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Nijmegen Continuity Questionnaire: Development and testing of a questionnaire that measures continuity of care

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ABSTRACT

Objective: To develop and pilot test a generic questionnaire to measure continuity of care from the patient's perspective across primary and secondary care settings.

Study Design and Setting: We developed the Nijmegen Continuity Questionnaire (NCQ) based on a systematic literature review and analysis of 30 patient interviews. The questionnaire consisted of 16 items about the patient-provider relationship to be answered for five different care providers and 14 items each on the collaboration between four groups of care providers. The questionnaire was distributed among patients with a chronic disease recruited from general practice. We used principal component analysis (PCA) to identify subscales. We refined the factors by excluding several items, for example, items with a high missing rate.

Results: In total, 288 patients filled out the questionnaire (response rate, 72%). PCA yielded three subscales: "personal continuity: care provider knows me," "personal continuity: care provider shows commitment," and "team/cross-boundary continuity." Internal consistency of the subscales ranged from 0.82 to 0.89. Interscale correlations varied between 0.42 and 0.61.

Conclusion: The NCQ shows to be a comprehensive, reliable, and valid instrument. Further testing of reliability, construct validity, and responsiveness is needed before the NCQ can be more widely implemented.

1. INTRODUCTION

What is new?

- We developed a generic questionnaire to measure continuity of care from the patient's perspective in primary and secondary care settings.
- Initial testing of this questionnaire shows it to be a comprehensive, reliable, and valid instrument.
- This is the first instrument that—regardless of morbidity and across multiple care settings—measures patients' experienced continuity of care as a multidimensional concept, that is, having a personal care provider and communication/cooperation between care providers.
- This is a promising questionnaire to identify problems and evaluate interventions aimed at improving continuity of care and to enable us to compare continuity experiences for different diseases and multimorbidity patterns.

Continuity of care is an important aspect of patient care. Having a personal care provider (personal continuity) is related to better health [1], more confidence in the care provider [2] and [3], more patient satisfaction [3], [4] and [5], higher quality of patients' life [6] and [7], and less health care costs [8] and [9]. Over time, many instruments have been developed to measure personal continuity [10].

However, because of recent developments in health care, the concept of continuity of care has changed [11], [12] and [13]. With more subspecialization, fragmentation of health care, part-time practice, and an increase in the number of patients with multiple chronic diseases, an increasing number of care providers are involved in the care of patients. Continuity of care is nowadays considered a multidimensional concept, including not only personal or relational continuity but also informational continuity and team/cross-boundary continuity requiring communication and collaboration between care providers [11], [12] and [13]. Some instruments have been developed to measure continuity of care as a multidimensional concept, but they all focus solely on a single disease [14], [15] and [16]. Such measurement instruments do not take into account that continuity is particularly important in situations where multimorbidity exists [17].

Moreover, most existing instruments are developed to measure continuity of care in one care setting, for example, in primary care, whereas a substantial number of chronic patients also contact medical specialists in the hospital or in an outpatient department.

At last, some instruments measure continuity of care from the provider's perspective or by using medical records, whereas we believe that continuity of care should be measured from the patient's perspective [18].

To our knowledge, there is no instrument available yet that measures patients' experienced continuity of care as a multidimensional concept regardless of morbidity and across multiple care settings. Such a measurement instrument would allow us to identify problems and evaluate interventions aimed at improving continuity of care. Moreover, it would enable us to compare continuity experiences for different diseases and multimorbidity patterns.

The aim of this study is, therefore, to develop and pilot test a generic questionnaire to measure continuity of care from the patient's perspective as a multidimensional concept and across multiple care settings.

2. METHODS

2.1. Development: item generation

We performed a systematic literature review of articles describing measurement instruments for continuity of care. We searched PubMed for articles focusing on continuity of care or related concepts, such as coordination or integration of care published from January 1997 to January 2007. We also searched in the reference list of all included articles and screened articles about continuity of care from our own database on continuity. We included all articles describing or using measurement instruments that included items about having a personal care provider and/or communication or cooperation between care providers (see Box 1). We screened 3,152 articles and finally included and analyzed 83 articles in which 82 different measurement instruments are described (search strategy and list of articles and instruments available on request). None of these 82 instruments measured patients' experienced continuity of care as a multidimensional concept regardless of morbidity and across multiple care settings.

[Box 1.]

