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REVIEW

Modeling the social determinants of resilience in health professions students: impact on psychological adjustment

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Abstract

Stressors inherent to training and stemming from the learning environment are associated with high rates of burnout, depression, and mental health problems in health professions students (HPS). There is evidence that disadvantaged or stigmatized groups are particularly affected. These problems not only impact students after graduation but may also have detrimental effects on patient outcomes. Resilience, conceptualized as the process of adapting well in the face of adversity, has inspired an increasing number of interventions aimed at addressing those problems in HPS. These interventions have mostly targeted individual students and their psychological traits while ignoring social and structural factors that may enhance or undermine individual resilience. To address this gap in the literature, the authors reviewed the evidence for psychosocial determinants of resilience and proposed a model inspired by the social determinants of health literature and the "upstream–downstream" metaphor. In this theoretical paper, the authors propose that upstream determinants such adverse childhood experiences and socioeconomic and sociodemographic markers of disadvantage have a direct effect on psychological adjustment and an indirect effect mediated by resilience. Additionally, the authors propose that the institutional downstream drivers of learning environment, social support, and sense of belonging moderate the direct and indirect effects of the upstream determinants on psychological adjustment. Future research should test these hypotheses and gather evidence that may guide the development of interventions. The authors present their model as part of a comprehensive response to recent calls to action to address diversity, equity and inclusion in health professions education.

Keywords Health professions education · Resilience · Veterinary medicine students · Nursing students · Medical students · Learning environment · Mental health · Disadvantaged students

Introduction

Health professions education takes place in stressful environments with high academic demands, substantial workloads, and increased psychological pressure (Collins & Foote, 2005; Fares et al., 2016; Labrague et al., 2017). Health professions students (HPS) experience

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higher rates of burnout and depression than their age-matched peers, despite entering professional education with relatively lower psychological distress (Dyrbye et al., 2010a; Killinger et al., 2017; Rotenstein et al., 2016). Poor mental health in HPS has been associated with low standardized test scores, professionalism lapses, and dropout (Jackson et al., 2016; Strauss et al., 2019). Worse yet, burnout has deleterious effects on healthcare quality and safety (Dyrbye et al., 2010a; Panagioti et al., 2018; Rudman & Gustavsson, 2012). Among the "calls to action" to address the harmful effects of stress on HPS, interventions targeting psychological resilience have gained considerable traction.

Resilience is variously defined as the "dynamic capability which can allow people to thrive on challenges given appropriate social and personal contexts (Howe et al., 2012)" and an active adaptation to stress resulting from biopsychosocial and ecological interactions (Kalisch et al., 2017). Regarding psychological adjustment, studies in HPS trainees and professionals have shown that resilience is positively associated with psychological well-being and negatively associated with burnout, anxiety, and depression (Chow et al., 2018; Kunzler et al., 2020; Mealer et al., 2012; Rees et al., 2015; Yu & Chae, 2020). Many modifiable determinants of resilience at the *individual* level have been validated, including meaning in life, sense of coherence, hardiness, self-esteem, active coping, self-efficacy, cognitive flexibility, and religiosity (Kunzler et al., 2020). While determinants of resilience are indeed important, the emphasis on resilience as an individual trait has placed the onus of "resilience failures" on individual HPS (Schoon & Bynner, 2003). This overshadows a *systemic* view in which "resilience depends just as much on the culturally relevant resources available to stressed individuals in their social, built, and natural environments as it does on individual thoughts, feelings, and behaviors" (Ungar & Liebenberg, 2011).

Systemic and institutional determinants may compound the impact of adversities that HPS may have faced before matriculation on resilience and psychological adjustment. Systemic and structural factors have been well-researched in the context of the social determinants of health (SDOH). According to SDOH models, a significant percentage of adult health outcomes are attributable to economic policies and systems, developmental agendas, social norms, social policies and political systems (Commission on Social Determinants of Health, 2008). In SDOH models, a well-known metaphor differentiates upstream ("the cause of causes") from downstream determinants (proximal causes) of health disparities (Braveman & Gottlieb, 2014). Generally, upstream determinants include socioeconomic resources, education, and racial discrimination while downstream determinants include health-related behaviors, disease, and injury (Braveman & Gottlieb, 2014). Based on a careful literature review and discussions by a multidisciplinary group of educators and social scientists, we proposed a model applying "social determinants of resilience" and created a visual representation (Fig. 1).

Method

Drawing from SDOH models, we conducted a targeted literature review of peer-reviewed articles in English discussing psychological constructs related to resilience that could be measured with brief and validated measures that had been used in veterinary, nursing and medical students, which are the three health professional schools at our university. Of note, our research project is one among several initiatives that seek to address diversity, equity and inclusion at our institution. The short-term aim of our project is to test our model with a confidential, online survey containing those measured administered prospectively to HPS over the course of their schooling. The long-term goal is to build an evidence base that
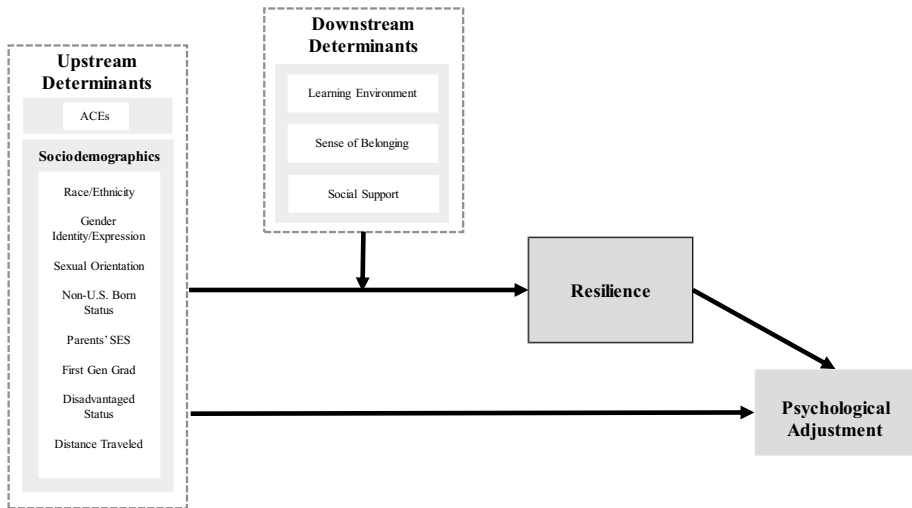
Fig. 1 The social determinants of resilience in health professions students model

may help develop and test equity-focused and resilience-informed interventions to enhance well-being and academic progress in all students.

We initially limited our search to the last 30 years; however, we allowed exceptions when identified articles referenced important work published before our original cutoff. The results of the review were extensively discussed by a multidisciplinary team of HPS and educators in an iterative process taking place over a period of several months.. We hypothesized that these psychological constructs and their measures would comprise the downstream determinants of resilience and psychological adjustment in our model. In a few cases where the evidence in HPS was scant, we searched the literature in college students for evidence supporting our model's hypotheses. Since we found evidence that these constructs have independent effects on both resilience and psychological adjustment, we further hypothesized that resilience would partly mediate these effects.

