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Lessons Learned From the Liver About the Undergraduate to Graduate Medical Education Transition

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ABSTRACT

The burden of cirrhosis and chronic liver disease is growing, yet there is a projected worsening deficit in hepatology providers. As such, cirrhosis and liver disease have been important inclusions within the core curricula of Internal Medicine. Formal assessments of provider preparedness resulting from the curriculum are lacking though. Prior studies have demonstrated that exposure to cirrhosis in undergraduate medical education is insufficient, as are learner comfort and self-reported knowledge levels. These findings are further corroborated by a multicenter survey of incoming Internal Medicine interns showing that subjective comfort with and objective knowledge of various liver disease topics are lacking compared to other common Internal Medicine topics. This paper also demonstrates how similar surveys may be used to identify additional topics that may require adjustments for curricular improvement.

The creation and maintenance of a national Internal Medicine (IM) core curriculum has been a herculean task that started in 1995 as a joint effort between the Clerkship Directors of Internal Medicine (CDIM) and Society of General Internal Medicine (SGIM)[1] and now is in its fourth version.[2] The authors of this version, which was published in 2022, wrote, "*Medical educators benefit from an updated standardized national curriculum that meets societal needs…*" One clear example of this principle in action is the inclusion of cirrhosis and liver disease in the various iterations of the curriculum. While these topics have often been attributed to the purview of the subspecialty of hepatology, increasing recognition of the substantial societal burden of cirrhosis has justified its ongoing incorporation. Within North America, the prevalence of cirrhosis has doubled over the past 2 decades,[3] and the annual hospitalization rate is increasing much more rapidly compared to congestive heart failure (CHF) and chronic obstructive pulmonary disease (COPD) (Figure 1).[4] These trends are only expected to worsen with the obesity, alcohol, and opioid epidemics.[3,5,6] Alarmingly, as the burden of cirrhosis grows, the number of hepatology providers to care for these patients faces a critical shortage. There was a projected 10% deficit in 2023, which is expected to grow to 35% by 2033.[7] Thus, it is critical that all physicians are comfortable and knowledgeable in managing various aspects of cirrhosis to address this already large and growing burden.

The authors of the fourth version of the national IM core curriculum go on to write, "*Medical educators benefit from an updated standardized national curriculum that prepares the future IM workforce.*" Implicit within this statement is that, as with all curricula, its efficacy needs to be assessed. However, interestingly, for as much effort has been dedicated to defining the content of the curriculum, much less has been devoted to assessing preparedness resulting from the curriculum. This task has become highly relevant as The Coalition for Physician Accountability's Undergraduate Medical Education-Graduate Medical Education Review Committee (UGRC) has published a comprehensive improvement of the

