient characteristics. Some studies have shown that PACIC scores improved after implementation of interventions aimed to improve chronic care delivery [7, 8] while other studies reported no improvement or lower PACIC scores [9, 10]. Studies have also reported opposing findings regarding the impact of socio-demographic characteristics, such as gender and age [2, 11, 12].

To our knowledge, the systematic exploration of the PACIC use and scores across studies has not yet been performed. In that context, the aims of this study were to systematically identify all studies using the PACIC instrument to explore the variation of overall PACIC scores across studies, and according to: (i) healthcare delivery characteristics, (ii) patient characteristics and (iii) instrument characteristics. We hypothesized that the variance of the overall PACIC scores would be mainly explained by the type of care patients received (i.e. patients receiving integrated care would have higher PACIC scores compared with patients receiving usual care). We chose to focus on PACIC scores in diabetic populations as the instrument has been validated and widely used in this population [13].

Methods

Data sources

We performed a systematic search of four indexed databases (Ovid MEDLINE, Ovid Embase, Ovid PsycINFO, CINAHL) and PubMed Central (PMC), without language restrictions, between January 2005, year of the first PACIC validation study, and October 2016. We used MeSH and free text words for the two main concepts, 'PACIC' and 'diabetes' (Supplementary material 1).

Study selection

Studies including patients diagnosed with type 1 or type 2 diabetes, receiving any type of care in any setting, and considering the PACIC instrument (the 11-, 20- or 26-item version [2, 13, 14]), were eligible for inclusion. Since we focused our interest on mean PACIC scores and their variations, any type of observational study (e.g. cross-sectional (XS), cohort) or interventional study (e.g. randomized-controlled trial (RCT), controlled before–after study (CBA) and before–after study (BA)) were considered. We excluded studies including patients with multiple chronic diseases if they did not present subgroup results for patients with diabetes. Studies were also excluded if only one item or dimension of the PACIC was measured or if a modified version of the PACIC was used.

After a first title and abstract screening, the full text of primary studies were evaluated by two authors (CA and IPB), working independently and in duplicate, to determine whether they met the eligibility criteria.

Primary outcome and effect modifiers

Our primary outcome was the overall PACIC score. The PACIC is a 20-item instrument measuring the extent to which patients report having received specific actions and care that are congruent with various aspects of the Chronic Care Model [2]. The original questionnaire was developed in English and has been translated and tested in many languages. Each item is scored on a 5-point scale, ranging from 1 to 5, and the overall PACIC is scored by averaging scores across all 20 items. The anchors of the 5-point scale are 'never/always' or 'almost never/almost always'. Two other versions have been validated: a 26-item version called PACIC-5As [13] and an 11-item short version [14], with an 11-point scale ranging from 'none (0)' to 'always (100)'.

We pre-defined the following effect modifiers: (a) healthcare delivery characteristics: setting (community, primary care practices, hospital or diabetes clinics, or mixed), usual care or integrated care (e.g. managed care, disease management program), healthcare professionals involved in patient care (general practitioners, others professionals (e.g. specialists, nurses, dietitians)); (b) patient characteristics: age (mean age, dichotomized at the study level as under or above 65), gender (percentage of men, dichotomized at the study level as under or above 50%) and type of diabetes (dichotomized at the study level as type 2 or any type); (c) study characteristics: country (categorized into continents and dichotomized into high-income economy versus others [15]), study quality (strong, moderate or weak) [16, 17] and (d) PACIC characteristics: number of items, language, anchors of the response scale ('never' vs. 'almost never'), and response scale (5-point vs. 11-point).

Data extraction

We extracted, independently and in duplicate, the overall PACIC score and standard deviation (SD) as well as the above characteristics. We contacted authors of 20 primary studies to obtain missing data; 14 replied and ten sent additional data. Missing SDs were replaced by the median SD of the other studies.

Study quality

We assessed the overall quality of the studies as strong, moderate or weak, based on the assessment of the risk of bias measured with a modified version of the Effective Public Health Practice Project quality assessment tool [16, 17] (Supplementary material 2). The quality of the studies was assessed globally, even if we only considered baseline data in this review.

Data management and synthesis

In studies with more than one study group, we considered the data separately if groups received different types of care (usual care vs. integrated care) or if the settings were different, and combined the data if groups received the same type of care in the same setting, using the formula presented in the section 7.7.3.8 of the Cochrane Handbook for Systematic Reviews of Interventions [18]. For studies with before and after data (RCTs, CBAs, BAs), only baseline data were considered. If authors did not use the 5-point response scale for the PACIC score, we cross-multiplied the score to match the 5-point scale score. As most studies using the 26-item version provided the overall PACIC score (calculated on the same 20 items of the original instrument), we combined the studies using either questionnaire in the same analyses and investigated the impact of the study presenting the 5 A summary score (calculated on 15 of the original items) [19] in sensitivity analyses. We analyzed separately the overall score calculated with the 11-item version.

First, random-effects meta-analyses were performed to obtain the pooled mean overall PACIC score, the 95% confidence interval (CI), the 95% prediction interval (PI) [20], and the I^2, measuring the level of heterogeneity between studies. We performed sensitivity

analyses excluding studies of weak quality. Second, we conducted subgroup analyses and univariate meta-regressions to explore heterogeneity and identify healthcare delivery, patient, and PACIC characteristics possibly associated with overall PACIC scores and explaining variance between studies (adjusted R^2 in univariate meta-regression). Third, we conducted multivariate meta-regressions, building a model with the forward selection approach using the adjusted R^2 as criterion for variable selection and retention.