We also posited that upstream determinants should include early life stress and sociodemographic characteristics associated with social disadvantage.

Results

Upstream determinants of resilience

We begin with upstream drivers, a logical starting point within this model, as these determinants entail the "causes of causes" within classic models of SDOH (Braveman & Gottlieb, 2014). In SDOH models, restricted outcomes over one's lifetime and across generations may lead to psychological maladaptation and an accumulation of risk as one risk factor reinforces others (Schoon & Bynner, 2003), Huang et al. (2015). Viewing resilience from this perspective, social determinants impact HPS long before they receive HPS education, leading to negative outcomes. For example, in a study of over 2000 pre-nursing university students, most students lost prior to nursing program application were first generation or minority students, an example of the so-called "leaky pipeline" (Bennett et al.,

2020). Just as SDOH research has shown that addressing social determinants of health can lead to reductions in health disparities (Braveman & Gottlieb, 2014), research on our model may lead to innovative interventions to enhance resilience in HPS.

Adverse childhood experiences

Adverse childhood experiences (ACEs) refer to childhood maltreatment, household and community dysfunction and other adversities experienced before the age of eighteen. The effects of self-reported ACEs on adult health have been well-documented, showing a graded relationship between the number of ACEs and health-harming behaviors and physical and mental health problems (Felitti et al., 1998).

In educational settings, ACEs exposure has been associated with declining educational achievement, worsening mental health, and increased dropout rates in college students (Duncan, 2000; Karatekin, 2018). Among nursing, medical and veterinary medical students, studies show over half reporting at least one ACE (Kameg et al., 2020; Sciolla et al., 2019; Strand et al., 2017). In studies conducted with nursing and medical students, higher numbers of ACEs were associated with increased risk for depression and burnout (McKee-Lopez et al., 2019).

Starting in the second half of the twentieth century, the relationship between childhood maltreatment and resilience (and subsequently ACEs and resilience) has received increased attention by clinicians, researchers and policy makers. Scholars argue that women's rights in the Western world, which led to a shift in society's view of children's agency, provided a powerful impetus for that interest (Haring et al., 2019). For example, higher levels of resilience have been shown to mitigate the negative impact of ACEs in children (Bethell et al., 2014). For HPS, evidence suggests ACEs-affected students are particularly at risk for training-related re-traumatization, highlighting a need for ACEs-informed training environments (Butler et al., 2017). Thankfully, the work has already begun, with thematic analysis of ACEs-affected medical students revealing several protective factors for resilience: non-parental support, role models, volunteering, and use of mental health services (Blickenstaff et al., 2021).

Socioeconomic disadvantage

Socioeconomic disadvantage (SED) in the form of inequalities in income distribution is widely accepted as one of the most influential variables among the social determinants of health (Angell, 1993). With regards to mental health alone, SED accounts for a two-fold increase in mental health conditions between the lowest and highest socioeconomic brackets (Holzer et al., 1986). The literature reviewed revealed scant data for HPS, but one study of Chinese medical students found that the mother's socioeconomic status (SES) (but not the father's) was associated with the student's self-reported psychological distress (Fan et al., 2007).

While research suggests low SES is associated with resilience deficits among national adult cohorts (Cosco et al., 2018), we are not aware of studies that have explored the connection between these variables among HPS. One study of ninth-grade students in a national probability sample found that a fixed mindset (a proxy for lower resilience in an expanded version of our model; see Limitations) was more prevalent in low SES students (Destin et al., 2019). In developing the current model, we aim to advance an understanding of the relationship between socioeconomic disadvantage, resilience, mental health and

academic outcomes, and inspire the development of resilience interventions that consider the needs of students from disadvantaged backgrounds.

Sociodemographic disadvantage

Race & Ethnicity: In recent years, health professions educators have received calls to action to recruit and support a more diverse workforce (Elmore, 2003). Despite these calls, significant grading disparities have been found to favor white medical students over students who are underrepresented in medicine (URM) and non-URM minorities, even when adjusting for age, gender, maternal education, and standardized test scores (Low et al., 2019). Similarly, a review of studies involving nursing students found evidence suggesting that discrimination, bias in grading practices, and isolation may explain the higher attrition rates of minority nursing students as compared to white students (Graham et al., 2016). There is a paucity of research exploring the experiences of non-U.S. born citizens in preclinical training, but similar themes of isolation, insensitivity, and other challenges have been reported in international medical residents (Chen et al., 2011).

Research examining psychological adjustment in minority medical students suggests a complex relationship. Regarding differences in quality of life, depression, and burnout between URM and non-URM students, several large multicenter surveys show contradictory findings. Some African American medical student cohorts have reported greater burnout compared to non-URM students, while others have reported less burnout (Dyrbye et al., 2006, 2007). As our model will suggest, there may be another side to the story, as URM students appear to experience fewer mental health difficulties within supportive learning environments (Dyrbye et al., 2007). It is possible that URM students have their own "brand" of resilience, one best facilitated within learning environments aimed at supporting a more diverse student body.

First Generation Status. Thus far, most research among first generation students (i.e., those who are the first in their families to attend college) has been conducted in undergraduate populations, although there are a few examples among HPS. In one study of medical students, first-generation students had significantly lower scores on self-care, perceptions of medical school support for family and personal responsibilities, and higher scores on sleep problems when compared to continuing generation peers (Mason et al., 2018). Among college students, comparative data suggests that first-generation students tend to report lower ratings of belonging, greater levels of depression and stress, and lower use of services compared to continued-generation peers (Stebleton et al., 2014).

Gender There are remarkably few studies exploring gender difference in HPS in contrast to epidemiological data documenting gender differences across the lifespan in resilience, types of stressors and traumatic experiences, coping styles, and prevalence of stress-related disorders. For example, women and girls generally exhibit greater vulnerability (Hirani et al., 2016). However, several studies have found lower levels of resilience in female as compared to male HPS, although some studies show the opposite pattern (Sundar & Archana, 2020; Jordan et al., 2020; Bahadir-Yilmaz and Oz, 2015). Research focusing on gender differences in resilience has been criticized for neglecting social domains associated with resilience in women (Hirani et al., 2016). In line with this critique, a recent study of frontline health care workers responding to the COVID-19 pandemic measured contextual factors (i.e., background stressors such as pre-pandemic burnout and index stressors such as caring for children/dependents during the pandemic) in addition to stress-related psychological distress. After controlling for background and index stressors, the gender

differences in psychological distress were no longer significant (Lowe et al., 2021). Similarly, empirical tests of our model should clarify the contribution of upstream and downstream determinants (i.e., background and index stressors) by controlling for them statistically, should they identify gender differences in resilience or psychological adjustment.

