Title

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

Running head

PACIC use in diabetes care

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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, Cinahl, Psychinfo, and Pubmed Central, 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 to 3.2, 95% predictive interval 1.9 to 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 versus 11) and the continent (Asia versus 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 to 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 (Medline, Embase, PsychInfo, Cinahl) and Pubmed Central, 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), 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’ versus ‘almost never’), and response scale (5-point versus 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 versus 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 5A 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 Figure 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 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 to 3.2, 95% PI 1.9 to 4.2) (Figure 2). The pooled overall PACIC score for the three studies using the 11-item version was 2.8 (95% CI 1.8 to 3.9, 95% PI -11.0 to 16.6) (Figure 2). Heterogeneity was very high in both groups (I^2=99.5%). In sensitivity analyses, removing studies of weak quality and the study presenting the 5A 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- versus 11-point) and the continent (Asia versus other continents) were significantly associated with higher PACIC scores, having a GP as main provider (versus 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 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 (versus an 11-point scale), and a study characteristic, i.e. taking place in Asia (versus in other continents); the choice of anchors ('never' versus '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 to 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 versus 11-point) would represent a large effect, whereas the impact of the continent (Asia versus 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 minimal important difference to help interpreting the clinical significance of observed differences.

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

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

GP: general practitioner, PCP: primary care practice, CI: confidence interval [1]number of observations in each subgroup [2]Adjusted R^2 in univariate meta-regression

Figure 1 PRISMA flow diagram

See eps file Fig 1

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

See eps file Fig 2

Supplementary materials

Supplementary material 1. Search strategy

Supplementary material 2. Risk of bias tool

Supplementary material 3. Characteristics of studies using the PACIC instrument among patients with diabetes

Supplementary material 4. Characteristics of ongoing studies or studies without published results using the PACIC instrument among patients with diabetes.

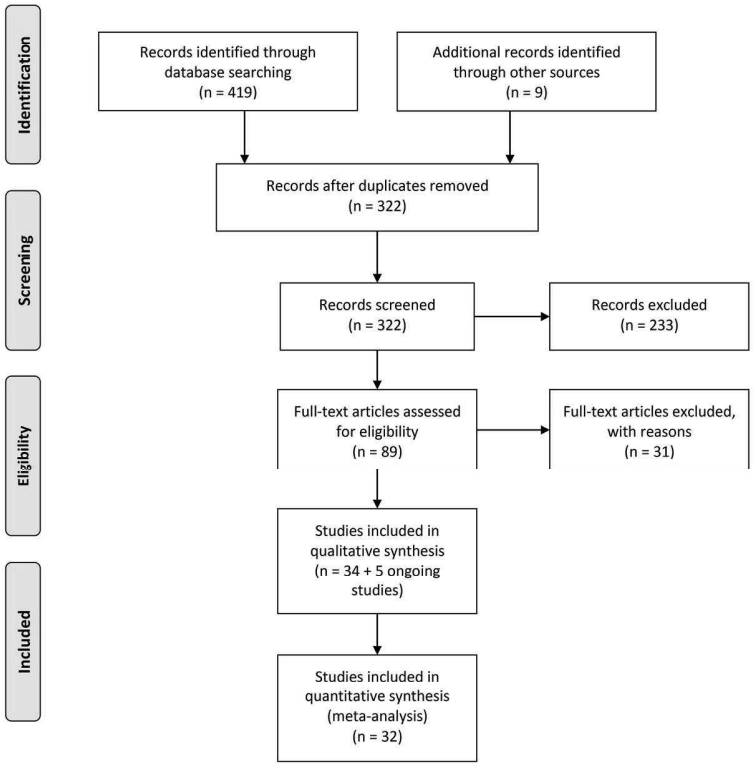

Figure 1 PRISMA flow diagram

232x301mm (300 x 300 DPI)