Results

Results of our search strategy are presented in Fig. 1; we included 32 studies [8–10, 12, 13, 19, 21–46] and 34 studies in the quantitative and qualitative synthesis of this review, respectively (two studies [47, 48] did not report overall PACIC scores). In addition, we identified three ongoing studies [49–51] and two studies without published results [52–54], presented in Supplementary material 4.

Qualitative synthesis
Details of the included studies are presented in Supplementary material 3.

Study characteristics
Most studies were XS studies ($n = 22$); six studies were RCTs, four studies were BAs and two studies were CBAs. The included studies were conducted in 13 different countries, mostly in North America ($n = 16$) and in Europe ($n = 10$); five studies [26–28, 32, 47] were conducted in low- and middle-income economies.

Healthcare delivery characteristics
The healthcare setting was primary care practices ($n = 18$), hospital outpatient clinics ($n = 3$), the community ($n = 2$), diabetes clinics ($n = 1$), and a mix of settings ($n = 9$). General practitioners were the main providers of care in 11 studies, while GPs and/or other healthcare professionals provided care in 12 studies, the type of providers being unclear in the remaining studies. At baseline, all patients were receiving usual care in 20 studies and integrated care in six studies [12, 33, 36, 37, 44, 47]; in seven studies [9, 21, 27, 29–31, 34], some patients were receiving usual while the others were receiving integrated care.

Patient characteristics
Studies included between 40 and 3761 patients (576.5 on average and 25 942 in total), of a mean age varying between 54 and 75.8
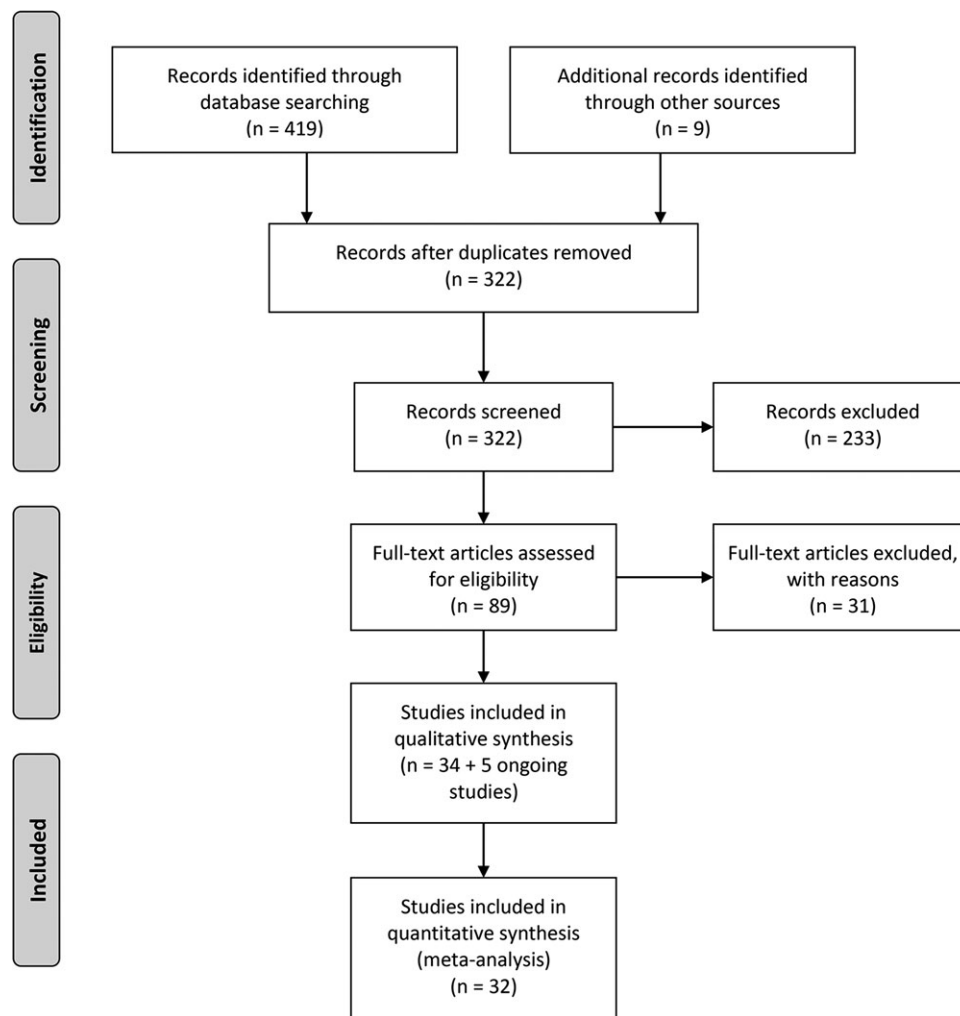

Figure 1 PRISMA flow diagram.

years (mean age <65 in 40% of study groups). The percentage of male patients ranged between 21% and 98% (percentage men < 50% in 48% of study groups), and patients were diagnosed with type 2 diabetes in the majority of studies (*n* = 27).

PACIC characteristics

Studies used mainly the 20-item version (*n* = 24); five studies [13, 19, 29, 33, 36] used the 26-item version, three studies [14, 44, 45] used the 11-item version, and two studies did not specify the version [30, 48]. While the majority of studies utilized the 5-point response scale, ranging from 1 to 5 (*n* = 29), the three studies using the 11-item version and two other studies [35, 40] utilized an 11-point response scale, ranging from 0 to 100. Among studies reporting the anchors, ten studies employed 'never/always' whereas 11 studies employed 'almost never/almost always'.

The questionnaire was provided to patients in 11 different languages: in English in 11 studies, in German [8, 29, 34], Dutch [10, 33, 37] and Spanish [12, 35, 40] in three studies each, in Cantonese in two studies [35, 40], and in Danish [22], French [25], Italian [45], Mandarin [21], Thai [27] and Turkish [32] in one study each.

