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INTERSECTIONALITY AS LIVE THEORY AND PRACTICE IN THE BIOMEDICAL SCIENCES

M. Boulicault, T. Rushovich, H. Shattuck-Heidorn, and S. S. Richardson

In the spring of 2021, as we emerged from the deadly winter of 2020, our lab published two seemingly unrelated papers. The first was a relatively straightforward statistical analysis of the relationships between race, sex, and COVID-19 mortality in the US, which we explicitly centered in Black feminist theory and intersectionality (and had a damned hard time getting published). The second was a lengthy theoretical analysis, proposing a counterhypothesis aimed at a set of claims around the decline of "Western" human sperm counts – claims which have been taken up as a banner by white nationalists and men's rights activists. At first glance, there are few clear-cut connections between these research projects. Yet, we argue that they each offer a complementary model of how to successfully integrate intersectional frameworks into biomedical research.

When we formed the GenderSci Lab in 2018, our aim was to challenge traditional knowledge production modes in the academy, particularly in the sciences. These traditional modes grant greater epistemic authority to certain bodies of knowledge (i.e., STEM fields) and often insist on disciplinary purity. In contrast, our lab, committed to analyzing claims of gender/sex differences in the biomedical sciences, draws together scholars across disciplines who are trained in diverse methodologies. Our experience working in this way has only deepened and affirmed our understanding that there is no possibility of an accurate, critical understanding of gender/sex as an explanatory category within the life sciences without the application of intersectional frameworks. In this essay, we offer an account of intersectionality as live theory and practice in feminist STS and science research, grounded in the GenderSci Lab's recent experience analyzing COVID-19 mortality and theories of global sperm count decline.

We will not detail the intellectual history of intersectionality; there are excellent chapters in this volume that cover this topic (as do recent texts including Hancock's *Intersectionality: An Intellectual History* (2016), Collins' *Intersectionality as Critical Social Theory* (2019), and Nash's *Black Feminism Reimagined: After Intersectionality* (2019)). Here, we focus on our experiences conducting research in the life sciences and practicing intersectionality as a guiding epistemological framework, motivating research questions, analytical designs, and publication strategies.

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37.1 Case studies in applying intersectionality to biomedical sciences

37.1.1 Sex and race in COVID-19 mortality data

In spring of 2020, at the start of the COVID-19 pandemic, our lab members were thrown into a virtual environment. Many of us found ourselves frantically grappling with a lack of childcare, or suddenly switching to teaching (or learning) online. We were, like everyone else, hyper-focused on the pandemic.

As demographic data on cases and deaths began to emerge, it became clear that in many places more men than women were dying of COVID-19. Reports of sex disparities were often accompanied by causal claims that attributed them to innate sex differences (Scully et al. 2020). We were struck by the lack of engagement with evidence for pre-existing and widespread gender-linked health differences between and among categories of men and women (Shattuck-Heidorn, Richardson, and Reiches 2020). There was ample, easily accessible evidence that these pre-existing differences could impact disease susceptibility and progression, including evidence from prior coronavirus pandemics demonstrating that apparent sex differences were largely explained by gender-differentials in comorbidities, occupations, and exposures, not biological factors (Bengtsson, Dribe, and Eriksson 2018; Jia et al. 2009; Paskoff and Sattenspiel 2019; Shattuck-Heidorn, Richardson, and Reiches 2020; Yang et al. 2017). Instead of a contextualized analysis of men and women's susceptibility to COVID-19, we watched as efforts to understand the sex disparity in COVID-19 outcomes focused on biologically driven differences between men and women, such as genes on the X and Y chromosomes, gonadal hormones, or deep evolutionary divergences related to immune function and reproduction (Klein et al. 2020; Takahashi et al. 2020).

In order to better understand such claims, we began tracking COVID-19 case and mortality rates by sex in the United States, manually collecting and updating the data on a weekly basis from state-level public health websites (Harvard GenderSci Lab 2020). We contextualized these data and made them publicly available by offering charts and figures examining the findings in relation to population size and age structure. Our results indicated that the apparent sex difference was far from straightforward; the male to female mortality rate ratio varied widely across states and over time. For example, in Texas, the weekly COVID-19 mortality rate was consistently higher among men than among women (in all but one week), while in Connecticut, the weekly COVID mortality rate was higher among women in about half the weeks. In New York, the initial wave of the pandemic had a startlingly high mortality among men (1.56 times as high as women), but then from May onwards this disparity decreased in magnitude, with a sex ratio as low as 1.1 (Harvard GenderSci Lab 2020).

