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A theory of change approach to curricular revision: filling a curricular gap identified through curriculum mapping

Mary Kate Worden[1*] and Megan J. Bray[2]

Abstract

Background Curriculum mapping enables continuous quality improvement of the medical curriculum by identifying where and how frequently specific knowledge, skills and attitudes are taught and assessed within an educational program. However, once curricular gaps and redundancies have been identified, selecting and implementing strategies for revising the curriculum can be challenging.

Methods Here we describe how we filled a curricular gap using a Theory of Change (ToC) model to create a framework and process for curricular revision.

Results Working backwards from our long-term goal of assuring that our graduates meet each of our educational program goals, the ToC approach prompted us to recognize and articulate implicit assumptions that underly our curriculum. It also helped guide us in identifying both the resources available for developing new curricular interventions and the strategies for filling the gap within each phase of our medical curriculum. Finally, the ToC framework required that we specify the short-term and medium-term outcomes for curricular revision, including new assessments that would confirm that all our students meet each of our educational program goals.

Conclusions Developing a Theory of Change model for curricular revision has multiple advantages: it makes explicit the planning for curricular change, it facilitates communication with curricular stakeholders, and it benchmarks the progress of curricular revision.

Keywords Curriculum mapping, Theory of Change, Curricular revision

Background

A medical school curriculum is a complex program of teaching and learning that must be coherent and coordinated to meet accreditation standards. To make the curriculum transparent to all stakeholders including faculty, students and oversight bodies, many medical school create a centralized curriculum map that demonstrates how their curriculum supports the educational goals of their program [1–3]. Curriculum designers use curriculum maps to compare an existing curriculum to an ideal curriculum recommended by national and/or international experts [4, 5]. By facilitating the identification of curricular gaps and redundancies, a curriculum map can serve as a tool for continuous quality improvement of the curriculum.

Reports on curricular gaps identified by curriculum mapping seldom propose actionable plans for how that the gap might be filled. For example, a 2014 comparison

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of the curriculum maps from all UK medical schools against consensus guidance for teaching about alcohol, drugs and tobacco revealed that the topic of iatrogenic addition was insufficiently addressed [6]. The authors of the study made no specific suggestions about how any of the UK medical schools might add this topic to their curricula. Similarly, a study that identified curricular gaps in teaching and learning related to social and behavioral sciences at a US medical school called for revisions to clerkships without specifying what the revisions should be [7]. Another curriculum mapping effort resulted in a recommendation that assessments of sexual health knowledge be added to a US medical school's curriculum without specifying what form the assessment should take, or at which point in the curriculum they should be implemented [8]. Most recently, a report on curriculum maps for four Massachusetts medical schools proposed that the competency of serious illness communication be deliberately included in a longitudinal curriculum [9], but did not suggest how this goal might be achieved at any of the schools.

Here we describe how curriculum mapping identified an unanticipated gap in our medical school curriculum and how we used the Theory of Change (ToC) methodology to identify and implement interventions for filling this curricular gap. Although we did not begin mapping for the purpose of identifying curricular gaps, finding one prompted us to reconsider the apparent mismatch between our intended (planned or written) curriculum, the delivered (taught and/or tested) curriculum and the experienced (learned) curriculum.

We selected the ToC approach for curriculum revision because it works well for designing and evaluating complex systems. By articulating a process for achieving specific long-term outcomes through a logical sequence of intermediate outcomes, a ToC requires explicit identification of any underlying assumptions and/or contextual factors that might influence the process of change [10]. Others have successfully used ToC frameworks to evaluate how interventions lead to desired outcomes within public health programs [11], which are inherently complex and large-scale programs with multiple interacting components delivered at multiple levels. Undergraduate programs of medical education (UME) are similarly complex: they must meet accreditation standards established by an outside governing body while incorporating teaching/learning in several biomedical and clinical disciplines under the direction of multiple course and clerkship directors overseen by an institutional curriculum committee.

Previously, ToC methodology has been used to develop a national consensus for implementing training for UK urology residents in quality improvement skills [12]. It has also guided the development, implementation, and evaluation of theory based educational interventions across the broad scope of graduate medical education [13]. However, the medical education literature likely underreports the extent to which the ToC model has been utilized for quality improvement projects. As ToC frameworks are usually created to serve as a roadmap for achieving internal change within a program, they largely serve the team of change agents that create them and are seldom disseminated [14].

Here we describe both how we identified a curricular gap and how we filled it by developing a Theory of Change model to guide curricular revision of an undergraduate medical education program at the University of Virginia School of Medicine.

Methods

Curriculum mapping: identifying a curricular gap

The curriculum at the University of Virginia School of Medicine is structured in three phases: Phase 1 (pre-clerkship), Phase 2 (clerkship) and Phase 3 (post-clerkship) [15]. Learning objectives and clerkship objectives for each phase of the curriculum have been in place since 2010, however these had never been mapped to the UME educational program goals, which are framed as the Twelve Competencies of the Contemporary Physician [15, 16] and shown in Table 1.

