Quality aspects of Dutch general practice–based data: a conceptual approach

Catharina van den Dungen\textsuperscript{a,}\textsuperscript{*,} Nancy Hoeymans\textsuperscript{b}, François G Schellevis\textsuperscript{c,d} and Hans J A M van Oers\textsuperscript{a,b}

\textsuperscript{a}Tranzo, Tilburg School of Social and Behavioral Sciences, Tilburg University, Tilburg, The Netherlands, \textsuperscript{b}Centre for Public Health Status and Forecasting, National Institute for Public Health and the Environment (RIVM), Bilthoven, The Netherlands, \textsuperscript{c}Netherlands Institute for Health Services Research (NIVEL), Utrecht, The Netherlands and \textsuperscript{d}Department of General Practice/EMGO Institute for health and care research, VU University Medical Centre, Amsterdam, The Netherlands.

\textsuperscript{*}Correspondence to Mw. C. van den Dungen, Tranzo, Tilburg School of Social and Behavioral Sciences, Tilburg University, Postbus 90153, Tilburg, 5000 LE, the Netherlands; E-mail: c.vandendungen@hotmail.nl

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\textbf{Background.} General practice–based data, collected within general practice registration networks (GPRNs), are widely used in research. The quality of the data is important but the recording criteria about what type of information is collected and how this information should be recorded differ between GPRNs.

\textbf{Objective.} We aim to identify aspects that describe the quality of general practice-based data in the Netherlands.

\textbf{Methods.} To investigate the quality aspects, we used the method of concept mapping, a structured conceptualization process for a complex multi-dimensional topic. We explored the ideas of representatives from 10 Dutch GPRNs on the quality of general practice–based data in five steps: preparation, generation of statements, structuring, representation and interpretation. In a brainstorm session, 10 experts generated statements about good data quality from general practice, which we completed with information from the literature. In total, 18 experts participated in the ranking and clustering of the statements. These results were analysed using ARIADNE software, using a combination of principal component analysis and cluster analysis techniques. Finally, the clusters were labelled based on their content.

\textbf{Results.} A total of 72 statements were analysed, which resulted in a two-dimensional picture with six clusters, ‘complete health record’, ‘coding of information’, ‘episode oriented recording’, ‘diagnostic validity’, ‘recording agreements’ and ‘residual category’.

\textbf{Conclusions.} The quality of general practice–based data can be considered on five content-based aspects. These aspects determine the quality of recording.

\textbf{Keywords.} Classification, episodes of care, data quality, general practice, medical records, registries.

\section*{Introduction}

General practitioners’ (GPs) first priority is to provide high-quality patient care. GPs’ record information is an electronic health records (EHR) to account for the given patient care. Structuring of this information gives an overview of the patients’ health problems. For daily patient care up to date, complete and valid information is necessary. General practice registration networks (GPRNs) collect information from individual practices and collate the data in a (central) database, for other purposes than daily patient care. This routinely recorded data is widely used in research, e.g. to evaluate health care, to estimate morbidity rates or to observe health inequalities.\textsuperscript{2–6}

GPs and practices participating in such a GPRN agreed to record information according to the recording quality standards of the specific network, to create uniform data. All networks collectively support the need for qualitatively good data, as a lot of effort is put into assuring data quality (training of GPs, cleaning of data, data feedback to the practice, meetings of GPs about diagnostic classification and recording). However, the recording criteria about what type of information is gathered (all morbidity or only more severe cases), how this information is recorded and why this information is collected (educational purpose,
morbidity estimation, provision of a sampling frame) differ between GPRNs. These different operational criteria about data recording and collection of the GPRNs might reflect different conceptual perspectives of good data quality.