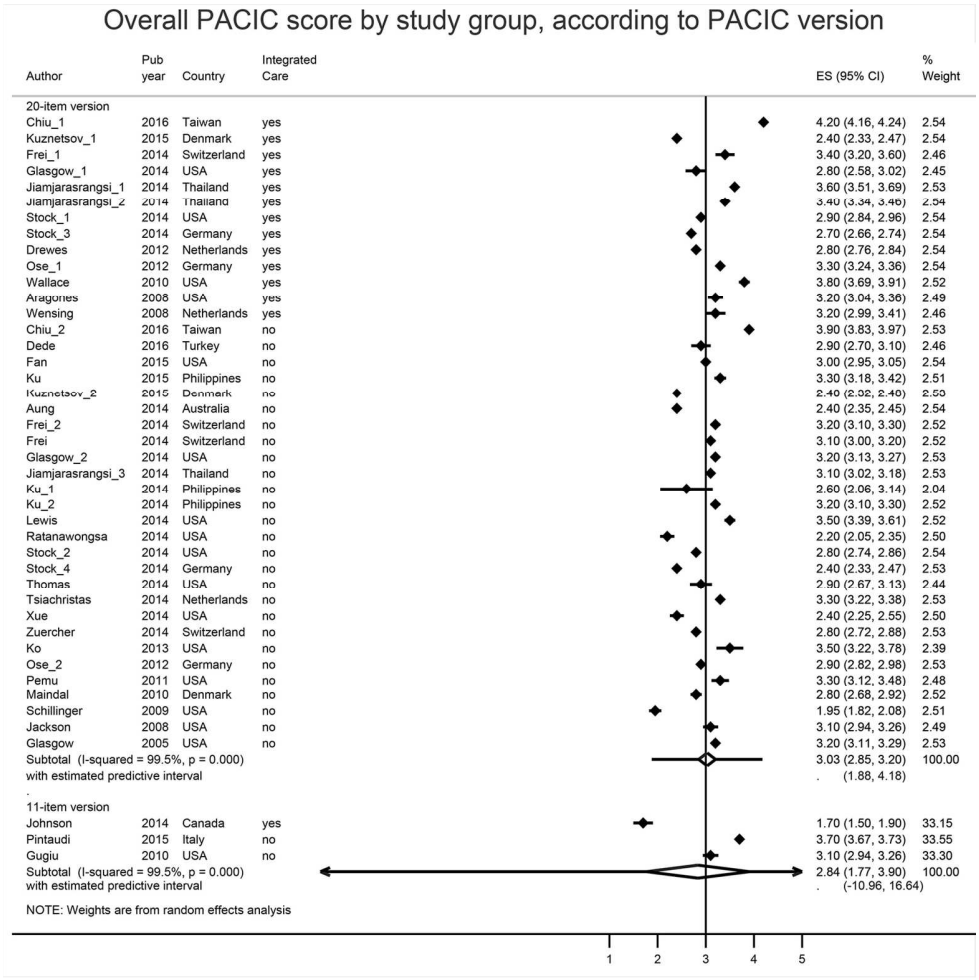

Figure 2 Forest-plot of overall PACIC score by study group, according to PACIC version

152x152mm (300 x 300 DPI)

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5-point scale	38	3.1 (2.9 to 3.3)	99.5%	20.0%
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GP: general practitioner, PCP: primary care practice, CI: confidence interval [1]number of observations in each subgroup [2]Adjusted R^2 in univariate meta-regression

Supplementary material 1. Search Strategy

Ovid MEDLINE (ran Oct 17, 2016)
1 exp Diabetes Mellitus/ (360749)
2 diabet*.mp. (555993)
3 1 or 2 (557604)
4 PACIC*.mp. (101)
5 “Patient Assessment of Chronic Illness Care”.mp. (91)
6 4 or 5 (121)
7 3 and 6 (48)

Ovid Embase (ran Oct 13, 2016)
1 exp diabetes mellitus/ (786658)
2 diabet*.tw. (707089)
3 1 or 2 (871856)
4 PACIC.tw (129)
5 Patient Assessment of Chronic Illness Care.tw (102)
6 4 or 5 (154)
7 3 and 6 (67)

Ovid PsycINFO (ran Oct 13, 2016)
1 exp diabetes mellitus/ (6780)
2 diabet*.tw. (25097)
3 1 or 2 (25528)
4 PACIC.tw (28)
5 Patient Assessment of Chronic Illness Care.tw (30)
6 4 or 5 (35)
7 3 and 6 (16)

CINAHL (ran Oct 13, 2016)
(MH “diabetes mellitus” OR TX diabet*) AND (TX PACIC OR Patient Assessment of Chronic Illness Care) (23)

PMC (PubMed Central) (ran Oct 17, 2016)
(diabetes* or diabetic* or diabetol*) AND (pacic OR "patient assessment of chronic illness care") (265)

Supplementary table 2. Risk of bias tool (adapted from the EPHPP)

Study ID (Author Year): _____ Rater initials: _____ Date: _____

Notes:

A) SELECTION BIAS

(A1) Are the individuals selected to participate in the study likely to be representative of the target population?

1 Very likely
2 Somewhat likely
3 Not likely
4 Can't tell

Patients would be representative if they comprised the entire source population, an unselected sample of consecutive patients, or a random sample (score very likely). They may not be representative if they are referred from a source (e.g. clinic) in a systematic manner (score somewhat likely) or self-referred (score not likely).

(A2) What percentage of selected individuals agreed to participate / replied to survey?