In preparation for an upcoming accreditation cycle and for the opening of a new regional campus, a three-person committee consisting of the Associate Dean for Curriculum (co-author M.J.B), the Director of Curriculum Integration and Development (co-author M.K.W), and the Senior Advisor for Educational Affairs began the process of curriculum mapping in 2019. The goal of the mapping exercise was twofold: to assure ourselves that all graduates of our medical school achieve each of the educational program goals, and to provide data that would help us meet the accreditation standards for the Liaison Committee on Medical Education [17].

The committee began by making collaborative decisions on how each of the session-level learning objectives associated with Phase 1 might map to one or more of the Twelve Competencies of the Contemporary Physician. However, this proved unfeasible because for the 18-month (pre-clerkship) Phase 1 of the curriculum, each hour of the curriculum is associated with several session- level learning objectives that describe knowledge, skills and attitudes students should be able to exhibit after having engaged in a class activity. To simplify the mapping process, the committee developed a set of 20–25 course level objectives for each of the thirteen pre-clerkship courses to specify the broad goals of teaching and learning in each of the

Table 1 Educational program goals: the Twelve Competencies Required of the Contemporary Physician

1. Demonstrate in practice a set of personal and professional attributes that enable independent performance of the responsibilities of a physician and adaptation to the evolving practice of medicine. Attributes include:
   - Humanism, compassion and empathy
   - Commitment to collegiality and interdisciplinary collaboration
   - Engagement in continuing and lifelong self-education
   - Awareness of a personal response to one's personal and professional limits
   - Engagement in community and social service
   - Commitment to high ethical standards for personal and professional conduct
   - Knowledge of legal standards and commitment to legal conduct
   - Awareness of economic issues in clinical practice
   - Cultural competency and responsiveness in clinical practice and professional relationships
2. Apply the scientific basis of medicine to:
   - Current clinical practice
   - The analysis and further expansion of medical knowledge and understanding
3. Engage and communicate with a patient, develop a student-patient relationship, and communicate with others in the professional setting, using interpersonal skills to build relationships for the purpose of information gathering, guidance, education, support, collaboration and the provision of individualized patient care
4. Take a clinical history, both focused and comprehensive
5. Perform a mental and physical examination
6. Select, justify and interpret selected clinical tests and imaging
7. Explain the rationale for and be able to perform a variety of basic clinical procedures
8. Record, present, research, analyze and manage clinical information
9. Diagnose and explain clinical problems in terms of pathogenesis, develop a basic differential diagnosis, and demonstrate clinical reasoning and problem identification
10. Identify, select, and justify clinical interventions in the natural history of disease, including basic preventive, curative and palliative strategies
11. Formulate a prognosis about the future events of an individual's health and illness based upon an understanding of the patient, the natural history of disease, and upon known intervention alternatives
12. Provide clinical care within the practical context of a patient's age, gender, personal preferences, family, health literacy, culture, religious perspective, and economic circumstances. This competency goal also includes consideration of relevant ethical, moral and legal perspectives including patient advocacy and public health concerns, as well as the resources and limitations of the healthcare system

The Twelve Competencies of the Contemporary Physician articulate the clinical and interpersonal skills students will possess at the completion of the UVA School of Medicine undergraduate education program

courses. These course objectives were approved by the curriculum committee and serve as an intermediate layer of the curriculum map. The Director of Curriculum Integration and Development next mapped each Phase 1 session-level learning objective (approximately 6800 in total) to one or more of the Phase 1 course objectives, and every course objective to one or more of the educational program objectives. Once complete, the preliminary maps for each course in Phase 1 were returned to the Associate Dean for Curriculum and the curriculum committee for review and approval.

Figure 1 demonstrates an example of how four specific session-level learning objectives in the Mind Brain and Behavior (MBB) course were mapped to two different MBB course objectives. These two course objectives map to three of the twelve educational program goals for the University of Virginia School of Medicine (Competencies 2, 6 and 9; see Table 1). Mapping was completed in a customized learning management system (VMed) that enables searches of the curriculum by learning objective, by keyword, by course objective, by course or by curricular thread (discipline) (Fig. 2).

Developing a Theory of Change framework to fill a curricular gap

To fill the apparent curricular gap on the topic of prognosis/prognostication identified through curriculum mapping (see Results) and to ensure that all our graduates meet each of the twelve educational program goals, including that of "formulating a prognosis…", the Director of Curriculum Integration and Development (M.K.W.) and the Associate Dean for Curriculum (M.J.B.) developed a Theory of Change framework for curricular revision (see Fig. 4). We began by articulating the implicit assumption that all graduates of our program achieve the twelve competencies that serve as our educational program goals (Table 1), including the skill of prognostication. We also articulated the assumption that many courses and clerkships in our curriculum included both teaching and assessment on this topic. Next, the two of us identified all the resources that might be available for correcting this gap, including the curricular time, the assessments and the personnel. Phase 1 preclerkship courses provided curricular time for teaching and learning about the concept of prognosis, whereas the clerkships in Phase 2 and required clinical courses