Non-heterosexual sexual orientation and nonbinary gender identity. This constitutes another example where the intersection of unsupportive learning environments and lifelong discrimination may result in adverse outcomes for HPS. In one of the largest longitudinal studies of its kind, medical students who identified themselves other than heterosexual reported higher levels of depression and anxiety than their heterosexual peers, a disparity that continued into residency training (Wang et al., 2020). Importantly, the association between non-heterosexual identity and psychological distress was partly mediated by experiences of harassment and isolation for medical students (Przedworski et al., 2015; Samuels et al., 2021) and a decreased sense of belonging for medical residents (Wang et al., 2020). Transgender medical students and physicians report censorship of speech or mannerisms and experiences of derogatory comments about transgendered individuals (Dimant et al., 2019). Thus far, research exploring resilience expression among LGBT + students across different learning environments appears practically non-existent. In developing the current model, we aim to promote further research in this important area of HPS well-being.

Downstream determinants of resilience

Following SDOH models, downstream determinants of resilience in our model entail individual-level psychological and behavioral traits such as "adaptive coping" or "mindfulness" (Rees et al., 2015). In our model, we propose an additional set of downstream determinants that include systemic factors not experienced by HPS until after matriculation, such as the learning environment. Due to space limitations, we set aside a discussion of individual-level determinants to focus on structural and interpersonal determinants embedded in educational programs, which we propose determine the differential expression of resilience across different groups of students. In doing so, we aim to stimulate resilience research that is simultaneously broader and more targeted, encouraging interventions to foster resilience at the system level and not exclusively at the individual level, thus ensuring that those efforts are directed toward a diversity of student backgrounds.

In what follows, we focus on three important aspects of health professions education: learning environment, social support, and sense of belonging. Together, these variables make up the "culture" of a health professions institution and therefore determine resilience expression in our model in the same broad way that culture may determine health outcomes in SDOH models (Hafferty, 1998, Wilkes et al., 2013).

Learning environment

Learning environment or climate is a broad term that encompasses physical and virtual classroom spaces, but also social and cultural contexts in which students learn (Genn, 2001). For HPS, the learning environment includes formal, informal, didactic, and clinical learning spaces, as well as sociocultural dimensions created by student, faculty and systemic factors. Learning environment can have both negative and positive effects on student achievement, engagement, motivation, and well-being (Soemantri et al., 2010).

Studies have shown that students from disadvantaged or stigmatized backgrounds may be particularly affected by their learning environment (Dyrbye et al., 2006, 2007; Samuels et al., 2021). In one study, multivariate analyses found a clear dose–response relationship between satisfaction with the learning environment and burnout, after controlling for clinical rotation characteristics and workload (Dyrbye et al., 2010b). Additionally, multisystem-based studies of health profession schools suggest that students, particularly URM students, continue to experience both overt and subtle manifestations (i.e., microaggressions) of negative learning environments in clinical programs (Ackerman-Barger et al., 2020). For example, URM medical students experience significantly more stereotype threat than age-matched peers, which has been shown to correlate with fewer honors earned in third-year clerkships (Bullock et al., 2019).

In U.S. medical students, higher resilience is significantly correlated with a more positive perception of the learning environment (Dyrbye et al., 2010b), while research in nursing students indicates that the impact of individual resilience on psychological and academic distress may be negatively amplified in unsupportive learning environments (Mcdermott et al., 2020). Together, these results suggest that learning environments that are supportive of the diverse needs of students may level the playing field and increase the chances that everyone can succeed, not just students with resilient personality traits (Mcdermott et al., 2020). URM nursing students report that increasing faculty diversity has been key to improving learning environment inclusivity (Metzger et al., 2020). This suggests that structural interventions may be essential for facilitating resilience among a diverse health professions student body.

Social support

Social support is a multidimensional construct highlighting the assisting nature of personal relationships, formally defined as the supply of tangible or intangible resources individuals gain from their network members (Song et al., 2011). There is evidence that social support has both direct and indirect effects on student well-being through moderation effects on stressors (e.g., academic load) and strain (e.g., student burnout). For example, a meta-analysis of the relationship between social support and student burnout reveals a strong, negative correlation (Kim et al., 2018). Likewise, studies in HPS have identified social support's role in protecting psychological well-being and reducing perceived stress, depression, anxiety, and suicidal ideations (He et al., 2018; Mao et al., 2019; Park et al., 2015; Reeve et al., 2013). Research suggests a positive correlation between social support and resilience, particularly among URM students (Ozsaban et al., 2019; Acheampong et al., 2019).

Sense of belonging

Sense of belonging refers to personal experience or involvement in a group or environment in which individuals perceive themselves as an integral part of that group or environment. A sense of belonging represents a fundamental human motivation, which is considered paramount to the human condition, often taking precedence over other needs, such as esteem and self-actualization (Baumeister and Leary, 1995). Acceptance and inclusion to a group, or lack there-of, may not be granted automatically, and may be communicated through subtle cues (Howansky et al., 2021). This aspect of belongingness may partially underpin the power of microaggressions to affect HPS, which –similarly to implicit bias—are

considered subjective and unconscious, and therefore offenders may not view them as damaging (Turner et al., 2021).

Sense of belonging has been shown to be empirically important in student populations. In college students, greater sense of belonging is associated with less interpersonal conflict, loneliness, anxiety, and depression (Hagerty et al., 1996). Qualitative and quantitative studies in HPS have shown a significant impact of sense of belonging on choice of medical specialty, school retention, motivation to learn, and perceived stress (Gerull et al., 2021; Grobecker, 2016; Honda et al., 2016; Middleton et al., 2021; Reilly and Fitzpatrick, 2009). Of particular concern, URM medical students report a lower sense of belonging than age matched peers (Isik et al., 2021). We notice here a parallel with research testing minority stress mode, initially developed to understand mental health disparities affecting sexual minorities (Meyer, 2003). For example, in a recent study in higher education, nonbinary students reported high levels of minority stress, which was related to negative perceptions of belonging and learning environment (Budge et al., 2020). Promoting a better sense of belonging may be a key to facilitating improved resilience among diverse HPS, as greater sense of belonging in other groups has been consistently associated with psychological well-being and positive psychosocial outcomes (Allen et al., 2021).

A model of the social determinants of resilience

The evidence reviewed suggests that measuring the effect of structural determinants of resilience may be critical in promoting positive psychological adjustment within diverse HPS, and avoiding deleterious outcomes such as depression, anxiety, burnout, and academic failures. Previous models of resilience have focused on individual determinants but have not accounted for the powerful influence of social and structural determinants within the life course of HPS. To bridge various levels of explanation, Fig. 1 depicts a model of resilience in HPS that takes advantage of conceptualizations underlying SDOH models. For heuristic purposes, the model places determinants along an upstream–downstream axis that converges on resilience to exert effects on psychological adjustment.

Upstream determinants are quantifiable markers of inequality in stress exposure and resources that may buffer against them. Among several to choose from, we have included ACEs, sociodemographic variables (e.g., race/ethnicity, gender, sexual orientation and gender identity/expression), and SED variables, which may influence resilience development before, during, and after matriculation to health professions programs. When testing our model, we intend to use multiple SED variables, depending on what is available to each health profession program. For example, medical schools can use the disadvantaged applicant status, a voluntary self-identification within in the American Medical College Application Service. The issues surrounding this particular variable (Lowrance and Birnbaum, 2019) suggest that no single SED variable (e.g., first-generation status or family's SES) may fully explain the SED construct, hence the need to combine multiple variables whose face validity made the suitable to measure SED.

