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Medical students retain pain assessment and management skills long after an experiential curriculum: A controlled study

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ABSTRACT

We implemented a pain assessment and management (PAM) curriculum for second year medical students and evaluated long-term skills retention compared to the prior year's class which did not receive the curriculum. The curriculum included pain pathophysiology, assessment and treatment instruction plus feedback on PAM practice with standardized patients. Both cohorts underwent a required end-of-third-year clinical skills examination. Intervention and control group performance on three pain cases (acute, chronic and terminal) was compared. The PAM curriculum was implemented 1.5 years before the intervention cohort participated in the clinical skills exam. More intervention students (134/159, 84.3% response rate) obtained basic (87.2% vs. 76.0%, $p = .028$) and comprehensive (75.2% vs. 60.9%, $p = .051$) descriptions of acute pain than control students ($n = 129/174$, 74.1% response rate). Intervention students demonstrated superior skills for terminal pain, including: more often asking about impact on functioning (40.7% vs. 25.8%, $p = .027$), advising change of medication (97.3% vs. 38.7%, $p < .001$), and providing additional medication counseling (55.0% vs. 27.0%, $p < .001$). Virtually all students obtained basic descriptions of chronic (intervention vs. control, 98.1% vs. 96.1%, $p = .367$) and terminal (92.9% vs. 91.7%, $p = .736$) pain. Surprisingly, more control than intervention students obtained a comprehensive description of chronic pain (94.6% vs. 77.8%, $p < .001$) and asked about current pain medication in the terminal case (75.6% vs. 55.0%, $p = .004$). Exposure to the curriculum resulted in durable increases in students' ability to perform PAM skills in patients with acute and terminal pain.

1. Introduction

Pain is a common symptom in all patient care settings [2,15] and the provision of appropriate, compassionate management and relief of this symptom is the responsibility of all physicians. As such, physicians and trainees must develop and maintain pain assessment and management (PAM) skills in order to provide high quality care [13].

Despite the clear need for competency in PAM skills, there is ample evidence that this competency is lacking at all levels of medical training [2,11–14,15,17]. To address this problem, various PAM curricula have been developed, implemented and analyzed. These curricula have accomplished short-term improvement in knowledge, attitudes and skills [1,4,5,18,19]. At the undergraduate level, Sloan et al. [16] delivered a multi-method curriculum in the 3rd year of medical school and demonstrated skills improvement 10–16 weeks after completion. To our knowledge, there have been no reported undergraduate medical curricula that show a longer-term retention of PAM skills in medical students.

In recognition of the importance of this issue and our lack of a formal effective PAM curriculum at the time, we received funding to design a multi-modal, experiential and interdisciplinary PAM curriculum for 2nd year medical students in the Class of 2007 (intervention group) at the New York University School of Medicine (NYU SOM). Our medical school curriculum is structured as 2 years of basic science (organized by organ system, delivered as a balance of lectures and seminars) followed by 2 years of nine required clinical clerkships and electives. The PAM curriculum was developed as a collaboration between the 2nd year Neuroscience and Physician, Patient and Society (PPS) courses and is one of three integrated PPS modules addressing Pain, Violence and Chronic Disease in the 2nd year. To assess the impact of the curriculum, we compared the PAM skills of the intervention group and an historical control group (the Class of 2006) in a quasi-experimental design, 1.5 years after exposure to the curriculum. We hypothesized that students exposed to the PAM curriculum, when compared to unexposed students, would demonstrate better PAM skills in patients presenting with acute, chronic or terminal pain syndromes.

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Table 1a
Pain assessment and management curriculum.

