Title: Exploring Wonder in Medical School Admissions: Correlations with Admissions Decisions

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ABSTRACT.

Background:

The capacity for wonder (CfW), which has been proposed as an important personal disposition for clinicians, may provide a meaningful picture of medical school applicants. The purpose of our study was to explore experiences of wonder among applicants and their association with components of the admissions process.

Methods:

The Johns Hopkins School of Medicine asks applicants to submit an essay about a time they experienced wonder in their everyday life. Among applicants who were interviewed in the 2021-2022 cycle, we analyzed an anonymized 50% random sample of essays (n = 224). Essays were coded using the validated CfW scale and categorized by topic. Standard bivariate statistical tests were used to assess whether the extent of wonder was associated with admissions decisions and interview scores.

Results:

Among applicants who were admitted, 80% had scores reflecting “high wonder,” 62% had “medium wonder” scores, and 27% had “low wonder” scores. Applicants’ extent of wonder was significantly associated with their admissions decisions ($p < 0.0002$), mean interview scores ($p = 0.00025$), and mean scores in research portfolio ($p < 0.0001$). Six broad essay topics were identified: connecting with others, engaging in art, experiences in nature, engaging in wellness, the pursuit of knowledge, and sports/exercise.

Conclusion:

Applicants’ capacity for wonder may be a relevant consideration in the admissions process. Future research should verify our findings at other institutions, investigate other components of the medical school application that may be associated with the capacity for wonder, and explore interventions to cultivate wonder throughout medical education.

Key Words: medical education, premedical students, medical school, professional burnout

INTRODUCTION.

Authentic consideration of applicants' personal qualities is an ongoing challenge in medical school admissions. A large body of literature identifies factors to consider during the admissions process.[1-3] Albanese et al. found that the literature identifies 87 different personal qualities as relevant to the practice of medicine, and Koenig et al. identified nine core personal competencies rated by stakeholders as being especially important for entering medical students.[1,2] Prober & Desai have argued recently that assessment of factors like empathy and communication skills should replace selection criteria that overweigh standardized test scores.[3] Although there is agreement about why/how these factors are relevant to excellence in clinical practice, merely assessing each factor discretely may fail to provide a genuine reflection of the applicant as a whole person. It is also challenging to select and measure personal qualities in a cost-effective and logistically feasible manner.[1,3]

The capacity for wonder—that is, the propensity to experience states of wonder in response to aspects of daily life—may underlie many desirable characteristics in medical professionals.[4] Indeed, researchers have linked the capacity for wonder to several personal characteristics that are necessary for clinical excellence—empathy, humility, tolerance for uncertainty, courage, curiosity—and have proposed it as an important personal disposition that can support and encourage character development in students aspiring to become physicians.[5] For example, the capacity for wonder enables people to show genuine interest in others, listen carefully, and acknowledge other perspectives, all behaviors that are foundational to empathy. Although empathy is crucial in healthcare, research shows that it often diminishes during medical school and residency.[6] Encouraging wonder in medical students may help counteract the decline of empathy and foster related traits in medical students.

Over the past decade, philosopher H. M. Evans wrote about the importance of wonder in clinical settings.[7-9] In 2012, he suggested that a sense of wonder can be a personal resource to the professional clinician and even described it as a "ubiquitous ethical source and a timely recalling of the embodied agency of both patient and clinician".[7] His work emphasizes the value of wonder in encouraging attentiveness and an appreciation of the human experience, even in routine or familiar clinical encounters.[7-9]

Wonder is a feeling of intense attentiveness and appreciation of an aspect of everyday life seen in a new light, which can be accompanied by reflection, exploration, and a change in perspective and motivation.[7,10,11] Wonder is distinct from curiosity and awe. Curiosity, a primarily cerebral experience, is an interest and motivation to explore something within an accepted framework.[11] On the other hand, awe is more of a spiritual experience associated with a sense of feeling small in response to "perceptually vast stimuli that overwhelm current mental structures".[12] Wonder might include cerebral and spiritual components, but its most distinctive features are affective and relational. The experience of wonder draws people in and engages them emotionally,[5] experiential sensibilities that are important for clinicians.

