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Design of a continuous multifaceted guideline-implementation strategy based on computerized decision support

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Abstract

Implementation of clinical practice guidelines into daily care is hindered by a variety of barriers related to professional knowledge, collaboration in teams and organizations, and practicability of the guidelines. Clinical computerized decision support (CCDS) has been shown to be one of the most effective instruments to improve compliance to practice guidelines by tackling barriers related to professional knowledge. To address other barriers, however, additional interventions are needed. In this study, a continuous multifaceted guideline-implementation strategy was developed which is based on CCDS but extends beyond the professional knowledge barrier. Two additional interventions were designed and embedded with CCDS in a continuous quality improvement framework. First, to address barriers within teams and organizations guideline compliance data are periodically aggregated into feedback reports for care providers. Second, barriers related to practicability of the underlying guidelines are addressed in a guideline-maintenance cycle. A case study in the field of cardiac rehabilitation is presented to demonstrate the feasibility of the developed strategy.

Keywords

Practice guidelines as topic, Cardiac rehabilitation, Health care quality, access, and evaluation

Introduction

Application of clinical practice guidelines can improve patient outcomes, reduce practice variation, and reduce costs of healthcare [1;2]. However, care professionals' often do not follow the recommendations of practice guidelines, for a variety of reasons [3]. A main challenge in contemporary healthcare is therefore to increase the implementation of practice guidelines in routine care [4]. Dissemination of practice guidelines on paper alone has generally proved to be insufficient. Instead, a carefully designed strategy for change usually needs to be used for effective implementation of guidelines [5].

Before designing such a strategy it is important to identify the various barriers that professionals face when trying to incorporate practice guidelines into daily care [6]. A frequently used classification of those barriers to guideline implementation is the division into internal and external barriers by Cabana et al [6]. Here, 'internal barriers' relate to the professional's knowledge of and attitude towards the guidelines. For instance, a professional may not know the details of a particular guideline by heart, or may in certain cases disagree with its recommendations. To overcome internal barriers, different implementation strategies exist such as professional educational, outreach visits, clinical computerized decision support (CCDS), and reminders [5]. Of those strategies CCDS is known to be highly effective because it provides relevant knowledge at the time and place clinical decisions are made [7,8].

However, modern medicine is no longer a matter of individual health care professionals but largely practiced as part of a team and embedded within complex organizations. Appropriate knowledge and attitudes of the individual are necessary but not sufficient for compliance to clinical standards. Professionals may also encounter so-called 'external' barriers which hamper their ability to execute guideline recommendations. These barriers stem from environmental factors related to the team, organisation or health system they work in [9]. Finally, glitches and impracticability's in the guidelines in question (e.g., ambiguities, omissions, and contradictions) may impede execution of the guidelines' recommendations [6].

Several studies have shown that for improving the implementation of clinical guidelines it is important to apply a multifaceted intervention with supplementary components [3]. In addition, to ensure that implemented changes persist over time, interventions preferably have a continuous character [10].

This paper presents a continuous, multifaceted guideline-implementation strategy that is based on computerized decision support but extends beyond the level of the individual professional. The strategy is illustrated with a case study in the field of cardiac rehabilitation.

Materials and Methods

Several systematic reviews have been conducted concerning the effectiveness of different guideline-implementation interventions [3,11,12]. We based our strategy on the recurring conclusion in these reviews that multifaceted interventions targeting different barriers to change are more effective than single interventions. However, there is limited evidence concerning which combination of guideline implementation strategies is effective under which circumstances.

To guarantee a continuous character of the strategy, the continuous quality improvement (CQI) framework was taken as a starting point [13]. Within this framework an improvement is put into practice by planning it, trying it, observing the results, and acting on what is learned [14]. We note that to support these steps, it is necessary that data of the process being improved is collected, stored, and analyzed.

We chose to direct our strategy at two specific types of external guideline barrier, namely organisational barriers and guideline-related barriers. The key element is to use the CCDS as an input module for a clinical registry that collects data from similar care processes in different clinics into a central database. The CCDS registry will be the basis of two continuous improvement processes, a feedback process and a guideline-revision process. This is depicted in Figure 1 and will be described in more detail below.