1 80 - 100% agreement (60-100% response rate if survey)
2 60 – 79% agreement (40-60% response rate if survey)
3 less than 60% agreement (<40% response rate if survey)
4 Not applicable
5 Can't tell

For interventional studies: Refers to the % of subjects that agreed to participate before they were assigned to a group

For survey-based studies: Refers to the % of subjects that returned the questionnaire/survey in cross-sectional studies (not the % of subjects without missing data)

RATE THIS SECTION	STRONG	MODERATE	WEAK
Strong: Selected individuals are very likely to be representative of the target population (Q1 is 1) **and** > 80% participation / 60-100% response rate (Q2 is 1). **Moderate**: Selected individuals are at least somewhat likely to be representative of the target population (Q1 is 1 or 2); **and** 60 - 79% participation / 40-60% response rate (Q2 is 2). 'Moderate' may also be assigned if Q1 is 1 or 2 **and** Q2 is 5 (can't tell). **Weak**: Selected individuals are not likely to be representative of the target population (Q1 is 3); **or** there is <60% participation / <40% response rate (Q2 is 3) **or** selection is not described (Q1 is 4); and level of participation is not described (Q2 is 5).	1	2	3

B) STUDY DESIGN

(B1) Indicate the study design

1 Randomized controlled trial (RCT) 2 Controlled clinical trial (CCT)
3 Cohort analytic (two group pre + post) 4 Case-control
5 Cohort (one group pre + post (before and after)) (BA) 6 Interrupted time series (ITS)
7 Cross-sectional study (XS) 8 Other specify _____
9 Can't tell

(B2) Were there two study groups?

No Yes

(B3) Was the study described as randomized?

No Yes Not applicable

(B4) If Yes, was the method of randomization described? (See dictionary)

No Yes Not applicable

(B5) If Yes, was the method appropriate? (See dictionary)

No Yes Not applicable

RATE THIS SECTION	STRONG	MODERATE	WEAK
Strong: RCTs, CCT; **Moderate**: cohort study, case control study, before-after, ITS; **Weak**: cross-sectional, other design	1	2	3

C) CONFOUNDERS

(C1) Were there important differences between groups prior to the intervention?

1 Yes 3 Can't tell
2 No 4 Not applicable (for cross-sectional or before-after studies with one study group only)

The following are examples of confounders:

1 Race 2 Sex
3 Marital status/family 4 Age
5 SES (income or class) 6 Education
7 Health status 8 Pre-intervention score on outcome measure

(C2) If yes, indicate the percentage of relevant confounders that were controlled (either in the design (e.g. stratification, matching) or analysis)?

1 80 – 100% (most)
2 60 – 79% (some)
3 Less than 60% (few or none)
4 Can't Tell
5 Not applicable (for cross-sectional or before-after studies with one study group only)

RATE THIS SECTION	STRONG	MODERATE	WEAK	N/A
Strong: will be assigned to those articles that controlled for at least 80% of relevant confounders (Q1 is 2); **or** (Q2 is 1). **Moderate**: will be given to those studies that controlled for 60 – 79% of relevant confounders (Q1 is 1) **and** (Q2 is 2). **Weak**: will be assigned when < 60% of relevant confounders were controlled (Q1 is 1) **and** (Q2 is 3) **or** control of confounders was not described (Q1 is 3) **and** (Q2 is 4).	1	2	3	4

D) BLINDING

(D1) Was the outcome assessor aware of the intervention or exposure status of participants?

1 Yes 3 Can't tell
2 No 4 Not applicable (for cross-sectional or before-after studies with one study group only)

(D2) Were the study participants aware of the research question?

1 Yes 3 Can't tell
2 No 4 Not applicable (for cross-sectional or before-after studies with one study group only)

RATE THIS SECTION	STRONG	MODERA	WEAK	N/A
Strong: Outcome assessor is not aware of the intervention status of participants (Q1 is 2); **and** study participants are not aware of the research question (Q2 is 2). **Moderate**: Outcome assessor is not aware of the intervention status of participants (Q1 is 2); **or** study participants are not aware of the research question (Q2 is 2); **or** blinding is not described (Q1 is 3 and Q2 is 3). **Weak**: Outcome assessor is aware of the intervention status of participants (Q1 is 1); **and** study participants are aware of the research question (Q2 is 1).	1	2	3	4

E) DATA COLLECTION METHODS -> STRONG
(E1 and E2) Were data collection tools shown to be valid and reliable? Yes

F) WITHDRAWALS, DROP-OUTS AND MISSING DATA

(F1) Were withdrawals and drop-outs reported in terms of numbers and/or reasons per group?

1 Yes 3 Can't tell
2 No 4 Not applicable (for cross-sectional studies)

(F2) Indicate the percentage of participants completing the study (at the final data collection period) (If the percentage differs by groups, record the lowest).