Considering the importance of wonder in academic and clinical settings,[5,6,13] Geller and colleagues developed and validated a measure of students' capacity for wonder (CfW) using a mixed-methods approach. Their work

established a 10-item CfW scale, which contains two subscales representing “perspective shifting” and “emotional reawakening.” This scale correlates with related constructs of humility, tolerance for ambiguity, curiosity, and empathy.[5]

Geller and colleagues administered their scale to medical students at a top tier medical school and found that second year students had the lowest mean CfW scores compared to students in other years.[13] The authors call for further investigation into what may occur during the second year of medical school to trigger a loss of wonder, and what interventions might mitigate this effect. They also hypothesize that applicants to medical school might vary in their capacity for wonder, a phenomenon worth studying.

To the extent that the capacity for wonder can serve as a proxy for several desirable personal characteristics, it may be fruitful and efficient to consider wonder in the admissions process. As a first step, this study aims to explore experiences of wonder among medical school applicants and their association with various aspects of their application. Our intention was to seek proof of concept that a qualitative elicitation of applicants’ capacity for wonder would offer a meaningful portrayal of who they are relative to admissions criteria.

METHODS.

We conducted a mixed methods analysis of a secondary dataset consisting of a sample of Johns Hopkins medical school applications.

Data Collection

After review and exemption by the Institutional Review Board, the admissions office provided us with an anonymized dataset of applications from applicants interviewed in the 2021-2022 cycle. We formed subgroups based on gender and whether the applicants were accepted or rejected, then randomly selected a 50% sample of applications within each subgroup (n = 224). We excluded applications that did not include secondary essays or were withdrawn before an admissions decision was made.

Starting in 2019, the Johns Hopkins School of Medicine has asked applicants to write an essay in response to the following prompt:

> *"Wonder encapsulates a feeling of rapt attention… it draws the observer in. Tell us about a time in recent years that you experienced wonder in your everyday life. Although experiences related to your clinical or research work may be the first to come to mind, we encourage you to think of an experience that is unrelated to medicine or science. What did you learn from that experience?"*

Applicants submitted these essays as a part of the school-specific secondary application, which included other essays, and were aware that reviewers would potentially evaluate the essays for admission to medical school. These essays were the primary focus of our dataset, which also included admissions decisions and interview scores in four categories: clinical exposure, research portfolio, leadership experience, and community service. Our team obtained interview scores from two interviewers and ranged from 1 to 5, with 1 being the best and 5 being the lowest. We only used essays from applicants had interviews, and we conducted our analysis after the conclusion of the admissions cycle.

Data Analysis

We uploaded the dataset to NVivo, read all the essays on wonder and coded them both qualitatively and quantitatively. In our qualitative analysis we categorized the essays by topic. For the quantitative analysis, we assigned discrete codes to each of the 10 items in the validated CfW scale (Table 1) and applied the codes to relevant segments of text in the essays. We trichotomized the number of codes assigned to each essay and created a variable called "extent of wonder". We classified essays with three or fewer items as "low wonder," essays with 4-6 items as "medium wonder," and essays with more than 6 items as "high wonder."

Admissions decisions were grouped into three categories: accepted, waitlisted, and rejected. For our quantitative analysis, using R, we conducted a Fisher's exact test to assess the association between extent of wonder and admissions decisions. The purpose of Fisher's exact tests is to assess whether there is a statistically significant difference between the proportions in two categorical variables. To assess the

association between extent of wonder and each of the different interview scores, we used one-way ANOVA, a statistical method of comparing the means of multiple groups.

RESULTS.

As shown in Table 2, out of our sample of 224 applications, there was a fairly even distribution by gender (approximately 56% female and 44% male). The overwhelming majority of applicants were 20 to 25 years old. Around 55% of applicants who wrote these essays were accepted, 3% were waitlisted, and 42% were rejected after being interviewed.

Essay Topics

Essays were categorized by the six distinct topics shown in Figure 1. The majority of essays (28%) focused on connecting with others, such as volunteering, religious communities, and relationships with friends and family. This was followed by engaging in art (such as painting, photography, and music; 23%) and experiences in nature (such as hiking or going to the beach; 20%). Less common topics included engaging in wellness (such as cooking, gardening, meditation, and journaling; 11%), the pursuit of knowledge (such as exploring topics in history and philosophy; 10%), and sports and exercise (such as going to sporting events, working out, and playing individual or team sports; 8%).

Coding of "Wonder" Essays

Table 1 shows the 10 codes in the validated CfW scale as well as sample quotes that correspond to each code. The two most prevalent codes in our analysis were "Take to heart experiences that challenge your understanding of the world," followed by "Find yourself drawing new connections between things in the world."