Study quality

Overall, the quality of studies was rated as moderate for three quarters of the studies (*n* = 24); eight studies were rated as weak, one study as strong, and one study as unknown (Table 1).

Quantitative synthesis

Intervention and control groups of RCTs and CBAs were combined at baseline in all studies except one [30], while intervention and control groups of seven XS studies were considered separately, resulting in 43 study groups for the quantitative analyses.

Variation in PACIC scores and meta-analysis

Mean overall PACIC scores fluctuated between 1.7 (SD 0.4) and 4.2 (SD 5.2); eight study groups (19%) had an overall PACIC score lower than 2.5, whereas five study groups (12%) had an overall PACIC score higher than 3.5.

The random-effects meta-analysis including the 40 study groups using the 20- or 26-item version showed a pooled overall PACIC score of 3.0, at the center point of the scale (95% CI 2.8–3.2, 95% PI 1.9–4.2) (Fig. 2). The pooled overall PACIC score for the three studies using the 11-item version was 2.8 (95% CI 1.8–3.9, 95% PI -11.0—16.6) (Fig. 2). Heterogeneity was very high in both groups (I^2=99.5%).

Table 1 Quality assessment per domain and overall, per study

Study	Selection bias	Study design	Confounders	Blinding	Missing data	Overall[a]
Aragones [12]	Moderate	Weak	N/A	N/A	Moderate	Moderate
Aung [38]	Weak	Moderate	N/A	N/A	Strong	Moderate
Chiu [21]	Moderate	Weak	Strong	Moderate	Strong	Moderate
Dede [32]	Unknown	Weak	N/A	N/A	Unknown	Unknown
Drewes [33]	Moderate	Weak	N/A	N/A	Strong	Moderate
Fan [24]	Moderate	Weak	N/A	N/A	Weak	Weak
Frei [8]	Moderate	Weak	Strong	Moderate	Moderate	Moderate
Frei [29]	Weak	Strong	Strong	Weak	Strong	Weak
Glasgow [30]	Moderate	Strong	Weak	Moderate	Strong	Moderate
Glasgow [13]	Moderate	Weak	N/A	N/A	Moderate	Moderate
Gugiu [46]	Moderate	Weak	N/A	N/A	Moderate	Moderate
Jackson [43]	Strong	Weak	N/A	N/A	Strong	Moderate
Jiamjarasrangsi [27]	Moderate	Weak	Strong	Moderate	Moderate	Moderate
Johnson [44]	Weak	Strong	Strong	Strong	Moderate	Moderate
Ko [41]	Weak	Moderate	Weak	Moderate	Moderate	Weak
Ku [26]	Moderate	Moderate	N/A	N/A	Strong	Moderate
Ku [28]	Moderate	Weak	Strong	Weak	Strong	Weak
Kuznetsov [9]	Moderate	Strong	Weak	Moderate	Weak	Weak
Lewis [39]	Moderate	Moderate	N/A	N/A	Weak	Moderate
Liu [47]	Strong	Weak	N/A	N/A	Strong	Moderate
Maindal [22]	Moderate	Weak	N/A	N/A	Strong	Moderate
Ose [34]	Moderate	Weak	Strong	Moderate	Strong	Moderate
Pemu [42]	Weak	Moderate	N/A	N/A	Strong	Moderate
Pintaudi [45]	Strong	Weak	N/A	N/A	Strong	Moderate
Ratanawangsa [40]	Weak	Strong	Strong	Moderate	Moderate	Moderate
Sansgiry [48]	Weak	Weak	N/A	N/A	Moderate	Weak
Schillinger [35]	Moderate	Strong	Strong	Moderate	Strong	Strong
Stock [31]	Weak	Weak	Strong	Moderate	Moderate	Weak
Thomas [19]	Weak	Weak	N/A	N/A	Moderate	Weak
Tsiachristas [10]	Moderate	Moderate	N/A	N/A	Moderate	Moderate
Wallace [36]	Strong	Weak	N/A	N/A	Strong	Moderate
Wensing [37]	Strong	Weak	N/A	N/A	Moderate	Moderate
Xue [23]	Weak	Strong	Strong	Moderate	Moderate	Moderate
Zuercher [25]	Moderate	Moderate	N/A	N/A	Strong	Moderate

N/A: not applicable. [a]We rated the domain 'data collection method' assessing validity and reliability of the data collection tool as strong for all studies based on the hypothesized validity and reliability of the PACIC questionnaire