1 80 -100% 4 Can't tell
2 60 - 79% 5 Not applicable (for cross-sectional studies)
3 less than 60%

(F3) Was the proportion of missing data similar in the intervention and control groups or 10% or less in studies without comparison groups?

1 Yes 3 Can't tell
2 No (-> indicate % missing data:_____)

RATE THIS SECTION	STRONG	MODERATE	WEAK
Strong: will be assigned when the follow-up rate is >=80% (Q2 is 1) **or** the proportion is similar or missing data <=10% (Q3 is 1). **Moderate**: will be assigned when the follow-up rate is 60 – 79% (Q2 is 2) or when missing data is 11-20% (Q3 is 2) or if the withdrawals, drop-outs and missing data are not described (Q1 is 3, Q2 is 4, or Q3 is 3) **Weak**: will be assigned when a follow-up rate is < 60% (Q2 is 3) **or** when missing data is >20% (Q2 is 3).	1	2	3

G) INTERVENTION INTEGRITY

(G1) What percentage of participants received the allocated intervention or exposure of interest?
1 80 -100%
2 60 - 79%
3 less than 60%
4 Can't tell
5 Not applicable (studies without interventions)

(G2) Was the consistency of the intervention measured?
1 Yes 3 Can't tell
2 No 4 Not applicable (studies without interventions)

(G3) Is it likely that subjects received an unintended intervention (contamination or co-intervention) that may influence the results?
1 Yes 3 Can't tell
2 No 4 Not applicable (studies without interventions)

H) ANALYSES

(H1) Indicate the unit of allocation (circle one) if interventional study
community organization/institution practice/office individual not applicable

(H2) Indicate the unit of analysis (circle one) if interventional study
community organization/institution practice/office individual not applicable

(H3) Are the statistical methods appropriate for the study design?
1 Yes
2 No
3 Can't tell

(H4) Is the analysis performed by intervention allocation status (i.e. intention to treat) rather than the actual intervention received?
1 Yes 3 Can't tell
2 No 4 Not applicable (studies without interventions)

COMPONENT RATINGS AND GLOBAL RATING

A. SELECTION BIAS	STRONG	MODERATE	WEAK	
B. STUDY DESIGN	STRONG	MODERATE	WEAK	
C. CONFOUNDERS	STRONG	MODERATE	WEAK	N/A
D. BLINDING	STRONG	MODERATE	WEAK	N/A
E. DATA COLLECTION METHODS	STRONG	MODERATE	WEAK	
F. WITHDRAWALS, DROPOUTS, MISSING DATA	STRONG	MODERATE	WEAK	

Global rating for the paper (circle one): **Final decision of both reviewers (circle one):**

1 STRONG (no WEAK ratings and 4 or more STRONG ratings) **1 STRONG**
2 MODERATE (one WEAK rating) **2 MODERATE**
3 WEAK (two or more WEAK ratings) **3 WEAK**

Supplementary table 3. Characteristics of studies using the PACIC instrument among patients with diabetes.

Author (publication year)	Study and healthcare delivery characteristics	Patient characteristics				PACIC instrument and overall score on a 5-point scale	
		N	Type of diabetes	Age, mean(SD)	Men, %	Language, nb of items, anchors	Overall score, mean (SD)
Chiu & al (2016) [1]	*Study design*: Cross-sectional study with 2 study groups: pay-for-performance (P4P) and non-pay-for-performance (non-P4P) *Country*: Taiwan *Setting:* mixed (medical centers, hospitals, clinics) *HC professionals*: physicians specialized in diabetology (P4P) *Type of care:* P4P: integrated care Non-P4P: usual care	1458 (total) P4P: 1037 Non-P4P: 421	Type 2	P4P: 61.5 (11.4) non-P4P: 61.5 (12.77)	P4P: 49.6% Non-P4P: 46.6%	Mandarin 20 items Almost never to almost always	P4P: 4.2 (0.6) non-P4P: 3.9 (0.7)
Dede & al (2016) [2]	*Study design*: Cross-sectional study *Country*: Turkey *Setting:* hospital clinics (internal medicine and pulmonary medicine outpatient clinic) *HC professionals:* various specialists *Type of care:* usual care	76	Type 2	55.0 (12.7)	36.8%	Turkish 20 items Never to always	2.9 (0.9)
Fan & al (2015) [3]	*Study design*: Cross-sectional study *Country*: USA *Setting:* primary care practice (n=34 in a practice-based research network) *HC professionals:* GPs *Type of care*: usual care	2055	Type 2	64.9 (12.3)	50.4%	English 20 items None of the time to all the time	3.0 (1.09)