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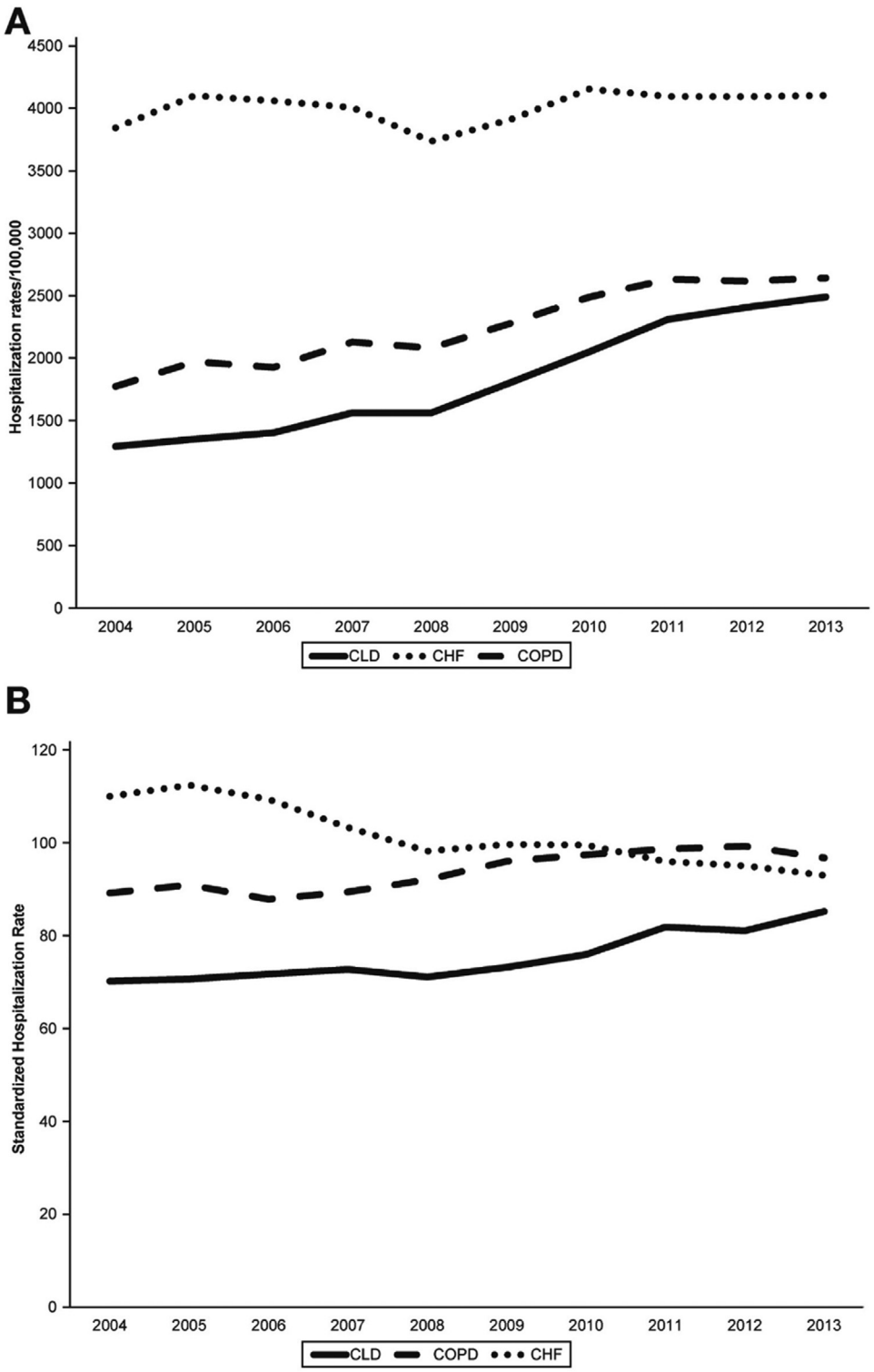

Figure 1. (**A**) Absolute rates for CLD-, CHF-, and COPD-related hospitalizations (per 100,000 hospitalizations), 2004-2013. (**B**) Standard hospitalization rates for CLD-, CHF-, and COPD-related hospitalizations, 2004-2013. CHF = congestive heart failure; CLD = chronic liver disease; COPD = chronic obstructive pulmonary disease. *Reprinted with permission from Elsevier*.

Undergraduate Medical Education (UME)-Graduate Medical Education (GME) transition.[8] Furthermore, in response to this document, the Association of American Medical Colleges (AAMC), the American Association of Colleges of Osteopathic Medicine (AACOM), and the Accreditation Council for Graduate Medical Education (ACGME) are cosponsoring an initiative to create a common set of foundational competencies for use in medical schools in the United States, which in draft form includes subcompetencies focused on medical knowledge and patient care.[9] Given the sheer size of the content included in the national IM core curriculum (82 topics), assessments likely need to occur at the level of individual core topics. This work has already begun for the core topic of cirrhosis. Although the results are not promising, they highlight ways to approach UME's effectiveness in teaching and instilling preparedness for other core topics in the curriculum.

First, the available data suggests exposure to cirrhosis during UME is inadequate. One survey of medical school leadership approximated that only 8.4% of third- and fourth-year medical students received dedicated exposure (in the form of an inpatient hepatology service, an inpatient gastroenterology and/or hepatology consult service, or hepatology clinic) to liver disease in the clinical learning environment.[10]

Table 1
Mean Comfort Levels for Managing Various Medical Conditions Compared to Congestive Heart Failure.