In the literature, much attention is paid to the completeness and correctness of data. We do acknowledge the importance of these aspects, and we investigate whether other aspects, e.g. structuring of the data, are also important to describe the quality of the data. Currently, there is no consensus of how practice-based data quality should be described and how it is usable for research. Other valuations of data-quality aspects can result in different interpretations of the data derived from different GPRNs. Therefore, our goal is to give a complete picture of the concept of data quality from general practice from the GPRN perspective.

In this study, we explored the conceptual ideas of representatives from Dutch GPRNs on the quality of general practice–based data. We aim to identify common aspects, resulting in a conceptual framework to describe quality of Dutch general practice–based data.

Methods

Concept mapping
We used the method of concept mapping to investigate common aspects of good quality of general practice–based data. Concept mapping is a structured conceptualization process to explore the conceptual ideas of experts about a complex multi-dimensional topic. The outcome of this process is a concept map, a visual representation of the group’s thinking which summarizes all ideas of the group. Concept mapping consists of six sequential steps: preparation, generation of statements, structuring, representation, interpretation and utilization. In this article, we report on steps one to five. In the discussion, we reflect on utilization of the concept map.

Preparation
We defined the central question ‘What determines good quality of data from general practice?’ as the starting point of the exercise. This research is part of a larger study that tries to explain differences in morbidity estimation among Dutch GPRNs. In this study, 10 GPRNs are represented, 15 experts of these 10 Dutch GPRNs were invited to participate in a brainstorm session to generate the statements about this topic to ensure a broad spectrum of ideas. These experts have been intensively working with general practice–based data in different positions: data manager, scientific researcher or general practitioner. In the structuring step, we invited 19 experts of the 10 participating GPRNs to obtain a broader and more solid map because the data analysis (principal component analysis and cluster analysis) runs better with more information.

Generation of statements
We planned a 2-hour meeting with the experts for a brainstorm session to generate statements about good quality of general practice–based data. First, we explained the process of concept mapping. Next, participants were asked to answer the central question by generating as many statements as possible.

The brainstorm session was divided into two parts. In the first part, the participants wrote down as many short phrases or sentences as they could think of, which described characteristics of qualitatively good general practice–based data. Writing down the statements was to ensure input from every participant. In the second part, we gathered the written statements and in rotation we invited every participant to explain the statements, and duplicate statements were removed. Discussion about the legitimacy of the statements was not allowed during the meeting. Checking the statements was important to explain their meaning. Sometimes rephrasing was necessary to make the statements clear and to ensure that a statement contained only one aspect of quality. We encouraged the participants to keep writing new ideas during the second part of the session. After the brainstorm session, the authors added several aspects from the literature, which they believed to be relevant, but were not mentioned by the participants during the brainstorm.

Structuring
In the structuring stage, we asked the experts who participated in the brainstorm session to invite other experts from their GPRN to broaden the basis of the exercise. In this stage, statements were structured to generate their interrelationship. Every statement was printed on a separate index card and sent to every participant. Structuring was carried out in two ways.

Ranking: The participants rated all statements on a 5-point Likert scale, where ‘1’ is not important and ‘5’ is very important as a criterion for data quality.

Clustering: The participants grouped the statements into a limited number of clusters based on meaning or similarity. This should be an associative process, without exhaustive reasoning of all possible associations. After clustering, the participants gave every cluster a label that covered the connection between the statements.

Representation
The findings of the participants were analysed using ARIADNE software, especially designed for concept mapping. The data was analysed using a combination of principal component analysis and cluster analysis techniques. ARIADNE first computed a binary symmetric similarity matrix for each participant; two statements in the same cluster were set at 1. Second, all individual matrices were aggregated into one
group matrix. Statements that were often linked had high numbers, meaning that they are conceptually more similar and correlate in some way. This group matrix was used as input for non-metric principal component analysis (PCA), a technique for translating the correlation between statements into coordinates in a multi-dimensional space. The first two dimensions of the PCA solution for each statement were plotted in a point map.

