

Original Research Article

Navigating pediatric undergraduate medical education: Curriculum mapping of problem-based learning and case-based learning in the pediatric curriculum

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Abstract

Background: The pre-clerkship curriculum at McMaster University uses problem-based learning (PBL) as the main teaching method and includes patients of all ages. However, informal data collected through surveys sent to McMaster medical students demonstrated that our students do not feel adequately prepared for their pediatric clerkship rotation. The purpose of this study was to map the McMaster pediatric pre-clerkship PBL curriculum and online Aquifer cases to the National Canuc-Paeds clinical presentations (<https://www.pupdoc.ca/en/canuc-paeds/>) to determine the comprehensiveness of our current pediatrics curriculum.

Methods: All 150 undergraduate problem-based learning cases were reviewed for pediatric content. In addition, the 32 pediatric Aquifer cases were reviewed to determine which Canuc-Paeds clinical presentations are addressed.

Results: Thirty-six out of 150 PBL cases included pediatric content, in which 15/29 of the required clinical presentations were covered, and many were addressed more than once. The majority of the objectives (25/29) were covered by at least one Aquifer case, while four objectives were not addressed by any case.

Conclusion: Mapping pre-clerkship PBL cases and Aquifer cases onto the Canuc-Paeds curriculum provides valuable insight into the pediatrics content in the pre-clerkship and clerkship curriculum and demonstrates areas where additional training is required. A similar methodology can also be used in other programs to evaluate their curriculum.

Keywords: Pediatrics; medical education; Aquifer; problem-based learning; McMaster

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Introduction

Curriculum mapping is an established process in the literature and has been proven to efficiently manage the curriculum and help to fulfill academic requirements (1). This method of evaluating the curriculum is essential in reviewing, developing, and improving any curriculum (1). The method for mapping can include three steps: 1) a mapping template prefilled with standardized data; 2) a curriculum mapping system; and 3) a curriculum review process (1). The Royal College of Physicians and Surgeons of Canada's (RCPSC) program directors' handbook chapter on how to develop a meaningful curriculum map demonstrates the need for a continuously evolving curriculum map and mapping to national objectives (2). The handbook suggests that a curriculum map can be created for different aspects of the curriculum, including objectives, teaching methods, resources, assessment methods, and faculty development (2). Factors that can lead to successful curriculum mapping include support of the institution, sufficient time, leadership, and being user-friendly (3). A recent German initiative mapped an entire undergraduate medical curriculum to their national learning objectives, including roles of the physician, knowledge, skills, attitudes, and patient-centered care (4). They demonstrate the importance of rigorous curriculum mapping to national objectives and reporting of these results. While our medical school has a robust curriculum map, it was difficult to practically capture how pediatrics is covered in the pre-clerkship curriculum (5).

Problem-based learning (PBL) is a well-established teaching method in undergraduate medical education. Evidence has shown that pediatric-focused PBL is associated with increased problem-solving and clinical reasoning in medical students (6). In fact, pediatric-focused PBL has been shown to be more effective than traditional didactic learning and continues to be effective during clerkship years (7-8). Our local pre-clerkship learning is built on PBL and includes 150 cases, covered in tutorials over the first 15 pre-clinical months, and includes patients of all ages. There are no formal pediatrics learning objectives in the pre-clerkship clinical skills student handbook (9).

To supplement PBL learning, virtual case-based learning (CBL) can be used to help fulfill pediatric learning objectives (10). CBL has also been proven to be more effective than didactic learning by improving students' competence in knowledge and clinical skill acquisition (10). A series of 32 pediatric cases widely used across North America is available to medical students online to supplement the curriculum through Aquifer, a non-profit organization that develops clinical teaching and learning methods (<https://aquifer.org/courses/aquifer-pediatrics>).

Canada has a national pediatrics curriculum for undergraduate medical education, developed by the Paediatric Undergraduate and Clerkship Directors of Canada (PUPDOC). The "Canuc-Paeds" curriculum, updated in 2021, contains 29 clinical presentations, with their corresponding "Key Conditions" providing more detailed core conditions (11). The purpose of this study was to map the pre-clerkship PBL curriculum and the Aquifer cases to the national Canuc-Paeds curriculum to identify gaps that can be supplemented with additional teaching. Mapping the pediatric curriculum will help identify both the topic areas that are addressed and those that are currently lacking to allow for the introduction of new cases or the modification of existing cases

to address these gaps. This study can provide an approach to evaluating the undergraduate pediatric curriculum at many medical schools, along with valuable information on the Aquifer pediatric cases.