We generated items for our questionnaire by including all items measuring aspects of the key domains of interest (Box 1) from the 82 identified instruments. We merged items with exactly the same content by using formulations that we think are easiest to understand and fit the Dutch situation.

In addition, we analyzed 30 patient interviews that were conducted as part of a study on continuity of care for additional items [19].

This resulted in a draft questionnaire (Nijmegen Continuity Questionnaire [NCQ]), including 20 general items (about types of care providers seen, age, sex, ethnicity, etc) and 136 items about continuity (16 items about the patient-provider relationship to be answered for five different care providers (80 items): most important care provider in general practice, other care provider in general practice, most important care provider in hospital/outpatient department, other care provider in hospital/outpatient department, and care

provider outside general practice and hospital/outpatient department, and 14 items on the collaboration between four groups of care providers (56 items): between care providers within general practice, between care providers within the hospital/outpatient department, between general practice and hospital/outpatient department, and between general practice and care providers outside general practice and hospital/outpatient department). The items on continuity were rated according to a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree), with an additional option to choose “?” (“I do not know”). Some items were negatively worded to reduce bias.

2.2. Validity: face validity and reading level

Subsequently, we tested face validity by interviewing 15 patients with chronic diseases (varying in age, number of chronic diseases, number of care providers seen, and type of general practice in which they were listed) according to the “thinking aloud technique” [20]. Patients were asked to think aloud when they answered each question. Interviews were audiotaped, and the interviewer wrote down verbal and nonverbal reactions indicating difficulties in instruction and item wording. Difficulties were corrected and tested in subsequent interviews. After 13 patients no new difficulties in the questionnaire were identified; therefore, we assumed that data saturation was achieved after 15 interviews, which corresponds to the description of Streiner and Norman [20]. Finally, the questionnaire included 136 items on continuity and 21 general items. The reading level of the NCQ was then assessed according to the Flesch–Kincaid grade level [21].

2.3. Pilot testing: participants

In January 2009, 31 general practitioner (GP) trainees working in practices in the eastern part of the Netherlands were asked to distribute 25 questionnaires each to patients with one or more chronic diseases. For these patients, continuity is particularly important, and most of them would have contacted a medical specialist in the hospital/outpatient department in the previous year. We excluded patients under the age of 18 years or who were unable to speak or read Dutch. Patients filled out the NCQ at home and could send it back directly to the researchers. The GP trainees registered age, sex, and type of chronic disease(s) of all participating patients and filled out some questions about the type of practice they worked in. In the Netherlands, every patient is enlisted with one GP. The GP functions as a gatekeeper for specialist care.

2.4. Analysis

We used SPSS version 16.0 (SPSS Inc., Chicago, IL, USA) to analyze the data. We assessed item completion rates, means, standard deviation (SD), and percentage respondents with the highest and lowest score per item (ceiling and floor effect). We treated the items as continuous variables. Principal component analysis (PCA) was used to identify subscales. We performed PCA on 16 items about the patient–provider relationship across multiple care settings and per care setting separately. In the first analysis, several observations from one patient are included (e.g., observations from the care provider in general practice and hospital/outpatient department), whereas in the second analysis, the observations are all independent. We also performed PCA on 14 items about the collaboration and information exchange between the groups of care providers across multiple care settings and per care setting separately. We compared varimax rotation with direct oblimin rotation and finally chose the rotation that resulted in factors with the highest interpretability. We retained the factors with eigenvalues greater than 1. We refined the factors by excluding items for several reasons: we excluded items that decreased the interpretability of the factor, had a relatively high rate of missing values, were relatively highly correlated to other items, had a relatively low SD, had a relatively high floor or ceiling effect, loaded high on two factors or loaded low on all factors. Reliability of the subscales was assessed using Cronbach α . We excluded items until Cronbach α was <0.90 to avoid item redundancy. For preliminary validation of the subscales, we assessed the mean, SD, and mean interitem correlations of the subscales and calculated Pearson correlations between the subscales.

3. RESULTS

3.1. Reading level

The estimated reading level was seven, indicating that respondents would need a seventh-grade education to understand the questionnaire [21]. The seventh grade is the seventh school year after kindergarten. Seventh graders are usually 12–13 years old.

3.2. Questionnaire response

In total, 24 GP trainees participated, and they asked 398 patients to fill out the questionnaire, of which 288 (72%) were returned.