As the pandemic wore on, it also became clear that there were severe disparities across racial groups in the United States that replicated pre-existing health disparities (Bassett, Chen, and Krieger 2020; Chowkwanyun and Reed 2020; Millett et al. 2020). Compared to white Americans, COVID-19 mortality rates were close to four times higher among non-Hispanic Black Americans, and three times higher among Hispanic Americans. Within specific age groups, disparities were even greater, for example, among those aged 35–44, the COVID-19 mortality rate was nine times higher among non-Hispanic Black Americans than non-Hispanic white Americans (Bassett, Chen, and Krieger 2020). Data and theoretical pieces laid out how these racial disparities were not due to innate biological susceptibility, but rather represented the effects of racism at the interpersonal, institutional and structural levels (Pilkington, 2020; Chotiner 2020; Egede and Walker 2020; Krieger 2020). For instance, COVID-19 outcomes were patterned by social and structural factors including racialized and economic segregation, crowded housing, and neighborhood poverty level (Chen and Krieger 2021; Yearby and

Mohapatra 2020). However, no reports examined how mortality varied by sex within race, or how the apparent sex difference in mortality varied across race.

Motivated by the importance of further understanding the clear racial disparities and the apparent sex disparity, we collected all available US state-level data that would allow us to conduct a sex-by-race analysis. We hypothesized that if there is a strong sex-driven biological contributor to the apparent sex disparity, there should be relatively similar sex differences across social groups. Conversely, if the reason for the sex difference is largely due to social factors, we would expect to see variation in the sex difference between social groups. Based on results of previously cited analyses, we expected that Black Americans would have higher COVID-19 mortality than white Americans, but we did not know what analyzing race by sex mortality rates would reveal.

Our results were stark (Figure 37.1) (Rushovich et al. 2021). When COVID-19 deaths were compared across sex and racial group we saw important variation that had been masked in univariate analyses. We found that Black men had much higher mortality rates than any other race or sex group, revealing a particularly vulnerable subgroup. But, contrary to the common story of "men" as uniquely vulnerable, Black women had three to four times the mortality rate of white or Asian/Pacific Islander men. We also found that the sex disparity in mortality varied widely between racial groups. The mortality difference between Black men and Black women was larger than the corresponding disparity among white men and white women, or among Asian/Pacific Islander men and Asian/Pacific Islander women. Additionally, our analysis revealed significant racial disparities within sex. The difference in mortality between Black women and white women was up to 3.8 times greater than the sex disparity between white men and white women.

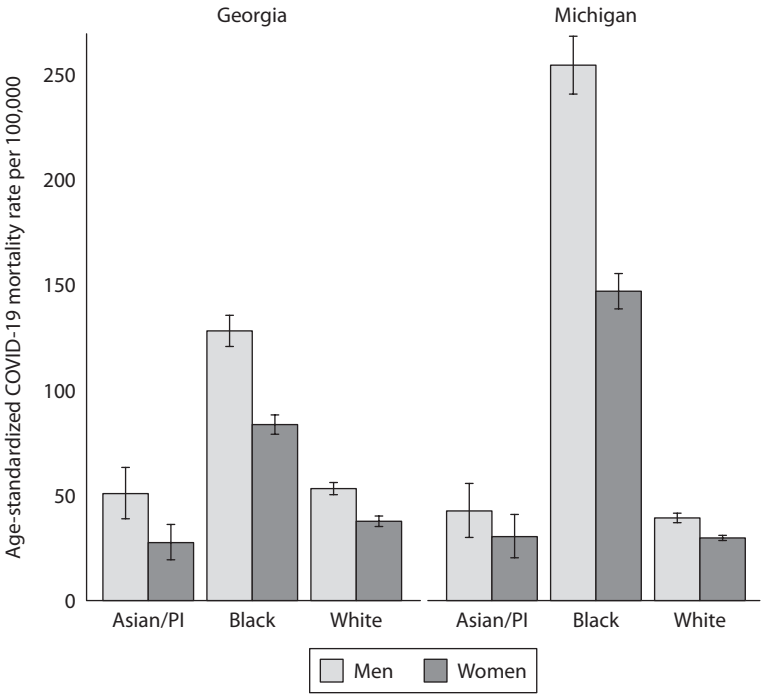

Figure 37.1 Age-standardized COVID-19 mortality rate by race and sex in Georgia and Michigan, USA (March 2020–September 2021).

