DE GRUYTERDiagnosis 2019; 6(2): 75–77

Editorial

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Diagnosis education - an emerging field

https://doi.org/10.1515/dx-2019-0029

There has been a longstanding need to improve how we teach diagnosis in health professions education programs. The substantial progress in the overlapping disciplines of clinical reasoning, cognitive psychology, and diagnostic error has yet to be translated into widespread curricular innovations. The methods we use to teach diagnosis to today's learners are strikingly similar to the approach used for decades: transfer of knowledge and "dwell time" in the clinical environment. In this special issue of *Diagnosis*, we celebrate scholars who have forged new approaches to promote diagnostic excellence and the reduction of diagnostic error through education. Their work represents the cutting edge of the emerging field of diagnosis education (Figure 1).

Three innovation reports in this issue integrate technology with traditional case-based learning. Kinnear and colleagues describe a workshop that introduces foundational concepts of Bayesian reasoning and demonstrates how to make these concepts actionable when seeing patients by using smartphone apps [1]. Goyal and colleagues describe how a time-honored tradition in medical education morning report - can make clinical reasoning explicit to learners and be enhanced and retooled to incorporate point-of-care ultrasound [2]. Their report illustrates how educators can integrate new technology with bedside medicine while engaging the patient in the diagnostic process. Altabbaa and colleagues examine an underused resource in diagnosis education: simulation [3]. The authors present a novel scenario design and debriefing process to educate learners about cognitive and systems pitfalls in diagnosis.

Nearly all innovations, however, share one fundamental, rate-limiting resource – teachers who are prepared to implement them. Grubenhoff and colleagues identify knowledge gaps among faculty about cognitive biases as well as their limited comfort in discussing diagnostic errors [4]. Schaye and colleagues describe a faculty development program in which teachers learned clinical reasoning concepts and then trialed their new skills with immediate feedback [5]. The authors go beyond self-efficacy measures and show a significant improvement of teaching performance through a group objective structured teaching exercise (GOSTE). This report underscores how we must apply the same rigor to evaluating faculty

development programs that we do to evaluating curricula for learners. Iyer and colleagues remind us of the importance of developing residents as clinicians *and* teachers through their curriculum on clinical reasoning [6]. Clinicians have to navigate diagnostic uncertainty with their patients, but clinicians-educators must also discuss diagnostic uncertainty with their learners. In their commentary, Santhosh and colleagues identify challenges to addressing diagnostic uncertainty and propose a novel framework to aid learners, faculty, and patients in maneuvering through uncertainty in the diagnostic process [7].

All fields of study are built on a foundation of basic science which generates new theories and insights. McBee and colleagues used think aloud protocols to delineate the clinical reasoning tasks of medical students and found that medical students verbalize reasoning tasks in purposeful but non-sequential patterns [8]. This finding suggests that effective clinical reasoning instruction may involve modeling and encouraging multiple pathways when solving a diagnostic problem. All theories need to be subjected to rigorous testing. Braun and colleagues conducted a series of experiments suggesting that scaffolding in diagnostic reasoning is ineffective at improving medical students' decision-making [9]. Kilian and colleagues question the effectiveness of a checklist, which is one form of the "diagnostic timeout" - a mainstay of many patient safety initiatives [10]. While these studies are not definitive, they do emphasize our field's obligation to establish which theory-derived practices are effective by empirical study rather than by belief or anecdote alone.

Diagnosis education curricula are developed with the goal of improving learners' diagnostic performance, and this too requires empiric testing. Bonifacino and colleagues created a brief clinical reasoning curriculum for internal medicine clerkship students, and in a pseudorandomized design, show that a fundamental workplace activity for all medical students – documenting diagnostic reasoning in the admission note – was improved among students who participated in the curriculum [11]. Howard-Anderson and colleagues extend the study of diagnosis to a real-world setting, showing that the diagnostic steps medical residents take when evaluating a febrile patient at night are heavily influenced by sign-out instructions from a colleague, highlighting how diagnosis, like much of medicine, is a social process [12].