Methods	Frequency (duration)	Content	Teachers
Lectures	4 (1-h)	Pathophysiology Assessment Pharmacotherapy Behavioral therapy/Alternative treatments	Core faculty
Small group, case-based seminars	2 (1.5-h)	Videotaped interviews of patients in pain from a range of cultural and socioeconomic backgrounds in a variety of clinical settings, discussion of attitudes and beliefs, role play practice of skills	Multidisciplinary faculty pairs
Formative OSCE	1 (1/2 day)	3 cases: Acute (neck) pain Chronic (back) pain Terminal (metastatic bone) pain Assessment domains: Assessment of pain Negotiation of a treatment plan	Standardized patients (individualized feedback based on behaviorally anchored checklists)

2. Methods

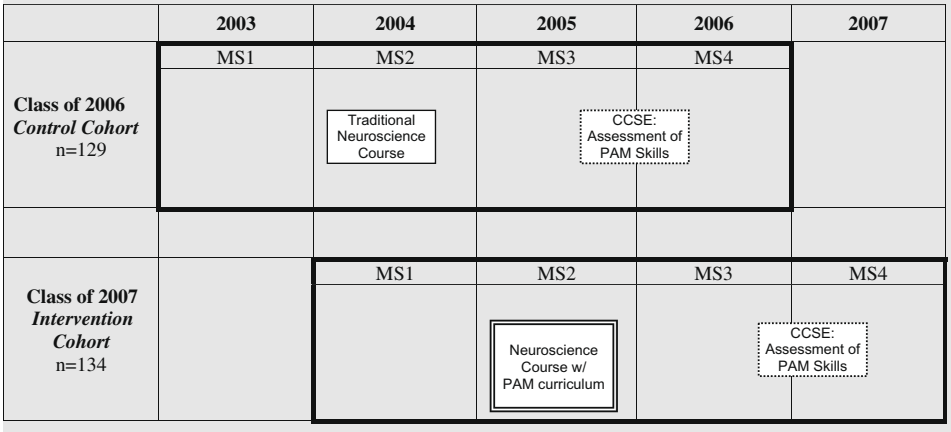
2.1. Study population

The study population was medical students at NYUSOM. The intervention cohort was the Class of 2007 (n = 159), who participated in the PAM curriculum during their 2nd year, 134 of whom gave informed consent (consent rate = 84.3%) to have their performance data included in this study. The historical control cohort was the Class of 2006 (n = 174, 129 consented, rate = 74.1%). While the Class of 2006 did receive lectures covering some of the PAM content (e.g. Pharmacology of Narcotic Analgesics), they did not receive a skills-targeted PAM curriculum. This study was approved by the Institutional Review Board of the School of Medicine.

2.2. Intervention

We used a systematic approach to curriculum development [10], assessing the baseline curriculum and conducting a literature review to specify goals, learning objectives and identify effective instructional methods appropriate to those goals [1,4,5,11–19]. The resulting Pain Assessment and Management (PAM) required curriculum consisted of four lectures to convey the relevant knowledge (e.g. pain pathophysiology, assessment, and pharmacotherapy as well as behavioral therapy and alternative treatments) and model skills; two 1.5-h faculty-facilitated small group seminars consisting of 15 students; and a 3-station formative Objective Structured Clinical Exam (OSCE) which was carefully designed to introduce students to three exemplar patients and provide additional skills practice and individualized feedback. Time for this 8-h module was allocated through restructuring of the Neuroscience course and consolidating redundant material, with no extra curricular time added. The case-based small group seminars were taught, when possible, by multidisciplinary faculty pairs of either a General Internist or General Pediatrician and a Pain or Palliative Care Specialist (MD or RN). To trigger discussion exploring student attitudes toward patients in pain we showed brief videotaped interviews with real patients from a range of cultural and socioeconomic backgrounds in both inpatient (post-operative and medical units) and outpatient clinical settings. In these seminars basic communication skills were practiced using role play. At the end of the module each student rotated through a 3-station OSCE, in which trained actors (Standardized Patients, SPs) portrayed patients with acute (neck), chronic (back) and terminal (metastatic bone) pain. In each case students were prompted to perform the following tasks: assessment of patient's pain, development of a therapeutic relationship, emotion handling and negotiation of a treatment plan. SPs evaluated the students' performance using behaviorally anchored checklists and provided verbal, individualized formative feedback. There was no faculty member observing the interactions. The PAM curriculum is detailed in Tables 1a and 1b.