There is an increasingly rich literature examining how STEM and other primarily quantitative fields can best apply intersectional approaches (Bauer 2014; Bauer and Scheim 2019; Bowleg 2008; Bowleg and Bauer 2016; Else-Quest and Hyde 2016). Largely, this prior work has agreed that STEM fields are well-poised to adopt a variety of statistical methods to analyze how intersecting social identities impact health and biology. However, such quantitative approaches to intersectionality must be embedded within an epistemological stance committed to contextualizing the data within broader societal structures of power and inequality. Given such epistemological commitments, intersectionality can motivate intra- and inter-categorical analysis in the biomedical sciences that uncovers previously hidden disparities.

For us, our commitment to intersectionality in this research is demonstrated through explicit framing of our analysis in Black feminist theory and intersectionality, as well as the contextualization of our results in terms of structural racism and the historical and ongoing oppression of Black communities in America. Our consideration of interacting categories of race and sex demonstrates how univariate analysis can mask important variation, as we uncovered patterns that were not visible when considering either race or sex on their own. However, in agreement with the larger discussion of the practice of intersectionality within the STEM fields cited above, we do not consider the adoption of a multivariate analysis sufficient for the practice of intersectionality. Multivariate analysis alone is unable to address or answer complex questions about the ways that intersecting systems of oppression produce COVID-19 mortality disparities. For us, what makes our analysis an application of intersectional methods is the consideration of societal power dynamics that underlie the patterns we observe, rather than the statistical interactions that we report.

37.1.2 Interrogating scientific assumptions in theories of global sperm count decline

For over 50 years, scientists have been concerned about declining sperm counts. In 2017, these concerns culminated in an extraordinarily high-impact meta-analysis reporting that average sperm counts among "Western" populations has decreased by 50% between 1973 and 2011 (Levine et al. 2017). As a demonstration of the degree of uptake this study received, consider that it is the most cited study ever published by *Human Reproduction Update*, a leading journal in the field of reproductive biology ("Web of Science," n.d.). Hagai Levine, the study's lead author, saw these results as a "canary in the coalmine" for male fertility and for "male health across the lifespan" (Levine et al. 2017, 654). In her 2021 book *Count Down*, Shanna Swan, one of the study's senior authors, compares the implications of the study to dystopian science fiction: "some of what we've been thinking of as fiction from stories such as *The Handmaid's Tale* and *Children of Men*, is rapidly becoming a reality" (Swan and Colino 2021, 8). Public media concurred, with the BBC pronouncing that declining sperm count "could make humans extinct," and *GQ* suggesting that "we're on track … to void the species entirely" (Ghosh 2017; Halpern 2018).

Claims of uniquely declining sperm among "Western" (white) men have received wide uptake by white supremacist and misogynistic groups, which is a key reason our lab chose to engage with and better understand this work. Relying on claims of declining sperm, these groups argue that the fertility and health of men in whiter "Western" nations are in imminent danger. Often, this danger is explicitly or implicitly linked to a perceived increase in the influence of diverse feminist and anti-racist movements and to longstanding white supremacist fears of white reproductive decline (Ferber 1999; Moore 2002; Moore 2018; Perret 2021).

To understand Levine et al.'s (2017) sperm decline claims, one must understand how they analyzed their data. In their meta-analysis, Levine et al. (2017) divided the world into "Western"

and "Other." "Western" was defined by the study authors as North America, Europe, Australia, and New Zealand, and "Other" included all remaining countries (see Figure 37.2) (Boulicault et al. 2021). They found among men unselected by fertility status, "Western" men had relatively high sperm counts in the 1970s–1980s (99.0 million/mL, compared to 72.7 million/mL among "Other" men unselected by fertility status).