Furthermore, cluster analysis was used to group individual statements on the point map into clusters. Each cluster reflected a conceptual domain or aspect. The authors evaluated all possible clusters using a cluster tree. We started with a cluster solution of 20 clusters. Each time the analysis moved to a lower number of clusters (e.g. from 20 to 19 clusters), we examined if clustering of the statements was more meaningful for conceptualization. Two criteria for a more meaningful conceptualization were (i) statements clustered together represent the same conceptual idea and (ii) two individual clusters do not represent the same conceptual idea.

**Interpretation**

After analysing the different outcomes, the experts determined during a second face-to-face meeting the final number of clusters and discussed the labelling of the clusters. The input for this discussion was sent to the experts before the meeting. Finally, based on the discussion with the experts, the authors determined the definitive labels and identified the two dimensions (the axes of the concept map).

**Results**

**Experts**

Representatives of the 10 participating GPRNs were invited to participate in this study. Ten experts of nine GPRNs took part in the brainstorm session. To obtain more power to the conceptual picture, 19 experts were invited to rank and cluster the statements. In total, 18 experts returned their findings of which 17 could be analysed using ARIADNE software. If there were any missing data, we asked the participants to complete the information. One expert, who did not participate in the generation of the statements, clustered more than 40 statements in one cluster and was therefore excluded from the analyses. Ten experts of nine of the participating GPRNs attended (eight experts of eight GPRNs also participated in the brainstorm session) the second meeting about the interpretation of the results.

**Statements**

During the brainstorm session, the participants generated 65 statements about data quality from general practice. After the session, the first author added seven statements from the literature, which resulted in a total of 72 statements (see online Supplement 1: Table S1). Most statements are related to the content and methods of the information that should be recorded in the general practice registrations.

The statements rated as most important were statements about structuring of information, ‘no bulk episodes, individual complaints or disorders are recorded under different episodes of care’ (mean rating 4.61) and coding of information ‘all episodes of care are (ICPC-) coded’ (mean rating 4.56). These aspects are important to identify health problems in the database. Statements, rated as least important, were ‘one episode of care includes sufficient sub-encounter codes that deviate from the episode title’ (mean rating 1.67) and ‘codes entered in the GP information system are checked by another person’ (mean rating 1.94). Table 1 shows the top 5 of highest and lowest rated statements. The total list of statements with corresponding rating and cluster is included in online Supplement 1: Table S1.

**Cluster map**

Five possible cluster maps were considered in the second meeting (4–8 clusters). All experts agreed that the concept map with six clusters was the best solution, see Figure 1. Next, we labelled the clusters based on content, representing the different aspects of quality of general practice–based data. The cluster ‘complete health record’ refers to all information available about patient’s health, including information from out of hour practice, a
patient’s history, laboratory results etc. ‘Coding of information’ means that the diagnoses in the EHR need to be coded with a classification (mostly with International Classification of Primary Care) and not only recorded as free text. This is important as GPRN often do not have access to free text information. ‘Episode oriented recording’ is a method of structuring health-care information in episodes of care. Episodes of care contain information (about diagnosis, referrals, interventions and medication) regarding one specific health problem, starting at the first contact for that problem and ending with the last contact for that problem. The ‘diagnostic validity’ refers to correct information and classification of a patient’s health problem. Do all recorded codes in the database for a certain patient represent the health status of that particular patient? ‘Recording agreements’ determine what information is available and how this should be recorded. For example, some GPRNs agreed to only record problems that are severe. The ‘residual category’ is a group of statements without a content-based connection.

Table 2 shows the six clusters with a selection of corresponding statements. Determination of the cluster ratings was based on the mean rating of all statements included in a cluster, the cluster ‘episode oriented recording’ (mean 3.36) was rated most important.