Table 1b
Pain assessment and management curriculum evaluation design.



2.3. Assessment and measures

At the end of their 3rd year, all medical students at NYU SOM are required to participate in a high-stakes, summative OSCE, known as the Comprehensive Clinical Skills Examination (CCSE). The CCSE consists of 8 different stations; at each station, the student has 15 min to take a focused history, perform relevant physical examinations, establish differential diagnoses and do an initial workup. After the encounter, the student is given 10 min to complete a patient note (graded by faculty) while the SPs rate the student's performance using a detailed, behaviorally specific checklist. Three of the eight patient cases in CCSE focus on pain complaints. Performance in these cases was therefore expected to reflect the effectiveness of the PAM curriculum. While the demographic details of the CCSE pain cases differed distinctly from the cases that were part of the PAM curriculum OSCE (as did the actors who portrayed them), the tasks students were asked to perform, the time allowed for those tasks, the nature of the pain syndrome (acute, chronic, and terminal) and the skills assessed were the same in both OSCEs.

The CCSE provides a robust assessment of students' communication, history gathering and physical examination skills across cases. Our SP checklists are built on a validated approach to assessing communication skills [8,20] which has been proven reliable (Cronbach's alphas for subsets of items consistently range .75–.90). Checklist items are grounded in specific anchors representing three categories of performance for the indicated behaviors: "not done", "partly done", and "well done". The same set of communication checklist items are used for all cases; history gathering and physical examination are assessed based on items specific to each case. In the three CCSE pain cases, PAM skills were assessed within the domain of history gathering. Table 2 provides a full description of the PAM items assessed, including the behavioral anchors for "not done", "partly done", and "well done" ratings, as well as details on the three cases (acute, chronic and terminal pain) in which PAM skills were assessed. Both the abdominal and chest pain cases involved acute pain and therefore focused only on basic pain assessment skills. The shoulder pain case involved a woman with metastatic bone cancer and therefore called for the student not only to assess the patient's ongoing pain but also to work with her on pain management; these skills are therefore labeled as "advanced" PAM skills.

Students gave informed consent to have their de-identified performance data analyzed in aggregate. In addition, students consented to allow us access to their undergraduate grade point average (GPA), Medical Colleges Admissions Tests scores (MCAT), United States Medical Licensing Exams Step 1 and Step 2 Knowledge test scores and nationally standardized exam (Shelf exam) grades from seven required clerkships. These data were obtained from the school registrar.

2.4. Evaluation design

Table 1b illustrates the timing of the PAM curriculum for the intervention group and that of the CCSE for both the intervention and control groups.

2.5. Analyses

We conducted cross tabulations for each of the relevant PAM checklist items within each of the three CCSE pain cases to describe the distribution of "not done", "partly done" and "well done" ratings for the two cohorts. Chi-square statistics were used to assess the significance of differences in the distributions between the cohorts. Admissions data (undergraduate GPA, MCAT scores), medical knowledge data (shelf exam scores, USMLE Steps 1 and 2) and

Table 2
Third year medical student comprehensive clinical skills exam: pain assessment and management skills checklist.

