Provision and assessment of pharmacology and pharmacotherapy education across an integrated medical school curriculum

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SUMMARY AND IMPLICATIONS

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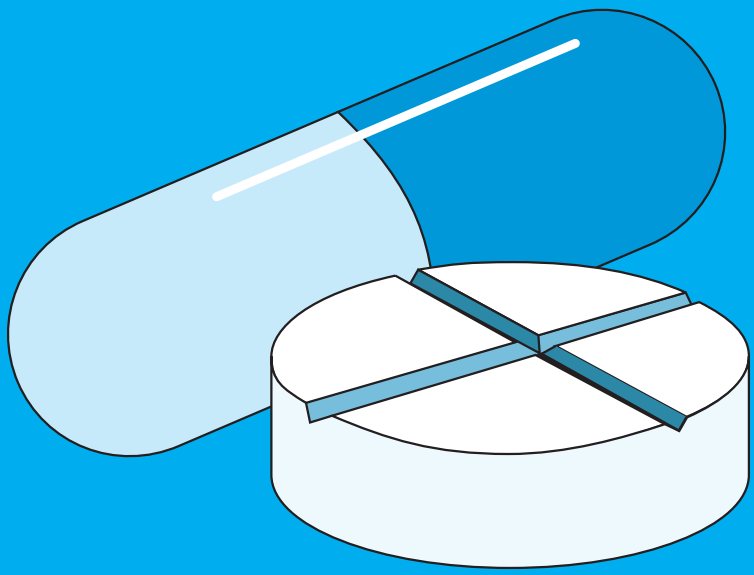

SUMMARY

The main objective of this thesis is to provide a conceptual framework for incorporating an educational innovation (a new approach to pharmaco-logy and pharmacotherapy education) in an integrated medical school curriculum. Medical school educational reform has fuelled the growing trend of curricular integration leaving some subjects like pharmacology and pharmacotherapy neglected. The hope is that with improved pharmacological knowledge and increased practice with making pharmacotherapy decisions, graduates of the Leiden University Medical Center (LUMC) will be better prepared to appropriately prescribe. The different chapters of this thesis describe the approach made by the Teaching Resource Center (TRC) to provide pharmacology and pharmacotherapy education to the LUMC. An attempt has been made to evaluate the impact of these educational strategies and interventions in a manner that goes beyond traditional assessment methods. Although not enough time has passed for a cohort of students to pass through an entire curriculum to make an assessment whether our graduates are better prescribers, the studies described in this thesis attempt to highlight both the positive and negative aspects of the approaches taken to reach this goal. This information can be used by other disciplines or institutions to assist in the introduction of a new learning strategy.

Evaluation of the environment at Leiden and in medical education

The introduction begins with a short history of pharmacological education both at Leiden University and abroad. The historical context is intended to provide the reader with a means to evaluate the environment in which our educational innovation took place. This is then followed by a discussion of three issues (competency development, curricular integration, and assessment) currently challenging medical education. The discussion provides further background information as to what the innovation attempted to achieve.

Determining the vision for integrating the pharmacological innovation

In chapter 1, the current curriculum at Leiden University Medical Center was reviewed and found to be compatible with the ability-based educational model. Five learning outcomes were established based on the following considerations:

1. what students are expected to be able to do upon completion of the curriculum;
2. what could be added to the current on-going curriculum and be viewed as relevant;

3 whether the outcomes could be taught, practiced, and assessed; and finally
4 what outcomes were consistent with the Dutch 'Training of Doctors: Blueprint 2001' for medical school education (1).
Two self-study learning strategies were developed that provided both the teaching material and training opportunities for students to realize the outcomes. The first is a computer-based teaching program that conveys pharmacology information (the TRC Pharmacology database). The second is a step-wise approach for creating a written therapy plan, the Individualized Therapy Evaluation and Plan or ITEP. Integration of the new pharmacology educational approach was planned to be a slow introduction into individual courses until all courses were adapted. At present more than 90% of identified courses and greater than 95% of the students in the curriculum use the TRC Pharmacology database, whereas 100% of students in 74% of identified courses have practiced making therapeutic plans with the ITEP.