We identified the two dimensions of the concept map. The horizontal axis represents the ‘context of providing health care’. We distinguished at the left end ‘multi-disciplinary care’ (information from healthcare professionals, e.g. medical specialist, pharmacist, practice assistant) and at the right end ‘individual GP care’ (information from direct patient care among GPs). The vertical axis covers the ‘content of medical recording’, where the lower end represents ‘basic recording’ (conditions or minimal requirements of recording) and the upper end ‘complete recording’ (structural recording of all information available in relation to the patient’s health problems).

Discussion

Summary of main findings

The conceptual framework to describe quality of general practice–based data consists of five content-based clusters: complete health record, coding of information, episode oriented recording, diagnostic validity and recording agreements. The statements in this conceptual framework contain mainly characteristics about what information should be recorded and how this should be structured, which is also recognized in the sequence of importance of the different clusters: episode oriented recording, coding of information and complete health record.

Strengths and limitations of the study

About 10 of the 11 major GPRNs in the Netherlands were represented in this research and the experts had different backgrounds. One GPRN expert was not able to participate in the brainstorm session but participated in ranking and clustering the statements and the discussion meeting. One GPRN was not interested in participating in the study. This GPRN differs from other networks as it uses free text instead of only coded information. If this network would be represented in this study, this might have led to a lower importance value of the cluster coding of information.
### Table 2  Quality aspects of data from general practice based on concept mapping

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<th>Quality aspects</th>
<th>Cluster rating</th>
<th>Content/criteria/examples of statements</th>
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| 1 Complete health record | 3.16 | Information from out-of-hour practice is recorded in the patient’s record  
Important information from patient’s medical history, recorded by the previous GP, is transferred to the patient’s new health record  
Health records of deregistered patients contain data of and reason for deregistration  
Information on multi-disciplinary care from the integrated information system is also available in the GP information system  
Data from medical specialists is entered into the patient’s health record  
All contra-indications known to the GP are recorded in patient’s health record  
Encounter information is complete; all past encounters are recorded and visible in the patient’s health record, including the encounters funded under a bundled payment scheme  
All laboratory results and measurements (including weight and height) are recorded in diagnostic section of the patient’s health record  
All medication is structurally recorded in the patient’s health record (including prescriptions from home visits, out-of-hour practice or specialists)  
All referrals to primary and secondary care can be traced in the referral register of correspondence module of the GP information system  
Correct recording of medical status (temporary stop, ended, continuous)  
All laboratory values are recorded in precise measurements (preferably numeric)  
Causes of death are recorded |
| 2 Coding of information | 3.35 | All assessment-parts of SOAP include an (ICPC-)coded diagnosis  
Medication is linked to the right episode of care  
All prescriptions are linked to a ICPC code  
All referrals are allocated a (diagnostic) ICPC code |
| 3 Episode oriented recording | 3.36 | No bulk episodes; individual complaints or disorders are recorded under different episodes of care  
All episodes of care are (ICPC-)coded  
Each sub-encounter is ICPC-coded or recorded under the correct episode  
The problem list is accurate; all relevant health problems are recorded as an ‘episode of interest’ or are included in the problem list  
Complications of diseases are to be recorded as new episodes of care  
The ICPC codes of all episodes of care are kept up-to-date; changes are recorded  
Co-morbidity is recorded in separate episodes of care  
Diagnoses not only as labelled disease but also as ICPC-coded episode of care  
Episodes that can occur only once are registered only once  
The episode list is updated at every patient encounter  
All problems or ‘episodes of interest’ are actively kept up to date regarding active and inactive status  
Each sub-encounter can be recorded under only one episode of care  
All referrals are linked to an episode of care |
| 4 Diagnostic validity | 2.97 | All patients with an active diagnostic ICPC code actually have that disease/disorder  
Coding ‘at the true level of understanding’  
Coding ‘at the highest level of understanding’  
ICPC codes match the patients’ conditions  
Only valid use of classification categories ‘others’; no escape codes are used  
A sufficient number of ICPC codes is recorded; ICPC codes cover the entire encounter |
| 5 Recording agreements | 3.01 | Within a GPRN, there are clear unambiguous registration agreements, that are not multi-interpretable  
Registration rules and agreements are well communicated and familiar to all practice team members  
GPs consult periodically about the quality of recording  
There are no big differences in recording quality between practice team members  
There are clear registration agreements between practice team members  
Regularly providing actual data (by appointment) |
| 6 Residual category | 2.46 | Complete recording for care purposes not just for reimbursement or billing |