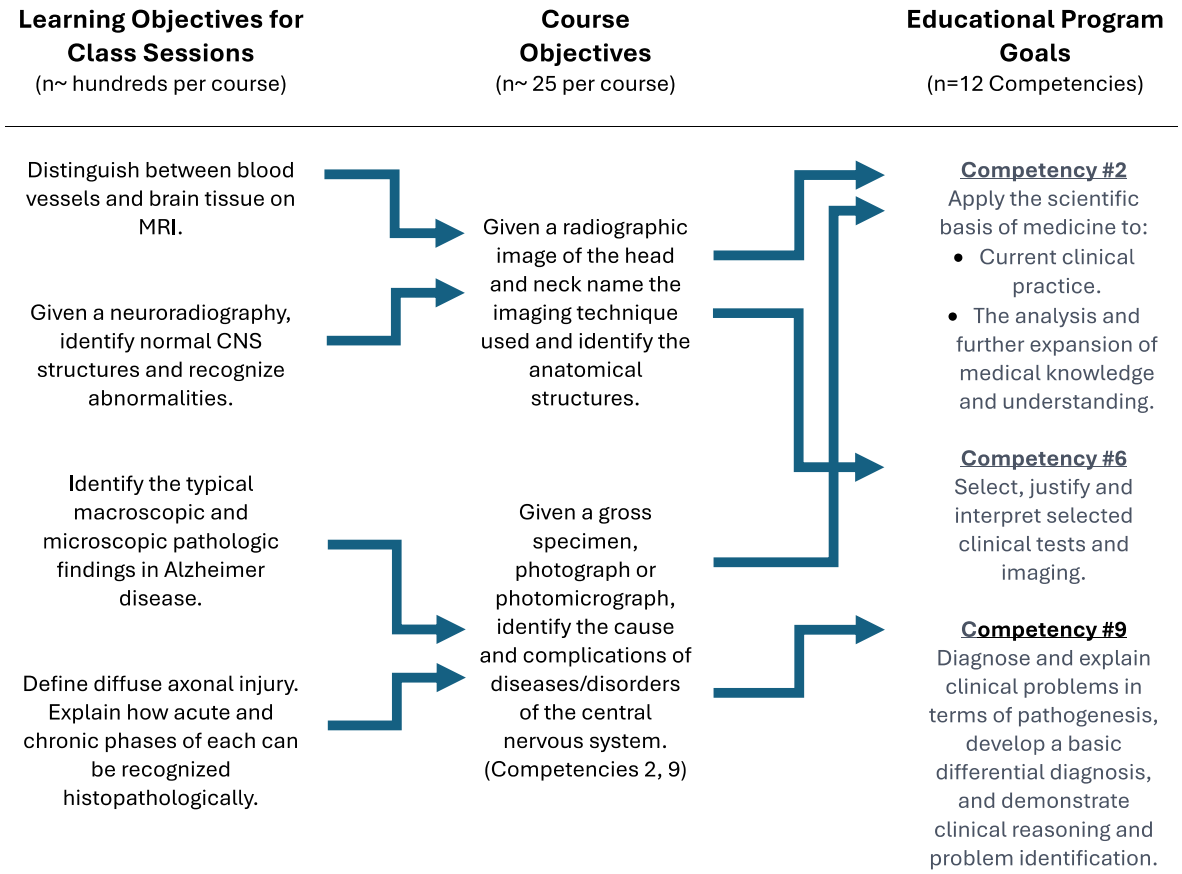

Fig. 1 Example of curriculum mapping for four learning objectives for the Phase 1 course Mind Brain and Behavior (MBB). These four learning objectives are mapped to three of the twelve educational program goals (i.e. the Twelve Competencies of the Contemporary Physician) [15] through intermediary links to two of the course objectives for MBB

in Phase 3 offered opportunities for practicing the skill of prognostication. All phases of the curriculum offered opportunities for assessing students on their mastery of prognosis/prognostication, whether on written examinations in Phase 1, or student performance evaluations and Objective Structured Clinical Examinations (OSCEs) in Phases 2 and 3. The personnel available to help with filling the gap included all the course and clerkship directors and curricular oversight bodies.

The third step in developing the ToC framework was to decide on curricular interventions that would help close the curricular gap on prognosis/prognostication. As we had already resolved to redesign the curricula for Phases 2 and 3 in preparation for the 2021 opening of a regional medical campus, one intervention was to collaborate with course directors for Phase 3 and the clerkship director for Internal Medicine to overhaul their course and clerkship objectives in alignment with each of our educational program goals (i.e., the Twelve Competencies Required of the Contemporary Physician) [15]. This ensured the skill of prognostication would be formally addressed in the Internal Medicine clerkship, as well as in each of the required Phase 3 courses, including Critical Care Medicine and Emergency Medicine and the hospital-based Advanced Clinical Electives. Written at a high level of Bloom's taxonomy of learning [18], the new clerkship objectives replaced all the existing objectives, many of which were written prior to 2019 and at a low level of Bloom's taxonomy. A second intervention was for the Associate Dean for Curriculum to prompt Phase 1 course directors to reconsider whether they were teaching and assessing on the topic of prognosis wherever appropriate in the pre-clerkship curriculum.