Author (publication year)	Study and healthcare delivery characteristics	Patient characteristics				PACIC instrument and overall score on a 5-point scale	
		N	Type of diabetes	Age, mean(SD)	Men, %	Language, nb of items, anchors	Overall score, mean (SD)
Ku & Kegels (2015) [4]	*Study design*: Before-after study (baseline data only) *Country*: Philippines *Setting*: primary care practices *HC professionals*: healthcare workers, GPs, nurses, midwives *Type of care*: usual care (at baseline)	164	Type 2	56.9 (10.8)	25.6%	Language ot reported 20 items Almost never to almost always	3.3 (0.8) *SD calculated from 95% CI (3.0 – 3.4)*
Kuznetsov & al (2015) [5]	*Study design*: cross-sectional analyses of cluster-RCT with 2 study groups: routine care (RC) and intensive multifactoral treatment (IMT) *Country*: Denmark *Setting:* primary care practice *HC professionals*: GPs *Type of care:* RC: usual care IMT: integrated care	937 (total) (6-year follow-up data) RC: 372 IMT: 565	Type 2	RC: 65.6 (6.7) IMT: 65.5 (6.9)	RC: 59.1% IMT: 59.1%	Language not reported 20 items Never to always	RC: 2.4 (0.8) IMT:2.4 (0.8)
Pintaudi & al (2015) [6-8]	*Study design*: cross-sectional study *Country*: Italy *Setting*: diabetes clinics *HC professionals*: diabetologists, nurses, dietitians *Type of care*: usual care	2374	Type 2	65.0 (10.2)	59.9%	Italian 11 items Anchors not reported *0-100 scale*	3.7 (0.8) *Calculated from mean PACIC score (SD) = 74.4 (16.1)*
Aung & al (2014) [9-14]	*Study design*: cross-sectional analyses of prospective cohort (2008 baseline data only) *Country*: Australia	3761	Type 2	62.5 (10.9)	55.3%	English 20 items None of the time to always	2.4 (1.6)

Author (publication year)	Study and healthcare delivery characteristics	Patient characteristics				PACIC instrument and overall score on a 5-point scale	
		N	Type of diabetes	Age, mean(SD)	Men, %	Language, nb of items, anchors	Overall score, mean (SD)
	Setting: mixed (population-based) *HC professionals*: mixed (population-based) *Type of care*: usual care						
Frei & al (2014) [15]	*Study design*: cross sectional study with 2 study groups: non-managed care (non-MC) and managed care (MC) *Country*: Switzerland *Setting*: primary care practice *HC professionals*: GPs *Type of care*: Non-MC: usual care MC: integrated care	374 (total) *Non-MC: 326* *MC: 48*	Type 2	Non-MC: 67.0 (10.6) MC: 73.3 (10.3)	Non-MC: 57.4% MC: 60.4%	German 20 items + 6 (5As) Never to always	Non-MC: 3.2 (0.9) MC: 3.4 (0.7)
Frei & al (2014) [16]	*Study design*: cluster-RCT (baseline data only) *Country*: Switzerland *Setting*: primary care practices *HC professionals*: GPs *Type of care*: usual care (at baseline)	326	Type 2	67.0 (10.5)	57.7%	German 20 items Anchors not reported	3.1 (0.9)
Glasgow & al (2014) [17]	*Study design*: 2 RCTs (baseline data only): 'My path to healthy life' trial [MyPath] and 'Reducing Distress and Enhancing Effective Management' trial [REDEEM] *Country*: USA *Setting*: MyPath: primary care practices	228 (total) *MyPath: 132* *REDEEM: 96*	Type 2	MyPath: 58.6 (9.1) REDEEM: 55.2 (10.9)	MyPath: 48.5% REDEEM: 40.6%	Language , nb of items and anchors not reported (*classified as 20 items*)	MyPath: 3.2 (0.4) REDEEM: 2.8 (1.1)