Association between extent of wonder and admissions status

Table 3 provides the frequency distributions for extent of wonder and its association with admissions status. Approximately 28% of essays had 3 or fewer items ("low wonder"), 56% had 4-6 items ("medium wonder"), and 16% had more than 6 items ("high wonder"). There was an association between applicants' extent of wonder and whether or not they were admitted to medical school. Out of 62 applicants with "low wonder," about one quarter were accepted and two thirds were rejected by the end of the application cycle. Among the 126 applicants with "medium wonder," twice as many applicants (62%) were accepted than were rejected (36%). Among the 36 applicants with "high wonder," over 80% were accepted. This association was statistically significant ($p < 0.0002$).

We also found a significant association of extent of wonder with mean interview scores ($p = 0.00025$) and mean scores in research portfolio ($p < 0.0001$). However, we did not find a significant association between extent of wonder and the three other interview scores (clinical exposure, leadership experience, and community service).

DISCUSSION.

To our knowledge, this is the first study to explore the capacity for wonder among applicants to medical school. Our results point to a significant correlation between medical school applicants' extent of wonder, applicants' interview scores, and ultimately, admissions decisions. We were not surprised by the associations of extent of wonder with mean interview scores or mean scores on research portfolio. Interviews inherently involve relational qualities, and the capacity for wonder may be a motivating factor for engaging in research. However, we expected a positive association between extent of wonder and interview scores for leadership and community service because both require strong interpersonal skills and a certain level of engagement. Perhaps the scoring of leadership and community service was based more on the number of hours devoted to leadership and community service activities rather than some estimate of quality, impact, or personal growth. This may indicate that leadership and community service scores reflect external accomplishments rather than qualities such as empathy and wonder.

Another notable finding was that many medical school applicants in our sample described experiences of wonder as connecting with others. This finding supports theoretical evidence that the experience of wonder is affective and relational.[12] The findings that many applicants also wrote about engaging in art and self-reflection in their wonder essays supports empirical evidence that arts-based education in medical school is associated with increased capacity for wonder scores, can foster professional identity formation, and can be transformative for students.[14]

Limitations

Our current study has several limitations. First, our sample only includes applicants who were interviewed. We do not know whether we would have categorized essays the same way or associated them with other aspects of the application (such as whether applicants received an interview) if our data had included students not invited for interviews. Second, there was a sole reader for these essays since this work was conducted as part of a project that a medical student led. As such, there may be potential biases, as the sole reader's perspectives or interpretations might have influenced the coding process. Although all co-authors discussed and agreed on codes in advance, we do not have a formal assessment of inter-rater reliability, which limits the rigor of the analysis. Due to time and financial constraints, we could not recruit additional coders, which would have reduced the risk of bias and improved reliability. We also did not use a deductive coding approach due to these constraints.

In addition, we did not have a way to control for the quality of the writing. Some applicants may have received help while brainstorming, writing, or editing their essays, which could have influenced the topic they chose to write about or the extent of wonder reflected in the essay. There are considerable differences in applicants' access to support and privilege, including their undergraduate institution, paid services, and social contacts. In turn, these socioeconomic factors could influence the topics, content, and quality of essays.[15] Since the quality of writing is likely to influence admissions decisions, it may have been a confounding variable in our analysis.

Moreover, there may be potential cultural biases in the CfW scale. Interpretations of wonder may vary across demographics, potentially influencing the topics applicants consider relevant to the prompt or how they describe experiences of wonder. These biases may also affect the content and perceived quality of essays. Lastly, we used data from only one institution, as Johns Hopkins is currently the only medical school that asks students to write essays on wonder.

Implications and Future Directions

Our study describes an early-stage initiative at a single institution that is both conceptually and methodologically innovative and may lay the groundwork for considering the role of wonder in the admissions process on a larger scale. Although the relationship we identified between the extent of wonder and admissions decisions was correlational, not causal, our findings provide proof of concept that the capacity for wonder may have a useful role to play; additional research is needed. To supplement our quantitative analysis, it would be interesting to conduct a qualitative content analysis of wonder essays to help us better understand and characterize applicants' experiences of wonder and explore the degree to which these qualitative experiences predict medical school admissions decisions. Incorporating wonder could align admissions with calls for innovations in the admissions process that emphasize empathy, compassion, communication, and other skills and qualities over standardized test scores, thus supporting more holistic student assessments.[3] It may be useful to examine how the capacity for wonder may supplement or relate to some of the core personal competencies that schools identify as important for entering medical students, including ethical responsibility to self and others, service orientation, resilience and adaptability, and teamwork.[2]