Results

Curriculum mapping of Phase 1, 2 and 3 courses

The results of mapping the entire 2018- 2019 Phase 1 curriculum are shown in Fig. 3, which shows how session-level learning objectives map to the twelve educational program goals for in the morning curriculum (organ systems courses) and the afternoon "doctoring" course (Foundations of Clinical Medicine) separately. As

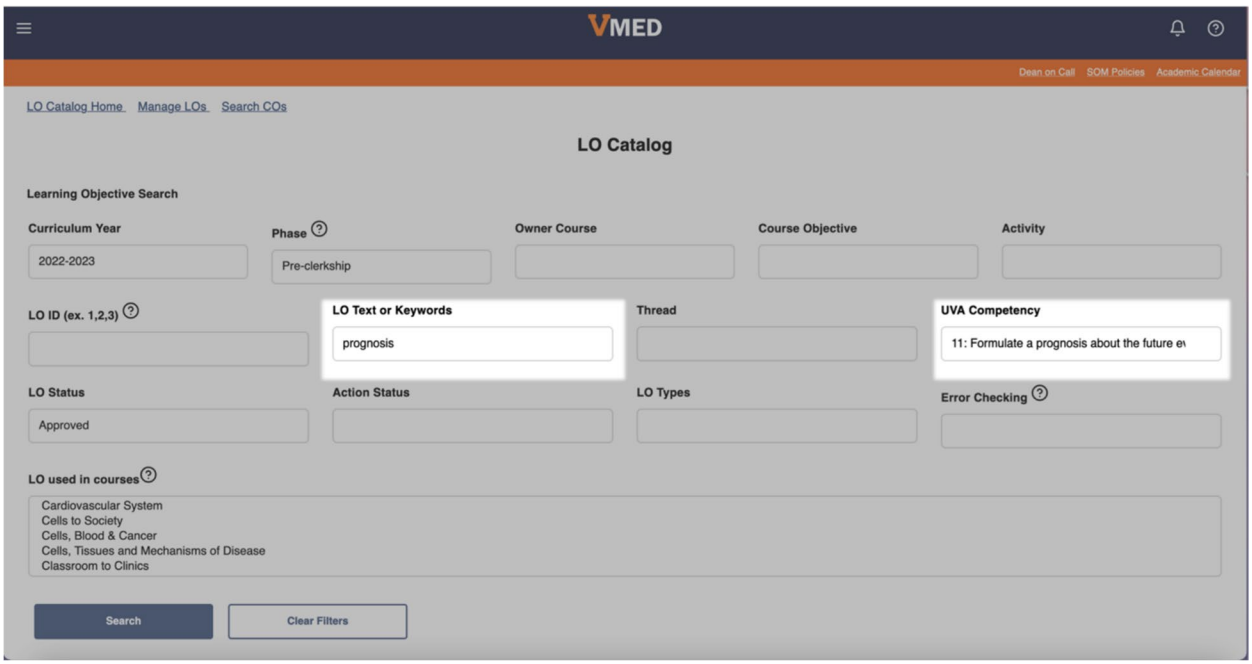

Fig. 2 Dashboard for VMed, the bespoke School of Medicine learning management system, illustrating how the pre-clerkship phase (Phase 1) of the 2022–2023 curriculum could be searched for learning objectives using the search term "prognosis" and the UVA Competency #11 (Formulate a prognosis…). The owner course, course objective, course activity and curricular thread (discipline) are not specified in this search

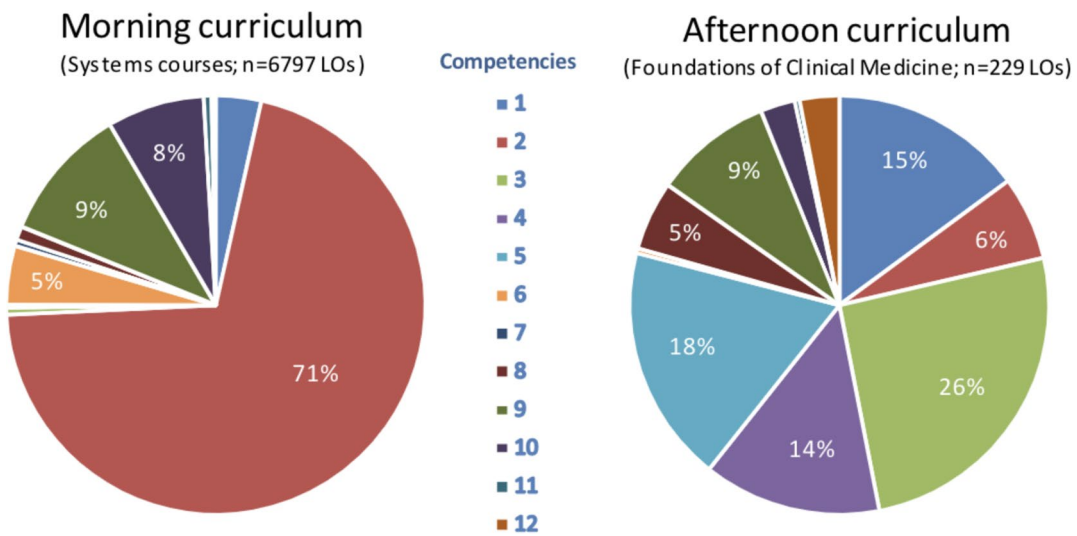

Fig. 3 Results of curriculum mapping for the 2018–2019 Phase 1 morning curriculum (organ-system courses) and afternoon curriculum (doctoring course). The pie charts indicate the percentage of learning objectives in the Phase 1 morning and afternoon curricula that correspond to each of the Twelve Competencies Required for the Contemporary Physician [15] that serve as educational program goals