3.3. Patient characteristics

Table 1 shows patients' characteristics and their medical care. Responders and nonresponders did not differ in age ($P = 0.77$), number of chronic diseases ($P = 0.19$), and type of general practice they were listed in ($P = 0.30$). Responders were more likely to be males ($P = 0.03$).

[TABLE 1.]

Most patients perceived general practice or hospital/outpatient department as their most important site of care (74% and 21%, respectively) and their GP and medical specialist as their most important care provider at these sites (264 of 288 patients [91.6%] and 177 of 179 patients [98.9%], respectively). Therefore, in this article, we will focus on the patient-provider relationship of the most important care provider in general practice and hospital/outpatient department and on the collaboration and information exchange between care providers within general practice, between care providers within the hospital/outpatient department, and between general practice and hospital/outpatient department.

3.4. Item analysis

Table 2 shows item means, SDs, missing rates, and percentage of respondents with the lowest and highest scores (floor and ceiling effect). Most items were weakly to moderately negatively skewed. The items about the collaboration between care providers within the hospital/outpatient department and the collaboration between general practice and hospital/outpatient department showed highest missing rates (mean of 26.1% and 24.9%, respectively).

[TABLE 2.]

3.5. Subscales

Before we performed PCA, we excluded items 3 and 9 (about trust and relationship) because these items were not distinctive for measuring continuity of care. For example, we found that patients could be negative about the continuity of their specialist (according to the other items) but still reported to experience a lot of trust in this care provider. Item 3 also showed poor variability.

PCA showed that the negatively worded items (items 6, 13, 20, and 25) loaded on a separate factor, which we could not interpret well. We found that patients answered these items more frequently with extreme values (higher ceiling effect). Patients answered inconsistently when comparing the negatively worded items with the positively worded items, which was also shown in other research [22]. Therefore, we decided to exclude the negatively worded items.

We performed PCA on the remaining items 1–16 about the most important care provider across multiple care settings and per care setting separately. Table 3 shows the varimax-rotated factor loadings of this first analysis. It resulted in the same factors as the last analysis. We compared varimax rotation with direct oblimin rotation and found no difference in final results. Two factors were generated, both with an eigenvalue above 1: "personal continuity: care provider knows me" and "personal continuity: care provider shows commitment," explaining a total variance of 70.3%.

[TABLE 3.]

We also performed PCA on the remaining items 17–30 about the collaboration between the groups of care providers across multiple care settings and per care setting separately, which resulted in the same single factor ("team/cross-boundary continuity"). Table 3 shows the factor loadings of this first analysis. This factor explained 73.7% of total variance.

3.6. Item reduction

We refined the factors by excluding some items. Table 3 shows the items that we excluded with their reasons for exclusion. From the first factor, we successively excluded items 2, 10, and 4. After excluding these items, Cronbach α was still high (0.90) and, therefore, we excluded item 8 as well. Factor 1 finally

consisted of items 1, 5, 7, 11, and 12. We did not exclude items from the second factor because it included only three items (items 14, 15, and 16).

From the third factor, we successively excluded items 17, 19, 24, 30, 26, 21, and 29. After excluding these items, Cronbach α was still high (0.92) and, therefore, we excluded item 22 as well. Factor 3 finally consisted of items 18, 23, 27, and 28. The final version of the NCQ can be found in the Appendix (see the Appendix on the journal's Web site at www.elsevier.com).

3.7. Reliability

Table 4 shows the mean interitem correlations and Cronbach α for the subscales after item reduction, as well as their means and SDs. Mean interitem correlation of the subscales varied between $r = 0.58$ and $r = 0.71$. Internal consistency (Cronbach α) ranged from 0.82 to 0.89.

[TABLE 4]

To assess the cohesiveness of the scale, correlations between the subscales were examined. The mean correlation between subscales "personal continuity: care provider knows me" and "personal continuity: care provider shows commitment" was $r = 0.61$. The mean correlation between subscales "personal continuity: care provider knows me" and "team/cross-boundary continuity" was $r = 0.42$. The mean correlation between subscales "personal continuity: care provider shows commitment" and "team/cross-boundary continuity" was $r = 0.49$.