Methods

A manual pre-screen identified that 36/150 pre-clerkship PBL cases contained pediatric content. One key objective is typically provided to students for each case, with more detailed enabling objectives provided to tutors who facilitate the PBL sessions. These mandatory learning objectives were reviewed to identify pediatric-specific learning objectives. These were then mapped to the Canuc-Paeds clinical presentations by numbering them. Other aspects of the curriculum such as didactic lectures, clinical skills classes, and professional competencies sessions were not mapped, since our aim was to focus on PBL as this is the main teaching method at McMaster University. Each objective that was pediatric-focused was identified (i.e., cases with patients up to age 18), and, out of those objectives, the ones that mapped to a Canuc-Paeds clinical presentation were recorded.

The main topics for each of the 32 pediatric Aquifer cases were also identified based on the case stem provided to students. Each case was similarly assessed to determine which Canuc-Paeds clinical presentations were addressed. A summary table of each Canuc-Paeds clinical presentation created with the total number of cases, or lack thereof, was recorded.

Results

There were 15/29 Canuc-Paeds objectives included in the pre-clerkship PBL curriculum, which include a number of core pediatric topics, as listed in Table 1. The majority of the objectives (25/29) were covered by at least one Aquifer case (Table 1). There were four objectives that were not addressed by any Aquifer case, while many objectives were covered by the Aquifer curriculum more than once. The clinical presentation(s) that each Aquifer case addressed was also recorded (Table 2).

Discussion

The Canuc-Paeds clinical presentations outline fundamental learning objectives in pediatrics for Canadian undergraduate medical students. This study mapped the PBL learning objectives at McMaster University as well as the Aquifer CBL cases to this curriculum. While the main form of learning at McMaster University is through PBL, the cases only covered 15/29 of the Canuc-Paeds clinical presentations. As a result, in order to learn all of the clinical presentations by graduation, students would need to master the rest of the clinical presentations during clerkship. This is challenging, as there is great variability with regard to students' experience during their

Table 1. The number of PBL tutorial cases and Aquifer cases that covered each Canuc-Paeds clinical presentation

Canuc-Paeds Clinical Presentation		Tutorial Cases	Aquifer Cases
1	Describe differences between the medical management of paediatric patients versus adult patients.	2	0
2	Recognize an acutely ill child.	0	4
3	Abdominal pain and abdominal mass	0	4
4	Adolescent Health Issues	7	3
5	Altered Level of Consciousness	0	2
6	Bruising / Bleeding	2	5
7	Dehydration	0	2
8	Development / Behavioural / Learning Problems	9	4
9	Diarrhea	0	0
10	Edema	1	1
11	Eye Issues	1	0
12	Fever	0	2
13	Genitourinary Complaints	3	2
14	Growth Problems	3	3
15	Headache	0	1
16	Inadequately explained injury	0	2
17	Limp / Extremity Pain	2	1
18	Lymphadenopathy	0	1
19	Mental Health Concerns	1	1
20	Murmur	0	2
21	Neonatal Jaundice	0	1
22	Newborn	4	3
23	Pallor / Anemia	1	2
24	Rash	0	5
25	Respiratory distress / Cough	2	4
26	Seizure / Paroxysmal event	2	1
27	Sore Ear	0	1
28	Sore Throat / Sore Mouth	0	0
29	Vomiting	1	1

Table 2: Pediatric Aquifer cases and the corresponding Canuc-Paeds clinical presentation numbers (corresponds to Table 1).