expected, the curriculum map for 2018–2019 showed that the science of medicine (Competency #2) was a strong emphasis for the morning courses, as was the interpretation of tests and images (Competency #6), explaining pathogenesis (Competency #9) and treatment (Competency #10). These same competencies were emphasized in the afternoon "doctoring" course, as were the personal and professional attributes of a physician (Competency #1), communication skills (Competency #3), taking a medical history (Competency

#4) performing a physical exam (Competency #5), and recording and presenting clinical information (Competency #8). In contrast, review of later phases of the curriculum (data not shown) demonstrated that Competencies #7 and 12 (both underrepresented in Phase 1) were well represented in Phases 2 (clerkships) and 3 (post-clerkships) when patient care and clinical procedures are strongly emphasized. However, there was a paucity of session-learning objectives related to Competency #11 (Formulate a prognosis…) in Phase 1 of the curriculum.

A review of learning objectives for 2018–2019 Phase 2 and Phase 3 courses also revealed relatively few objectives related to Competency #11 ("Formulate a prognosis…."). Of the 781 learning objectives in aggregate listed for 16 required clerkships in Phase 2, only 7 referenced formulating a prognosis for a patient. Review of the Phase 3 learning objectives listed for 63 post-clerkship courses (including 17 advanced clinical electives) identified only 1 out of 642 that would map to the competency "formulate a prognosis…".

To investigate further, all three phases of the curriculum were remapped using synonyms for prognosis such as "trajectory of illness", "goals of care" and similar terms. The results confirmed that our curricular map for the 2018–2019 year had a curricular gap related to prognosis/prognostication, a realization that threatened the validity of any assumption that all graduates of our program achieved all twelve goals of our educational program.

A Theory of Change framework to fill a curricular gap

Our ToC framework guided us to anticipate three short-term outcomes of the interventions we implemented for Phase 1 courses and Phase 2/3 clerkships and advanced clinical electives. First, we anticipated increases in the number of session-level learning objectives in Phase 1 and that the number of course and clerkship objectives in Phases 2 and 3 related to prognosis/prognostication. After short-term outcomes were achieved, we expected the medium-term outcomes from our curricular revision would be that students would be assessed on prognosis or prognostication in every phase of curriculum, either on written exams, student performance evaluations and/or OSCEs.

Since the overhaul of the Phase 2 and 3 in the 2019–2020 academic year, we have completed mapping for all three phases of the curriculum and ensured that student performance evaluations for Phase 2 and 3 courses address prognostication. Meeting each of these medium-term benchmarks for curricular revision helps provides reassurance we are reaching our long-term goal for all graduates to achieve Competency #11 (Formulate a prognosis…). To date, the skill of prognostication has not yet been assessed on Objective Structured Clinical Exams (OSCEs). This remains a goal for the future.

Discussion

At the start of our curriculum mapping efforts in 2018–2019, we did not anticipate identifying any specific gaps in our UME curriculum and were surprised to realize how few of our session-level learning or course objectives (and assessments) related to prognostication. Previous reviews of our UME curriculum by faculty and students had not identified this topic as an area of deficiency for our learners, suggesting that the experienced (or learned) curriculum was adequate on this topic. Nonetheless, our intended (written) curricular session-level learning objectives did not provide evidence that our students mastered this competency. Mismatches between the intended (planned or written) curriculum, the delivered (taught and/or tested) curriculum and the experienced (learned) curriculum can occur whenever instructor goals, classroom instruction and assessments, and student perceptions of curricula do not align [19, 20].

Correcting misalignments and/or gaps in a curriculum map is essential if all stakeholders, including curricular oversight bodies and accreditors, are to have an accurate and shared understanding of what the curriculum includes and how it is sequenced. Moreover, a robust curriculum map facilitates the process of identifying how new topics can be included in an existing curriculum. Sullivan and colleagues, for example, leveraged a curriculum map at their own medical school to propose how new curricular content on climate change could be added to existing curricular sessions without increasing curricular time [21].