Because of the relatively high correlation between "personal continuity: care provider knows me" and "personal continuity: care provider shows commitment," we hypothesized that showing commitment is a cumulative quality of personal continuity. When care providers know their patients very well, they can either show or not show the cumulative quality commitment. However, care providers who do not know their patients very well will probably not show commitment. In other words, "knowing the patient well" is a prerequisite for "showing commitment." We found support for this hypothesis in our data. Of all patients who answered that their care provider knew them very well (mean score <4), 59% answered that their care provider showed the cumulative quality commitment (mean score ≥ 4), whereas 41% of patients answered that their care provider did not show this cumulative quality well. Of the patients that answered that their care provider did not know them very well, 82% also answered that this care provider did not show the cumulative quality commitment well.

3.8. Construct validity

The construct validity of the NCQ was partly supported by the results of the PCA. In accordance with the definition of continuity in the literature, both personal continuity and team/cross-boundary continuity were identified in our questionnaire. We did not find a differentiation between informational continuity and team/cross-boundary continuity. We found that personal continuity might be subclassified in "care provider knows me" and "care provider shows commitment."

Construct validity was further supported by the high internal consistency of the subscales. The moderate correlations between "personal continuity" and "team/cross-boundary continuity" provide evidence of good discriminant validity. The high correlation (0.61) between "personal continuity: care provider knows me" and "personal continuity: care provider shows commitment" was expected because they both measure aspects of personal continuity.

4. DISCUSSION

Initial testing of the NCQ shows that it is a comprehensive, reliable, and valid generic instrument to measure patients' experiences of continuity of care as a multidimensional concept across multiple care settings. To our knowledge, this is the first generic questionnaire that measures continuity of care as a multidimensional concept from the patient's perspective regardless of care setting and morbidity. The NCQ allows us to identify problems and evaluate interventions aimed at improving continuity of care. Moreover, it will enable us to compare continuity experiences for different diseases and multimorbidity patterns.

The NCQ subscales reflect recent definitions of continuity of care [11], [12] and [13]. However, contrary to conceptual literature, patients did not differentiate between informational continuity and team/cross-boundary continuity. Haggerty et al. [23] also found that these two dimensions are hard to differentiate for patients. Face and content validity of the NCQ are supported by the involvement of patients and the

published literature in the development of the questionnaire. Readability, which was tested by interviewing patients and calculating the Flesch–Kincaid grade level, was good. The internal consistencies of the subscales and the interscale correlations provide evidence of a reliable and valid questionnaire with good discriminant abilities. The correlation between the subscales “personal continuity: care provider knows me” and “personal continuity: care provider shows commitment” was highest (0.61). We found support for the hypothesis that “knowing the patient well” is a prerequisite for “showing commitment.” Although this hypothesis is tested on the same data as it is based on, we think that patients are able to differentiate between “care provider knows me” and “care provider shows commitment.” Maintaining both these subscales will enrich the questionnaire and enable us to better differentiate personal continuity.

Further testing of reliability (test–retest), responsiveness, and construct validity against external criteria, such as satisfaction and confidence in care provider, is needed before the NCQ can be more widely implemented. The sample size and response rate of participants in this study were high, which strengthens our results and conclusions.

It is important to realize that this questionnaire measures continuity of care from the patient’s perspective, which we believe it should be measured from [18]. Information from health records is not used in this measure. This makes it even more important to further test the reliability (test–retest).

4.1. Item reduction

Most patients perceived general practice or hospital/outpatient department as their most important site of care and their GP and specialist as their most important care provider at these sites. For future research, we decided, therefore, to reduce the items of the NCQ by focusing solely on the personal continuity provided by these care providers and on the team/cross-boundary continuity between these care providers (see the Appendix on the journal’s Web site at www.elsevier.com). This shortens the questionnaire without losing important data, which will improve patients’ motivation to fill out the questionnaire.

4.2. Generalizability to other countries

Our questionnaire is developed and tested in the Netherlands, a country where the GP has a gatekeeping role. This questionnaire is, therefore, easily applicable in other countries with the same care system, such as the United Kingdom. We think that our questionnaire is also useful in countries with a different care system. Possibly, the GP can be replaced by another care provider, which makes the questionnaire applicable to other care systems.

4.3. Limitations

One of the limitations of this study is that we solely recruited patients from general practice. Because most patients also contacted the hospital/outpatient department in the last year, we assume that our results are also applicable to patients recruited via the hospital/outpatient department. Further study is however needed to confirm this. Another limitation is that we solely included patients with a chronic disease, which lowers generalizability. However, continuity of care seems to be most important for patients with a chronic disease, and we do not think that our main results will differ substantially for patients without a chronic disease.