Author (publication year)	Study and healthcare delivery characteristics	Patient characteristics				PACIC instrument and overall score on a 5-point scale	
		N	Type of diabetes	Age, mean(SD)	Men, %	Language, nb of items, anchors	Overall score, mean (SD)
	REDEEM: community (community medical groups and diabetes education centers) *HC professionals*: MyPath: not reported REDEEM: not reported *Type of care*: MyPath: usual care REDEEM: integrated care						
Jiamjarasrangsi & al (2014) [18]	*Study design*: Cross-sectional study with 3 comparison groups: primary care unit (PCU) in hospitals [PCU hosp], PCU in public health centers [PCU comm], and non-PCU in hospitals [non-PCU hosp] *Country*: Thailand *Setting*: PCU hosp: hospital clinics PCU comm: community Non-PCU hosp: hospital clinics *HC professionals*: not reported *Type of care*: PCU hosp: integrated care PCU comm: integrated care Non-PCU hosp: usual care	1000 (total) *PCU hosp: 255* *PCU comm: 659* *Non-PCU hosp: 86*	Type 2	PCU hosp: 60.6 (13.0) PCU comm: 62.2 (10.0) Non-PCU hosp: 65.0 (11.6)	PCU hosp: 29.8% PCU comm: 25.3% Non-PCU hosp: 44.2%	Thai 20 items Almost never to almost always	PCU hosp: 3.6 (0.7) PCU comm: 3.4 (0.8) Non-PCU hosp: 3.1 (0.4)
Johnson & al (2014) [19-21]	*Study design*: controlled before-after study (baseline data only) *Country*: Canada	157	Type 2	57.8 (9.8)	44.6%	Language and anchors not reported	1.7 (1.3) *Calculated from*

Author (publication year)	Study and healthcare delivery characteristics	Patient characteristics				PACIC instrument and overall score on a 5-point scale	
		N	Type of diabetes	Age, mean(SD)	Men, %	Language, nb of items, anchors	Overall score, mean (SD)
	Setting: primary care practice (in primary care networks) *HC professionals*: GPs *Type of care*: integrated care					11 items *0-100 scale*	*mean PACIC score (SD) = 34.6 (26.7)*
Ku & al (2014) [22]	*Study design*: Cross-sectional study with 2 study groups: Veterans Memorial Medical Center (VMMC) and Local Government Health Units (LGHU) *Country*: Philippines *Setting*: VMMC: hospital clinics (family physician-led tertiary hospital-based outpatient clinic) LGHU: community centers (local government health units) *HC professionals:* VVMC: GPs LGHU: GPs, nurses, and midwives *Type of care*: VVMC: usual care LGHU: usual care	549 (total) *VMMC: 350* *LGHU: 199*	not reported	VMMC: 65.7 LGHU: 57.6	VMMC: 50.3% LGHU: 25.6%	Language not reported 20 items Almost never to almost always	VVMC: 2.6 (5.2) LGHU: 3.2 (0.7) *Unpublished data sent by author. SD calculated from 95% CI: VVMC:* 2.1-3.2; LGHU: 3.1-3.3.
Lewis & al (2014) [23]	*Study design*: before-after study (baseline data only) *Country*: USA *Setting:* mixed (clinical and community based care) *HC professionals:* not reported	257 (with PACIC data)	Type 2	54 (11.6) *Unpublished data sent by author.*	26% *Unpublished data sent by author.*	English 20 items None of the time to always	3.5 (0.9)

Author (publication year)	Study and healthcare delivery characteristics	Patient characteristics				PACIC instrument and overall score on a 5-point scale	
		N	Type of diabetes	Age, mean(SD)	Men, %	Language, nb of items, anchors	Overall score, mean (SD)
	Type of care: usual care (at baseline)						
Ratanawongsa & al (2014) [24, 25]	*Study design*: step-wedge RCT (baseline data only) *Country*: USA *Setting*: clinics in a practice-based research network *HC professionals*: GPs *Type of care*: usual care (at baseline)	252	Type 1 and 2	55.8 (8.3)	25.8%	English, Spanish and Cantonese 20 items Anchors not reported *1-100 scale*	2.2 (1.2) *Calculated from mean PACIC score (SD) = 44.6 (23.4)*
Stock & al (2014) [26]	*Study design*: cross-sectional study in 2 countries with 2 study groups in each country: Diabetes management program (DMP) and routine care (non-DMP) in Germany, ProvenCare Chronic Diabetes Program (PCDP) and routine care (non-PCDP) in USA *Country*: Germany and USA *Setting*: Germany: primary care practice USA: mixed (PCPs and other physicians in a medical group, and hospitals) *HC professionals*: Germany: GPs USA: multispecialty physicians *Type of care*: DMP and PCDP: integrated care Non-DMP and non-PCDP: usual care	Germany: 2470 (total) *DMP: 1791* *non-DMP: 679* USA: 1692 (total) *PCDP: 866* *non-PCDP: 826*	Type 2	DMP: 75.1 (5.6) Non-DMP: 75.8 (6.0) PDCP: not reported Non-PDCP: not reported	DMP: 50.3% Non-DMP: 53% PCDP: 52.7% Non-PCDP: 56.7%	English and German 20 items Anchors not reported	DMP: 2.7 (0.9) Non-DMP: 2.4 (0.9) PCDP: 2.9 (missing SD) Non-PCDP: 2.8 (missing SD) *German data sent by authors.*
Thomas & al	*Study design*: cross-sectional study	89	Type 2	not reported	39.3%	Language not	2.9 (1.1)