Although some authors have criticized Theory of Change models as overly linear [22], this linearity can be helpful when considering complex systems. Utilizing the ToC approach for curricular revision prompted us to recognize our fallacy in assuming there was good alignment between our curriculum map and our educational goals. Moreover, it helped us to strategize how best to fill the gap in our curriculum map by guiding us in identifying specific resources that were available for correcting this misalignment, including opportunities for learning and assessment within our curriculum, and curricular leaders who could be tapped to help. Other authors have reported finding and filling a curricular gap without specifying how they decided on the specific curricular interventions or how they implemented curricular revision. For example, Fisher and colleagues proposed including Interprofessional Education (IPE), simulation and e-learning pedagogies in a UK medical school curriculum to address a curricular gap on the topic of delirium, but did not explain why they thought these teaching

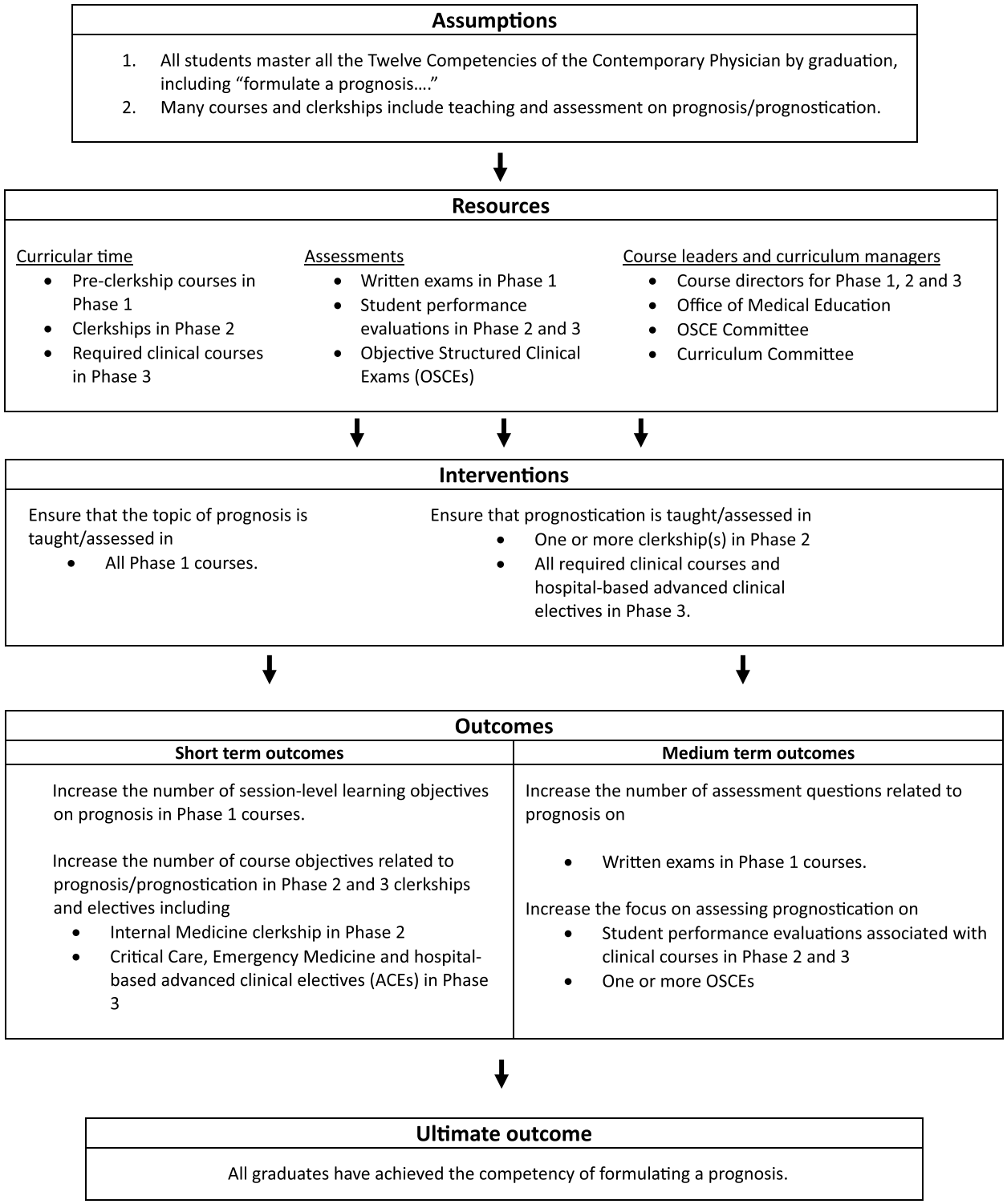

Fig. 4 Theory of Change framework for curricular revision to address a curricular gap on prognostication. The framework requires specification of any underlying assumptions about the existing curriculum design (i.e., the need for change), the resources available for curricular revision (i.e., the personnel, curricular time, and testing materials necessary to effect change), the curricular interventions that would fill the identified curricular gap (i.e., the strategies for effecting change), and the short-term, medium-term and ultimate outcomes or indicators expected from revising the curriculum (i.e., the benchmarks for measuring change)

strategies would be best [23]. Similarly, a report that identified a gap in substance misuse teaching at 19 medical schools in England did not describe how or why the authors decided on specific learning outcomes or curricular materials in order to fill the gap [24].