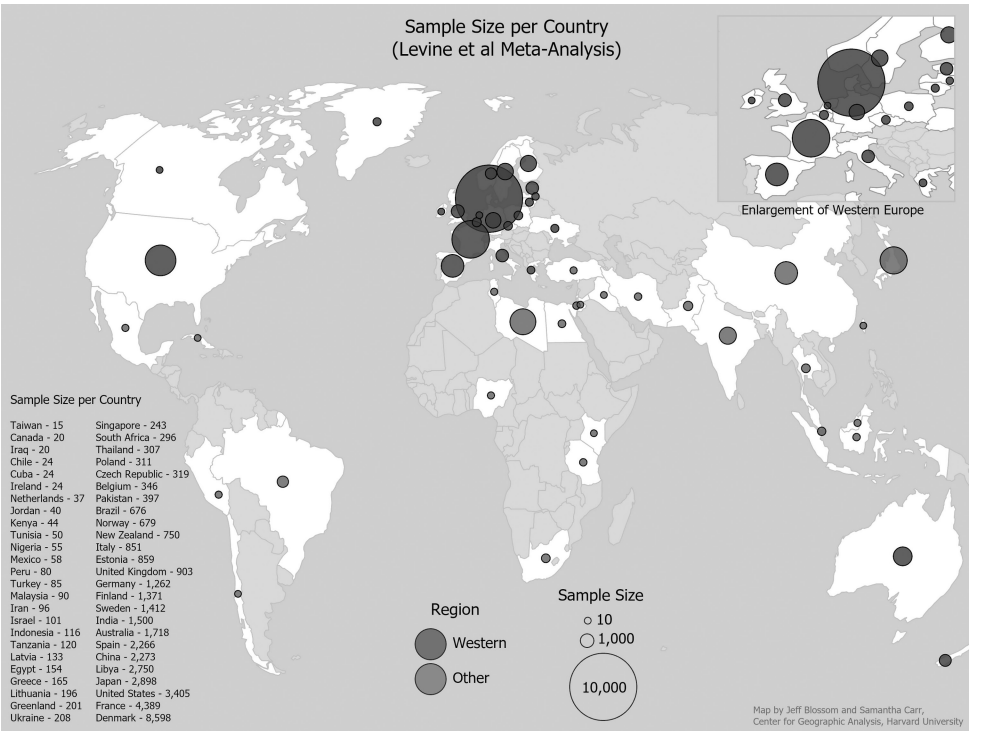

Figure 37.2 Number of sperm samples per country over the period 1973–2011 included in Levine et al. 2017. Source: Boulicault et al. 2021.

As of 2011, average sperm concentration among "Western" men has declined to 47.1 million/mL, while "Other" men's sperm concentration sits at 62.6 million/mL (see Table 37.1). These data led to Levine et al.'s operative claim that sperm count is declining at an unchecked rate among men categorized as "Western." (Table 37.1).

Table 37.1 Sperm concentration in the first and last years of the Levine et al. (2017) meta-regression analysis, for all men and by fertility and geographic groups "Western" and "Other"

Category	N	*First year*	*First year sperm count (millions/mL)*	*Last year*	*Last year sperm count (millions/mL)*
All men	244	1973	92.8	2011	66.4
Unselected Western	110	1973	99.0	2011	47.1
Fertile Western	65	1977	83.8	2009	62.0
Unselected Other	30	1986	72.7	2010	62.6
Fertile Other	39	1978	66.4	2011	75.7

Source: Boulicault et al. 2021.

In our analysis of sperm decline claims, we argue that Levine et al. (2017) use the categories of "Western" and "Other" to implicitly define a sperm count optimum—that of 1970s "Western" men—and treat deviations from this optimum as pathological. Further, the use of these categories assumes that it is warranted to compare bodies across these categories and across time. Yet, due to complex histories of migration between and across the Global South and the Global North, men in 1970s "Western" countries will be very different demographically from the men living in those countries today (Galka 2021). By organizing their data within these categories, the researchers invoke a history of racialized and gendered narratives situating men's bodies and environments labeled "Western" as an ideal under threat. As such, we argue that this categorization scheme serves as a key site where narratives of declining masculinity and narrative fears of imperiled white supremacy intersect within sperm decline research.

Demonstrating the conceptual, evidential, and ethical failures of the "Western" versus "Other" categorization scheme was not the only aim of our intervention. We also wanted to know if the patterns revealed by Levine et al.'s meta-analysis could be explained—perhaps better explained—without these assumptions. Put another way, how could scientific research on sperm count trends proceed with an awareness of the ways that gendered and racialized assumptions intersect to inform our scientific intuitions, assumptions, and decisions about how to best aggregate, compare, and analyze data?