The model's main variables are linked by two pathways in Fig. 1: (1) A direct influence of upstream variables upon mental health and psychological adjustment, and (2) an indirect pathway mediated by resilience. We propose that resilience, and therefore positive psychological adjustment within health programs, may vary widely based on the systemic, cultural, and economic pressures that play upon individuals differently according to each student's race/ethnicity, SOGIE, and other sociodemographic characteristics.

The relationship between these upstream variables, resilience, and psychological adjustment may in turn be affected by downstream determinants built into institutional cultures (i.e. learning environment, social support, and sense of belonging). As reviewed, research indicates that each of these downstream determinants are correlated with both psychological adjustment and resilience. Furthermore, it has been shown that URM students are more likely to experience more unsupportive learning environments, less social support, and less sense of belonging than their peers (Dyrbye et al., 2007, 2010b; Isik et al., 2021; Samuels et al., 2021). Therefore, we predict two effects of downstream drivers: (1) a moderating effect on the pathway between upstream drivers and psychological adjustment, and (2) a moderating effect on the pathway from upstream drivers to resilience. In other words, the learning environment, social support, and sense of belonging should influence the psychological success of students differently, depending on their life courses and backgrounds. Moreover, individual resilience resulting from each student's social determinants will be expressed most robustly within programs that best support them (i.e., programs with supportive learning and social environments and a high levels of inclusivity).

Discussion

In response to rising rates of burnout and other mental health problems in HPS, educators and school administrators have focused on single or, less often, multiple individual personality traits. We argue that this approach represents a missed opportunity to address systemic or structural determinants of resilience. Here we address this gap with a focused review of the literature of those determinants and a resulting theory-driven, testable model. The model's central premise is that by addressing systemic determinants of resilience, such as the learning environment, social support, and sense of belonging, psychological adjustment will improve for all students. The implications of this for health sciences educators is to approach learners with a richer, more targeted approach to promoting academic success. Critically, our model suggests that system-level interventions should be explored in addition to individual-level interventions, particularly for students from backgrounds historically marginalized and underrepresented in health professions.

By the very fact of matriculating in health professions schools, HPS from disadvantaged backgrounds have demonstrated the "capability to thrive on challenges given appropriate social and personal contexts", which is the very definition of resilience (Howe et al., 2012). Our model was prompted by anecdotal observations and in-depth conversations with students who often struggle to navigate the stressors of health professions schools, despite a demonstrated ability to overcome adversity.

Perhaps, as health professions educators, we have erred in defining resilience quantitatively (i.e., some have less, some have more). Instead, we might ask what *type* of resilience a student may have, and what resources can best support the expression of these different "brands" of resilience. If the aim of health professions education is to build a resilient *and* diverse workforce, then it is our responsibility to understand how resilience is differentially expressed in students from diverse backgrounds, characterize the learning environments and supports that best foster resilience in all students, and rigorously translate that knowledge into institutional resources, policies, and professional and institutional cultures that promote a multilevel view of resilience.

By utilizing the present model, researchers may better aim investigations and interventions at determinants that are most relevant to resilience in diverse HPS, particularly

disadvantaged students who face greater threats to optimal psychological adjustment and academic success. Beyond graduation, enhanced resilience in HPS may have a catalytic effect on future practice by lowering the risk of mental health problems (e.g., burnout) while maximizing outcomes known to improve patient experiences (e.g., reduced clinician turnover).

Limitations and future directions

An important limitation of this proposal is that it is not the result of a systematic review of the literature but the product of extensive interdisciplinary dialogue, collective reflection, and a focused review of the literature. In addition, we focused our research on nursing, veterinary and medical students assuming that our model would be largely applicable to other HPS including physical and occupational therapy. Despite this caveat, the scope of our review was considerable: approximately two thirds of the articles reviewed were not included in the final manuscript. We feel confident that we are unlikely to have missed large empirical studies on the topic. While more comprehensive than most, an additional limitation of the current model is the exclusion of individual-level determinants (e.g., adaptive coping style and trait mindfulness) and extra-institutional structural determinants of resilience in HPS (e.g., precarious living environment, food insecurity, and accumulated debt) due to space limitations. Also absent from our model are microaggressions as well as disability status and other equity-denied groups and their intersections, which we view as structural determinants of resilience. While there is evidence linking racial discrimination to negative mental health outcomes and well-being in medical students (Perry et al., 2016), to our knowledge the interaction of those variables with resilience has only been shown in African American college students (Brown and Tylka, 2011) and registered nurses (Byers et al., 2021).

Since our reviewed targeted the empirical literature on resilience and its determinants, we did not discuss in any length critical conceptualizations of resilience that have been proposed by others (Luthar et al., 2000; Kalisch et al., 2017; Traynor, 2018; Ungar et al., 2013). Ours, however, seems to be the first of its kind as applied to HPS.

Another important limitation of this review and model is the focus on psychosocial to the exclusion of biological determinants. Future research may be able to integrate social and psychological aspects of resilience to the staggering body on data on neurobiological (Bush & Roubinov, 2021) and genetic (Niitsu et al., 2019) determinants of resilience. As an example of this type of research, we note a longitudinal study of first-year medical residents that found that saliva-measured telomere shortening (a biomarker of stress exposure) after a year was six times greater than expected and that shortening was associated with work hours (Ridout et al., 2019). Of significance to our model of upstream determinants, reported ACEs were significantly associated with baseline telomere length, after controlling for age and sex. If replicated, a corollary to this type of study is that the effectiveness of future structural or systemic as well as individual-level interventions may be tracked by non-invasive resilience biomarkers, in addition to self-reported and interviewer-based measures of resilience and psychological adjustment.

Another line of inquiry for future research is the inclusion of academic success as an additional outcome in our model, in addition to psychological adjustment. The literature of the relationship between resilience and academic performance in HPS is equivocal (Chisholm-Burns et al., 2021), although studies in college students in the U.S. and

elsewhere consistently find an association between resilience and academic success (Hartley, 2011; Bittmann, 2021; Allan et al., 2014).

Our model is currently being tested at the University of California, Davis School of Medicine, School of Veterinary Medicine, and Betty Irene Moore School of Nursing. Starting in the fall of 2019, our research team has been conducting a longitudinal study to assess changes in perceptions of learning environment and social support over time and correlating these changes with measures of resilience, mental health, and academic achievement. Through this interdisciplinary approach, we hope to verify the accuracy of our theory-based model and advance the general understanding of the social determinants of resilience in HPS.