Overall PACIC score by study group, according to PACIC version

Author	Pub year	Country	Integrated Care		ES (95% CI)	% Weight
20-item version						
Chiu_1	2016	Taiwan	yes		4.20 (4.16, 4.24)	2.54
Kuznetsov_1	2015	Denmark	yes		2.40 (2.33, 2.47)	2.54
Frei_1	2014	Switzerland	yes		3.40 (3.20, 3.60)	2.46
Glasgow_1	2014	USA	yes		2.80 (2.58, 3.02)	2.45
Jiamjarasrangsi_1	2014	Thailand	yes		3.60 (3.51, 3.69)	2.53
Jiamjarasrangsi_2	2014	Thailand	yes		3.40 (3.34, 3.46)	2.54
Stock_1	2014	USA	yes		2.90 (2.84, 2.96)	2.54
Stock_3	2014	Germany	yes		2.70 (2.66, 2.74)	2.54
Drewes	2012	Netherlands	yes		2.80 (2.76, 2.84)	2.54
Ose_1	2012	Germany	yes		3.30 (3.24, 3.36)	2.54
Wallace	2010	USA	yes		3.80 (3.69, 3.91)	2.52
Aragones	2008	USA	yes		3.20 (3.04, 3.36)	2.49
Wensing	2008	Netherlands	yes		3.20 (2.99, 3.41)	2.46
Chiu_2	2016	Taiwan	no		3.90 (3.83, 3.97)	2.53
Dede	2016	Turkey	no		2.90 (2.70, 3.10)	2.46
Fan	2015	USA	no		3.00 (2.95, 3.05)	2.54
Ku	2015	Philippines	no		3.30 (3.18, 3.42)	2.51
Kuznetsov_2	2015	Denmark	no		2.40 (2.32, 2.48)	2.53
Aung	2014	Australia	no		2.40 (2.35, 2.45)	2.54
Frei_2	2014	Switzerland	no		3.20 (3.10, 3.30)	2.52
Frei	2014	Switzerland	no		3.10 (3.00, 3.20)	2.52
Glasgow_2	2014	USA	no		3.20 (3.13, 3.27)	2.53
Jiamjarasrangsi_3	2014	Thailand	no		3.10 (3.02, 3.18)	2.53
Ku_1	2014	Philippines	no		2.60 (2.06, 3.14)	2.04
Ku_2	2014	Philippines	no		3.20 (3.10, 3.30)	2.52
Lewis	2014	USA	no		3.50 (3.39, 3.61)	2.52
Ratanawongsa	2014	USA	no		2.20 (2.05, 2.35)	2.50
Stock_2	2014	USA	no		2.80 (2.74, 2.86)	2.54
Stock_4	2014	Germany	no		2.40 (2.33, 2.47)	2.53
Thomas	2014	USA	no		2.90 (2.67, 3.13)	2.44
Tsiachristas	2014	Netherlands	no		3.30 (3.22, 3.38)	2.53
Xue	2014	USA	no		2.40 (2.25, 2.55)	2.50
Zuercher	2014	Switzerland	no		2.80 (2.72, 2.88)	2.53
Ko	2013	USA	no		3.50 (3.22, 3.78)	2.39
Ose_2	2012	Germany	no		2.90 (2.82, 2.98)	2.53
Pemu	2011	USA	no		3.30 (3.12, 3.48)	2.48
Maindal	2010	Denmark	no		2.80 (2.68, 2.92)	2.52
Schillinger	2009	USA	no		1.95 (1.82, 2.08)	2.51
Jackson	2008	USA	no		3.10 (2.94, 3.26)	2.49
Glasgow	2005	USA	no		3.20 (3.11, 3.29)	2.53
Subtotal (I-squared = 99.5%, p = 0.000)					3.03 (2.85, 3.20)	100.00
with estimated predictive interval					(1.88, 4.18)	
11-item version						
Johnson	2014	Canada	yes		1.70 (1.50, 1.90)	33.15
Pintaudi	2015	Italy	no		3.70 (3.67, 3.73)	33.55
Gugiu	2010	USA	no		3.10 (2.94, 3.26)	33.30
Subtotal (I-squared = 99.5%, p = 0.000)					2.84 (1.77, 3.90)	100.00
with estimated predictive interval					(−10.96, 16.64)	

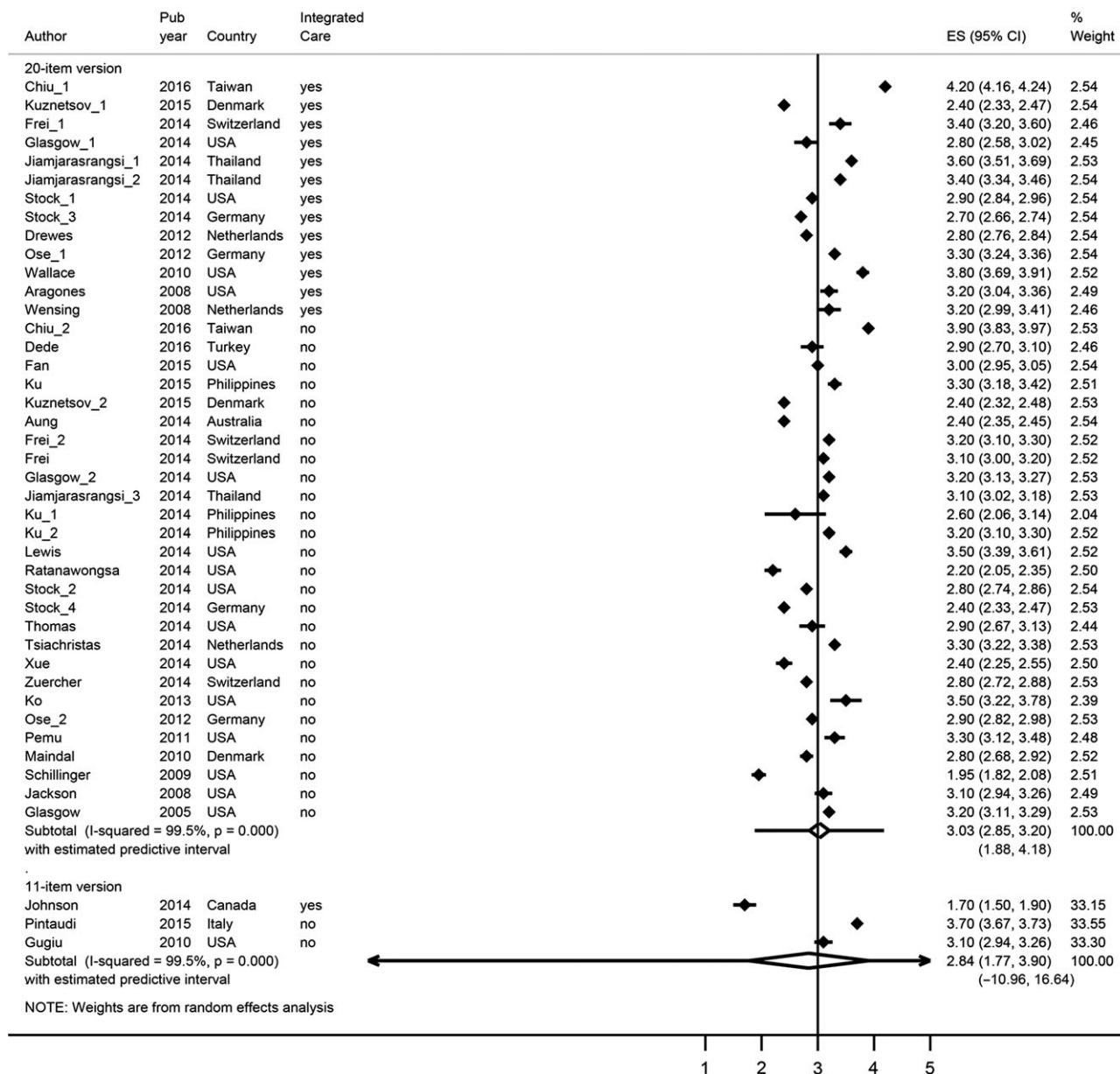NOTE: Weights are from random effects analysis