To be clear, we do not propose that schools use or even calculate a quantitative assessment of the *extent* of wonder as part of the admissions process at this time. While it is important to consider applicants' personal qualities and experiences, quantifying these characteristics may have unintended consequences, as there is often a tension between expected and genuine responses when addressing essay questions in the admissions process.[16] For example, applicants may tailor their responses or even exaggerate details to include more items in the capacity for wonder scale if they believe that reviewers will score their essays for extent of wonder. Instead of using extent of wonder solely as a quantitative assessment tool, it is important to understand applicants' personal experiences of wonder and consider how to use them to learn about applicants more holistically.

This exploratory study points toward several fruitful directions for subsequent research. First, our findings should be verified at other institutions. This would require other schools to consider including an essay about wonder in their secondary application and could potentially lead to future multi-institutional studies. Comparing wonder across different medical school settings and exploring how cultural background and identity influence experiences and interpretations of wonder would provide deeper insights. In addition, it would be useful to know whether essays about wonder influence, consciously or unconsciously, the screeners' recommendations regarding which applicants to interview. Other components of the medical school application— such as

undergraduate studies (i.e., whether and to what extent applicants studied the humanities), personal statements, and responses to other questions in the secondary application (including experiences applicants may have had during a gap year)—may also be associated with the capacity for wonder. Using artificial intelligence and language processing programs would make it possible to code essays more efficiently and include more variables for an in-depth qualitative analysis.

The capacity for wonder may have broader applicability to medical education than just the admissions process. Exploring interventions that support this capacity could benefit medical students at various stages of their education. For example, new curricular initiatives and programs that involve the arts and humanities could help sustain students' capacity for wonder.[17] This may be particularly important for second-year medical students, who one study found to have the lowest mean CfW scores.[13] Considering high burnout rates among medical students, future research could also explore whether cultivating the capacity for wonder may be protective against burnout.[18] Additionally, longitudinal studies could examine associations between capacity for wonder and success and flourishing throughout medical training, providing insight into its lasting impact beyond the admissions process.

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FIGURES AND TABLES.

Table 1. Items in the CfW Scale and Sample Quotes from Medical School Applicants Corresponding to Each Code

CfW Scale Items	Quotes
W1: Find yourself drawing new connections between things in the world	"Since the tree was able to grow despite its isolation and the cliff's poor growing conditions, I thought it reflected people's resilience and resourcefulness during the hardships of the pandemic."
W2: Take to heart experiences that challenge your understanding of the world	"Maintaining a garden has taught me to appreciate the unexpected joys of cultivating organic (and, by extension, unpredictable) growth and that some of the most meaningful of insights can come from the unlikeliest sources."
W3: Be described by others as inquisitive	N/A
W4: Find yourself pausing to reflect	"I stared at my peanut butter and jelly sandwich, wondering at the deep meaning that this simple sandwich has to me, sticking with me through various achievements and obstacles."
W5: Move among several different perspectives on the same situation like a camera or microscope lens zooming in and out	"I can't help but find the excess beautiful and disturbing. I indulge my eyes, my nose, and my mouth in more fruit than I could eat in a lifetime, taking a single bite out of the ripest peaches and tossing them to the ground before grabbing the next. I am intoxicated by the mellow, tangy pulp that crescendos into a deep sweetness on my tongue; yet at the same time, the taste bitters as I feel like an accomplice to food waste, insecurity, and world hunger."
W6: Experience familiar things as if for the first time	"It's a song I had heard in the car many times in my life but putting my full attention into it, I felt as though I was hearing it for the first time."
W7: Feel amazement during the ordinary course of events	"I grew familiar with the perpetual noises of the city, from public transit announcements and traffic jams to phones ringing incessantly and the rapid footsteps of working professionals. But I never ceased to be amazed by these 'seemingly mundane' everyday moments."
W8: Feel personally engaged by an experience that takes your breath away	"It wasn't just that Carson wrote in such beautiful prose for literary arguments; her words seemed to capture and articulate everything swirling in my mind about the nature of human desire and connection, and why century after century we continue to write about it. Simply put, her writing moved me as I breathlessly read page after page in wonder."
W9: See the world with an interest of a child	"I looked with wonder and childlike awe, as I saw the light of a million dying stars. If we wished upon a star within a starry night, this would undoubtedly be the night when dreams would come to life."
W10: Experience surprise	"The shock came when an actor took the stage and began signing, captions of which filled the televisions in the shop windows. This struck a personal note."