Topic	Mean Likert score (1 = not at all comfortable; 5 = very comfortable) $n = 172$	*P* value
CHF	3.5	
Pneumonia	3.7	.005
NSTEMI	3.4	.22
COPD	3.3	.079
Abnormal Liver Tests	3.2	.01
Altered Mental Status	3.1	<.001
Ascites	3.0	<.001
SBP	3.0	<.001
Hepatic Encephalopathy	2.8	<.001
Alcohol-associated Liver Disease	2.8	<.001
Cirrhosis	2.7	<.001
NAFLD	2.6	<.001
HIV	2.3	<.001
HCV	2.1	<.001
HBV	2.1	<.001

CHF = congestive heart failure; *COPD* = chronic obstructive pulmonary disease; *HBV* = hepatitis B virus; *HCV* = hepatitis C virus; *HIV* = human immunodeficiency virus; *NAFLD* = nonalcoholic fatty liver disease; *NSTEMI* = non-ST-elevation myocardial infarction; *SBP* = spontaneous bacterial peritonitis.

In a small cohort of recently graduated medical students representing 30 different medical schools with a 100% response rate, 98% agreed that hepatology is an integral component of IM training, but only 42% felt their hepatology education during medical school was sufficient and only 22% reported dedicated clinical exposure to liver disease.[11] In a follow-up, anonymous, Institutional Review Board (IRB)-exempt survey of incoming interns in 9 IM residency programs (Baylor College of Medicine, John H. Stroger Hospital of Cook County, Massachusetts General Hospital, Mayo Clinic, University of California San Diego, University of Chicago, University of Colorado, University of Illinois Chicago, and University of Wisconsin-Madison), this deficit was confirmed: of 172 respondents (38% response rate), 82% agreed that chronic liver disease is integral to UME, but only 67% and 56% agreed that they had sufficient preclinical and clinical exposure, respectively, as compared to 91% and 87% for cardiopulmonary diseases, respectively (unpublished).

Second, comfort and knowledge with managing cirrhosis do not seem to be robust. Only 32% of a smaller cohort of recent medical school graduates within a single residency program reported comfort in managing cirrhosis, and only 30%-44% self-reported moderate/strong knowledge of topics such as spontaneous bacterial peritonitis (SBP), hepatic encephalopathy, alcohol-associated hepatitis, esophageal varices, and ascites.[11] These findings were further corroborated within the aforementioned larger cohort, as comfort levels with several other IM topics (eg, pneumonia, COPD) were comparable to CHF, but cirrhosis, its complications, and its associated etiologies were lower (Table 1). Interestingly, other core topics from the IM curriculum (eg, altered mental status, HIV) were also lower, confirming that other topics may need to be analyzed with similar approaches. Also, only 52% of this cohort answered a validated multiple-choice question derived from the Medical Knowledge Self-Assessment Program (MKSAP) 18 on SBP correctly, while 85% answered a COPD question correctly (unpublished). This is comparable to the previously published performance of 46%-65% of students correctly answering MKSAP 16 questions on SBP treatment, acute kidney injury in cirrhosis, alcohol-associated hepatitis, and nonalcoholic steatohepatitis.[11] Finally, this lack of comfort and knowledge with liver disease reported in medical school was also shown to persist into the second and third years of IM residency training but was overcome with increased clinical exposure.[12]

Although limited by smaller sample sizes, unpublished data, and potential recall bias of students, the sum of these data suggests that cirrhosis and its complications are being disproportionately underemphasized in UME as compared to other topics, such as cardiopulmonary diseases. Novel ways to standardize the approach to learning about this core IM topic in clerkships are needed, keeping in mind that many institutions do not have dedicated services for hepatology-focused care. Further, cirrhosis may not be the only core medical education topic that is affected. As described above, graduates from UME learning environments are lacking comfort with other topics in the IM curriculum too. Thus, similar work as has been done for cirrhosis is needed for other core topics, especially given the increasing analysis of the UME-GME transition, which includes examination of medical knowledge on core IM topics. However, to do this, consensus and coordinated efforts will be needed on the best mechanism to broadly assess the content and efficacy of various UME learning environments. Several options include the AAMC's Annual Graduation Questionnaire, which tends to not be specialty-focused; the Alliance for Academic Medicine's (AAIM) Clerkship Director Survey, which does not allow for assessments of the learner's perspective; the UME-GME individualized learning plans, which currently lack centralized collection processes; performance of incoming interns on the In-Training exam,[12] which does not allow for subjective assessments; or, as the collective work described here demonstrates, the direct surveying of incoming residents at various residency programs, which inherently represents a diverse group of medical school experiences but is limited by recall bias.