Conclusion

Considering gaps in the literature of resilience in HPS and a critical appraisal of the construct, the authors reviewed the evidence for psychosocial determinants of resilience and propose a model inspired by the SDOH literature and its well-known "upstream–downstream" metaphor. Although the model is consistent with similar conceptualizations of resilience by others, to our knowledge this is the first application to HPS. The authors propose that upstream determinants have a direct effect on psychological adjustment and an indirect effect mediated by resilience. The authors also propose that the each of the downstream drivers learning environment, social support, and sense of belonging moderate the direct and indirect effects of the upstream determinants on psychological adjustment. Unquestionably, the value of our model awaits empirical testing by our group (and hopefully others). Meanwhile, this cohesive set of hypotheses grounded in available research represents a cogent response to calls to action to address both stress-related psychological problems in HPS as well as long-standing systemic barriers to achieve equity, diversity and equity in health professions education. We hope that evidence gathered that may inform the development of interventions targeting systemic, institutional and individual determinants that undermine resilience and academic success at the undergraduate and graduate levels of health professions education.

Declarations

Conflict of interest All authors certify that they have no affiliations with or involvement in any organization or entity with any financial interest or non-financial interest in the subject matter or materials discussed in this manuscript.

References

Ackerman-Barger, K., Boatright, D., Gonzalez-Colaso, R., Orozco, R., & Latimore, D. (2020). Seeking inclusion excellence: Understanding racial microaggressions as experienced by underrepresented medical and nursing students. *Academic Medicine, 95*(5), 758–763. https://doi.org/10.1097/ACM.00000 00000003077

Acheampong, C., Davis, C., Holder, D., Averett, P., Savitt, T., & Campbell, K. (2019). An exploratory study of stress coping and resiliency of black men at one medical school: A critical race theory perspective. *J of Racial Ethnic Health Disparities, 6*, 214–219. https://doi.org/10.1007/s40615-018-0516-8

Allen, K. A., Kern, M. L., Rozek, C. S., McInereney, D., & Slavich, G. M. (2021). Belonging: A Review of Conceptual Issues, an Integrative Framework, and Directions for Future Research. *Australian Journal of Psychology, 73*(1), 87–102. https://doi.org/10.1080/00049530.2021.1883409

Angell, M. (1993). Privilege and health–what is the connection? *The New England Journal of Medicine, 329*(2), 126–127. https://doi.org/10.1056/NEJM199307083290210

Bahadir-Yilmaz, E., & Fatma Oz, R. N. (2015). The resilience levels of first-year medical, dentistry, pharmacy and health sciences students. *International Journal of Caring Sciences, 8*(2), 385.

Baumeister, R. F., & Leary, M. R. (1995). The need to belong: desire for interpersonal attachments as a fundamental human motivation. *Psychological Bulletin, 117*(3), 497.

Bennett, J. B., Neeper, M., Linde, B. D., Lucas, G. M., & Simone, L. (2018). Team Resilience training in the workplace: E-Learning adaptation, measurement model, and two pilot studies. *JMIR Mental Health, 5*, e35. https://doi.org/10.2196/mental.8955.

Bethell, C. D., Newacheck, P., Hawes, E., & Halfon, N. (2014). Adverse childhood experiences: Assessing the impact on health and school engagement and the mitigating role of resilience. *Health Affairs (Millwood), 33*, 2106–2115. https://doi.org/10.1377/hlthaff.2014.0914

Bittmann, F. (2021). When problems just bounce back: about the relation between resilience and academic success in German tertiary education. *SN Social Sciences, 1*(2), 65. https://doi.org/10.1007/s43545-021-00060-6

Blickenstaff, H. R., Bastin, T. J., & Byram, J. N. (2021). Exploring resilience factors in medical students with adverse childhood experiences: A pilot study. *Academic Psychiatry*. https://doi.org/10.1007/s40596-021-01560-6

Braveman, P., & Gottlieb, L. (2014). The social determinants of health: It's time to consider the causes of the causes. *Public Health Reports, 129*(Suppl 2), 19–31. https://doi.org/10.1177/00333549141291S 206

Brown, D. L., & Tylka, T. L. (2011). Racial discrimination and resilience in African American young adults: Examining racial socialization as a moderator. *Journal of Black Psychology, 7*(3), 259–85.

Budge, S. L., Domínguez, S., Jr., & Goldberg, A. E. (2020). Minority stress in nonbinary students in higher education: The role of campus climate and belongingness. *Psychology of Sexual Orientation and Gender Diversity, 7*(2), 222–229. https://doi.org/10.1037/sgd0000360

Bullock, J. L., Lai, C. J., Lockspeiser, T., O'Sullivan, P. S., Aronowitz, P., Dellmore, D., Fung, C.-C., Knight, C., & Hauer, K. E. (2019). In pursuit of honors: A multi-institutional study of students' perceptions of clerkship evaluation and grading. *Academic Medicine, 94*, S48–S56. https://doi.org/10.1097/ACM.0000000000002905

Butler, L. D., Carello, J., & Maguin, E. (2017). Trauma, stress, and self-care in clinical training: Predictors of burnout, decline in health status, secondary traumatic stress symptoms, and compassion satisfaction. *Psychological Trauma: Theory, Research, Practice, and Policy, 9*(4), 416–424.

Bush, N., & Danielle S. R. (2021). Bringing a neurobiological perspective to resilience, in *Michael Ungar (ed.), Multisystemic Resilience: Adaptation and Transformation in Contexts of Change*. https://doi.org/10.1093/oso/9780190095888.003.0003

Byers, O. M., Fitzpatrick, J. J., McDonald, P. E., & Nelson, G. C. (2021). Giving while grieving: Racism-related stress and psychological resilience in Black/African American registered nurses. *Nurs Outlook, 69*(6), 1039–1048. https://doi.org/10.1016/j.outlook.2021.05.010

Chen, P.G.-C., Curry, L. A., Bernheim, S. M., Berg, D., Gozu, A., & Nunez-Smith, M. (2011). Professional challenges of non-U.S.-born international medical graduates and recommendations for support during

residency training. *Academic Medicine, 86*, 1383–1388. https://doi.org/10.1097/ACM.0b013e31823035e1

Chisholm-Burns, M. A., Berg-Poppe, P., Spivey, C. A., Karges-Brown, J., & Pithan, A. (2021). Systematic review of noncognitive factors influence on health professions students' academic performance. *Advances in Health Sciences Education: Theory and Practice, 26*(4), 1373–1445. https://doi.org/10.1007/s10459-021-10042-1

Chow, K. M., Tang, W. K. F., Chan, W. H. C., Sit, W. H. J., Choi, K. C., & Chan, S. (2018). Resilience and well-being of university nursing students in Hong Kong: A cross-sectional study. *BMC Medical Education, 18*, 13. https://doi.org/10.1186/s12909-018-1119-0

Collins, H., & Foote, D. (2005). Managing stress in veterinary students. *Journal of Veterinary Medical Education, 32*, 170–172. https://doi.org/10.3138/jvme.32.2.170

Commission on Social Determinants of Health (2008). Closing the gap in a generation: Health equity through action on the social determinants of health. *The Lancet*. https://www.who.int/publications/i/item/WHO-IER-CSDH-08.1

Cosco, T. D., Cooper, R., Kuh, D., & Stafford, M. (2018). Socioeconomic inequalities in resilience and vulnerability among older adults: A population-based birth cohort analysis. *International Psychogeriatrics, 30*, 695–703. https://doi.org/10.1017/S1041610217002198