The first component of our strategy consists of a CCDS system that is based on a formal (i.e., computer-interpretable) representation of the guideline to be implemented, and that is used in daily patient care to assist clinical decision making [15]. In a review of Shiffman et al it was shown that guideline adherence improved in 14 of 18 guideline-based CCDS systems in which it was measured [16]. In a later review of Kawamoto et al it was shown that CCDS systems in general significantly improve clinical performance [8]. In our strategy an existing CCDS system, aiming to overcome the professional knowledge barrier, is also used to collect clinical data in a central data registry. These data cover demographic and clinical characteristics of the patients, recommendations that were given by the system, the actual decisions that were made by its users, and outcomes of care. Using these data, compliance to the guidelines can be assessed at patient level by comparing system recommendations and actual decisions.

The second component is a benchmark-feedback loop. All clinics using the CCDS system and delivering data to the clinical registry receive feedback reports with benchmark information on a regular (e.g., monthly or quarterly) basis. The feedback reports contain graphical and descriptive (numerical) summaries of all clinic-specific data over the time period in question, with comparison to benchmark values (e.g. national target values or average performance within a peer group). Viewing personal performance within the context of peer performance is an effective motivator for change [17].

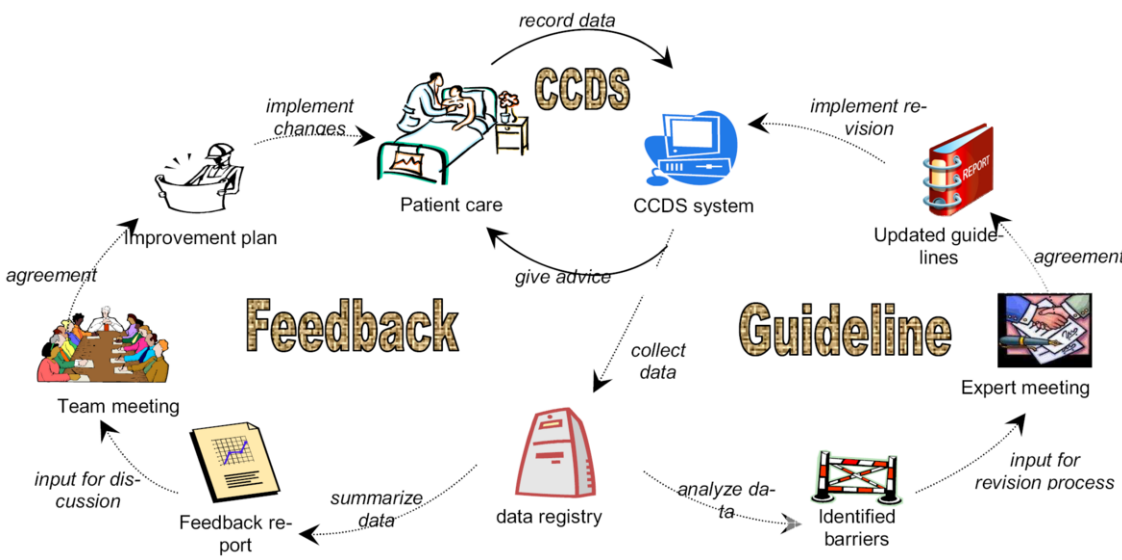

Figure 1 – Schematic depiction of proposed guideline-implementation strategy

CCDS loop: *CCDS system provides guideline-based decision support to clinical professionals in daily care, based on data that are recorded at the bedside.* ***Feedback loop:*** *Data from CCDS systems at different clinics are collected and stored in a central data registry and used to generate feedback reports for each of the clinics. Reports steer discussions in team meetings where a quality improvement plan is formulated, which is subsequently implemented in daily patient care.* ***Guideline loop:*** *The data registry will also serve as input for a guideline revision process by analysing compliance levels. This is supplemented with qualitative information from the users and used by domain experts to formulate the revision, which is subsequently carried through in the knowledge base of the CCDS.*

An essential part of the benchmark-feedback loop is that the reports are discussed during team meetings, and explanations are sought for deviations from benchmarks. Subsequently, organisational improvement initiatives should be formulated and implemented at the shop floor. An example where the benchmark-feedback loop is typically effective is absence of a resource needed to enable patients receiving a particular treatment. The individual professional will be confronted with CCDS advice to offer that treatment but will be unable to comply. The problem is that individual professionals are usually neither responsible nor empowered to acquire resources. When a feedback report reveals the non-compliance for this particular treatment, a team representative empowered to do so (typically a manager) can decide to acquire the resource, resulting in increased compliance to the guideline.