A last limitation is that most GP trainees approached less than 25 patients each. We do not have data of patients who met the inclusion criteria but who were not approached by the GP trainees. This may have resulted in a slight bias in the recruitment of participants. However, it is unlikely that this has influenced the factors identified in the PCA nor would it result in main differences in initial testing of reliability and construct validity. It may yield differences in individual experiences of continuity of care, but we did not aim to describe this.

5. CONCLUSION

This study provides initial evidence for the comprehensiveness, reliability, and validity of the NCQ as a generic questionnaire that measures continuity of care as a multidimensional concept from the patient’s perspective across multiple care settings. Further testing of reliability (test–retest), construct validity, and responsiveness is needed before the NCQ can be more widely implemented.

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APPENDIX SUPPLEMENTARY MATERIAL

Nijmegen Continuity Questionnaire.

Appendix: Nijmegen Continuity Questionnaire (NCQ)

Nijmegen Continuity Questionnaire

Questionnaire instructions

We are interested in your experiences with the care providers that you contacted in the last 12 months.

This questionnaire includes 28 statements, and will take about 5-10 minutes to complete.

There are no right or wrong answers. Your honest opinion is what counts.

For each statement, choose the answer that best describes your opinion.

All the information you provide will be kept completely confidential. Your answers will **not** be passed on to your care providers or others.

Any comments/remarks:

.....

.....

.....

.....

.....

.....

Thank you for your help!

TABLES AND BOX

Box 1 Key domains of interest

Personal care provider

The patient has a personal care provider in every care setting with whom he/she can develop an ongoing relationship (personal/relational continuity).

Communication and cooperation between care providers

Care providers in the same care setting and between different care settings communicate and cooperate to connect their care in a coherent way. Care providers use information on past events to deliver care that is appropriate to the patient's current circumstances (informational/cross-boundary/management continuity).

Table 1. Characteristics and medical care of responders and nonresponders

Patient characteristics	Responders (N = 288), n (%)	Nonresponders (N = 110), n (%)
Age (mean)	64.6	64.9
< 50	35 (12.2)	14 (12.7)
50–59	61 (21.2)	17 (15.5)
60–69	77 (26.7)	25 (22.7)
70–79	86 (29.9)	35 (31.8)
> 80	29 (10.1)	11 (10.0)
Missing	0 (0)	8 (7.3)
Male sex	133 (46.2)	39 (35.5)
Ethnicity		
Dutch	259 (89.9)	
Other	29 (10.1)	
Medical care		
Number of chronic diseases according to care provider (mean)	1.91	1.72
Type of chronic diseases		
Diabetes mellitus	106 (36.8)	46 (41.8)
Asthma/chronic obstructive pulmonary disease	58 (20.1)	23 (20.9)
Myocardial infarction	17 (5.9)	5 (4.5)
Cerebrovascular accident/transient ischemic attack	0 (0)	1 (0.9)
Hypertension	123 (42.7)	33 (30.0)
Mental disorder	9 (3.1)	2 (1.8)
Malignancy	13 (4.5)	1 (0.9)
Disorder of muscles, bones, or joints	33 (11.5)	16 (14.5)
Other	83 (28.8)	27 (24.5)
Listed in single-handed general practice	45 (15.6)	35 (31.8)
Total number of care providers in the last year (mean)	3.97	
In general practice (mean)	2.02	
In hospital (mean)	1.30	
Total number of contacts in the last year in general practice		
0 times	0 (0.0)	
1–2 times	40 (13.9)	
3–5 times	128 (44.4)	
> 5 times	116 (40.3)	
Missing	4 (1.4)	
Total number of contacts in the last year in hospital/outpatient department		
0 times	88 (30.6)	
1–2 times	86 (29.9)	
3–5 times	58 (20.1)	
> 5 times	54 (18.8)	
Missing	2 (0.7)	

Values are in numbers (percentages) unless otherwise indicated.

