Designing Learning Outcomes for Handoff Teaching of Medical Students Using Group Concept Mapping: Findings From a Multicountry European Study

TITLE: Designing Learning Outcomes for Handover Teaching of Medical Students using Group Concept Mapping

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Abstract

Purpose

To develop, by consultation, agreed learning outcomes for the teaching of handover to medical students using Group Concept Mapping.

Method

In 2013, the authors used Group Concept Mapping, as it is a structured, mixed approach applying both quantitative and qualitative measures to identify an expert group's common understanding about the learning outcomes for the teaching of handover to medical students,

Results

45 experts contributed to the brainstorming session. 22 of the 45 (48%) from 4 European countries completed the pruning, sorting and rating phases. 68% had more than 10 years professional experience, 45% had more than 5 years experience in curriculum development. The experts identified 10 themes with which to select learning outcomes and operationally define them to form a basis for a curriculum on handover training for medical students. The themes entitled 'Being able to perform handover accurately' and 'Demonstrate proficiency in handover in workplace' were rated as most important. 'Demonstrate proficiency in handover in simulation' and 'Engage with colleagues, patients and carers' were rated most difficult to achieve.

Conclusions

The study identified expert consensus on 10 themes for designing learning outcomes for a handover training curriculum for medical students. Those outcomes considered most important were also among those considered most difficult to achieve. The next step is the design of the curriculum, its implementation and assessment of the success

or not of this educational strategy in preparing new medical graduates to be proficient in the handover process.

Handover has been defined as '*the transfer of professional responsibility and accountability for some or all aspects of care for a patient, or group of patients, to another person or professional group on a temporary or permanent basis*'.[1] Improperly conducted handovers lead to wrong treatment, delays in medical diagnosis, life threatening adverse events, patient complaints, increased health care expenditure, increased hospital length of stay and a range of other effects that impact on the health system.[2] Over the past 20 years there has been a reduction in the working hours of hospital doctors in the US due to the Accreditation Council for Graduate Medical Education duty hours restriction, and in Europe from the European Working time Directive. [3,4,5] As a consequence of this, the number of shift changes has increased with a subsequent rise in the frequency of handover of care. Newly qualified doctors feel unprepared for handover, not knowing what is expected of them and are challenged in applying their knowledge, skills and attitudes within the handover process. [6] This should not be unexpected, as for example there appears to be little formal teaching in handover performance in the USA or the UK. [7,8,9] Although there have been initial efforts to overcome this situation and provide training for handovers, [9,10] a recent systematic review of educational interventions to improve handover showed a paucity of research into handover education and limited evidence of the effectiveness of current educational strategies. [12] In view of these shortcomings and as a starting point to address these educational deficiencies, we undertook this study to develop, by consultation, agreed learning outcomes for the teaching of handover to medical students.

Method

Setting, process and participants

We conducted this study at the School of Medicine University College Cork (UCC), Ireland, Open Universiteit of the Netherlands (OUNL), RWTH Aachen University (UKA), Germany and Fundacion Avedis Donabedian (FAD), Barcelona Spain. We undertook this study as part of the PATIENT project, a multi-country European Union funded project. [13] We invited a group of experts to participate in a Group Concept Mapping (GCM) process, to identify a common understanding about learning outcomes for handover training for medical students. We chose GCM, as it is a structured, mixed approach applying both quantitative and qualitative measures to identify an expert group's common understanding about a particular issue. [14,15,16] The method involves the expert participants in idea generation, sorting of ideas into groups and rating the ideas on some values in our case on importance and difficulty to achieve. The participants work individually then it is the advanced statistical techniques of multidimensional scaling (MDS) and cluster analysis that quantitatively aggregates individual inputs from the participants to reveal objective patterns in the data. [15,16] One of the distinguishing characteristics of GCM is visualisation, which is a substantial part of the analysis. Visualisation allows for grasping at once the emerging data structures, their interrelationships, and their interpretation to support decision-making. The GCM process took place over the period of May to June 2013.

Expert Selection

We designed a selection framework for identifying experts to contribute to the GCM process. Included were patient organisations, academics (non discipline specific) and / or clinicians (doctors or nurses) involved in medical education at undergraduate or postgraduate level, or research into the handover process, or had published in relevant academic peer reviewed journals in relation to handover. Using this framework we

constructed a list of experts, who were then invited to participate in the GCM. We avoided duplication of experts by undertaking a cross check process.

Group Concept Mapping

The GCM procedure consisted of five phases: (1) idea generation (brainstorm) and idea pruning, (2) sorting of ideas into groups, (3) rating on two values (importance and difficulty to achieve), (4) analysis of the data and (5) interpretation of the results. We invited experts through the project's online management system and explained the rationale for the study. We assured the experts of anonymity with regards to their inputs, provided them with a link to the brainstorming page of a web-based tool for data collection and analysis (Concept System Global, 2013). They could visit the web site as many times as they needed using their own username and password and were then asked to generate ideas by completing the following trigger statement: "One specific learning outcome of the Handover module is…" using short phrases or statements expressing one thought. We gave the experts two weeks to complete the idea generation task.