To this end, we proposed a new hypothesis that we term the "sperm count biovariability hypothesis" as an alternative to Levine et al.'s "sperm count decline hypothesis" (Boulicault et al. 2021). The biovariability hypothesis allows for the possibility that, similar to other measures of reproductive function such as testosterone and progesterone, sperm counts may vary non-pathologically across populations and time. In line with currently available evidence, it begins with the premise that, above a certain threshold, high average population sperm counts are not necessarily optimal, nor are 1970s Western sperm counts a species-typical baseline. A biovariability approach, we argued, invites a wider interpretation of sperm count trends, without ruling out the possibility that sperm counts are declining among certain populations, or that sperm decline in certain contexts may be pathological. In summary, examining the same data and background literature with a different set of assumptions, we argued that the interpretation that population sperm counts vary within a wide optimum and across complex environmental and geographic conditions is at least as plausible as Levine et al.'s interpretation that steady pathological decline is occurring within populations categorized as "Western."

Compared to our work on COVID-19 and gendered structural racism, here the role of intersectional theory is not as obvious. We offer no original intra- or inter-categorical data analyses, and we do not explicitly call on intersectionality in the article itself. However, in many ways, we find that this piece more deeply sustains some of the key tenets of intersectionality, in particular, commitments to activism and to engaging with power in academic knowledge production and in broader social discourses. By rejecting the implicit assumption that white "Western" men represent the norm, our sperm count biovariability hypothesis offers a framework for more equitable, emancipatory scientific research on men's reproductive health. It constructs a new approach to global sperm count research that builds some of the central commitments and methods of intersectionality into the underlying scientific research framework.

As we will discuss further below, our work on sperm count decline research also demonstrates how our lab brings multiple perspectives to bear in order to generate critical knowledge that cuts across disciplines, examining societal and scientific power structures from multiple angles. In STEM fields, as in other disciplines, incorporating intersectionality challenges researchers to push beyond what Bilge describes as an "add-and-stir approach of incorporating minority issues as subject matter to extant disciplines in their conventional frames" (Bilge 2014). Practicing

intersectionality as live theory requires forging into the territory of anti-disciplinarity (Chen and Luetz 2020), including deeply questioning extant power structures both in academia and society at large. Aiming to put this into practice, we work to leverage the power available to us to put our research out into the world beyond academia. When we think beyond the work of the specific projects described above, to the broader work of the GenderSci Lab, this working-beyond-disciplinary-silos is a critical aspect of how we see ourselves as engaging robustly with intersectionality within our research practice.

37.2 Forging intersectionality in the STEM fields through sustained interdisciplinarity: the example of the GenderSci Lab

The GenderSci Lab is a collaborative, interdisciplinary lab at Harvard dedicated to generating concepts, methods, and theories for scientific research on sex and gender. In founding our lab, we drew inspiration from feminist collaboratives and research labs, such as the Civic Laboratory for Environmental Action Research ("CLEAR," n.d.), which claim feminism and anti-colonialism as central to their lab practices and research modalities. We see ourselves as part of a longstanding effort to incorporate feminist and other critical frameworks that actively consider societal power dynamics directly into scientific practice. Together with these other scholarly communities, the GenderSci Lab is aiming to fundamentally reimagine how science is conducted.

A home for scholars from a wide range of disciplines, we consider ourselves as both working across disciplinary boundaries and working to dissolve these same boundaries. The GenderSci Lab includes members trained in philosophy, neuroscience, epidemiology, history of science, anthropology, biology, and psychology. This wide range of disciplinary frameworks both informs the research questions we choose and provides diverse methodologies and skill sets with which to analyze and contextualize our findings. Our working model focuses on process and values, and performs an ongoing experiment in modeling a form of STS-science knowledge creation that extends beyond the boundaries of any particular discipline.

When we reflect on our experience as a lab focused on engaging in and developing dialogue with the empirical life sciences, we quickly land on our interdisciplinarity as a central site of praxis. We have described what we do as "practicing together," perhaps to capture that our work is always in process, always incomplete, always experimental, with many unrealized ideals. Our movement beyond our own disciplines is one of the most generative and dynamic parts of the lab; few of us have elsewhere experienced true, sustained interdisciplinarity. Yet we also find this knowledge-building model to be at odds with the organization of the academy as sharply divided across the natural, social, and humanistic disciplines, producing siloed ways of creating knowledge (Subramaniam 2014).