Author (publication year)	Study and healthcare delivery characteristics	Patient characteristics				PACIC instrument and overall score on a 5-point scale	
		N	Type of diabetes	Age, mean(SD)	Men, %	Language, nb of items, anchors	Overall score, mean (SD)
(2014) [27]	*Country*: USA *Setting*: primary care practice (private physicians network) *HC professionals*: multispecialty *Type of care*: usual care					reported 20 items + 6 (5As) Almost never to almost always	*5A summary score*
Tsiachristas & al (2014) [28, 29]	*Study design*: before-after study (baseline data only) *Country*: Netherlands *Setting*: primary care practice *HC professionals*: multiple care providers (e.g. GP, nurse, dietician, physiotherapist) *Type of care*: usual care (at baseline)	407 (diabetic patients only)	Type 2	66.2 (9.7)	57.0%	Dutch 20 items Anchors not reported	3.3 (0.85)
Xue & al (2014) [30]	*Study design*: cluster-RCT *Country*: USA *Setting*: primary care practices *HC professionals*: not reported *Type of care*: usual care (at baseline)	221	Type 1 and 2	62.9 (10.8)	35.7%	English 20 items Anchors not reported	2.4 (1.1) *Unpublished data sent by author.*
Zuercher & al (2014) [31-33]	*Study design*: cross-sectional analyses of prospective cohort (baseline data only) *Country*: Switzerland *Setting*: mixed (population-based) *HC professionals*: multiple care providers *Type of care*: usual care	519	Any type	64.5 (11.3)	59.7%	French 20 items Never to always	2.8 (0.95)
Ko & al (2013)	*Study design*: controlled before-after	40	Type 2	58 (13)	60%	Language and	3.5 (0.9)

Author (publication year)	Study and healthcare delivery characteristics	Patient characteristics				PACIC instrument and overall score on a 5-point scale	
		N	Type of diabetes	Age, mean(SD)	Men, %	Language, nb of items, anchors	Overall score, mean (SD)
[34]	study (baseline data only) *Country*: USA *Setting:* community (outpatient care services and community outreach programs) *HC professionals*: not reported *Type of care*: usual care					anchors not reported 20 items	
Liu & al (2013) [35]	*Study design*: cross-sectional study *Country*: China *Setting:* community health centers *HC professionals*: multiple care providers (often exclusively GPs) *Type of care*: integrated care (health management)	960	Type 2	68.3 (10.4)	39.6%	Language not reported 20 items Almost never to almost always	not reported *Author contacted but not reply.*
Sansgiry & al (2013) [36]	*Study design*: cross-sectional study *Country*: USA *Setting:* not clear (Veterans Affairs center) *HC professionals*: not reported *Type of care*: not reported	126	not reported	not reported	not reported	not reported	not reported
Drewes & al (2012) [37]	*Study design*: cross-sectional study *Country*: Netherlands *Setting*: primary care practice (n=69) *HC professionals*: GPs *Type of care*: integrated care	1547	Type 2 (mostly)	65.7 (11.4)	53.6%	Dutch 20 items + 6 items regarding team functioning Almost never to almost	2.8 (0.8) *Unpublished data sent by author.*

Author (publication year)	Study and healthcare delivery characteristics	Patient characteristics				PACIC instrument and overall score on a 5-point scale	
		N	Type of diabetes	Age, mean(SD)	Men, %	Language, nb of items, anchors	Overall score, mean (SD)
						always	
Ose & al (2012) [38, 39]	*Study design*: cross sectional study with 2 study groups: disease management program (DMP) and routine care (RC) *Country*: Germany *Setting*: primary care practice *HC professionals*: not reported *Type of care*: DMP: integrated care RC: usual care	1399 (total) *DMP: 865* *RC: 534*	Type 2	DMP: 70.2 (8.3) RC: 70.5 (8.9)	DMP: 46.2% RC: 46.6%	German 20 items Almost never to almost always	DMP: 3.26 (0.9) RC: 2.86 (0.9)
Pemu & al (2011) [40]	*Study design*: before-after study (baseline data only) *Country*: USA *Setting*: Primary care practice (in community physicians network) *HC professionals*: physicians *Type of care*: usual care (at baseline)	141	Any type	56 (9.2)	23%	Language and anchors not reported 20 items	3.3 (1.1)
Gugiu & al (2010) [41, 42]	*Study design*: cross-sectional study *Country*: USA *Setting*: primary care practice (physicians and practices network) *HC professionals*: not reported *Type of care*: usual care	529	Type 2	63.4 (missing SD)	52.7%	English 11 items Anchors not reported *0-100 scale*	3.1 (1.9) *Calculated from mean PACIC score (SD) = 61.7 (38.0), estimated from Table 2*
Maindal & al (2010) [43]	*Study design*: cross-sectional study *Country*: Denmark *Setting*: mixed	560	Type 2	66.4 (10.7)	60%	Danish 20 items Never to	2.8 (1.4) *Overall score*