The third component of our strategy consists of a guideline maintenance cycle in which the CCDS data registry is used to identify guideline-related barriers for implementation. The first step of this cycle is to analyze the compliance data in the clinical registry in order to identify possible bottlenecks for carrying out the guideline's recommendations. For instance, excessive complexity of a guideline can result in a consistently low compliance on specific parts. When a procedure is difficult to execute in daily practice professionals may choose to systematically replace this procedure by a simpler one. Another example is the existence of vagueness or ambiguities in the guideline. These may result in high inter-practice variation. When the guidelines are unclear how to assess a specific patient item, different clinics will choose their own assessment method, often resulting in variation among the clinics. A third example is the presence of inconsistencies within the guideline itself or with other guidelines. When the recommended treatment for a subgroup of patients differs between two guidelines, this can result in significant treatment variation for this subgroup, among the clinics.

The second step of the guideline-maintenance cycle is to identify the underlying causes of the phenomena that were observed in the first step. For this purpose the compliance data should be complemented with qualitative information gathered from professionals who use the CCDS, for example during interviews or focus groups.

The final step is to revise the guidelines based on the results from the first two steps in one or more meetings with domain experts. In these meetings identified bottlenecks for guideline implementation are discussed. When proposing revisions experts should be involved to guarantee accordance with the latest scientific evidence. Participation of professional associations in the revision process is advisable to guarantee approval and adequate support of the revised guidelines.

Results

We describe the results of applying the developed strategy to a case study in the field of cardiac rehabilitation (CR). CR is a multidisciplinary treatment to help patients recover quickly from a cardiac incident or a cardiac intervention and improve their overall physical, mental and social functioning [18]. It has proven to be cost-effective in different economic evaluations conducted in North America and Europe [19]. However, in many Western countries cardiac rehabilitation services are under-utilized, poorly standardized, and do not follow the available scientific evidence [18]. Consistent with international standards [18, 20], the Dutch Guidelines for CR 2004 state [21] that professionals should conduct a needs assessment procedure where data items concerning the patient's medical, physical, psychological, and social condition and lifestyle are gathered. Based on the needs assessment procedure an individualized rehabilitation programme should be offered which consists of four possible therapies: exercise training, education and counselling, lifestyle change therapy, and relaxation and stress management training.

For our case study we used data from a recent trial with the CArdiac Rehabilitation Decision Support System (CARDSS) system [22, 23]. This system was developed in a combined guideline-development and formalization process of the Dutch Guideline for CR [24]. Via a structured dialogue CARDSS actively guides its users through the needs assessment procedure and formulates a preliminary rehabilitation programme containing the recommended therapies. Furthermore it contains an Electronic Patient Record (EPR) for CR.

In a multicentre cluster-randomized trial CARDSS was provided to care professionals in 31 Dutch outpatient clinics to stimulate the implementation of the guideline. Participating clinics worked during a minimum of six months with either of two versions of CARDSS: an intervention version with full functionally or a control version with the EPR services but without the therapy recommendations from the CDSS. The trial data from 21 clinics, including 2787 patients, were analyzed on compliance with respect to guideline recommendations, assessed separately for each of the four rehabilitation therapies. CARDSS increased compliance with the recommended decisions for exercise training, education and counselling, and for relaxation therapy. For lifestyle change therapy there was no improvement. All data of the trial were collected in a central registry database. For further details of the trial, we refer the reader to Goud et al [23].

The registry database included data on patient demographics (age and sex), reason for referral to cardiac rehabilitation (e.g. myocardial infarction, CABG, angina pectoris), objective exercise capacity, subjective (i.e., self-perceived) exercise capacity, psychological and social status, marital status, employment status and three lifestyle parameters (smoking status, eating habits, physical activity). These data were used to generate a feedback report for each of the 21 participating clinics. The reports summarized the deployment of needs assessment instruments, assessed risk behaviour and lifestyle parameters, and therapeutic decisions, outlined in the form of tables and charts. For each of the variables that was summarized in the report, also the grand mean and standard deviation (i.e. averaged over all 21 clinics) was reported as benchmark value. In order to leave sufficient room for interpretation and discussion in the team meetings, no other targets were included in the

reports. The feedback reports were positively received by the clinics although there were some doubts about the quality and reliability of the data. Several clinics reported that they created facilities to offer lifestyle change programs to their patients after reading the report. However many clinics found it difficult to create time to discuss the report.