Checklist items	Checklist anchors			Cases	
	Not done	Partly done	Well done		
Basic skills					
Obtained basic description of pain: Location, duration, quality, intensity	Did not ask	Obtained information on 1–2 pain characteristics	Obtained information on 3–4 pain characteristics; used open-ended and/or follow-up questions to elaborate	Abdominal pain (acute) *Patient profile:* Professional female, 38 year old, in hospital gown, sitting on an exam table, bent forward clutching abdomen	Chest pain (acute) *Patient profile:* Male, 60 year old, in hospital gown, lying back on a stretcher; sweating, writhing in pain
Asked additional pain information: Radiation and what worsens	Did not ask	Inquired only about radiation OR what makes worse	Inquired about BOTH radiation and what makes worse	*Student tasks:* • Take a focused history • Perform an abdominal exam • Establish differential diagnosis/es and initial workup	*Student tasks:* • Take a focused history • Perform cardiovascular, pul. exams • Establish differential diagnosis/es and initial workup • Interpret EKG, chest X-ray
Advanced skills				Shoulder pain (chronic pain associated with metastatic cancer)	
Asked about current pain medication: Name, dose, freq	Did not ask about pain medication	Asked only name of medication; did not quantify dose or frequency	Asked name of medication AND quantified amount (either dose or frequency)	*Patient Profile:* Female, 62 year old, in hospital gown, sitting on a chair. Appears tired (not slept well) and somewhat uncomfortable	
Advanced skills					
Asked about impact of shoulder pain on functioning	Did not ask	Asked only generally or for 1 life domain	Asked specifically about impairment in at least 2 life domains	*Student Tasks:* • Take a focused history • Perform a focused exam of the upper extremity • Strategize a pain management plan • Establish differential diagnosis/es and initial workup	
Advised need for a different medication	Did not advise	Agreed to new med; BUT no specific recommendation	Agreed to new med and made a specific recommendation		
Provides additional counseling on pain medication	Did not provide	Counseled about breakthrough pain OR constipation	Counseled about both breakthrough pain AND constipation		

overall communication and history-gathering skills as measured by the full 8-station CCSE were used to assess underlying differences between the two cohorts. Variables found to be significantly different were used as covariates in subsequent analyses (ANCOVAs) to adjust the mean PAM scores and therefore control for cohort differences. Initial power analyses based on our set sample sizes ($n > 120$ per cohort) suggest sufficient power (.80) to detect small-to-medium effect sizes (Cohen's eta squared $f > .03$) when comparing mean differences between the cohorts with four covariates in the ANCOVA [6]. Data on actual exposure to the curriculum are not available, although attendance was over 80% for most sessions. Our analysis is therefore intention to treat.

3. Results

Almost all students performed at a high level in the chronic (abdominal) pain case. The intervention cohort assessed acute (chest) pain more effectively than the control cohort. In the terminal (shoulder) pain case, students' ability to obtain a basic description of the pain did not differ by cohort. The intervention cohort consistently managed terminal pain more effectively than the control cohort, asking about the impact of the shoulder pain on functioning in more life domains, appropriately recommending a different pain medication and providing additional counseling on issues related to pain medication. More students in the *control* cohort asked about current medications than those in the intervention. Table 3 summarizes the data by case, divided into basic assessment and advanced management skills.

We explored whether the univariate differences may be due to underlying differences between the two cohorts in admissions academic data (undergraduate GPA, MCAT scores), medical knowledge (Step 1 and Step 2 exam scores, shelf exam scores) and communication and history-gathering skills (overall performance on the CCSE). Cohorts had slight differences in their Step 2 Clinical Knowledge Scores (control cohort mean = 228.74, SD = 20.20; intervention cohort mean = 234.01; SD = 18.18; $t = 2.21$, $p = .028$), their Neurology shelf exam scores (control cohort mean = 72.00, SD = 6.58; intervention cohort mean = 74.48, SD = 7.06; $t = 2.92$, $p = .004$) and in their overall OSCE (all eight cases) communication (control cohort mean = 61.6%, SD = 10.5%; intervention cohort mean = 54.6%, SD = 10.6%; $t = 5.38$, $p = 2.29$) and history-gathering skills (control cohort mean = 46.6%, SD = 8.6%; intervention cohort mean = 44.2%, SD = 8.5%; $t = 2.29$, $p = .023$). The intervention cohort performed slightly better on several knowledge assessments and slightly worse in clinical competence assessments based on patient notes.