In conclusion, clearly defining core IM topics in a national curriculum has successfully standardized the focus of UME educators to mirror the needs of society. But as we have learned from liver disease, the medical education community now needs to shift its focus to assessing preparedness of UME learners to identify topics necessitating widespread improvement.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

CRediT authorship contribution statement

Alexander Y. Pan: Writing – review & editing, Writing – original draft, Visualization, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Pedram J. Khorsandi:** Conceptualization. **Jeanne M. Farnan:** Conceptualization. **Margarita N. German:** Investigation. **Pranab M. Barman:** Investigation. **Madeline A. Berschback:** Investigation. **Michael Kriss:** Writing – review & editing, Investigation. **Ross McMillan:** Investigation.

Omar Mousa: Investigation. **Frederick B. Peng:** Investigation. **Tejinder Randhawa:** Investigation. **Kamilah Scales:** Writing – review & editing, Conceptualization. **Adam E. Mikolajczyk:** Writing – review & editing, Writing – original draft, Visualization, Supervision, Project administration, Methodology, Investigation, Conceptualization.

References

1. CDIM-SGIM Core Medicine Clerkship Curriculum Guide: a resource for teachers and learners; 2006. Available at: https://www.sgim.org/File%20Library/SGIM/Communities/Education/Resources/OnlineCDIM-SGIM-Core-Media.pdf. Accessed January 12, 2024.
2. Zakowski LJ, Bennett NL, Chheda S, et al. Update and renewal of a national internal medicine curriculum for medical students: process and outcomes. *Am J Med*. 2022;135(11):1382–1386. doi:10.1016/j.amjmed.2022.07.011.
3. Moon AM, Singal AG, Tapper EB. Contemporary epidemiology of chronic liver disease and cirrhosis. *Clin Gastroenterol Hepatol Off Clin Pract J Am Gastroenterol Assoc*. 2020;18(12):2650–2666. doi:10.1016/j.cgh.2019.07.060.
4. Asrani SK, Kouznetsova M, Ogola G, et al. Increasing health care burden of chronic liver disease compared with other chronic diseases, 2004-2013. *Gastroenterology*. 2018;155(3):719–729 e4. doi:10.1053/j.gastro.2018.05.032.
5. Viral Hepatitis Surveillance Report—United States, 2019. Centers for Disease Control and Prevention; 2021. https://www.cdc.gov/hepatitis/statistics/2019surveillance/index.htm.
6. Hofmeister MG, Rosenthal EM, Barker LK, et al. Estimating prevalence of hepatitis C virus infection in the United States, 2013-2016: hepatology. *Hepatology*. 2019;69(3):1020–1031. doi:10.1002/hep.30297.
7. Russo MW, Fix OK, Koteish AA, et al. Modeling the hepatology workforce in the United States: a predicted critical shortage. *Hepatology*. 2020;72(4):1444–1454. doi:10.1002/hep.31425.
8. Coalition for Physician Accountability. The Coalition for Physician Accountability's Undergraduate Medical Education-Graduate Medical Education Review Committee (UGRC): recommendations for comprehensive improvement of the UME-GME transition. 2021. Available at: https://physicianaccountability.org/wp-content/uploads/2021/08/UGRC-Coalition-Report-FINAL.pdf. Accessed January 14, 2024.
9. Foundational competencies for Undergraduate Medical Education. Available at: https://engage.aamc.org/UME-Competencies-AAMC-ACGME-AACOM. Accessed January 14, 2024.
10. Pan AY, Feld LD, Farnan JM, Herrine SK, Mikolajczyk AE. The time is now for mandatory liver-focused clinical experiences in medical school. *Hepatol Commun*. 2019;3(6):847 -847. doi:10.1002/hep4.1338.
11. Pan AY, Zilberstein NF, Farnan JM, McConville JF, Mikolajczyk AE. Recently graduated medical students lack exposure to and comfort with chronic liver diseases. *Dig Dis Sci*. 2021. doi:10.1007/s10620-021-07182-0.
12. Mikolajczyk AE, Aronsohn AA, McConville JF, Jensen DM, Farnan JM. A call to action: the need for hepatology-focused educational interventions in Internal Medicine Residency training: Correspondence. *Hepatology*. 2015;62(2):655–656. doi:10.1002/hep.27591.