*Aspects of data quality sorted per cluster from most to least importance.  
†Mean ranking of the cluster based on all included statements.  
‡Statements rated ≥ 3.00 or higher are selected as representative of that specific cluster.  
§Statements included from literature.
Ten experts of nine Dutch GPRNs participated in the brainstorm session to generate statements that determine good quality of data. Although this group brought up a broad range of statements, the concept map only represents the ideas of this group of experts. Therefore, we need to be careful in generalizing the results. To diminish the chance of missing important statements about GP data, we added statements (rates ranging from 1.94 to 4.28) found in the literature. The experts did not question the relevance, validity or meaning of these statements.

As this study was limited to Dutch GPRNs, international generalization of the outcomes can be difficult. For example, episode oriented recording is a method which is currently common in the Netherlands. Using this method, GPs organize the information of separate consultations for the same health problem into an episode of care, which makes it possible to investigate transitions over time (e.g. cough evolves to be a pneumonia). In other countries and other information systems where the information is structured differently, some quality aspects may be of less relevance.

**Comparison with existing literature**

The literature on data quality in general practice emphasizes the importance of completeness and correctness. In this study, the cluster diagnostic validity represents correctness, apparent in the statements ‘All patients with an active diagnostic International Classification of Primary Care (ICPC) code actually have that disease/disorder’ and ‘ICPC codes match the patients’ conditions’. However, this cluster was not ranked as most important (mean value of 2.97 on a scale from 1 to 5). A reason for this might be that the experts respect the GPs to be medical experts and that diagnostic validity is already important for daily patient care.

Completeness of the data is represented in ‘complete health record’, implying that all information from different health care professionals and laboratory results should be recorded. Research about quality showed that prescriptions are best recorded. Structuring of data into episodes of care is ranked most important. This way of structuring, e.g. linking different information (prescriptions, referrals etc.) to one health problem, makes it more plausible that a person actually has the specific disease and therefore this represents a better quality of the diagnostic information. Structuring of data in episodes of care is also important to distinguish new from existing health problems and to investigate whether a problem is recurring.

Training of GPs in using a classification system (e.g. ICPC) is essential for the quality of coding. All GPRNs train their participating GPs in recording coded information. They also give feedback about their recording performance on a regular basis. This may be the reason that coding of information is rated as second important aspect.

The cluster residual category is rated least important; in the second meeting, no expert recognized a label covering the content of this cluster. There was also lot of discussion on the validity of the statements in this cluster. The statement ‘A patient record is actively included in the database by the GP when the record is complete’, for example only concerns one specific GPRN and is therefore not important to the overall data quality from general practice.

**Implications for future research or clinical practice**

This concept map can be used to determine data quality of general practice registrations. The next step is to make the statements operational and measurable. To distinguish sufficient quality from poor quality, criteria about the level of variation should be formulated.

The purpose of using routine-based data from general practice will result in different interpretations of the concept map because for different purposes different aspects of quality are important. For example, valid diagnoses and correct identification of new and existing episodes are of vital importance for the determination of morbidity in the population. When investigating the quality of health care, additional quality aspects are required, including coding of information, episode oriented recording and complete health record. Furthermore, the availability of information that is not in the register plays a role. GPs have also access to ‘not recorded’ (from memory) and ‘not coded’ (free text) information, information that researchers using the data lack. This makes structural recording and coding of information especially important for data used for secondary purposes.

**Supplementary material**

Supplementary material is available at *Family Practice* online.

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Declaration

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