Figure 2 Forest-plot of overall PACIC score by study group, according to PACIC version.

In sensitivity analyses, removing studies of weak quality and the study presenting the 5 A summary score did not alter the results.

Subgroup analyses and meta-regressions

In the subgroup analyses among studies using the 20- or 26-item version, differences in scores between subgroups varied between 0 and 1 (median: 0.3); heterogeneity remained very high in all subgroups (Table 2).

In univariate meta-regressions (Table 2), whereas the response scale (5- vs. 11-point) and the continent (Asia vs. other continents) were significantly associated with higher PACIC scores, having a GP as main provider (vs. a GP and/or other healthcare professionals) was significantly associated with lower PACIC scores. The final multivariate model included the response scale and the continent, explaining 33% of the variance and significantly predicting higher PACIC scores.

Removing the two studies using an 11-point response scale from the analyses altered the results of univariate meta-regressions: gender, type of anchors, continent, and age, explaining 20%, 18%, 16% and 11% of the variance, respectively, were significantly associated with higher PACIC scores. However, none of these variables remained significant when combined in a multivariate model.

Discussion

Our systematic review of the literature on the use of the PACIC instrument in patients with diabetes identified 34 studies using the PACIC, in 11 different languages in 13 countries, predominantly in North America and Western Europe. Studies were mainly conducted in primary care practices; two thirds of patients were receiving usual

Table 2 Subgroup analyses: pooled overall PACIC scores, heterogeneity, and explained variance, according to healthcare delivery, patient and PACIC characteristics

Characteristics	N^a	Pooled overall PACIC scores (95% CI)	Heterogeneity (%)	Explained variance[b]
Healthcare delivery characteristics				
Integrated care	13	3.2 (2.9–3.6)	99.7	4.7%
Usual care	27	2.9 (2.8–3.1)	98.9	
GP and/or other healthcare professionals	12	3.2 (2.8–3.6)	99.8	13.3%
GP only	15	2.8 (2.6–2.9)	98.3	
PCP and/or other settings	18	3.2 (2.9–3.5)	98.6	8.9%
Primary care practices	22	2.9 (2.8–3.0)	99.6	
Low- and middle-income economies	7	3.2 (3.1–3.4)	94.2	0%
High-income economies	33	3.0 (2.8–3.2)	99.6	
Asia	9	3. 4 (3.1–3.7)	99.3	15.9%
Other continents	31	2.9 (2.8–3.1)	98.7	
Patient characteristics				
Patients' mean age >65	21	3.1 (2.8–3.4)	99.6	1.9%
Patients' mean age <65	16	2.9 (2.8–3.1)	98.5	
% of men >50%	21	3.2 (2.9–3.4)	99.4	6.6%
% of men <50%	19	2.9 (2.8–3.0)	98.3	
Type 2 diabetes only	33	3.1 (2.9–3.3)	99.6	4.0%
Type 1 and/or type 2 diabetes	4	2.7 (2.3–3.1)	97.2	
PACIC characteristics				
English	9	3.0 (2.8–3.3)	99.0	−6.4%
German	7	3.0 (2.7–3.3)	98.9	
Other	14	3.1 (2.7–3.5)	99.7	
'Almost never' to 'almost always' anchors	16	3.2 (2.9–3.5)	99.6	6.7%
'Never' to 'always' anchors	12	2.9 (2.7–3.1)	98.6	
5-Point scale	38	3.1 (2.9–3.3)	99.5	20.0%
11-Point scale	2	2.1 (1.8–2.3)	84.1	

GP: general practitioner, PCP: primary care practice, CI: confidence interval [a]number of observations in each subgroup [b]Adjusted R^2 in univariate meta-regression.

care, while one-third was receiving integrated care. The majority of studies employed the 20- or 26-item instrument and a 5-point response scale; while half adopted the 'never/always' anchors, the other half adopted the 'almost never/almost always' anchors. Mean overall PACIC scores fluctuated between 1.7 and 4.2, with a pooled overall score of 3.0, at the center of the scale. The heterogeneity of the scores was very high and remained high in all subgroup analyses.