Our multi/inter/anti-disciplinarity is connected to how we understand ourselves as able to practice intersectionality. As we see it, intersectional analysis in STEM requires a theoretical and conceptual framing for research that is grounded in a commitment to unpacking power-knowledge dynamics. In working across disciplines to bring the insights on societal power structures to bear on gender/sex as it is understood in the biomedical sciences, we often find ourselves theorizing from the ground up to summon the resources to understand a problem in a way that does not present a unidimensional understanding of gender/sex. McKittrick writes of interdisciplinarity as "dislodging our biocentric system of knowledge," and of the power of thinking with the sciences, the humanities, and the social sciences together (2021). We find that activating such a framework in the context of science engagement work can require reeducating ourselves and our audience every time. For instance, scientific journals or reviewers may not make room for or see the relevance of theory and framing from the

humanities and social science fields in a STEM article. STEM fields may have rigid background assumptions guiding how they interpret biological claims that make it difficult to enter into dialogue or publish within them (Jordan-Young 2010; McFarling 2021).

Sustaining the multi/inter/anti-disciplinary space necessary for our practice of intersectionality requires substantial labor. We work to create a trusting, empathetic, and collaborative environment that is intellectually challenging and inviting for all. It takes time to hear each other's perspectives and, sometimes, to teach each other basic concepts from our respective fields. It takes skills-building, as we acclimate to modes of discourse that involve curiosity and charitable probing of different standpoints and perspectives. These are further ways in which practicing intersectionality is at odds with the organization and structure of the academy. The work goes slower, and as such, it is high risk and not necessarily high reward, by the standard output measures of the academy. However, this work allows us to have far greater insight into the knowledge formations and discourses in which we hope to intervene.

Consider, for instance, how we were able to build cross-disciplinary knowledge to zero-in on the problematic assumptions operating in sperm decline research. Here, we drew from our rich background of disciplinary perspectives to interrogate and re-theorize the categories of "Western" and "Other." Biologically and epidemiologically-trained lab members identified and challenged the assumption that "Western" or "Other" countries represent biologically continuous populations capable of underwriting meaningful comparisons of sperm count across time and place. Lab colleagues from history provided further evidence for this challenge by chronicling the complex migration patterns that have shifted the demographic make-up of "Western" and "Other" since the 1970s. The philosophers among us crafted a conceptual framework for thinking about sperm count data without the use of these problematic categories. Lab members trained in science studies provided context on the eugenic history of "replacement theory" claims and the interface between rightwing social movements and academia. Together, we worked through these diverse arguments, evidence bases, and conceptual frameworks from across disciplines to build our sperm count biovariability hypothesis.

An essential move in our intervention was to demonstrate how the "West"/"Other" categorization scheme was both conceptually and evidentially unwarranted. Levine et al. assume that nations are static, bounded populations, with men residing in those nations "likely to be representative of the general population" (Levine et al. 2017, p. 655). We pointed to complex histories of several types of migration patterns to challenge this assumption and to show how late 20th-century migration continuously and variously redefines the populations of the nations included in Levine's analysis. When sperm count decline researchers assume that the driver of sperm count is the individual's developmental rather than current environment, country of residence is a poor proxy for a sample population, because populations have not stayed within their borders during the study period. The ways in which sperm decline researchers categorized their data in the 2017 meta-analysis thus does not rely on sound biological or epidemiological reasoning, but rather on mostly intuitive distinctions arising from racist and sexist assumptions embedded deep into our cultural fabric. But to reveal and critically analyze this network of assumptions in all of its dimensionality required the distinctive interdisciplinary strengths that we have, across not only epidemiology and reproductive biology but also history and philosophy of science, race, ethnic, gender, and cultural studies, and sociology of science.

While transcending disciplinary boundaries allows us to better triangulate how societal power dynamics affect both human biological variation and the structure of scientific research, working in this manner brings challenges. In our COVID-19 mortality analysis, by anchoring a relatively straightforward, conventional epidemiologic analysis in Black feminist theory and intersectionality, we created a work product that was contrary to the general organization

of the academy and disciplinary publishing silos. Despite the fact that the paper offered well-grounded, original, and crystal clear data analysis for understanding mortality disparities in the pandemic, we ran into significant obstacles publishing the work. Our COVID-19 mortality race and sex paper was ready for publication in July 2020, in critical early days of the pandemic. While publishing it, we worked on an extensive piece with *ProPublica* on the death rates among Black men (Johnson and Martin 2020). Post-publication, our work was cited in major press outlets (Craven 2021; Gonzalez 2021; Padilla 2021). Yet, we were desk-rejected from six medical and public health journals before finding a home at the *Journal of General Internal Medicine* (Rushovich et al. 2021). It is impossible to know why our paper was desk-rejected. However, we believe it's possible that our explicit framing of the analysis in Black feminist theory and intersectionality as well as our discussion of racism and structural inequities was at the root, for at least some journals. We note that three of the six journals were *Journal of the American Medical Association* (*JAMA*) journals. In early 2021, the universe of *JAMA* journals came under fire for inadequate consideration of racism by the editors for, among other things, requesting authors to replace references to racism with "bias" and considering pieces focused on racism and health as "opinion" pieces (McFarling 2021).