When the idea generation phase was completed, we then asked the experts to participate in idea pruning. We asked them to check, edit and if needed reduce the ideas to a manageable list (about 100) for the next stages of sorting and rating. We gave guidelines for idea pruning as follows: look for statements that contain more than one idea and if needed split them; remove identical ideas; check whether the ideas address the focus point; make sure that each unique idea is included in the final list; and make sure that the idea is clear, concise and understandable. This final list was randomised, and then made available again to this group of experts, firstly for the sorting of ideas into groups based on similarity in meaning and giving names to the

groups; and secondly for the rating of the ideas on two values of importance and difficulty. We gave the experts three weeks to complete both sorting and rating. We sent a reminder after two weeks. As in the brainstorming phase, the participants could save their work and return later to continue.

Outcome measures and data analysis

The primary outcomes measures that we analysed in our study were the themes that emerged from the GCM with which to select learning outcomes and operationally define them to form a basis for a curriculum on handover training for medical students. The secondary outcome measures that we analysed were the rating of these themes on importance to achieve and difficulty to achieve. The analysis includes multi dimensional scaling (MDS) and the Ward agglomerative hierarchical cluster analysis (HCA). [15,17] Nonmetric multidimensional scaling uses the group proximity matrix and symbolises it as a point map upon which statements are displayed as points on a two-dimensional space with distances between them replicating the frequency with which they were grouped together by participants. Cluster analysis uses multidimensional scaling to group statements into clusters that represent underlying themes. HCA starts with the assumption that all ideas are individual clusters, and consequently merges ideas until it arrives at one cluster. Subsequently, human experts need to look at the solution proposed and decide upon the number of clusters that represents the data in the best possible way and reflects the context of the study.

Results

61 experts registered initially for online data collection. 45 of the 61 (74%) of these experts contributed effectively to the brainstorming session. 22 of the 45 (48%) experts who contributed to the brainstorming phase completed the pruning, sorting

and rating phases. The 45 experts produced 229 statements during the idea generation phase. 107 statements remained after pruning. The Ward agglomerative HCA placed the statement in clusters. Three demographic questions were included in the sorting and rating phase, on country of experts, professional experience in clinical healthcare, teaching in healthcare and curriculum development in healthcare, for results see Table 1.

Primary outcome measures

The first outcome of the multidimensional scaling is a point map. The two-dimensional graphical configuration represents the learning outcomes (as points on the map) and shows how they are related. The closer the points are to each other, the closer in meaning they are. This is a result of more people grouping them together during the sorting.

An important question here is how does this configuration represent the original judgment of the participants. To determine the extent to which the raw qualitative judgment of the participants matches the quantitative conceptual model in the map, we look at the stress value, a statistic generated by MDS to indicate the goodness-of-fit between the two realms. For group concept mapping studies it should be in the range between 0.205 and 0.365. [13] The stress index of this study is 0.338, which is in this range and indicates that the map is a good representation of the original sorting of the experts. In addition, MDS assigns each statement a bridging value, which is between 0 and 1. A low bridging value means that a statement has been grouped together with statements around it. A higher bridging value means that the statement has been grouped together with some statements further apart from the either side. Some groups of learning outcomes can already be detected by a simple visual inspection, but to make the process more efficient, the HCA was applied. GCM starts

with the assumption that all ideas are individual clusters, in our case 107 clusters and consequently merges ideas until it arrives at one cluster. To determine the number of clusters that best reflects the data we checked different solutions provided by the HCA, numbering between 16 and 5 cluster solutions. [20]

We prepared a checklist with the suggestions made by the HCA for merging clusters and invited a small group from the experts (4) to help with deciding upon the 'best' fitting solution. At each step of the merging the experts had to indicate whether they ' agreed', were 'undecided', or 'disagreed with the suggestion. After completing the assignment, the final solution could be either 9 or 10 clusters. The 9 and 10 cluster solutions were checked again and a 10 cluster configuration was selected as the 'best' fitting solution. The next step in making sense of the data was to attach meaningful labels to the clusters. There are three methods available for labelling. The first is to use the labels suggested by the system; the second is to look at the bridging values of the statements composing the cluster; the third is to read through all the statements in a cluster and to define, in a label, the theme of the statements. To define the cluster labels we combined all three methods. Figure 1 shows the 10 cluster solution with labels, the clusters as learning outcomes are listed in table 2.