For the guideline-revision process, patterns of compliance to the guidelines were analyzed in the registry database. It appeared that for all the parameters relating to rehabilitation needs, there was significant variation among the clinics. The largest variation was found in the percentages of patients judged to have an insufficient exercise capacity, which ranged from 54.5% to 89.8%. Large variation was also found in the percentages of patients judged to have an unrealistic subjective exercise capacity (37.7% – 63.9%) and to have social problems (31.1% – 60.9%). To identify the causes of this variation, semi-structured interviews with 29 users of CARDSS were conducted. Barriers to change that were mentioned in the interviews were lack of facilities (e.g. to measure all patients' exercise capacities with a bicycle test), vagueness/ambiguity in the guidelines (e.g. unclear how to assess anxiety and depression) and lack of agreement with the guidelines (e.g. criteria for a healthy lifestyle).

The combination of the quantitative compliance data with the qualitative data from the interviews showed that the variation and non-compliance were partly caused by guideline-related barriers. The results of both studies were discussed in a professional focus group set up with representatives of several professional associations (cardiologists, rehabilitation and sport physicians, company doctors, nurse practitioners, physiotherapists, psychologists, social workers and dieticians). They were asked to present revisions to solve the assessed barriers which would fit into daily care practice using their knowledge of the literature. Because of the large variation in assessed patient needs between CR clinics, the revised guidelines advise against using clinical judgment only to assess any rehabilitation needs. In addition, it was decided to add specific instruments to assess the anxiety and depression and a healthy life style and cardiovascular risk.

Discussion

In this study a continuous, multifaceted strategy to implement clinical practice guidelines was developed, and applied in a case study in the field of cardiac rehabilitation. The strategy combines CCDS with a benchmark-feedback loop and periodic updates of the underlying guidelines. As such, our strategy addresses not only the decision-making process of individual professionals but also decisions at higher levels of clinical organisations and in knowledge-management cycles.

A first limitation of our intervention is the need for a CDSS with data registry integrated at the point of care. Another potential limitation of the benchmark-feedback loop is the assumption that a conferring structure with regular team meetings is present at the participating clinics. If this is not the case, sending feedback reports will probably not have impact as they are simply not discussed. Probably this was true in most clinics that participated in our case study because structural follow-up actions on the feedback reports were rare. A recent Cochrane review states that the effects of feedback are likely to be stronger when it is combined with educational meetings directed towards actively involving care professionals in the improvement process [25]. It may therefore be sensible to extend the benchmark-feedback loop in our strategy with educational meetings. A final limitation is that the general professional mentality towards quality assurance should be positive, as professionals must be willing to think and work on quality improvements.

A notorious difficulty in benchmarking is choosing the appropriate target values. We choose to report the mean of all clinics but this can result in an undesirable, passive attitude in clinics whose performance is above average but not optimal. A different option is use full compliance to guideline recommendations as target value. However, this will often be unrealistic. In many clinical domains specific patient characteristics (such as comorbidities) require professionals to deviate from the guidelines. It is then unclear what the ideal compliance rate should be. A possible solution may be found in the Achievable Benchmarks for Care tool. In essence, this tool represents the average performance of the top 10% of the clinics being assessed. It encourages providers to strive for superior performance knowing that the target level of excellence has already been achieved by a select group of their colleagues [26].

Another explanation for difficulties during implementing changes in clinical practice is the presence of patient-related barriers [6]. This group of external barriers to guideline implementation is not specifically addressed in our strategy but could have played a role in our case study, for instance when patients were resistant or perceived no need for guideline recommendations.

The clinical registry based on the CCDS data is used for both the feedback to professionals as well as for the analyses of guideline related barriers for guideline implementation. Results are depending on the data entered in the systems and it is important to avoid data entry errors. Professionals should be thoroughly trained to work with the system and it is advisable to perform periodic data audits to identify data entry errors. In addition, users of the system should be aware that data from all patients that are treated should be entered into the system to prevent a selection bias.

The main novelty in our strategy is found in the combination of different components that supplement each other in a single continuous quality improvement strategy. Our implementation strategy can be used to implement guidelines on multiple levels in health care as part of continuous quality improvement which is advocated as an important mechanism for promoting the implementation of best practices in medical care. However, in our case study the different components were only once applied to the field of CR. Continuous data collection and analyzing is necessary to assess the long-term utility. Further the strategy should be applied during other guideline implementa-

tion projects to learn more about its application in other health care settings.

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