Utilizing a Theory of Change model for curricular revision has the advantage of requiring curriculum designers to articulate reasonable short-term and medium-term outcomes that would measure progress toward curriculum revision. Our outcomes included curriculum committee approval of new course objectives in Phase 2 and 3, and confirmation that student performance on prognostication is assessed on the evaluations associated with clinical courses in Phase 2 and 3 (see Fig. 4). Identifying and listing the anticipated outcomes of curricular revision makes the process of transparent to stakeholders. Given that many curricular reforms at medical schools meet with inertia and resistance [25], communicating how curricular revision will be measured is critical. Facilitating the buy-in of stakeholders is an essential element of any successful change effort [26].

In summary, utilizing the structured Theory of Change approach to implement curricular revision has several advantages. First, the ToC methodology requires that the assumptions underlying a curriculum and the corresponding curriculum map be made explicit. As described above, this requirement can provoke new realizations on the part of educational leaders about the design of an existing curriculum and its curriculum map. Second, developing a ToC model prompts curriculum designers to list multiple interventions that might be appropriate for revising the curriculum. This strategy discourages any temptation to jump to conclusions on quick fixes to "patch", and superficially correct, curricular gaps. Thirdly, the ToC framework requires that short and long-term outcomes be articulated to specify how progress towards the long-term goal of curricular revision will be measured. This step clarifies, in a manner transparent to all stakeholders, how curricular change will be recognized and documented. The ToC framework also can be used at the classroom level to understand the effects of individual education experiences [27].

The authors acknowledge that it is a limitation of this report that we describe evidence of a curricular gap based on a lack of learning objectives on the topic of prognosis and prognostication. We did not consider the degree to which the curriculum did or did not include assessments of these topics. However, as the policy at our institution is that all assessments must be linked to learning objectives, it is unlikely that significant assessment of prognosis/prognostication took place in the absence of learning objectives. In addition, it is a limitation that we report outcomes from using the Theory of Change model to effect curricular revision at one US medical school. Nevertheless, as the approach could be used to correct curricular gaps of any type within educational programs of any scale, we report our experience in hopes that the ToC approach might be of interest to educators those who oversee and design health science curricula at other schools.

Conclusion

In summary, our initial attempts at curriculum mapping revealed an unanticipated finding, that over 4 years of the curriculum, the intended curriculum rarely included teaching or assessment on the topic of prognostication. Using the Theory of Change approach, we developed a strategy for revising all three phases of the curriculum to fill this curricular gap. Creating a theory of change framework for curricular revision can be a useful consensus-building process that allows those who design, lead, manage and evaluate the curriculum to come to a shared understanding of the goals of curricular revision and how they will be realized.

Abbreviations

MBB	Mind Brain and Behavior course
OSCEs	Objective Structured Clinical Examinations
ToC	Theory of Change
VMed	The bespoke learning management system at the University of Virginia School of Medicine

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Authors' contributions

MKW: Study Project Design, Implementation, Data input/analysis, Manuscript writing, review, and editing, Publication correspondence. MB: Data input/analysis, Manuscript review and editing.

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Data availability

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate

Not applicable.

Consent for publication

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Competing interests

The authors declare no competing interests.