Development and implementation of the pharmacology learning strategy: TRC Database

Chapter 2 begins with a review of the development of the TRC icon language which is used to create graphical descriptions of pharmacological mechanisms. Unfortunately, these illustrations were only provided in a loose-leaf format and were not being consistently used in the curriculum. The chapter provides a description of how a self-study computer program (a comprehensive database of the illustrations using the TRC icon language) provided pharmacological information throughout the curriculum. At the time of development, there were two major decisions to be made:
1 should individual students' use of the database be tracked, and
2 should the database be freely available on the internet?
It was decided to incorporate a so called 'back-end' to the database for recording student use and to place the TRC Pharmacology database on the web. These decisions provided the opportunity to see that students increasingly used the program over time (indicating they like using the database) and that their use (and the use by other universities) increased by offering it on the internet.

It was apparent from the results in chapter 2 that the students were using the TRC Pharmacology database, but were they learning anything from it? Chapter 3 takes advantage of the large amount of student utilization data to make unique assessments in terms of learning. Individual student use was compared to the final course grades and found an increase in TRC database use by an individual student was related with an increase in course grades without regard to student or course. The most encouraging result was the determination of an inverse relationship between the intercept (expected grade achieved if the student did not use the program) and

slope (the rate in rise of the course grade if use increased) of an individual student. This indicated that poor students benefit most from using the TRC database. Although it can be argued that there may be better assessments to use to evaluate student learning, course grades remain one of the strongest predictive factors for success on medical examinations. In addition, by continuously analyzing the utilization and performance of students using the program, improvements to the TRC Pharmacology database have been introduced in order to improve the students' learning efficiency.

Development and implementation of the pharmacotherapy learning strategy: ITEP

In order to create a pharmacotherapy learning strategy, we first did an assessment of the current practice of communicating a therapy plan in the local environment. This objective analysis was important since this aspect of the practice of medicine is often considered an art and thus susceptible to local dogma. Thus, this chapter describes the results of a survey of local physicians' abilities to communicate a therapeutic plan. The survey reviewed 80 letters written by specialists after a referral and assessed them based on local and international standards. As suspected, the letters were found to be deficient with regard to pharmacotherapy information (pharmacokinetic considerations, compliance, rationale of therapy, dosing regimen, or monitoring of effectiveness or side effects) by both assessments. There were also large differences in the manner in which the letters were written. It is possible to attribute these findings to the fact that the Netherlands does not have a standard format for developing and communicating a therapeutic plan. This is in contrast to the situation in the United States where the 'SOAP' (Subjective, Objective, Assessment and Plan) notes (2) are commonly used.

Using the information gleamed from chapter 4, a new format (the ITEP: Individualized Therapy Evaluation and Plan) for structuring pharmacotherapy plans was introduced into the LUMC curriculum. The ITEP method was created so that students could practice developing and writing a structured therapeutic plan. Chapter 5 describes the effect on student learning as the ITEPs were introduced into the curriculum. Comparisons were between cohorts of students just being introduced to the ITEP format and those who had multiple opportunities to practice earlier in the curriculum. Further comparisons were made between the students' ability to complete simple and complex pharmacotherapeutic cases. The results of the research indicate that after a short introduction, the students could use the ITEP and complete simple cases, but complex cases were too overwhelming. Many more students in the later cohorts, who had multiple opportunities to practice with the ITEP format, were able to complete

the more complex case. These findings suggest that the ITEP should be introduced as early in the curriculum as possible to allow the student with multiple practice opportunities.

Getting the innovation integrated into the curriculum

The last chapter of the thesis describes the approach taken to get the above mentioned educational changes integrated in a mature medical curriculum. In contrast to most new educational efforts limited to one subject area, the changes mentioned in the previous chapters of this thesis had to be made in many courses across an integrated curriculum. This entailed a major curricular effort. A review of the literature with regard to integrating an educational innovation throughout a curriculum revealed that most major changes are coordinated by those high in the administration of the faculty. The literature also recommends that human resource departments should be involved, or that one needs to dedicate the necessary resources, in order to guarantee success. These sorts of recommendations would seem to indicate that an individual faculty member or department would find it difficult to undertake such a cross-curricular effort. Instead our experience shows us that there are other aspects that contribute to the success of curricular change. We demonstrated that one could focus on finding a small group of early adopters of the educational innovation and planning for small successes. By combining both literature resources and our experience, a new eight step process (with success factors identified for each step) was created to aid faculty members in getting their innovations into the curriculum.