Destin, M., Hanselman, P., Buontempo, J., Tipton, E., & Yeager, D. S. (2019). Do Student Mindsets Differ by Socioeconomic Status and Explain Disparities in Academic Achievement in the United States? *AERA Open*. https://doi.org/10.1177/2332858419857706

Dimant, O. E., Cook, T. E., Greene, R. E., & Radix, A. E. (2019). Experiences of transgender and gender nonbinary medical students and physicians. *Transgender Health, 4*, 209–216. https://doi.org/10.1089/trgh.2019.0021

Duncan, R. D. (2000). Childhood maltreatment and college drop-out rates: Implications for child abuse researchers. *Journal of Interpersonal violence, 15*, 987–995. https://doi.org/10.1177/088626000015009005

Dyrbye, L. N., Massie, F. S., Eacker, A., Harper, W., Power, D., Durning, S. J., Thomas, M. R., Moutier, C., Satele, D., Sloan, J., et al. (2010a). Relationship between burnout and professional conduct and attitudes among US medical students. *JAMA, 304*, 1173–1180. https://doi.org/10.1001/jama.2010.1318

Dyrbye, L. N., Power, D. V., Massie, F. S., Eacker, A., Harper, W., Thomas, M. R., Szydlo, D. W., Sloan, J. A., & Shanafelt, T. D. (2010b). Factors associated with resilience to and recovery from burnout: A prospective, multi-institutional study of US medical students. *Medical Education, 44*, 1016–1026. https://doi.org/10.1111/j.1365-2923.2010.03754.x

Dyrbye, L. N., Thomas, M. R., Eacker, A., Harper, W., Massie, F. S., Power, D. V., Huschka, M., Novotny, P. J., Sloan, J. A., & Shanafelt, T. D. (2007). Race, ethnicity, and medical student well-being in the United States. *Archives of Internal Medicine, 167*, 2103–2109. https://doi.org/10.1001/archinte.167.19.2103

Dyrbye, L. N., Thomas, M. R., Huschka, M. M., Lawson, K. L., Novotny, P. J., Sloan, J. A., & Shanafelt, T. D. (2006). A multicenter study of burnout, depression, and quality of life in minority and nonminority US medical students. *Mayo Clinic Proceedings, 81*, 1435–1442. https://doi.org/10.4065/81.11.1435

Elmore, R. G. (2003). The lack of racial diversity in veterinary medicine. *Journal of the American Veterinary Medical Association, 222*, 24–26. https://doi.org/10.2460/javma.2003.222.24

Fan, A. P. C., Chen, C.-H., Su, T.-P., Shih, W.-J., Lee, C.-H., & Hou, S.-M. (2007). The association between parental socioeconomic status (SES) and medical students' personal and professional development. *Annals of the Academy of Medicine, Singapore, 36*, 735–742.

Fares, J., Al Tabosh, H., Saadeddin, Z., El Mouhayyar, C., & Aridi, H. (2016). Stress, burnout and coping strategies in preclinical medical students. *North American Journal of Medical Sciences, 8*, 75–81. https://doi.org/10.4103/1947-2714.177299

Felitti, V. J., Anda, R. F., Nordenberg, D., Williamson, D. F., Spitz, A. M., Edwards, V., Koss, M. P., & Marks, J. S. (1998). Relationship of childhood abuse and household dysfunction to many of the leading causes of death in adults. *American Journal of Preventive Medicine, 14*, 245–258. https://doi.org/10.1016/S0749-3797(98)00017-8

Genn, J. M. (2001). AMEE Medical Education Guide No. 23 (Part 1): Curriculum, environment, climate, quality and change in medical education-a unifying perspective. *Medical Teacher, 23*, 337–344. https://doi.org/10.1080/01421590120063330

Gerull, K. M., Parameswaran, P., Jeffe, D. B., Salles, A., & Cipriano, C. A. (2021). Does medical students' sense of belonging affect their interest in orthopaedic surgery careers? A qualitative investigation. *Clinical Orthopaedics and Related Research*. https://doi.org/10.1097/CORR.0000000000001751

Graham, C. L., Phillips, S. M., Newman, S. D., & Atz, T. W. (2016). Baccalaureate minority nursing students perceived barriers and facilitators to clinical education practices: An integrative review. *Nursing Education Perspectives, 37*, 130–137.

Grobecker, P. A. (2016). A sense of belonging and perceived stress among baccalaureate nursing students in clinical placements. *Nurse Education Today, 36*, 178–183. https://doi.org/10.1016/j.nedt.2015.09.015

Hafferty, F. W. (1998). Beyond curriculum reform: Confronting medicine's hidden curriculum. *Academic Medicine, 73*(4), 403–475.

Hagerty, B. M., Williams, R. A., Coyne, J. C., & Early, M. R. (1996). Sense of belonging and indicators of social and psychological functioning. *Archives of Psychiatric Nursing, 10*, 235–244. https://doi.org/10.1016/S0883-9417(96)80029-X

Haring, U., Sorin, R., & Caltabiano, N. J. (2019). Reflecting on childhood and child agency in history. *Palgrave Communications, 5*, 52. https://doi.org/10.1057/s41599-019-0259-0

Hartley, M. T. (2011). Examining the relationships between resilience, mental health, and academic persistence in undergraduate college students. *Journal of American College Health, 59*(7), 596–604. https://doi.org/10.1080/07448481.2010.515632

He, F. X., Turnbull, B., Kirshbaum, M. N., Phillips, B., & Klainin-Yobas, P. (2018). Assessing stress, protective factors and psychological well-being among undergraduate nursing students. *Nurse Education Today, 68*, 4–12. https://doi.org/10.1016/j.nedt.2018.05.013

Hirani, S., Lasiuk, G., & Hegadoren, K. (2016). The intersection of gender and resilience. *Journal of Psychiatric and Mental Health Nursing, 23*(6–7), 455–467. https://doi.org/10.1111/jpm.12313

Holzer, C. E., Shea, B. M., Swanson, J. W., Leaf, P. J., et al. (1986). The increased risk for specific psychiatric disorders among persons of low socioeconomic status. *American Journal of Social Psychiatry, 6*(4), 259–271.