The PAM scores of the cohorts were compared controlling for performance on Step 1 Clinical Knowledge and Neurology shelf exams and the communication and history-gathering domains of the CCSE by entering these as covariates in an ANCOVA model. Table 4 provides the mean PAM scores adjusted for students' scores on the covariate variables. Overall, adjustment slightly attenuated the differences between the cohorts and did not change the direction or magnitude of the effects. Basic assessment skills in the context of acute and chronic pain were scored as percent "well done" given that almost all students performed these skills regardless of cohort. The more advanced skills assessed in the terminal pain case were scored on the basis of being done at all (percent "partly done" or "well done"). After controlling for cohort differences, the intervention cohort significantly outperformed the control cohort in acute pain basic and terminal pain advanced pain management skills. The latter difference was quite large: on average, students in the control cohort group were rated as having "done" (partly or well)

Table 3
Distribution of responses: OSCE checklist assessment of pain assessment and management skills (%).

Pain assessment and management skills	Cohort	Checklist items (%)			Chi-square
		Not done	Partly done	Well done	
Chronic pain (abdominal): basic assessment					
Obtained basic description of pain	Control ($n = 129$)	0	3.9	96.1	.81
	Intervention ($n = 134$)	0	1.9	98.1	$p = .367$
Asked additional pain information	Control ($n = 129$)	.8	4.7	94.6	15.23
	Intervention ($n = 134$)	.9	21.3	77.8	$p < .001$
Acute pain (chest): basic assessment					
Obtained basic description of pain	Control ($n = 129$)	0	24.0	76.0	4.82
	Intervention ($n = 134$)	0	12.8	87.2	$p = .028$
Asked additional pain information	Control ($n = 129$)	4.7	34.4	60.9	5.85
	Intervention ($n = 134$)	1.8	22.9	75.2	$p = .051$
Terminal pain (shoulder): advanced assessment					
Obtained basic description of pain	Control ($n = 129$)	0	7.1	92.9	.11
	Intervention ($n = 134$)	0	8.3	91.7	$p = .736$
Asked about current pain medication	Control ($n = 129$)	.8	23.6	75.6	11.15
	Intervention ($n = 134$)	.9	44.0	55.0	$p = .004$
Terminal pain (shoulder): advanced pain management					
Asked about impact of shoulder pain on functioning	Control ($n = 129$)	74.2	15.6	10.2	7.21
	Intervention ($n = 134$)	59.3	29.6	11.1	$p = .027$
Advised need for a different medication	Control ($n = 129$)	61.3	5.6	33.1	101.02
	Intervention ($n = 134$)	2.8	45.0	52.3	$p < .001$
Provides additional counseling on pain medication	Control ($n = 129$)	73.0	11.9	15.1	19.23
	Intervention ($n = 134$)	45.0	22.9	32.1	$p < .001$

Table 4
Comparison between control (Class of 2006) and intervention cohort (Class of 2007): mean scores in OSCE pain assessment and management skills controlling for cohort differences.

Pain assessment and management skills	Score basis	Mean[a]% (Std error)		F	p	Effect size eta squared[b]
		Control cohort $n = 129$	Intervention cohort $n = 134$			
Chronic pain (abdominal)						
Assessment skills	% Well done	95.4% (1.9%)	88.1% (2.0%)	6.54	.011	.03
Acute pain (chest)						
Assessment skills	% Well done	66.5% (2.9%)	82.8% (3.1%)	13.52	<.001	.06
Terminal pain (shoulder)						
Assessment skills	% Done or well done	99.7% (.4%)	99.4% (.5%)	.18	.676	.02
Advanced pain management skills	% Done or well done	28.8% (2.7%)	54.3% (3.0%)	39.5	<.001	.15

[a] Means adjusted for the following covariates: USMLE Clinical Knowledge Score, Neurology Shelf Exam, Overall OSCE Communication Score, Overall OSCE History Gathering Score.

[b] This number is interpreted as the proportion of variance in the assessment skills attributed to control or intervention group assignment.

less than a third of the relevant pain management skills (28.8%, SE 2.7%) whereas intervention cohort students performed more than half of the pain management skills (54.3%, SE 3.0%) assessed in the terminal pain case (effect size Cohen's Eta-squared = .15) [6]. The cohorts did not differ in their advanced assessment skills (shoulder pain): students, on average, performed virtually all of the relevant assessments (mean > 99.4% for both cohorts).