The way we practice intersectionality is based on the notion that, for STEM fields in particular, producing knowledge well requires synthesizing partial, situated knowledges across disciplines and identities (Haraway 1988). Here, we have emphasized this critical link between interdisciplinary process and intersectionality, what we would call *intersectionality as live theory and practice*. Yet, without reducing intersectionality to a synonym for diversity work, it is also necessary to reflect on how diversity within the sciences is part of intersectionality and reflected in the lab.

37.2.1 The role of diversity

An active and important, but in many ways distinct, scholarly conversation concerning intersectionality within STEM fields is focused on *who* is practicing science (Armstrong and Jovanovic 2015; Charleston and Adserias 2014; Ong 2005). Intersectionality has been referenced in institutional efforts to address these issues, for example, the Center for Open Science's recent *Guidelines for Inclusive Practice in Science* are explicitly centered in intersectionality and contain recommendations for hiring practices, resumes, and interviews (https://osf.io/muk7v/).

The lack of inclusion of Black, Indigenous, and other minoritized identities is a major challenge to the legitimacy and trustworthiness of the sciences. As has long been demonstrated and theorized in feminist science studies and philosophy of science, who is practicing science influences the realm of hypotheses and research programs considered and has a major impact on the arc of scientific research (Collins 2019; Haraway 1988; Harding 2004; Longino 1990). Within our own lab, we have prioritized outreach and inclusion of diverse lab members. However, we have encountered challenges in recruiting diverse candidates. We believe this limits our lab in terms of the perspectives we consider, the work we undertake, and our approaches to our work, both scholarly and public. While we do not wish to eclipse or obscure the contributions of many people of color and of diverse sexualities and genders within our lab, we are currently a majority white lab space.

We are committed to ongoing reflection on why we have had relatively few non-white lab members, and to working to address barriers (both systemic and individual) and increase recruitment outreach. As one practical example of a possible barrier that we can address, we aim to fund our undergraduate research assistants, as a basic move toward equalizing formal research opportunities. We also prioritize networking and presenting at events that might draw diverse

scholars, such as the Black Feminist Health Science Studies Collaboratory, both to stay abreast of scholarly work and to ensure that we build the relationships necessary to recruit diverse students.

Other barriers may be more complex. For example, the focus of our lab on the science of sex differences can, by one framing, be seen as a concern of elite white women for whom sex is the primary marker of subordination. Here, we hope that as our work gains visibility it will be clearer how the focus in traditional sex differences research on "all women" compared to "all men" obscures variation within sex, including across race and ethnicity, and invisibilizes transgender, nonbinary, and gender expansive people. For us, there is no study of scientific claims of sex or gender without a consideration of how concepts of race, sexuality and class interact with and are already baked into such claims (Owens 2018; Roberts 1997). Our research contributions inform discourses about who is counted and visible in public health data, what explanations are privileged in studies about disease differences, and how institutionalized data collecting and reporting practices impact the data's usefulness to marginalized communities.

37.2.2 Disseminating knowledge through nontraditional modes of publication

Finally, we believe that intersectionality calls on us to consider how our research is distributed and requires moving beyond traditional models of scholarly publication and dissemination to write for wider audiences both in and out of the academy. One of our principal means of doing this dissemination work—reflecting our mantra of producing "knowledge that matters"—is by generating multi-media packaging of the research we produce. For most of our research, the published peer-reviewed paper is simply one dimension of the work. We always aim to simultaneously publish a high-visibility op-ed and roll out accessible, often multi-part, "explainers" on our blog (Boulicault and Reiches 2021; Shattuck-Heidorn 2020) We have also published open-access lesson plans and teaching materials ("Gender/Sex in COVID-19 Teaching Module," n.d.) and a guide for reporting responsibly and accurately about gender/sex in COVID-19 for journalists (Danielsen and Noll 2020). In this way, we aim to make critical interventions in both scholarly and public spheres.