Secondary outcome measures

We asked the group of experts to rate using 1-to-5 scale the statements on importance (1 = not at all important; 5 = very important) and on how difficult they would be to achieve (1 = very difficult; 5 = very easy). Figure 2 shows the mean rating values on importance and difficulty to achieve computed for each cluster of statements and presented as a third dimension (layers) on the top of the cluster map. Table 2 lists the clusters on importance and difficulty to achieve. The clusters entitled 'Being able to perform handover accurately' and 'Demonstrate proficiency in handover in

workplace' were rated as most important. 'Demonstrate proficiency in handover in simulation' and ' Engage with colleagues, patients and carers' were rated most difficult to achieve.

"Importance to achieve" versus "Difficulty to achieve"

The ladder graph in Figure 3, also called a "pattern match", compares the clusters on their importance to achieve and difficulty to achieve ratings. The lines between the cluster labels show how pairs of clusters are related according to their ratings' values. A Pearson product-moment correlation coefficient shows how strong the connection is between the two patterns of data (importance to achieve and difficulty to achieve).

The correlation between two data sets is negative and very low ($r = -0.04$). The pattern match helps to easily detect differences between the two ratings in some clusters. For example, the cluster 'Being able to perform handover accurately' scores very high on importance but it seems it is relatively difficult to achieve. The same applies to the clusters 'Demonstrate proficiency in handover in workplace', 'Demonstrate proficiency in handover in simulation' ' and 'Engage with colleagues, patients and carers'. In contrast, the clusters 'Application of structured handover methods', and ' Prepare clinical documentation' score low on importance and are easy to implement into practice.

Discussion

45 experts contributed effectively to the brainstorming session and 22 experts completed the pruning, sorting and rating phases. 68% of the 22 experts in the sorting and rating phase had more than 10 years professional experience, and 45% had more than 5 years experience in curriculum development.

There are several implications from our GCM study. We identified 10 themes with which to select learning outcomes and operationally define them to form a basis for a

curriculum on handover training for medical students. In contrast to the traditional position on learning outcomes seen as only expected results of the teaching and learning, the current study emphasized the need to consider the means by which to achieve the desired learning outcomes, reflected by the two clusters on performing in simulated and real settings. The results of our current study are in line with some other studies. [15] We identify similar issues such as need for skills in application of structured handover methods and tools, standardisation of handover procedures, effective communication and collaboration between different stakeholders, and the role of work place learning. At the same time our study extended the scope of handover topics and teaching methods to performing handover accurately, minimizing errors and risks, understanding the effect of good practices in handover and recognising the consequences of improper handover. Our study emphasized the idea of creating a simulated environment for teaching and learning handover. Learning outcomes have also been prioritized in terms of how important they are and how easy or difficulty they can be accomplished. For example some learning outcomes such as 'Being able to perform handover accurately', 'Demonstrate proficiency in handover in workplace', 'Demonstrate proficiency in handover in simulation' and 'Engage with colleagues, patients and carers' are very important but considered difficult to achieve.

The significance of our study is that experts from 4 European countries generated the groups of statements that provided the themes for the learning outcomes. We also using a structured, mixed method approach applying both quantitative and qualitative measures to provide an expert informed basis for defining learning outcomes. A future handover training curriculum for medical students might be designed using

these, at a European or international level, for example in keeping with the World Health Organisation's Patient Safety Curriculum Guide. [21]

The limitations of our study include a small sampling and the generalizability of our study's findings. According to a meta-analytical review containing 69 group concept mapping studies, conducted in the last 10 years, a sample of 20-30 participants is optimal for generating valid and reliable results from sorting data. [19] The variability of stress value increased when 15 or fewer sorters were involved, no improvement of the stress value was detected when more than 35 sorters were included. 22 participants in our study were involved in sorting the statements, which is within the recommended range. The stress index of our study of 0.338 is also in the suggested borders and indicates good internal representation validity. A higher number of experts involved in the rating phase was desirable however sorting is the primary activity in the group concept mapping studies, rating is the secondary one. Also while our study suggests what we could expect from learners in terms of knowledge, skills and attitudes, the level of these categories needs to be determined for example using taxonomies in the cognitive and affective domains. Finally as most of the participants in our study come from three medical schools associated with UCC, UKA and FAD, the results and recommendations should be applied to only these institutions. Interested parties could either use the findings to define the learning outcomes of handover teaching relevant to their medical schools or replicate the study to generate original findings.

Conclusions

Our GCM study identified expert consensus on 10 themes for designing learning outcomes for a handover training curriculum for medical students. These could form the basis for a future curriculum designed for example in keeping with the World

Health Organisation's Patient Safety Curriculum Guide. These learning outcomes are extensive and may be more suitable for incorporation into the medical curriculum as a whole rather than simply a specific training module on handover. Those outcomes considered most important were also among those considered most difficult to deliver. The next step is the design of the curriculum and its implementation, followed by assessment of the success or not of this educational strategy in preparing new medical graduates to be proficient in the handover process.

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Ethical Approval: As this was an educational study conducted in established educational settings, involving normal educational practices and did not involve subjects; the study was exempt from ethical approval.

Previous Presentations: None

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