Our main hypothesis, that patients receiving integrated care would have significantly higher scores, was not verified in the analyses. The two variables significantly predicting higher PACIC scores were an instrument characteristic, i.e. using a 5-point response scale (vs. an 11-point scale), and a study characteristic, i.e. taking place in Asia (vs. in other continents); the choice of anchors ('never' vs. 'almost never') also became a significant predictor when we excluded the two studies using the 11-point scale from the analyses. Having these two instrument characteristics as significant predictors is not surprising as the number of points on a scale and the type of anchors are essential elements in response style, where acquiescence (agreeing with items), extremity (favoring the extreme point) and moderation (favoring the midpoint) affect how individuals answer a Likert scale [55]. Consequently, interpreting the combined results of studies using different number of points on the response scale and different anchors requires caution as response styles might explain observed differences. In addition, previous studies have shown that response styles vary substantially between countries [55–57].

These issues add to the complexity of comparative research, where similarities and differences between population groups are investigated with self-reported instruments, requiring not only that the measured constructs have the same factorial structure (i.e. configural invariance), but also that the comparison of the means between groups are meaningful and defensible (i.e. strong and strict factorial invariance) [58]. The required strong factorial invariance, also called scalar invariance, is especially an issue in cross-national and cross-cultural comparisons as cultural norms and language are likely to influence rating tendency and yield different scores that do not reflect difference in care but rather differences in the way populations answer questions. Thus, the finding that patients in Asia tended to report higher PACIC scores on average compared with patients in other continents, could be due to differences in culture or language.

We found PACIC score differences between subgroups ranging between 0 and 1. If we look at the observed score differences in terms of effect size using Cohen's effect size classification (0.2 = small, 0.5 = medium, 0.8 = large) [59], the impact of the number of points on the scale (5-point vs. 11-point) would represent a large effect, whereas the impact of the continent (Asia vs. other continents) would represent a medium effect. What such a score difference means, and whether these differences are meaningful to patients, remain unclear, however, requiring thus caution when interpreting PACIC results. In fact, up to now, no minimal important difference (MID), which provides a 'measure of the smallest change in the patient-reported outcome of interest that patients perceive as important, either beneficial or harmful, and that would lead the patient or clinician to consider a change in management' [60], has been defined for the PACIC instrument. Longitudinal studies have reported statistically significant changes in PACIC scores after the implementation of the Chronic Care Model (e.g. a mean change

of 0.2 in a RCT [8] and mean change of 0.3 in a BA [26]), but whether these changes were clinically significant remains undetermined. To derive a MID for the PACIC, anchor-based and distribution-based approaches could be combined as suggested in the literature [61, 62], using meaningful patient experiences and outcomes measures as anchors. In addition, the interpretability of the PACIC, defined as the degree to which one can assign qualitative meaning to an instrument's quantitative scores or change in scores [61], and its sensitivity to detect change, also need to be further thoroughly investigated.

The main strength of the study is that, to our knowledge, this systematic review is the first to have examined the use of the PACIC instrument worldwide and the variation of PACIC scores across studies, pooling evidence from 13 countries. However, the following two main limitations need to be considered when interpreting the results. First, the PACIC was neither created nor tested to make cross-national comparisons. This means that observed differences in scores between studies and countries may be due to cultural factors and nation-specific rating tendencies rather than to differences in chronic care received. Second, it was only possible to systematically extract a few characteristics that could then be used in the subgroup analyses. Other potential effect modifiers, such as health literacy [36] and number and type of comorbidities [2], which might explain differences and between study variance, were not available.

Even if the PACIC is a widely used instrument to assess care according to patients, the direct comparison of PACIC scores between studies should be performed with caution because studies may employ different versions of the instrument and it remains unknown how cultural factors affect its overall score. We encourage future research to investigate the appropriateness of using the PACIC instrument to compare chronic care across groups and countries, and to determine the MID to help interpreting the clinical significance of observed differences.

Supplementary material

Supplementary material is available at International *Journal for Quality in Health Care* online.