Table 2. Item means, SDs, missing rates, floor and ceiling effect

Questionnaire items	Most important care provider ...														
	... In general practice (N = 269)					... In hospital/outpatient department (N = 166)									
	Mean	SD	Missing?, n (%)	Floor effect, n (%)	Ceiling effect, n (%)	Mean	SD	Missing?, n (%)	Floor effect, n (%)	Ceiling effect, n (%)					
1. I know this care provider very well	3.89	0.815	3 (1.1)	2 (1.2)	61 (22.7)	3.21	0.996	5 (3.0)	10 (6.0)	11 (6.6)					
2. This care provider knows me very well	3.92	0.786	5 (1.9)	2 (1.2)	60 (22.3)	3.24	1.025	6 (3.6)	11 (6.6)	12 (7.2)					
3. I have a lot of trust in this care provider	4.13	0.702	5 (1.9)	0 (0.0)	79 (29.4)	4.02	0.635	4 (2.4)	0 (0.0)	32 (19.3)					
4. This care provider knows very well which care I receive more	3.97	0.823	19 (7.1)	2 (1.2)	63 (23.4)	3.38	0.960	16 (9.6)	5 (3.0)	14 (8.4)					
5. This care provider knows my medical history very well	3.59	0.965	18 (6.7)	3 (1.8)	44 (16.4)	3.02	1.066	18 (10.8)	12 (7.2)	11 (6.6)					
6. I always have to repeat my story when I see this care provider again	2.19	0.873	15 (5.6)	2 (1.2)	49 (18.2)	2.38	0.829	14 (8.4)	0 (0.0)	19 (11.4)					
7. This care provider always knows very well what he/she did previously	3.51	0.917	17 (6.3)	3 (1.8)	32 (11.9)	3.26	0.937	19 (11.4)	5 (3.0)	8 (4.8)					
8. This care provider remembers me very well when he/she sees me	4.10	0.790	17 (6.3)	3 (1.8)	75 (27.9)	3.41	1.032	14 (8.4)	9 (5.4)	14 (8.4)					
9. I have a very good relationship with this care provider	3.80	0.861	13 (4.8)	1 (0.6)	59 (21.9)	3.26	0.963	7 (4.2)	9 (5.4)	12 (7.2)					
10. This care provider knows my relevant medical data very well	3.56	0.919	23 (8.6)	3 (1.8)	37 (13.8)	3.15	0.975	19 (11.4)	8 (4.8)	9 (5.4)					
11. This care provider knows my familial circumstances very well	3.32	1.057	19 (7.1)	10 (5.9)	34 (12.6)	2.48	0.929	21 (12.7)	18 (10.8)	2 (1.2)					
12. This care provider knows my daily activities very well	3.12	1.001	27 (10.0)	10 (5.9)	20 (7.4)	2.46	0.941	17 (10.2)	20 (12.0)	3 (1.8)					
13. This care provider has always forgotten what I told before	1.97	0.789	21 (7.8)	4 (2.4)	65 (24.2)	2.42	0.819	19 (11.4)	0 (0)	18 (10.8)					
14. This care provider contacts me if it is needed, I do not have to ask	3.16	1.109	31 (11.5)	18 (10.7)	26 (9.7)	3.04	1.133	25 (15.1)	7 (4.2)	15 (9.0)					
15. This care provider knows very well what I believe is important in my care	3.53	0.873	26 (9.7)	7 (4.1)	22 (8.2)	3.21	0.975	17 (10.2)	6 (3.6)	9 (5.4)					
16. This care provider keeps in contact sufficiently when I see other care providers	3.26	0.971	39 (14.5)	10 (5.9)	20 (7.4)	2.98	0.929	33 (19.9)	6 (3.6)	5 (3.0)					
Questionnaire items	Collaboration between care providers ...														