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
Newborn male infant evaluation and care																						X							
Infant female well-child visits (2, 6, and 9 months)			X					X					X																
3-year-old male well-child visit						X																	X	X					
8-year-old male well-child check								X					X																
16-year-old female health maintenance visit				X		X													X										
16-year-old male preparticipation evaluation				X																									
2-hour-old male newborn with respiratory distress																						X			X				
6-day-old female with jaundice																						X							
2-week-old female with lethargy																						X							
6-month-old female infant with a fever												X																	
4-year-old male with fever and adenopathy												X						X						X					
10-month-old female with a cough																									X				
6-year-old female with chronic cough																									X				
18-month-old female with congestion																											X		
Two siblings: 4-year-old male and 8-week-old male with vomiting								X																					X
7-year-old female with abdominal pain and vomiting								X																					
4-year-old female refusing to walk																		X											
2-week-old male with poor feeding																						X							
16-month-old male with first seizure		X														X								X		X			
7-year-old male with a headache																		X											
6-year-old male with bruising			X			X											X							X					
16-year-old female with abdominal pain			X	X								X																	
15-year-old female with lethargy and fever		X			X	X																							
2-year-old female with altered mental status		X			X																								
2-month-old male with apnea																										X			
9-week-old male not gaining weight														X															
8-year-old female with abdominal pain			X			X																							
18-month-old male with developmental delay								X														X							
9-week-old male Infant with hypotonia								X																					
2-year-old male with sickle cell disease		X																						X					
5-year-old female with puffy eyes										X																			
5-year-old female with Rash																									X				

pediatric core rotations in terms of setting, patient population, preceptors, and additional informal learning experiences.

Furthermore, there is currently no available overview of undergraduate pediatrics learning objectives across all three years of training at our medical school. Our results provide valuable information that can be used to enhance the undergraduate pediatric curriculum in accordance with the Canuc-Paeds clinical presentations. Specifically, important clinical presentations that were not covered by any PBL case included core pediatric topics, such as neonatal jaundice, rash, fever, abdominal pain, and acute care topics such as altered level of consciousness and recognizing an acutely ill child. Additional PBL cases, resources, or objectives can be created to ensure that these clinical presentations are covered. Other schools that use PBL can also evaluate their pediatrics curriculum using similar methods to determine clinical presentations that are not currently taught and to develop new resources or learning materials for medical students. Additionally, schools who teach using traditional didactic approaches can also use a similar mapping process for their curriculum by applying the same concepts to their main form of teaching (i.e., lectures).

The current pediatrics clerkship curriculum focuses on clinical rotations, which may be inadequate to address all pediatric learning objectives, and learning around patient encounters rather than a fixed, case-based learning curriculum. Mapping the Aquifer online cases is helpful

in determining which of the Canuc-Paeds objectives are not covered and could use additional resources. Specifically, elements of our curriculum not covered by Aquifer included describing differences between the medical management of pediatric patients versus adult patients, diarrhea, eye issues, and sore throat/sore mouth. These gaps can be addressed with additional teaching in these areas in order to ensure students are learning these important clinical issues during their medical education.

Despite the practical benefits of curriculum mapping, there is little published to support the best approach. There is no pediatrics-specific literature that looks at mapping the pre-clerkship or clerkship curriculum to the Canuc-Paeds clinical presentations. However, one study extracted demographic data and chronic versus acute presentations from PBL cases (12). Another study used a similar methodology by analyzing Aquifer teaching cases with a 20-item case review spreadsheet, as opposed to national curriculum guidelines. They used this information to evaluate the effectiveness of Aquifer cases in addressing race and culture (13). Lastly, Sehgal et al. mapped the Aquifer Geriatric cases to the AAMC/JAHF Minimum Geriatrics Competencies for Medical Students to evaluate and determine which clerkship specialties each case can be used to supplement and found that Aquifer cases were an efficient way to teach geriatrics to medical students (14). While mapping of the undergraduate medical curriculum has been done using alternative methods, as demonstrated above, mapping the PBL and pediatric Aquifer cases to the Canuc-Paeds curriculum provides clear information on which clinical presentations need further teaching to provide a solid foundational pediatrics knowledge base for all McMaster medical students. Curriculum mapping can be used by other medical programs to evaluate their pediatrics curriculum and where core learning objectives are and are not being met to ensure optimization of pediatrics undergraduate medical education. This mapping can help to ensure that there is an improvement in students' pre-clerkship pediatrics exposure and optimize their knowledge and skill attainment during their clinical time in pediatrics.

Conclusion

Curriculum mapping helps educators to understand the current state of the curriculum and to see gaps. Mapping our pre-clerkship PBL and Aquifer cases to the national pediatric objectives in the Canuc-Paeds clinical presentations provided valuable insight into the current state of our pre-clerkship and clerkship curriculum and revealed areas where new cases need to be developed or where additional training is required to optimize content. These data can also be used when modifying the clerkship curriculum to ensure objectives that are not covered in pre-clerkship are covered in clerkship. This approach is applicable to other medical programs and specialties, including programs that use PBL and other teaching methods.

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