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References

1. Wagner EH. Chronic disease management: what will it take to improve care for chronic illness? *Eff Clin Pract* 1998;1:2–4.
2. Glasgow RE, Wagner EH, Schaefer J et al. Development and validation of the Patient Assessment of Chronic Illness Care (PACIC). *Med Care* 2005;43:436–44.
3. Nelson EC, Eftimovska E, Lind C et al. Patient reported outcome measures in practice. *BMJ* 2015;350:g7818.
4. Snyder CF, Jensen RE, Segal JB et al. Patient-reported outcomes (PROs): putting the patient perspective in patient-centered outcomes research. *Med Care* 2013;51:S73–9.
5. Black N, Jenkinson C. Measuring patients' experiences and outcomes. *BMJ* 2009;339:b2495.
6. Vrijhoef HJ, Berbee R, Wagner EH et al. Quality of integrated chronic care measured by patient survey: identification, selection and application of most appropriate instruments. *Health Expect* 2009;12:417–29.
7. Cramm JM, Nieboer AP. Factorial validation of the patient assessment of chronic illness care (PACIC) and PACIC short version (PACIC-S) among cardiovascular disease patients in the Netherlands. *Health and Quality of Life Outcomes* 2012;10:104.
8. Frei A, Senn O, Chmiel C et al. Implementation of the chronic care model in small medical practices improves cardiovascular risk but not glycemic control. *Diabetes Care* 2014;37:1039–47.
9. Kuznetsov L, Simmons RK, Sandbaek A et al. The impact of intensive multifactorial treatment on perceptions of chronic care among individuals with screen-detected diabetes: results from the ADDITION-Denmark trial. *Int J Clin Pract* 2015;69:466–73.
10. Tsiachristas A, Cramm JM, Nieboer AP. Rutten-van Molken MP. Changes in costs and effects after the implementation of disease management programs in the Netherlands: variability and determinants. *Cost Eff Resour Alloc* 2014;12:17.
11. Rick J, Rowe K, Hann M et al. Psychometric properties of the patient assessment of chronic illness care measure: acceptability, reliability and validity in United Kingdom patients with long-term conditions. *BMC Health Serv Res* 2012;12:293.
12. Aragones A, Schaefer EW, Stevens D et al. Validation of the Spanish translation of the Patient Assessment of Chronic Illness Care (PACIC) survey. *Prev Chronic Dis* 2008;5:A113.
13. Glasgow RE, Whitesides H, Nelson CC et al. Use of the Patient Assessment of Chronic Illness Care (PACIC) with diabetic patients: relationship to patient characteristics, receipt of care, and self-management. *Diabetes Care* 2005;28:2655–61.
14. Gugiu PC, Coryn C, Clark R et al. Development and evaluation of the short version of the Patient Assessment of Chronic Illness Care instrument. *Chronic Illn* 2009;5:268–76.
15. https://datahelpdesk.worldbank.org/knowledgebase/articles/906519#High_income Accessed [February 15, 2017.
16. Armijo-Olivo S, Stiles CR, Hagen NA et al. Assessment of study quality for systematic reviews: a comparison of the Cochrane Collaboration Risk of Bias Tool and the Effective Public Health Practice Project Quality Assessment Tool: methodological research. *J Eval Clin Pract* 2012;18:12–8.
17. Thomas BH, Ciliska D, Dobbins M et al. A process for systematically reviewing the literature: providing the research evidence for public health nursing interventions. *Worldviews Evid Based Nurs* 2004;1:176–84.
18. Higgins JPT, Green S Cochrane Handbook for Systematic Reviews of Interventions. The Cochrane Collaboration 2011.
19. Thomas J 3rd, Iyer NN, Collins WB. Associations between perceived chronic care quality, perceived patient centeredness, and illness representations among persons with diabetes. *J Healthc Qual* 2014;36:50–9.
20. IntHout J, Ioannidis JP, Rovers MM et al. Plea for routinely presenting prediction intervals in meta-analysis. *BMJ Open* 2016;6:e010247.
21. Chiu HC, Hsieh HM, Lin YC et al. Patient assessment of diabetes care in a pay-for-performance program. *Int J Qual Health Care* 2016;28:183–90.
22. Maindal HT, Sokolowski I, Vedsted P. Adaptation, data quality and confirmatory factor analysis of the Danish version of the PACIC questionnaire. *Eur J Public Health* 2012;22:31–6.
23. Xue L, Piatt G, Zgibor JC. Effect of peer leader supported diabetes self-management in glycemic control and patient centeredness. *Diabetes* 2014;63:A173.
24. Fan J, McCoy RG, Ziegenfuss JY et al. Evaluating the structure of the Patient Assessment of Chronic Illness Care (PACIC) survey from the patient's perspective. *Ann Behav Med* 2015;49:104–11.
25. Zuercher E, Casillas A, Hagon-Traub I et al. Baseline data of a population-based cohort of patients with diabetes in Switzerland (CoDiab-VD). *Swiss Med Wkly* 2014;144:w13951.
26. Ku GM, Kegels G. Implementing elements of a context-adapted chronic care model to improve first-line diabetes care: effects on assessment of chronic illness care and glycaemic control among people with diabetes enrolled to the First-Line Diabetes Care (FiLDCare) Project in the Northern Philippines. *Prim Health Care Res Dev* 2015;16:481–91.

27. Jiamjarasrangsi W, Attavorrarat S, Navicharern R *et al.* Assessment of 5-year system-wide type 2 diabetes control measures in a Southeast Asian metropolis. *Asian Biomedicine* 2014;**8**:75–82.

28. Ku GM, Kegels G. A cross-sectional study of the differences in diabetes knowledge, attitudes, perceptions and self-care practices as related to assessment of chronic illness care among people with diabetes consulting in a family physician-led hospital-based first line health service and local government health unit-based health centers in the Philippines. *Asia Pac Fam Med* 2014;**13**:14.

29. Frei A, Senn O, Huber F *et al.* Congruency of diabetes care with the Chronic Care Model in different Swiss health care organisations from the patients' perspective: a cross sectional study. *Swiss Med Wkly* 2014;**144**: w13992.

30. Glasgow RE, Fisher L, Strycker LA *et al.* Minimal intervention needed for change: definition, use, and value for improving health and health research. *Transl Behav Med* 2014;**4**:26–33.

31. Stock S, Pitcavage JM, Simic D *et al.* CHRONIC CARE. Chronic care model strategies in the United States and Germany Deliver Patient Centered, High-Quality Diabetes Care. *Health Aff* 2014;**33**:1540–8.

32. Dede B, Sari M, Gursul A *et al.* Variables affecting quality of care of the outpatients having a chronic condition. [Turkish]. *TAF Prev Med Bull* 2016;**15**:238–47.

33. Drewes HW. de Jong-van Til JT, Struijs JN, Baan CA, Tekle FB, Meijboom BR, *et al.* Measuring chronic care management experience of patients with diabetes: PACIC and PACIC+ validation. *Int J Integr Care* 2012;**12**:e194.

34. Ose D, Freund T, Urban E *et al.* Comorbidity and patient-reported quality of care: an evaluation of the primary care based German disease management program for type 2 diabetes. *J Public Health (Germany)* 2012;**20**:41–6.

35. Schillinger D, Handley M, Wang F *et al.* Effects of self-management support on structure, process, and outcomes among vulnerable patients with diabetes: a three-arm practical clinical trial. *Diabetes Care* 2009;**32**:559–66.

36. Wallace AS, Carlson JR, Malone RM *et al.* The influence of literacy on patient-reported experiences of diabetes self-management support. *Nurs Res* 2010;**59**:356–63.