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References

1. Plaza CM, Draugalis JR, Slack MK, Skrepnek GH, Sauer KA. Curriculum Mapping in Program Assessment and Evaluation. Am J Pharm Educ. 2007;71(2):20. https://doi.org/10.5688/aj710220.
2. Chakrabarti R, Wardle K, Wright T, Bennie T, Gishen F. Approaching an undergraduate medical curriculum map: challenges and expectations. BMC Med Educ. 2021;21(1):341. https://doi.org/10.1186/s12909-021-02778-6.
3. Harden RM. AMEE Guide No. 21: Curriculum mapping: a tool for transparent and authentic teaching and learning. Medical Teacher. 2001;23(2):123–137. https://doi.org/10.1080/01421590120036547.
4. Al-Eyd G, Achike F, Agarwal M, et al. Curriculum mapping as a tool to facilitate curriculum development: a new School of Medicine experience. BMC Med Educ. 2018;18(1):185. https://doi.org/10.1186/s12909-018-1289-9.
5. Murphy R, Barnes CJ, Enright PD, Gratton V, Bush SH. Mapping an undergraduate medical education curriculum against national and international palliative care reference learning objectives. BMC Med Educ. 2024;24(1):105. https://doi.org/10.1186/s12909-024-05082-1.
6. Carroll J, Goodair C, Chaytor A, Notley C, Ghodse H, Kopelman P. Substance misuse teaching in undergraduate medical education. BMC Med Educ. 2014;14(1):34. https://doi.org/10.1186/1472-6920-14-34.
7. Satterfield JM, Adler SR, Chen HC, Hauer KE, Saba GW, Salazar R. Creating an ideal social and behavioural sciences curriculum for medical students: Social and behavioural sciences for medical students. Med Educ. 2010;44(12):1194–202. https://doi.org/10.1111/j.1365-2923.2010.03713.x.
8. Stumbar SE, Brown DR, Lupi CS. Developing and Implementing Curricular Objectives for Sexual Health in Undergraduate Medical Education: A Practical Approach. Acad Med. 2020;95(1):77–82. https://doi.org/10.1097/ACM.0000000000002891.
9. Reidy JA, Chan SH, Boelitz KM, et al. A Call to Action: Using Curriculum Mapping at Four Medical Schools in Massachusetts to Advance Serious Illness Communication Training in Undergraduate Medical Education. J Palliat Med. 2024;27(1):39–46. https://doi.org/10.1089/jpm.2022.0562.
10. Center for Theory of Change. Setting Standards for Theory of Change. https://www.theoryofchange.org/.
11. Breuer E, Lee L, De Silva M, Lund C. Using theory of change to design and evaluate public health interventions: a systematic review. Implementation Sci. 2015;11(1):63. https://doi.org/10.1186/s13012-016-0422-6.
12. Balayah Z, Khadjesari Z, Keohane A, To W, Green JSA, Sevdalis N. National implementation of a pragmatic quality improvement skills curriculum for urology residents in the UK: Application and results of 'theory-of-change' methodology. The American Journal of Surgery. 2021;221(2):401–9. https://doi.org/10.1016/j.amjsurg.2020.12.007.
13. Song SL, Yu ZZ, Pavlech L, Scott IU, Greenberg PB. Theoretical Frameworks in Medical Education: Using a Systematic Review of Ophthalmology Education Research to Create a Theory of Change Model. J Grad Med Educ. 2022;14(5):568–82. https://doi.org/10.4300/JGME-D-22-00115.1.
14. Reinholz DL, Andrews TC. Change as a Scientific Enterprise: Practical Suggestions about Using Change Theory. Hora M, ed. LSE. 2024;23(1):es1. https://doi.org/10.1187/cbe.23-06-0103.
15. Bray MJ, Gusic ME, Canterbury RJ. University of Virginia School of Medicine. Acad Med. 2020;95(9S):S534–7. https://doi.org/10.1097/ACM.0000000000003328.
16. Corbett EC. Defining Educational Objectives at the University of Virginia: Academic Medicine. 2000;75(2):151–2. https://doi.org/10.1097/00001888-200002000-00010.
17. Liaison Committee for Medical Education. Functions and structure of a medical school. Standards for accreditation of medical education programs leading to the MD degree. Association of American Medical Colleges and American Medical Association; 2024.
18. Anderson LW, Krathwohl D, Airasian P, Cruikshank K, Mayer R, Pintrick P, et al. Taxonomy for learning, teaching, and assessing: a revision of Bloom's taxonomy of educational objectives, abridged edition. 1st edition. New York, Munich: Longman; 2009. p. 302.
19. Clemmons AW, Donovan DA, Theobald EJ, Crowe AJ. Using the Intended–Enacted–Experienced Curriculum Model to Map the Vision and Change Core Competencies in Undergraduate Biology Programs and Courses. Long T, ed. LSE. 2022;21(1):ar6. https://doi.org/10.1187/cbe.21-02-0054.
20. Moercke AM, Eika B. What are the clinical skills levels of newly graduated physicians? Self-assessment study of an intended curriculum identified by a Delphi process: What are the clinical skills levels of newly graduated physicians? Med Educ. 2002;36(5):472–8. https://doi.org/10.1046/j.1365-2923.2002.01208.x.
21. Sullivan JK, Lowe KE, Gordon IO, et al. Climate Change and Medical Education: An Integrative Model. Acad Med. 2022;97(2):188–92. https://doi.org/10.1097/ACM.0000000000004376.
22. Byrne D. Evaluating complex social interventions in a complex world. Evaluation. 2013;19(3):217–28.
23. Fisher JM, Gordon AL, MacLullich AMJ, et al. Towards an understanding of why undergraduate teaching about delirium does not guarantee gold-standard practice–results from a UK national survey. Age Ageing. 2015;44(1):166–70. https://doi.org/10.1093/ageing/afu154.
24. Notley C, Goodair C, Chaytor A, Carroll J, Ghodse H, Kopelman P. Report of the substance misuse in the undergraduate medical curriculum project in England. Drugs: Education, Prevention and Policy. 2014;21(2):173–176. https://doi.org/10.3109/09687637.2013.792788.
25. Kumar VD, Basheer A. Comparing Curricular Reform in Medical Schools and the Ship of Theseus: Insights Regarding Philosophical and Ideological Characteristics. MedSciEduc. 2019;29(2):599–602. https://doi.org/10.1007/s40670-019-00726-0.
26. Anderson A. The Community Builders Approach to Theory of Change: A Practical Guide to Theory Development. The Aspen Institute Roundtable on Community Change; 2005:37. https://www.theoryofchange.org/pdf/TOC_fac_guide.pdf.
27. Mackey M, Drew SV, Nicoll-Senft J, Jacobson L. Advancing a theory of change in a collaborative teacher education program innovation through universal design for learning. Soc Sci Human Open. 2023;7(1): 100468. https://doi.org/10.1016/j.ssaho.2023.100468.

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