

Give the nose some credit: rationale for a need to include scent training in medical education

En-Dien Liao

Texas Tech University Health Sciences Center

Elleana Joy Majdinasab (✉ Elleana.majdinasab@ttuhsc.edu)

Texas Tech University Health Sciences Center

Christopher Q Le

Texas Tech University Health Sciences Center

Malvika Ramesh

Texas Tech University Health Sciences Center

Anu Satheeshkumar

Texas Tech University Health Sciences Center

Vadivel Ganapathy

Texas Tech University Health Sciences Center

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Abstract

Medical education largely overlooks the sense of smell in clinical training notwithstanding clear evidence that several diseases carry with them pathognomonic scents that can serve as diagnostic clues. We report here an observational cross-sectional study in which we assessed students' attitudes toward the utility of scent in the process of medical diagnosis as well as their competence and confidence in being able to apply recognition of odor to specific diseases in the clinical setting. We found that nearly 90% of medical students felt that formal incorporation of scent in their medical training would make them more competent physicians. However, approximately 80% of them did not feel confident using scent as a diagnostic aid. Currently, there is a lack of emphasis on the usefulness of the sense of smell in modern medical education, and in the study reported here, we consider the rationale for possible inclusion of olfactory exposure in clinical training.

Introduction

The sense of smell is vastly underutilized and overlooked throughout medical training. Basic science/clinical faculty and curriculums currently teach the use of sight, sound, and touch to shape clinical education into an intuitive experience. Interestingly however, there is a lack of emphasis on the potential usefulness of taste or smell in clinical training. This is surprising given the fact that many common diseases emit strong, pathognomonic odors that, with years of experience, clinicians anecdotally come to recognize and use as reliable clues toward determining the correct diagnosis. Examples include bacterial vaginosis, diabetic ketoacidosis, pseudomembranous colitis, chronic wounds, liver disease, and kidney disease.

Textbooks and professors make a point to verbally characterize pathognomonic odors with terms such as "fishy," "musty," "mousy," "grape-like," and "sickly-sweet" among others. So much so, that these adjectives become beloved "buzzwords" and "give-away clues" that students seek and recognize in the question stems of their licensing exams to pick the correct answer. However, students rarely, if ever, have the opportunity to formally experience and learn these odors before setting foot in the hospital/clinical setting. Even during clinical training, there is no guarantee that students will be exposed to and learn to associate scents to specific diseases. In the event that students do find themselves within odorous rooms, it may take multiple encounters of the same diagnosis for students to piece together a pattern. This could be secondary to preceptors not going out of their way to mention it and students finding it potentially ill-mannered to inquire about patients' odor.

In essence, there is a gap within the medical educational curriculum wherein students lack sufficient training in identifying medically relevant scents they will eventually face in their career while treating patients. Given this potential area for improvement, we were curious to see whether medical students' views and perception were consistent with such a gap. We distributed a survey to current medical students to assess their current level of scent training/proficiency and perceived importance of it. We hypothesized that the data would demonstrate student familiarity with specific diseases and their corresponding odors, but a lack of confidence in identifying them in clinical practice. Our goal in this investigation was to determine if such a deficiency in medical/clinical training does indeed exist and, if it does, to propose to the designers of medical curriculums to consider the value and implementation of scent exposure to students during their training. We anticipate that highlighting the added value of scent training to medical education may encourage future healthcare workers to consider the utility of smell when caring for patients.

Methods

This investigation was an observational, cross-sectional study. An Institutional Review Board (IRB)-approved survey was emailed to 720 students attending the medical school here at the Texas Tech University Health Sciences Center,

Lubbock, TX during the Summer of 2021. The survey's focus was to assess current student opinions regarding the use and utility of scent training in their medical curriculum. It was explained that their responses would be used to identify whether further emphasis on smell education in the medical curriculum could be clinically beneficial. Inclusion criteria included male and female medical students, PhD students, and graduate medical students between ages 18 to 65 attending Texas Tech University Health Sciences Center. Primary outcome data is the extent and quality of scent training currently present in medical education. Secondary outcome data is whether there is a need for formal olfactory exposure and training in our clinical educational systems.

Results

A total of 139 students responded to the survey. From the 139 students, 40 students were first-year medical students (MS1), 35 second-year medical students (MS2), 28 third-year medical students (MS3), 29 fourth-year medical students (MS4), and 7 other students, which included entering first-year medical students (MS0, n = 1), Graduate Medical Education students (GME, n = 4), PhD students (n = 1), and MD/PhD students (n = 1).

A clear majority of the participants (88.6%; 117/139) felt that formal training in the diagnostic utility of smell would help them become more competent physicians. When asked *"Do you feel with your current healthcare educational training that you can accurately make diagnoses based on medically relevant scents?"* 40.9% and 37.1% of all students reported not competent at all or slightly competent in using scents to accurately make a diagnosis, respectively. To the question *"Among the 5 senses, where would you rank the sense of smell in terms of importance in reaching a diagnosis?"* 27.3% of all students reported slight importance, 39.4% moderate importance, and 23.5% high importance. Distribution of the responses is shown in Fig. 1.