Table 2. Characteristics of Medical School Applicants

Characteristic	TOTAL (N=224) N (%)
Gender	
Female	126 (56%)
Male	98 (44%)
Other	0 (0%)
Age	
20-25	198 (88%)
>25	26 (12%)
Admissions Decisions	
Accepted	124 (55%)
Waitlisted	6 (3%)
Rejected	94 (42%)

Figure 1. Categorization of Essay Topics Among Medical School Applicants

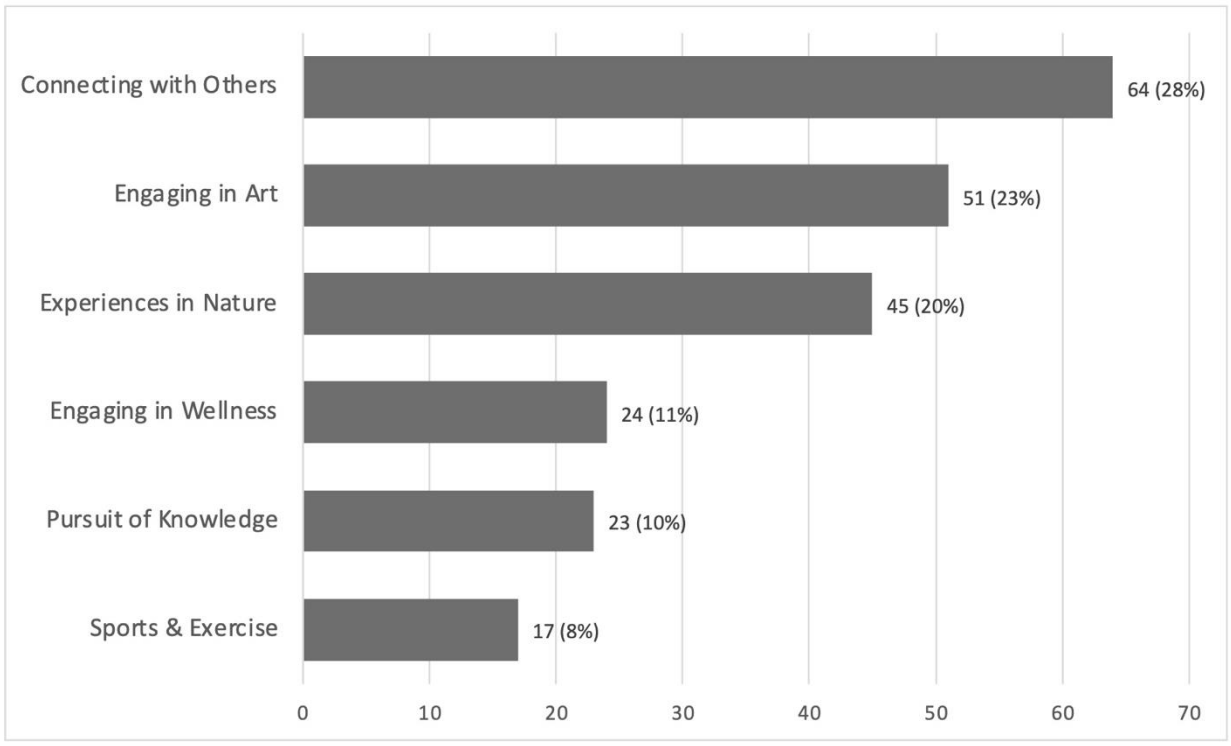

Table 3. Association Between Wonder Extent, Admissions Decisions, and Interview Scores Among Medical School Applicants

Extent of Wonder		Admissions Status			Mean Interview Scores	
	Total	Rejected	Accepted	Waitlisted	Mean Interview Scores	Mean Scores in Research Portfolio
Low: ≤3 CfW items	62	43 (69.4%)	17 (27.4%)	2 (3.2%)	1.75	1.74
Med: 4-6 CfW items	126	45 (35.7%)	78 (61.9%)	3 (2.4%)	1.55	1.39
High: >6 CfW items	36	6 (16.7%)	29 (80.6%)	1 (2.8%)	1.50	1.31
		$p < 0.0002$			$p = 0.00025$	$p < 0.0001$