Author (publication year)	Study and healthcare delivery characteristics	Patient characteristics				PACIC instrument and overall score on a 5-point scale	
		N	Type of diabetes	Age, mean(SD)	Men, %	Language, nb of items, anchors	Overall score, mean (SD)
	HC professionals: not reported *Type of care*: usual care					always	*computed from mean and SD of each individual item*
Wallace & al (2010) [44]	*Study design*: cross-sectional study *Country*: USA *Setting*: hospital clinic *HC professionals*: multidisciplinary team *Type of care*: integrated care	195	Type 2	58 (missing SD)	36%	English 20 items + 6 (5As) Almost never to almost always	3.8 (0.8)
Schillinger & al (2009) [45-47]	*Study design*: RCT (baseline data only) *Country*: USA *Setting*: primary care practice *HC professionals*: GPs *Type of care*: usual care (at baseline)	339	Type 2	56.1 (missing SD)	41%	English, Spanish, Cantonese 20 items Almost never to almost always *1-100 scale*	1.95 (1.2) *Calculated from a mean PACIC score (SD) = 39.0 (24.8)*
Aragones & al (2008) [48]	*Study design*: cross-sectional study *Country*: USA *Setting*: hospital clinic *HC professionals*: not reported *Type of care*: integrated care	100	Type 2	63.7 (10.7)	21%	Spanish 20 items None of the time to always	3.2 (0.8)
Jackson & al (2008) [49]	*Study design*: cross sectional study *Country*: USA *Setting*: primary care practice (in a Veteran Affairs medical center)	189	not reported	65.0 (10.7)	97.9%	English 20 items None of the time to always	3.1 (1.1)

Author (publication year)	Study and healthcare delivery characteristics	Patient characteristics				PACIC instrument and overall score on a 5-point scale	
		N	Type of diabetes	Age, mean(SD)	Men, %	Language, nb of items, anchors	Overall score, mean (SD)
	HC professionals: GPs *Type of care*: usual care						
Wensing & al (2008) [50]	*Study design*: cross-sectional study *Country*: Netherlands *Setting:* primary care practice (n=4) *HC professionals*: GPs *Type of care*: integrated care	88 (diabetic patients only)	Type 2	68.8 (8.9)	43%	Dutch 20 items Almost never to almost always	3.2 (1.0)
Glasgow & al (2005) [51]	*Study design*: cross-sectional study *Country*: USA *Setting:* primary care practice (n=30) *HC professionals*: not reported *Type of care*: usual care	363	Type 2	64.1 (11.9)	52.8%	English 20 items + 6 (5As) Almost never to almost always	3.2 (0.9)

RCT: randomized controlled trial, HC: healthcare, GP: general practitioner, SD: standard deviation, nb: number

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Supplementary table 4. Characteristics of ongoing studies or studies without published results using the PACIC instrument among patients with diabetes.

Author (publication year)	Study and healthcare delivery characteristics	Patient characteristics		PACIC instrument
		N patients planned	Type of diabetes	Language, nb of items
Yu & al (2015) [1]	*Study design*: Cluster-RCT *Country*: Canada *Setting*: family practice groups (health integration networks) *HC professionals*: physicians, nurses, dietitians and/or pharmacists *Type of care*: usual care (at baseline)	112 (2x56)	Type 2	Not reported
Bozorgmehr & al (2014) [2]	*Study design*: RCT *Country*: Germany *Setting*: primary care practice *HC professionals*: GPs *Type of care*: usual care (at baseline)	582	Type 2	not reported 11 items
Drewelow & al (2012) [3]	*Study design*: cluster-RCT *Country*: Germany *Setting:* primary care practice *HC professionals:* GPs *Type of care:* usual care (at baseline)	780	Type 2	PACIC-D Not clear
Freund & al (2011) [4, 5]	*Study design*: cluster-RCT *Country*: Germany *Setting*: primary care practice (n=130) *HC professionals*: GP or general internist, healthcare assistants *Type of care*: usual care (at baseline)	2210	Type 2	Not clear
Versnel & al (2011) [6]	*Study design*: RCT *Country*: Netherlands *Setting*: primary care practice *HC professionals*: GP, practice nurse, diabetes nurse, dietician *Type of care*: integrated care (at baseline)	230	Type 2	not reported 20 items

RCT: randomized controlled trial, GP: general practitioner, HC: healthcare, nb: number

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