IMPLICATIONS

In this thesis a process for incorporating pharmacology and pharmacotherapy education in an integrated curriculum is described and evaluated. This effort has resulted in a majority of courses and students at the Leiden University Medical Center using our educational strategy to improve pharmacological and pharmacotherapeutic knowledge and abilities. This represents the first time such an effort has been successful. In a recent report by Maxwell et al. the effort to get pharmacology incorporated across the curriculum was abandoned as '...it was too much effort, and too difficult to work with the various clinicians and scientists' (3). As a result, Maxwell et al. advocated the utilization of a self-study computer program called eDrug, using an approach much like the one described in this thesis (3). As stated previously in chapter 2, the TRC Pharmacology database is used by students from all the medical schools within the Netherlands and some access it from across the world. In addition, the illustrations created for the database are used in non-electronic media and are incorporated into three major

Dutch textbooks: Farmacologie [Pharmacology] by Sitsen (4), Algemene Farmacologie [General Pharmacology] by van Ree (5) and Leerboek Psychiatrie [Textbook Psychiatry] by Hengeveld (6).The TRC icon language also serves as the basis for the description of the mechanisms of action of new drugs in the Nederlands Tijdscrijft voor Geneeskunde [Dutch Journal of Medicine] (7). The use of the TRC Pharmacology database extends beyond the primary target group to include Dutch biomedical, biopharmaceutical, psychology and nursing students. Outside the Netherlands, the TRC database averages visits from 14 different countries each year. The result of this widespread use is an improvement in the program itself as collaborators often provide meaningful feedback that is unique to their point-of-view.

In contrast to the TRC database, the adoption of the ITEP learning strategy for creating a therapeutic plan has been mostly local. The ITEP format is used in the clinical courses as the method for practicing evaluating therapeutic options and creating a therapeutic plan. The clinical rotations of internal medicine and psychiatry have adopted the ITEP as the format for clerkship students to develop a therapeutic plan and to present to their mentors. The internal medicine department of the Leiden University Medical Center has gone so far as to alter the medical charts to allow for the ITEP s to be incorporated into the medical record. Currently the residents in internal medicine are receiving training in the use of the ITEP using a Train-the-Trainer model. Expansion into other departments has been limited by what has been deemed a lack of manpower to provide students with meaningful feedback.

In the fall of 2005 we made a proposal to a gathering of Dutch pharmacotherapeutic teachers to create a National standard for a therapeutic plan (8). The goal was to establish common outcomes for pharmacotherapy (in the form of a patient therapeutic plan) that would prepare students for their future tasks, and which could be assessed. After a series of sessions with this group, the proposal was accepted. This led to the development of the '6Step' treatment plan for use by all Dutch medical and pharmacy students (9). The various universities maintain the right to follow their own educational methods for pharmacotherapy, but all must converge on this agreed standard. It is fortunate that all have come to use an identical standard for this important educational outcome. As such, it will be easier to assess the educational strategies discussed in this paper as applied at Leiden University Medical Center against those implemented by other Dutch institutions.

FINAL THOUGHTS

Extensive efforts were made to systematically assess the students and teaching strategies detailed in this thesis. In order to evaluate the educational innovations we have chosen to follow the evaluation hierarchy

as described by Kirkpatrick. The hierarchy assesses the power of the evaluation methods on four different levels. For example, on the first level only the student's reaction to the educational intervention is evaluated, whereas the implications that result from a change in students' behaviour are evaluated on the fourth. We have carefully considered these different levels when attempting to measure the influence of our innovation. Up to now, we have been able to evaluate up to level three: the effect of our educational intervention on the behavior of the students. But we are prepared to take the assessments further. For example, we will be able to measure if the physicians of the future are better able to document and communicate their therapeutic plans, as the current level of therapeutic communication by physicians in the community has already been established. Ultimately it is important to also evaluate the effects of our intervention on the fourth level. This unfortunately lays beyond our reach as much time must pass before we can determine if there are fewer admissions to hospitals secondary to medication errors, or if there is less money spent on inappropriate therapy, etc. The goal of our effects in the area of educational innovation should be to determine the impact of our strategies on the society at large.

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