	... Within general practice (N = 154)			... Within hospital/ outpatient department (N = 77)			... In general practice and hospital/ outpatient department (N = 152)								
	Mean	SD	Missing?, n (%)	Floor effect, n (%)	Ceiling effect, n (%)	Mean	SD	Missing?, n (%)	Floor effect, n (%)	Ceiling effect, n (%)	Mean	SD	Missing?, n (%)	Floor effect, n (%)	Ceiling effect, n (%)
17. These care providers communicate very well with each other	3.83	0.733	22 (14.3)	3 (1.9)	15 (9.7)	3.34	0.965	19 (24.7)	2 (2.6)	5 (6.5)	3.48	0.887	39 (25.7)	3 (2.0)	9 (5.9)
18. These care providers transfer information very well to each other	3.83	0.763	22 (14.3)	2 (1.3)	21 (13.6)	3.37	0.927	18 (23.4)	1 (1.3)	4 (5.2)	3.63	0.805	30 (19.7)	1 (0.7)	10 (6.6)
19. The care of these care providers is very well adapted to each other	3.80	0.751	24 (15.6)	3 (1.9)	15 (9.7)	3.28	0.978	20 (26.0)	1 (1.3)	5 (6.5)	3.50	0.821	37 (24.3)	1 (0.7)	9 (5.9)
20. I often get contradictory information from these care providers	1.99	0.722	9 (5.8)	2 (1.3)	28 (18.2)	2.42	0.824	11 (14.3)	1 (1.3)	6 (7.8)	2.19	0.765	16 (10.5)	1 (0.7)	19 (12.5)
21. The care between these care providers goes very smoothly	3.82	0.626	21 (13.6)	1 (0.6)	13 (8.4)	3.44	0.834	22 (28.6)	1 (1.3)	4 (5.2)	3.46	0.723	41 (27.0)	1 (0.7)	4 (2.6)
22. These care providers are very well informed of each other	3.78	0.719	31 (20.1)	2 (1.3)	14 (9.1)	3.28	0.878	23 (29.9)	0 (0.0)	3 (3.9)	3.39	0.893	43 (28.3)	2 (1.3)	6 (3.9)
23. These care providers work together very well	3.80	0.668	21 (13.6)	1 (0.6)	15 (9.7)	3.47	0.823	24 (31.2)	0 (0.0)	4 (5.2)	3.39	0.835	37 (24.3)	2 (1.3)	5 (3.3)
24. These care providers always agree about the care I receive	3.60	0.724	33 (21.4)	1 (0.6)	8 (5.2)	3.36	0.851	27 (35.1)	1 (1.3)	3 (3.9)	3.44	0.737	49 (32.2)	1 (0.7)	4 (2.6)
25. I always have to tell my story again when I see the other care provider	2.64	0.988	13 (8.4)	2 (1.3)	16 (10.4)	2.77	0.941	11 (14.3)	2 (2.6)	4 (5.2)	2.70	0.971	20 (13.2)	4 (2.6)	9 (5.9)
26. These care providers are very involved in each other's care	3.64	0.725	30 (19.5)	2 (1.3)	11 (7.1)	3.25	0.918	24 (31.2)	1 (1.3)	4 (5.2)	3.35	0.81	48 (31.6)	2 (1.3)	4 (2.6)
27. The care of these care providers is very well connected	3.74	0.619	17 (11.0)	1 (0.6)	8 (5.2)	3.29	1.014	15 (19.5)	3 (3.9)	6 (7.8)	3.50	0.784	35 (23.0)	2 (1.3)	6 (3.9)
28. These care providers always know very well from each other what they do	3.63	0.669	31 (20.1)	1 (0.6)	8 (5.2)	3.11	1.021	21 (27.3)	4 (5.2)	3 (3.9)	3.25	0.841	47 (30.9)	2 (1.3)	4 (2.6)
29. These care providers know the results of each other's medical examination very well	3.67	0.653	26 (16.9)	1 (0.6)	8 (5.2)	3.20	1.122	23 (29.9)	4 (5.2)	5 (6.5)	3.45	0.808	42 (27.6)	2 (1.3)	5 (3.3)
30. These care providers know very well who else is concerned in my care	3.55	0.764	33 (21.4)	1 (0.6)	10 (6.5)	3.04	1.098	23 (29.9)	6 (7.8)	3 (3.9)	3.22	0.872	45 (29.6)	3 (2.0)	4 (2.6)