Honda, K., Levett-Jones, T., Stone, T., & Maguire, J. (2016). Japanese nursing students' sense of belonging: A story of Uchi (insider) and Soto (outsider). *Nurse Education in Practice, 20*, 85–92. https://doi.org/10.1016/j.nepr.2016.07.004

Howansky, K., Maimon, M., & Sanchez, D. (2021). Identity safety cues predict instructor impressions, belonging, and absences in the psychology classroom. *Teaching of Psychology*. https://doi.org/10.1177/0098628321990362

Howe, A., Smajdor, A., & Stöckl, A. (2012). Towards an understanding of resilience and its relevance to medical training. *Medical Education, 46*, 349–356. https://doi.org/10.1111/j.1365-2923.2011.04188.x

Huang, J. Y., Gavin, A. R., Richardson, T. S., Rowhani-Rahbar, A., Siscovick, D. S., & Enquobahrie, D. A. (2015). Are early-life socioeconomic conditions directly related to birth outcomes? Grandmaternal education, grandchild birth weight, and associated bias analyses. *American Journal of Epidemiology, 182*(7), 568–578. https://doi.org/10.1093/aje/kwv148

Isik, U., Wouters, A., Croiset, G., & Kusurkar, R. A. (2021). What kind of support do I need to be successful as an ethnic minority medical student? A qualitative study. *BMC Medical Education, 21*, 6. https://doi.org/10.1186/s12909-020-02423-8

Jackson, E. R., Shanafelt, T. D., Hasan, O., Satele, D. V., & Dyrbye, L. N. (2016). Burnout and alcohol abuse/dependence among U.S. medical students. *Academic Medicine, 91*, 1251–1256. https://doi.org/10.1097/ACM.0000000000001138

Jordan, R. K., Shah, S. S., Desai, H., Tripi, J., Mitchell, A., & Worth, R. G. (2020). Variation of stress levels, burnout, and resilience throughout the academic year in first-year medical students. *PLoS One, 15*, e0240667. https://doi.org/10.1371/journal.pone.0240667

Kalisch, R., Baker, D. G., Basten, U., Boks, M. P., Bonanno, G. A., Brummelman, E., Chmitorz, A., Fernàndez, G., Fiebach, C. J., Galatzer-Levy, I., et al. (2017). The resilience framework as a strategy to combat stress-related disorders. *Nature Human Behaviour, 1*, 784–790. https://doi.org/10.1038/s41562-017-0200-8

Kameg, B. N., Lindsay, D., Lee, H., & Mitchell, A. (2020). Substance use and exposure to adverse childhood experiences in undergraduate and graduate nursing students[formula: See text]. *Journal of the American Psychiatric Nurses Association, 26*, 354–363. https://doi.org/10.1177/1078390320905669

Karatekin, C. (2018). Adverse childhood experiences (aces), stress and mental health in college students. *Stress and Health, 34*, 36–45. https://doi.org/10.1002/smi.2761

Killinger, S. L., Flanagan, S., Castine, E., & Howard, K. A. S. (2017). Stress and depression among veterinary medical students. *Journal of Veterinary Medical Education, 44*, 3–8. https://doi.org/10.3138/jvme.0116-018R1

Kim, B., Jee, S., Lee, J., An, S., & Lee, S. M. (2018). Relationships between social support and student burnout: A meta-analytic approach. *Stress and Health, 34*, 127–134. https://doi.org/10.1002/smi.2771

Kunzler, A. M., Helmreich, I., König, J., Chmitorz, A., Wessa, M., Binder, H., & Lieb, K. (2020). Psychological interventions to foster resilience in healthcare students. *Cochrane Database Systematic Reviews, 7*, CD013684. https://doi.org/10.1002/14651858.CD013684

Labrague, L. J., McEnroe-Petitte, D. M., Gloe, D., Thomas, L., Papathanasiou, I. V., & Tsaras, K. (2017). A literature review on stress and coping strategies in nursing students. *Journal of Mental Health, 26*, 471–480. https://doi.org/10.1080/09638237.2016.1244721

Lowrance, A. M., & Birnbaum, M. G. (2019). Am i disadvantaged? How applicants decide whether to use the disadvantaged status in the american medical college application service. *Academic Medicine, 94*(11), 1766–1773. https://doi.org/10.1097/ACM.0000000000002798

Low, D., Pollack, S. W., Liao, Z. C., Maestas, R., Kirven, L. E., Eacker, A. M., & Morales, L. S. (2019). Racial/ethnic disparities in clinical grading in medical school. *Teaching and Learning in Medicine, 31*, 487–496. https://doi.org/10.1080/10401334.2019.1597724

Lowe, S. R, Hennein, R, Feingold, J. H., et al. (2021). Are women less psychologically resilient than men? Background stressors underlying gender differences in reports of stress-related psychological sequelae. *Journal of Clinical Psychiatry, 83*(1):21br14098. https://doi.org/10.4088/JCP.21br14098

Luthar, S. S., & Cicchetti, D. (2000). The construct of resilience: implications for interventions and social policies. *Development and Psychopathology, 12*(4), 857–885. https://doi.org/10.1017/s0954579400004156

Mao, Y., Zhang, N., Liu, J., Zhu, B., He, R., & Wang, X. (2019). A systematic review of depression and anxiety in medical students in China. *BMC Medical Education, 19*, 327. https://doi.org/10.1186/s12909-019-1744-2

Mason, H. R. C., Winseman, J., & Marcellon, R. (2018). First-generation medical student wellness in the United States. *Journal of Best Practices.*

Mcdermott, R. C., Fruh, S. M., Williams, S., Hauff, C., Graves, R. J., Melnyk, B. M., & Hall, H. R. (2020). Nursing students' resilience, depression, well-being, and academic distress: Testing a moderated mediation model. *Journal of Advanced Nursing, 76*, 3385–3397. https://doi.org/10.1111/jan.14531

McKee-Lopez, G., Robbins, L., Provencio-Vasquez, E., & Olvera, H. (2019). The relationship of childhood adversity on burnout and depression among BSN students. *Journal of Professional Nursing, 35*, 112–119. https://doi.org/10.1016/j.profnurs.2018.09.008

Mealer, M., Jones, J., Newman, J., McFann, K. K., Rothbaum, B., & Moss, M. (2012). The presence of resilience is associated with a healthier psychological profile in intensive care unit (ICU) nurses: Results of a national survey. *International Journal of Nursing Studies, 49*, 292–299. https://doi.org/10.1016/j.ijnurstu.2011.09.015

Metzger, M., Taggart, J., & Aviles, E. (2020). Fourth-year baccalaureate nursing students' perceptions of inclusive learning environments. *Journal of Nursing Education, 59*, 256–262. https://doi.org/10.3928/01484834-20200422-04

Meyer, I. H. (2003). Prejudice, social stress, and mental health in lesbian, gay, and bisexual populations: Conceptual issues and research evidence. *Psychological Bulletin, 129*(5), 674–697. https://doi.org/10.1037/0033-2909.129.5.674

Middleton, R., Fernandez, R., Cutler, N., Jans, C., Antoniou, C., Trostian, B., & Riley, K. (2021). Students' perceptions of belonging in the School of Nursing at a regional university in Australia. *Nurse Education Today, 99*, 104817. https://doi.org/10.1016/j.nedt.2021.104817

Niitsu, K., Rice, M. J., Houfek, J. F., Stoltenberg, S. F., Kupzyk, K. A., & Barron, C. R. (2019). A systematic review of genetic influence on psychological resilience. *Biological Research for Nursing, 21*(1), 61–71. https://doi.org/10.1177/1099800418800396

Ozsaban, A., Turan, N., & Kaya, H. (2019). Resilience in nursing students: The effect of academic stress and social support. *Clinical and Experimental Health Sciences, 9*, 71–78. https://doi.org/10.33808/marusbed.546903