Students were then asked to self-assess competency in identifying odors related to specific diseases. 6.47% reported competence in identifying phenylketonuria (PKU, n = 9), 27.34% reported competence for diabetic ketoacidosis (DKA, n = 38), 14.39% for *C. difficile* (n = 20), 20.14% for *P. aeruginosa* (n = 28), 43.17% for skin necrosis (n = 60), and 38.13% for bacterial vaginosis (n = 53). Table 1 shows the reported competency among students in recognizing specific odors associated with certain diseases.

Table 1

Reported competency among students in recognizing specific odors. *Other group includes MS0 students, Graduate Medical Education students, PhD, and MD/PhD students.

Odor	Competency	No Competency	Percent Competency	Percent Competency Breakdown				
				MS1 (n = 40)	MS2 (n = 35)	MS3 (n = 28)	MS4 (n = 29)	Other* (n = 7)
Phenylketonuria (Mousy Odor)	9	130	6.47%	7.5% (n = 3)	11.43% (n = 4)	3.57% (n = 1)	3.45% (n = 1)	0% (n = 0)
Diabetic ketoacidosis (Fruity Odor)	38	101	27.34%	22.5% (n = 9)	28.57% (n = 10)	21.43% (n = 6)	41.38% (n = 12)	14.29% (n = 1)
<i>Clostridium difficile</i> (Horse Barn Odor)	20	119	14.39%	17.5% (n = 7)	11.43% (n = 4)	17.86% (n = 5)	10.34% (n = 3)	14.29% (n = 1)
<i>Pseudomonas aeruginosa</i> (Grape Odor)	28	111	20.14%	7.5% (n = 3)	31.43% (n = 11)	32.14% (n = 9)	13.8% (n = 4)	14.29% (n = 1)
Skin Necrosis (Foul Odor)	60	79	43.17%	37.5% (n = 15)	34.29% (n = 12)	39.29% (n = 11)	65.52% (n = 19)	75% (n = 3)
Bacterial Vaginosis (Fishy, Foul Odor)	53	86	38.13%	27.5% (n = 11)	31.43% (n = 11)	42.86% (n = 12)	58.62% (n = 17)	28.57% (n = 2)

Discussion

The results from our study show significant student interest in olfactory training, with almost 90% of students believing such exposure would make them more competent physicians. Yet, despite being able to connect “textbook” descriptions of odors to medical diagnoses, our study suggests that most medical students do not feel comfortable utilizing smell for diagnostic purposes, despite seeing a large potential for its use in their future practices. 78% of students felt either slightly competent or not competent at all in making accurate diagnoses when presented with a medically relevant scent. 62.9% of students ranked the sense of smell as either of moderate or high importance in the process of reaching a diagnosis. Therefore, we argue that there is a need for specific, targeted training in recognizing medically relevant scents. We propose that healthcare educational institutions consider the implementation of smell training into their existing curricula. It was interesting to note that for certain diseases, namely diabetic ketoacidosis, skin necrosis, and bacterial vaginosis, fourth-year medical students’ competencies just about doubled upon comparison to their first- and second-year counterparts. Though the reason could be the strong odor associated with these conditions, one might expect similar results for pseudomembranous colitis caused by *Clostridium difficile*, whose competencies remained stable among all years. It is likely that diabetic ketoacidosis, skin necrosis, and bacterial vaginosis are extremely commonplace in both the clinic and hospital setting, more so than pseudomembranous colitis, and students were able to make strong associations during their clinical rotations through repeated exposure. As expected, competencies were lowest for the musty/mousy odor of phenylketonuria as the disorder is very rare and unlikely to be encountered.

Smell is often overlooked as an important clinical skill (Hayden, 1980). Yet, smell has been used in clinical education settings in the past. A “sniffing bar” was created at one time to train clinicians in emergency department settings to correctly recognize and treat ingestion of lethal toxic substances before lab identification is performed (Goldfrank et al., 1982). More recently, there has been interest in creating a diagnostic electronic nose. There is exciting and ongoing research surrounding artificial intelligence and nanotechnology coming together to create sensors that can detect volatile organic compounds on patients’ breaths (Nakhleh et al., 2017).