Mean score (1 = strongly agree, 2 = agree, 3 = neutral, 4 = disagree, and 5 = strongly disagree).

Floor effect: number (percentage) of respondents with the lowest score. Ceiling effect: number (percentage) of respondents with the highest score.

Abbreviation: SD, standard deviation.

Table 3. Factor loadings and excluded items with their reasons for exclusion

Type of continuity	Factor loadings			Excluded items	Reasons for exclusion
	Factor 1	Factor 2	Factor 3		
	Eigenvalue: 7.304	Eigenvalue: 1.130	Eigenvalue: 8.617		
PCA					
PCA on items 1, 2, 4, 5, 7, 8, 10, 11, 12, 14, 15, 16					
Personal continuity: care provider knows me					
2. This care provider knows me very well (n = 424)	0.880			x	Highly correlated to item 1 (0.924) but more difficult to answer
1. I know this care provider very well (n = 427)	0.870				
5. This care provider knows my medical history very well (n = 399)	0.806				
11. This care provider knows my familial circumstances very well (n = 395)	0.746				
8. This care provider remembers me very well when he/she sees me (n = 404)	0.743			x	Relatively high ceiling effect and relatively low SD
4. This care provider knows very well which care I receive more (n = 400)	0.739			x	Relatively high ceiling effect and relatively low SD
10. This care provider knows my relevant medical data very well (n = 393)	0.726	0.427		x	High loading on two factors and relatively high missing rate
12. This care provider knows my daily activities very well (n = 391)	0.702				
7. This care provider always knows very well what he/she did previously (n = 399)	0.629				
Personal continuity: care provider shows commitment					
14. This care provider contacts me if it is needed, I do not have to ask (n = 379)		0.887			
16. This care provider keeps in contact sufficiently when I see other care providers (n = 363)		0.791			
15. This care provider knows very well what I believe is important in my care (n = 392)	0.495	0.705			
PCA on items 17, 18, 19, 21, 22, 23, 24, 26, 27, 28, 29, 30					
Team and cross-boundary continuity					
23. These care providers work together very well (n = 301)			0.901		
22. These care providers are very well informed of each other (n = 286)			0.884	x	Relatively high missing rate
19. The care of these care providers is very well adapted to each other (n = 302)			0.880	x	Highly correlated to item 18 (0.808) but more difficult to answer
26. These care providers are very involved in each other's care (n = 281)			0.876	x	Relatively high missing rate
17. These care providers communicate very well with each other (n = 303)			0.867	x	Highly correlated to item 18 (0.860) but more difficult to answer
18. These care providers transfer information very well to each other (n = 313)			0.850		
27. The care of these care providers is very well connected (n = 316)			0.849		
29. These care providers know the results of each other's medical examination very well (n = 292)			0.849	x	Content is comparable to item 19, but with higher missing rate and lower SD
28. These care providers always know very well from each other what they do (n = 284)			0.848		
24. These care providers always agree about the care I receive (n = 274)			0.819	x	Relatively low loading on factor, relatively low SD, relatively high missing rate
30. These care providers know very well who else is concerned in my care (n = 282)			0.796	x	Decreases the interpretability of the factor, relatively high missing rate, relatively low loading on factor

(Continued)

Table 3. Continued

Type of continuity	Factor loadings			Excluded items	Reasons for exclusion
	Factor 1	Factor 2	Factor 3		
	Eigenvalue: 7.304	Eigenvalue: 1.130	Eigenvalue: 8.617		
21. The care between these care providers goes very smoothly ($n = 299$)			0.739	x	Relatively low SD, relatively high missing rate, relatively low loading on factor

Values <0.40 are suppressed. Missing values were excluded pairwise.
 Abbreviations: PCA, principal component analysis; SD, standard deviation.

Table 4. Summary statistics of the subscales of the NCQ

Statistics	Personal continuity: care provider knows me	Personal continuity: care provider shows commitment	Team and cross-boundary continuity
Number of items	5	3	4
Mean interitem correlation (range)			
Most important care provider in general practice	0.58 (0.17) ($n = 233$)	0.61 (0.16) ($n = 219$)	—
Most important care provider in hospital/outpatient department	0.58 (0.26) ($n = 133$)	0.66 (0.14) ($n = 124$)	—
Collaboration between care providers within general practice	—	—	0.67 (0.16) ($n = 117$)
Collaboration between care providers within hospital/outpatient department	—	—	0.71 (0.25) ($n = 52$)
Collaboration between general practice and hospital/outpatient department	—	—	0.67 (0.15) ($n = 98$)
Cronbach α			
Most important care provider in general practice	0.87	0.82	—
Most important care provider in hospital/outpatient department	0.87	0.85	—
Collaboration between care providers within general practice	—	—	0.89
Collaboration between care providers within hospital/outpatient department	—	—	0.89
Collaboration between general practice and hospital/outpatient department	—	—	0.89
Potential range of scores	1–5	1–5	1–5
Mean of patient scores (SD)			
Most important care provider in general practice	3.48 (0.77)	3.32 (0.82)	—
Most important care provider in hospital/outpatient department	2.90 (0.78)	3.12 (0.89)	—
Collaboration between care providers within general practice	—	—	3.76 (0.59)
Collaboration between care providers within hospital/outpatient department	—	—	3.37 (0.81)
Collaboration between general practice and hospital/outpatient department	—	—	3.47 (0.71)

Missing values were excluded listwise.
 Abbreviations: NCQ, Nijmegen Continuity Questionnaire; SD, standard deviation.