4. Discussion

Not surprisingly, by the time medical students complete all their core required clerkships they are consistently able to demonstrate the ability to assess pain location, duration, quality and intensity in patients with chronic and terminal pain syndromes (less so when the pain is acute). Most students at this level also remember to assess pain radiation, aggravating and relieving factors, ask about pain medication—including class of drug, dose and frequency—*regardless* of whether they have received a comprehensive, intensive and experiential PAM curriculum. Where the PAM curriculum is likely to have made a long-term impact is on student's ability to apply a systematic approach to patients with terminal pain—assessing impact of pain on function, counseling around needed changes to an ineffective medicine regimen, and providing additional pain medication counseling (e.g., recommending a standing long-acting narcotic analgesic with additional dosing for breakthrough pain, non-pharmacologic approaches to pain reduction). It is these skills that are probably least likely to be reinforced during the largely inpatient care experiences students have during the clerkship year.

Unexpectedly, students in the control cohort demonstrated asking about current medication in the setting of terminal pain at a significantly higher rate. Given the 15 min time constraint of the CCSE stations, we suspect that intervention students may have allotted more time to advanced PAM skills to the detriment of exploring current medication. Control group students, who did not perform the advanced skills at a high rate, would have had more time to spend in familiar territory of asking a detailed medication history, thereby getting more credit. This finding could be an example of what is known as expertise reversal effect. In this phenomenon, when instruction or assessment is designed to measure novice-level skills, students with greater expertise appear to under-perform because they skip steps as a result of more automatic or intuitive reasoning ability [9]. Clearly more needs to be done to explore these unexpected findings. We are now using Unannounced SPs with our residents to explore whether these tradeoffs are an artifact of the testing situation or translate to actual care of patients even when time is a little more flexible.

Pain is a complex and omnipresent medical symptom. Navigating the pain issues in patient encounters is a perennial challenge for physicians and trainees, and the creation of a curriculum that imparts a thorough, skills-oriented, practical and compassionate approach to managing pain is of great importance for medical education. Our findings support that such curricula, even when implemented in the preclinical years of medical school, can be effective and should include active, clinically compelling instructional methodologies complemented by individualized practice with feedback. This deliberative rehearsal process is critical to long-term retention of learning because it provides the time and context needed for learners to create their own clinically meaningful routines and habits. Such a process is necessary for both the integration of new knowledge into long-term memory and the creation of working clinical schema that expertise theorists tell us are essential for the development of clinical judgment and competence [3,7]. While previous studies have shown that pain curricula improve pain assessment and management skills immediately after the curricular intervention [1,4,5,16,18,19] our work demonstrates that this learning can persist.

Limitations to our research include, foremost, the study design that compared our intervention group with an historical cohort. Although there were no substantive baseline differences between the two cohorts and there was no major shift in the enrollment policies of the medical school during this time period, the possibility exists that the learners in these consecutive classes in our medical school have a confounding and unknown reason for their differing OSCE performance. Over the past decade or two there has been a secular trend nation-wide toward increasing awareness of the need to assess and address pain; however, there is no reason to believe this would have affected the intervention cohort more than the prior years' students. Except for the curriculum described, no new additional curriculum was implemented with either cohort and there were no new campaigns regarding pain assessment and management in our teaching hospitals. This is a study of only one urban medical school. For that reason, the results of our study may not be generalizable to all medical schools. Finally, this study is not capable of speaking to the effect of our curriculum on clinical practice outside of standardized patient testing situations.

Ultimately, what is critical is that the positive impact our curriculum has shown on PAM skills of medical students translates to actual patient care practice. The fact that we have demonstrated long-term retention of these skills is promising in this regard. Future research would need to address the limitation of our single-institution, sequential cohort design by creating a controlled trial of learners from the same class of medical students, include multiple institutions and follow subjects longitudinally to assess real patient outcomes. Though this approach would be methodologically complex and costly, if a preclinical educational intervention in medical school could be linked to better patient care in practice it would be worth the investment because it would provide the evidence needed to guide medical education policy and practice.