There are limitations to this observational study. The first and foremost is the small size of the cohort; only 139 out of 720 contacted medical students responded to the survey. Among the participants, the overwhelming majority of responses was from medical students. Our study also lacks representation from students of other healthcare professions who are trained to diagnose diseases, such as nurse practitioner or physician assistant programs. Furthermore, the survey was conducted at only a single medical school in West Texas. Therefore, the results of our study may not represent the experiences and opinions of students attending other medical schools with different curricula in different parts of the country. In addition, the respondents’ unequal experience, competence, and opinions in scent recognition may be influenced by the randomness of patient encounters during clinical MS3 and MS4 years. Finally, in retrospect, we do believe that the question, “*Do you feel with your current healthcare educational training that you can accurately make diagnoses based on medically relevant scents?*” was poorly worded in that it appears to imply there was an expectation to be able to diagnose certain odorous diseases on the sole basis of scent when that was never the case. Diagnosis is an extensive process that involves multiple modalities of analysis; we are only suggesting that scent be considered as one of many components.

We hope that the results from this study will encourage future research on the incorporation of olfactory training in medical education. We believe that such future studies should investigate the impact of targeted training of medically relevant smells upon students’ ability to learn and recognize medical diagnoses. We are of the opinion that utilizing scent as a diagnostic aid can be useful in providing future clinicians with additional competencies that can benefit patients. The vast majority of medical students acknowledge the utility of smell in the clinical setting, but the same students do not feel comfortable using their knowledge of pathognomonic scents to aid in diagnosis. We venture to argue that this gap in medical education can be easily addressed by formally including scent exposure in the clinical years. Further research can be targeted toward determining effective methods of providing scent exposure and in which manner it can be incorporated into medical curricula.

Declarations

Competing interests:

The authors have no relevant financial or non-financial interests to disclose.

Ethics approval:

This is an observational study. The Institutional Review Board at the Texas Tech University Health Sciences Center reviewed the study protocol and confirmed that no ethical approval is required.

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Figures

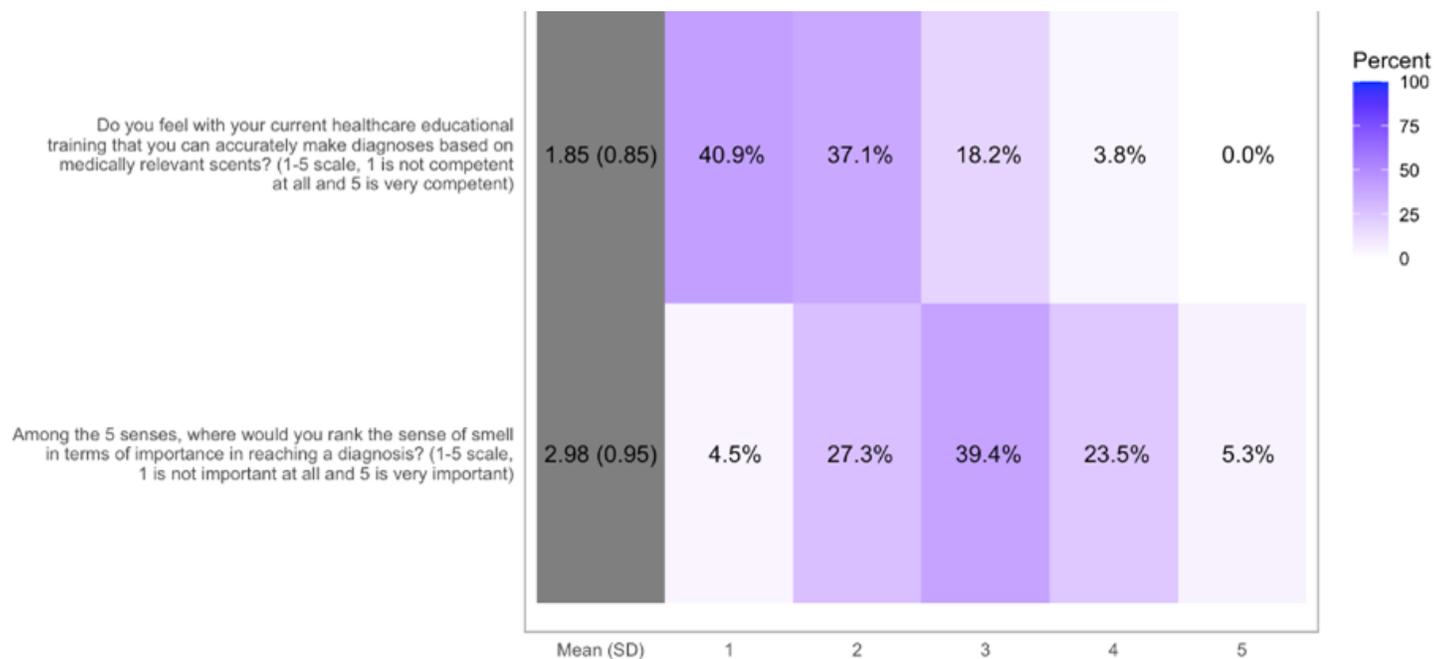


Figure 1

Subjective student responses to survey questions based on a 1-5 scale (1 = no agreement, 2= slight agreement, 3= moderate agreement, 4= high agreement, 5 = total agreement)