Panagioti, M., Geraghty, K., Johnson, J., Zhou, A., Panagopoulou, E., Chew-Graham, C., Peters, D., Hodkinson, A., Riley, R., & Esmail, A. (2018). Association between physician burnout and patient safety, professionalism, and patient satisfaction: A systematic review and meta-analysis. *JAMA Internal Medicine, 178*, 1317–1331. https://doi.org/10.1001/jamainternmed.2018.3713

Park, K. H., Kim, D., Kim, S. K., Yi, Y. H., Jeong, J. H., Chae, J., Hwang, J., & Roh, H. (2015). The relationships between empathy, stress and social support among medical students. *International Journal of Medical Education, 6*, 103–108. https://doi.org/10.5116/ijme.55e6.0d44

Perry, S. P., Hardeman, R., Burke, S. E., Cunningham, B., Burgess, D. J., & van Ryn, M. (2016). The impact of everyday discrimination and racial identity centrality on african american medical student well-being: a report from the medical student change study. *Journal of Racial and Ethnic Health Disparities, 3*(3), 519–526. https://doi.org/10.1007/s40615-015-0170-3

Przedworski, J. M., Dovidio, J. F., Hardeman, R. R., Phelan, S. M., Burke, S. E., Ruben, M. A., Perry, S. P., Burgess, D. J., Nelson, D. B., Yeazel, M. W., et al. (2015). A comparison of the mental health and well-being of sexual minority and heterosexual first-year medical students: A report from the Medical Student CHANGE Study. *Academic Medicine, 90*, 652–659. https://doi.org/10.1097/ACM.0000000000000658

Rees, C. S., Breen, L. J., Cusack, L., & Hegney, D. (2015). Understanding individual resilience in the workplace: The international collaboration of workforce resilience model. *Frontiers in Psychology, 6*, 73. https://doi.org/10.3389/fpsyg.2015.00073

Reeve, K. L., Shumaker, C. J., Yearwood, E. L., Crowell, N. A., & Riley, J. B. (2013). Perceived stress and social support in undergraduate nursing students' educational experiences. *Nurse Education Today, 33*, 419–424. https://doi.org/10.1016/j.nedt.2012.11.009

Reilly, J. E. R., & Fitzpatrick, J. J. (2009). Perceived stress and sense of belonging in doctor of nursing practice students. *Journal of Professional Nursing, 25*, 81–86. https://doi.org/10.1016/j.profnurs.2008.10.002

Ridout, K. K., Ridout, S. J., Guille, C., Mata, D. A., Akil, H., & Sen, S. (2019). Physician-training stress and accelerated cellular aging. *Biological Psychiatry, 86*(9), 725–730. https://doi.org/10.1016/j.biopsych.2019.04.030

Rotenstein, L. S., Ramos, M. A., Torre, M., Segal, J. B., Peluso, M. J., Guille, C., Sen, S., & Mata, D. A. (2016). Prevalence of depression, depressive symptoms, and suicidal ideation among medical students: A systematic review and meta-analysis. *JAMA, 316*, 2214–2236. https://doi.org/10.1001/jama.2016.17324

Rudman, A., & Gustavsson, J. P. (2012). Burnout during nursing education predicts lower occupational preparedness and future clinical performance: A longitudinal study. *International Journal of Nursing Studies, 49*, 988–1001. https://doi.org/10.1016/j.ijnurstu.2012.03.010

Samuels, E. A., Boatright, D. H., Wong, A. H., Cramer, L. D., Desai, M. M., Solotke, M. T., Latimore, D., & Gross, C. P. (2021). Association between sexual orientation, mistreatment, and burnout among US medical students. *JAMA Network Open, 4*, e2036136. https://doi.org/10.1001/jamanetworkopen.2020.36136

Schoon, I., & Bynner, J. (2003). Risk and resilience in the life course: Implications for interventions and social policies. *Journal of Youth Studies, 6*, 21–31. https://doi.org/10.1080/1367626032000068145

Sciolla, A. F., Wilkes, M. S., & Griffin, E. J. (2019). Adverse childhood experiences in medical students: Implications for wellness. *Academic Psychiatry, 43*, 369–374. https://doi.org/10.1007/s40596-019-01047-5

Soemantri, D., Herrera, C., & Riquelme, A. (2010). Measuring the educational environment in health professions studies: A systematic review. *Medical Teacher, 32*, 947–952. https://doi.org/10.3109/01421591003686229

Song, L., Son, J., & Lin, N. (2011). Social support. *The SAGE handbook of social network.*

Stebleton, M. J., Soria, K. M., & Huesman, R. L. (2014). First-generation students' sense of belonging, mental health, and use of counseling services at public research universities. *Journal of College Counseling, 17*, 6–20. https://doi.org/10.1002/j.2161-1882.2014.00044.x

Strand, E. B., Brandt, J., Rogers, K., Fonken, L., Chun, R., Conlon, P., & Lord, L. (2017). Adverse childhood experiences among veterinary medical students: A multi-site study. *Journal of Veterinary Medical Education, 44*, 260–267. https://doi.org/10.3138/jvme.0816-123R

Strauss, E. J., Markus, D. H., Kingery, M. T., Zuckerman, J., & Egol, K. A. (2019). Orthopaedic resident burnout is associated with poor in-training examination performance. *Journal of Bone Joint Surgery America, 101*, e102. https://doi.org/10.2106/JBJS.18.00979

Sundar, M., & Archana, R. (2020). International Journal of Research in Pharmaceutical Sciences.

Turner, J., Higgins, R., & Childs, E. (2021). Microaggression and implicit bias. *American Surgeon, 87*(11), 1727–1731. https://doi.org/10.1177/00031348211023418

Traynor, M. (2018). Guest editorial: What's wrong with resilience. *Journal of Research in Nursing , 23*(1), 5–8. https://doi.org/10.1177/1744987117751458

Ungar, M. (2013). Resilience, trauma, context, and culture. *Trauma Violence Abuse, 14*(3), 255–266. https://doi.org/10.1177/1524838013487805

Ungar, M., & Liebenberg, L. (2011). Assessing resilience across cultures using mixed methods: Construction of the child and youth resilience measure. *Journal of Mixed Methods Research, 5*, 126–149. https://doi.org/10.1177/1558689811400607

Wang, K., Burke, S. E., Przedworski, J. M., Wittlin, N. M., Onyeador, I. N., Dovidio, J. F., Dyrbye, L. N., Herrin, J., & van Ryn, M. (2020). A comparison of depression and anxiety symptoms between sexual minority and heterosexual medical residents: A report from the medical trainee change study. *LGBT Health, 7*, 332–339. https://doi.org/10.1089/lgbt.2020.0027

Wilkes, M. S., Hoffman, J. R., Slavin, S. J., Usatine, A., & Richard, P. (2013). The next generation of doctoring. *Academic Medicine, 88*(4), 438–441. https://doi.org/10.1097/ACM.0b013e318285b019

Yu, J., & Chae, S. (2020). The mediating effect of resilience on the relationship between the academic burnout and psychological well-being of medical students. *Korean Journal of Medical Education, 32*, 13–21. https://doi.org/10.3946/kjme.2020.149

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