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References

[1] Allard P, Maunsell E, Labbe J, Dorval M. Educational interventions to improve cancer pain control: a systematic review. J Palliat Med 2001;4:191–203.
[2] Cassell EJ. Diagnosing suffering: a perspective. Ann Intern Med 1999;131:531–4.
[3] Charlin B, van der Vleuten C. Standardized assessment of reasoning in contexts of uncertainty: the script concordance approach. Eval Health Prof 2004;27:304–19.
[4] Chen I, Goodman B, Galicia-Castillo M, Quidgley-Nevares A, Krebs M, Gliva-McConvey G. The EVMS pain education initiative: a multifaceted approach to resident education. J Pain 2007;8:152–60.
[5] Cohen IT, Bennett L. Introducing medical students to paediatric pain management. Med Educ 2006;40:476.
[6] Cohen J. Statistical power analysis for the behavioral sciences. Rev. ed. New York: Academic Press; 1977.
[7] Ericsson KA. Deliberate practice and the acquisition and maintenance of expert performance in medicine and related domains. Acad Med 2004;79:S70–81.
[8] Kalet A, Pugnaire M, Cole-Kelly K, Janicik R, Ferrara E, Schwartz MD, Lipkin M, Lazare A. Teaching communication in clinical clerkships: models from the Macy Initiative in Health Communications. Acad Med 2004;79:511–20.
[9] Kalyuga S, Ayres P, Chandler P, Sweller P. The expertise reversal effect. Educ Psychol 2003;38:22–31.

[10] Kern DE, Thomas PA, Howard DM, Bass EB. Curriculum development for medical education: a six-step approach. Baltimore (MD): The Johns Hopkins University Press; 1998.
[11] Lasch K, Greenhill A, Wilkes G, Carr D, Lee M, Blanchard R. Why study pain? A qualitative analysis of medical and nursing faculty and students' knowledge of and attitudes to cancer pain management. J Palliat Med 2002;5:57–71.
[12] Niemi-Murola L, Heasman P, Pyörälä E, Kalso E, Pöyhiä R. Training medical students to manage a chronic pain patient: both knowledge and communication skills are needed. Eur J Pain 2006;10:167–70.
[13] Mitka M. "Virtual textbook" on pain developed: effort seeks to remedy gap in medical education. JAMA 2003;290:2395.
[14] Niemi-Murola L, Nieminen JT, Kalso E, Poyhia R. Medical undergraduate students' beliefs and attitudes toward pain: how do they mature? Eur J Pain 2007;11:700–6.
[15] Roper Starch Worldwide Inc. Chronic pain in America: roadblocks to relief. Study conducted for American Academy of Pain Medicine, American Pain Society and Janssen Pharmaceutica; 1999.
[16] Sloan PA, Plymale M, LaFountain P, Johnson M, Snapp J, Sloan DA. Equipping medical students to manage cancer pain: a comparison of three educational methods. J Pain Symptom Manage 2004;27:333–42.
[17] Upshur CC, Luckmann RS, Savageau JA. Primary care provider concerns about management of chronic pain in community clinic populations. JGIM 2006;21:652–5.
[18] Ury WA, Rahn M, Tolentino V, Pignotti MG, Yoon J, McKegney P, Sulmasy DP. Can a pain management and palliative care curriculum improve the opioid prescribing practices of medical residents? JGIM 2002;17: 625–31.
[19] Watt-Watson J, Hunter J, Pennefather P, Librach L, Raman-Wilms L, Schreiber M, Lax L, Stinson J, Dao T, Gordon A, Mock D, Salter M. An integrated undergraduate pain curriculum, based on IASP curricula, for six health science faculties. Pain 2004;110:140–8.
[20] Yedidia MJ, Gillespie CC, Kachur E, Schwartz MD, Ockene J, Chepaitis AE, Snyder CW, Lazare A, Lipkin M. Effect of communications training on medical student performance. JAMA 2003;290:1157–65.