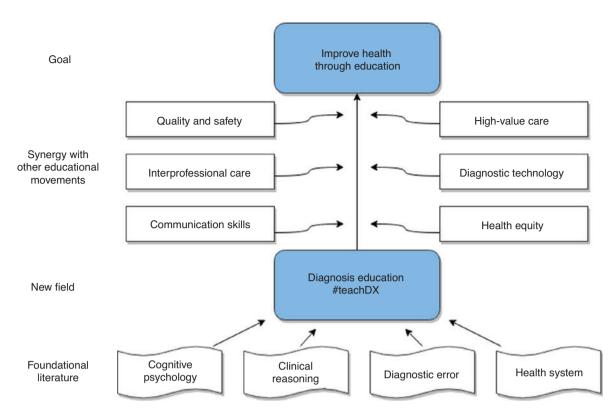


Figure 1: Diagnosis Education in the landscape of Health Professions Education – built on many areas of study, diagnosis education will be most effective in synergy with other emerging fields.

Teachers can find inspiration and synergy with other fields that are not traditionally aligned with diagnosis and clinical reasoning education. Lewis and colleagues highlight the limited teaching about diagnostic error in emergency medicine training programs and suggest that diagnostic error can be integrated with medical liability, quality assurance, and risk management instruction [13]. Radhakrishnan and colleagues apply the novel lens of a manufacturing and quality improvement paradigm (lean) to describe the diagnostic process for medical students [14]. Viewing diagnosis through the perspectives of different fields may prove to be a highly effective way to instill and reinforce diagnostic excellence and error mitigation.

What diagnosis education articles do we hope to see in the future? (Figure 2). We eagerly anticipate expansion of many of the ideas presented in this special issue. However, we must ensure that teaching and learning about diagnosis is not a niche topic for which a committed few advocate amidst the many other worthy competing interests in health professions education. Diagnosis education is an interdisciplinary and evolving field that has origins in the clinical reasoning, cognitive psychology, diagnostic error, and health systems literature. Our community's ideas for improving diagnosis will reach more learners and have more impact if we forge curricular collaborations with other successful education movements,

Box 1: Educational initiatives of the Society to Improve Diagnosis in Medicine (SIDM).

- Virtual patient cases for undergraduate medical education in partnership with Aquifer
- Continuing professional development modules on diagnostic error in partnership with the American College of Physicians and the Society of Hospital Medicine
- Consensus Curriculum on Diagnosis, funded by the Josiah H. Macy, Jr Foundation, to transform diagnosis education through a competency-based, interprofessional approach
- Monthly #teachdx Twitter chats
- Education Precourses at the Diagnostic Error in Medicine Conference
- SIDM Assessment of Reasoning Tool
- SIDM Clinical Reasoning Toolkit
- SIDM Fellowship in Diagnostic Excellence



What is the future of diagnosis education?

- Synergy with other education movements (e.g. high-value care and interprofessional care)
- Empiric studies that question our current practices and theories (e.g. diagnostic timeouts, scaffolding)
- Innovations that break down silos (e.g. LEAN methodology)
- Diagnosis research "in the wild" in real-world clinical settings
- Faculty development programs that impart diagnosis education skills
- Assessment of technology that improves diagnosis and diagnosis education

Figure 2: Future directions for diagnosis education - we must continue to push the field forward through novel innovations and rigorous study.

such as high-value care, interprofessional education, and quality and safety. We must join forces with other groups that share the same goal of improving health through education.

Certainly, there is much work to do – diagnostic errors remain far too common. We hope the work of the teachers and scholars featured in this issue inspires and energizes our readers with the progress already being made.

Author contributions: All the authors have accepted responsibility for the entire content of this submitted manuscript and approved submission.

Research funding: None declared.

Employment or leadership: None declared.

Honorarium: None declared.

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