37. Wensing M, van Lieshout J, Jung HP *et al.* The Patients Assessment Chronic Illness Care (PACIC) questionnaire in The Netherlands: a validation study in rural general practice. *BMC Health Serv Res* 2008;**8**:182.

38. Aung E, Donald M, Williams G *et al.* Patient-assessed quality of chronic illness care, patient activation and health-related quality of life in type 2 diabetes. *Diabetes Res Clin Pract Suppl* 2014;**106**:S24.

39. Lewis MA, Bann CM, Karns SA *et al.* Cross-site evaluation of the alliance to reduce disparities in diabetes: clinical and patient-reported outcomes. *Health Promot Pract* 2014;**15**:92S–102S.

40. Ratanawongsa N, Handley MA, Sarkar U *et al.* Diabetes health information technology innovation to improve quality of life for health plan members in urban safety net. *J Ambul Care Manage* 2014;**37**:127–37.

41. Ko J, Delafield R, Davis J *et al.* Characteristics of patients with type 2 diabetes mellitus in two rural, medically underserved communities. *Hawai'i J Med Public Health* 2013;**72**:191–6.

42. Pemu PE, Quarshie AQ, Josiah-Willock R *et al.* Socio-demographic psychosocial and clinical characteristics of participants in e-HealthyStrides©: an interactive e-health program to improve diabetes self-management skills. *J Health Care Poor Underserved* 2011;**22**:146–64.

43. Jackson GL, Weinberger M, Hamilton NS *et al.* Racial/ethnic and educational-level differences in diabetes care experiences in primary care. *Prim Care Diabetes* 2008;**2**:39–44.

44. Johnson JA, Al Sayah F, Wozniak L *et al.* Collaborative care versus screening and follow-up for patients with diabetes and depressive symptoms: results of a primary care-based comparative effectiveness trial. *Diabetes Care* 2014;**37**:3220–6.

45. Pintaudi B, Lucisano G, Gentile S *et al.* Correlates of diabetes-related distress in type 2 diabetes: findings from the benchmarking network for clinical and humanistic outcomes in diabetes (BENCH-D) study. *J Psychosom Res* 2015;**79**:348–54.

46. Gugiu C, Coryn CL, Applegate B. Structure and measurement properties of the patient assessment of chronic illness care instrument. *J Eval Clin Pract* 2010;**16**:509–16.

47. Liu LJ, Li Y, Sha K *et al.* Patient assessment of chronic illness care, glycemic control and the utilization of community health care among the patients with type 2 diabetes in Shanghai, China. *PLoS ONE [Electronic Resource]* 2013;**8**:e73010.

48. Sansgiry S, Naik AD, Brown AC *et al.* Quality of life among diabetes patients. *Value Health* 2013;**16**:A196.

49. Yu CH, Ivers NM, Stacey D *et al.* Impact of an interprofessional shared decision-making and goal-setting decision aid for patients with diabetes on decisional conflict—study protocol for a randomized controlled trial. *Trials* 2015: **16**:286.

50. Bozorgmehr K, Szecsenyi J, Ose D *et al.* Practice network-based care management for patients with type 2 diabetes and multiple comorbidities (GEDIMAplus): study protocol for a randomized controlled trial. *Trials* 2014;**15**:243.

51. Drewelow E, Wollny A, Pentzek M *et al.* Improvement of primary health care of patients with poorly regulated diabetes mellitus type 2 using shared decision-making—the DEBATE trial. *BMC Fam Pract* 2012;**13**:88.

52. Versnel N, Welschen LM, Baan CA *et al.* The effectiveness of case management for comorbid diabetes type 2 patients; the CasCo study. Design of a randomized controlled trial. *BMC Fam Pract* 2011;**12**:68.

53. Freund T, Peters-Klimm F, Rochon J *et al.* Primary care practice-based care management for chronically ill patients (PraCMan): study protocol for a cluster randomized controlled trial [ISRCTN56104508]. *Trials* 2011;**12**:163.

54. Freund T, Peters-Klimm F, Boyd CM *et al.* Medical assistant-based care management for high-risk patients in small primary care practices: a cluster randomized clinical trial. *Ann Intern Med* 2016;**164**:323–30.

55. Smith PB, Vignoles VL, Becker M *et al.* Individual and culture-level components of survey response styles: a multi-level analysis using cultural models of selfhood. *Int J Psychol* 2016;**51**:453–63.

56. Jurges H. True health vs response styles: exploring cross-country differences in self-reported health. *Health Econ* 2007;**16**:163–78.

57. Smith PB. Acquiescent response bias as an aspect of cultural communication style. *J Cross Cult Psychol* 2004;**35**:50–61.

58. Gregorich SE. Do self-report instruments allow meaningful comparisons across diverse population groups? Testing measurement invariance using the confirmatory factor analysis framework. *Med Care* 2006;**44**:S78–94.

59. Cohen J. Hillsdale NJ (ed). *Statistical power analysis for the behavioral sciences*, 2nd ed.. Hillsdale, NJ: Lawrence Earlbaum Associates, 1988.

60. Schunemann HJ, Guyatt GH. Commentary—Goodbye M(C)ID! Hello MID, where do you come from? *Health Serv Res* 2005;**40**:593–7.

61. Guyatt GH, Osoba D, Wu AW *et al.* Clinical Significance Consensus Meeting G. Methods to explain the clinical significance of health status measures. *Mayo Clin Proc* 2002;**77**:371–83.

62. Crosby RD, Kolotkin RL, Williams GR. Defining clinically meaningful change in health-related quality of life. *J Clin Epidemiol* 2003;**56**:395–407.