On our blog, we write for experts across disciplines and for the broader public. These blog posts, especially, represent a substantial labor of love. The posts are often deeply involved, delving into aspects that fit alongside the published piece but that often were not welcomed in the context of a STEM publication. For our paper on sperm decline science, for example, we delved into the methodology and philosophy of measurement of sperm samples (Boulicault 2021) and documented the alt-right's coverage of the sperm decline hypothesis (Perret 2021). While geared toward a general audience, the blog pieces are rigorous, cited, and peer-reviewed internal to the lab, sometimes taking as much or more time than the academic publication. But, together with the op-eds, this writing allows us to have a much broader impact than traditional academic journals. In 2020, our website had nearly 30,000 visits, and individual blog posts had as many as 3,600 reads.

As we consider our multi-media publication strategy, it is worth taking a moment to consider the placement of the lab at Harvard University. After all, when considering a discussion of counter-hegemonic or even radical intellectual projects, it can hardly go unmentioned that the lab sits at one of the most powerful universities in the world. We have sought to strategically engage the advantages that come with this. Headlines such as "Freaking Out About Declining Sperm Count? Don't, Harvard Researchers Say" came straight from our own press release (Santora 2021). Many aspects of our press engagement strategies and our multi-media packaging of research could be applied at other institutions and outside of the university. Learning multi-

media strategies and how to write press releases, honing skills for writing op-eds, cultivating a list of reporters who work gender/sex, race, and social justice beats—these are ways in which, as scholars, we aim to increase the real-world impact of our work.

37.3 Conclusion

Within the sciences, there are increasing calls for incorporating intersectionality as a theoretical framework in the development of research questions and in methodological approaches (Agénor 2020; Bowleg 2012). When we consider our recent research experiences, the primary question that arises is not whether quantitative fields can effectively incorporate intersectionality methodologically. Rather, it is whether these disciplines are prepared to expand their definitions of ways of knowing so as to create space for intersectional analysis in the STEM fields.

Like others (Bauer 2014; Bowleg and Bauer 2016; Else-Quest and Hyde 2016), we find that quantitative analyses alone are insufficient as a practice of intersectionality. In our COVID-19 work we found that, despite our commitment to a social justice-oriented stance motivated by intersectionality, the analysis itself did not fulfill our goals. Rather, it was our contextualizing framework and discussion of our results, and our work to make our results more widely known, that push us to consider this research as intersectionality in practice. In contrast, in our analysis of sperm decline literature, we did not conduct any statistical analyses motivated by intersectionality; however, we found that unpacking how unexamined gendered and raced assumptions underlay the sperm decline claims perhaps more deeply reflected the tenets of intersectionality. In both research areas, we believe our multi/inter/anti-disciplinarity as a lab was fundamental to how we practice intersectionality, while also bringing its own challenges in the confines of the academy.

We have learned that the active consideration of societal power dynamics is likely much harder to incorporate into STEM fields than the simple inclusion and analysis of diverse and intersecting identity categories. Indeed, we find the greatest resistance to our own work in the areas where we cross disciplinary boundaries and incorporate feminist and anti-racist theory. We find that the STEM fields continue to see themselves as inherently, even mandatorily, apolitical, despite decades of scholarship establishing that science is socially situated and deeply inflected with political values at multiple levels (Collins 2019; Haraway 1988; Harding 2004; Richardson 2013; Roberts 1997). Intersectional analyses within the biomedical sciences will require a broad range of disciplinary frameworks, tools, and methodologies. Due to strict disciplinarity, and a vision of scientific objectivity as value-neutrality, STEM fields risk co-opting intersectionality and reducing it to a neoliberal politics of "diversity" that is unmoored from greater questions of social justice and structural power dynamics (Bilge 2014).

Our practice of intersectionality in the STEM fields cannot be boiled down to a checklist, e.g., does an analysis consider certain specified variables. Rather, practicing intersectionality will likely require building and sustaining rich, interdisciplinary, and diverse communities empowered to challenge traditional knowledge making structures. This work is challenging within the traditional confines of academia, but worth it. When we ask lab members to talk about what aspects of the lab they find most valuable and generative, the points we have raised here (working across disciplines, interrogating power structures, working to incorporate critiques of academic power structures into the foundation of the lab), emerge as central to why members join, and stay, in lab. An intersectional framework is essential for our analyses of gender/sex in the biomedical sciences, and for producing knowledge that matters. We find that, for us, the process of practicing intersectionality can offer ways to fundamentally reimagine how scientific research is conducted.

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